16 Salinity

The basis for four categories of Salinity scores in the SVAP2 as written focus on the look of riparian and streamside vegetation – degree (none, minimal, significant or severe) of wilting, bleaching, leaf burn, stunting, and presence or proportion of salt-tolerant vegetation on site (none, some, dominant or most). Other indicators are whitish salt accumulations on streambanks. The rationale for this element cites irrigation of salt-laden soils, dryland crop/fallow systems with saline seeps, oil and gas well operations and animal waste, with a caveat for naturally occurring geologic weathering that can produce salts and should not be scored. However, there are numerous sources of elevated salinity in streams that may be factored into stream assessments where these factors are or may be present.

Salinity sources can include (NSW 2018):

- Watering lawns, golf courses, crops – all can increase salinity (in addition to nutrient loads).
- Other urban sources:
- effluent
- building materials
- industrial waste water
- fertilizers and chemicals
- Direct measurements using specific conductivity block or refractometer

In addition, many industrial processes may increase stream salinity levels:

- saline water from mines (working and abandoned) from groundwater seepage and from rainwater coming into contact with mine workings or spoil
- discharged cooling water from coal-fired power stations that has been partly evaporated, concentrating the salt content

On its face, the protocol suggests elimination of the salinity element from the New England standard set is reasonable, since none of the streams in our broadly distributed dataset were impaired according to the criteria set out in the SVAP2 elements, and the protocol itself allows for eliminating elements that clearly do not apply. In addition to various sources of increased salinity from urbanized areas, industrial operations and agricultural sources, deicing operations of roads, bridges and other paved areas may be the most ubiquitous source in many streams throughout New England. Roads in mountainous areas are often in the stream valleys, where the flattest and most regular grades are found, and where settlements were historically made. Heavily developed areas also tend to have roads and streams in close proximity, with additional paved areas requiring treatment throughout the winter months. Road crossings (bridges and culverts) constitute the most direct access to streams from deiced surfaces, with bridges typically receiving the greatest amount of treatment due to the lower overall temperatures (suspended in air, without the partial insulation provided by the ground), though these may be considered point sources rather than a reach-wide impact.

A recent summary of Transportation and Hydrology Studies of the U.S. Geological Survey in New England cites locally-focused Water Quality investigations that include "…determinations of the effects of road salting on the quality of runoff and receiving waters." These studies are being led by the USGS New England Water Science Center (USGS 2018) in cooperation with state Departments of Transportation of Connecticut (CTDOT), Maine (MEDOT), Massachusetts (MassDOT), New Hampshire

(NHDOT), Rhode Island (RIDOT) and Vermont (VTrans). As of 2016, USGS had ongoing or completed projects on various pollutant inputs – sediment, nutrients, metals, deicing chemicals and others from highways and bridges in MA, NH, VT and CT, and featured a 2013 regional effort to develop a highway-runoff discharge model to evaluate the potential effects of various pollutant loading on receiving waters, with potential effectiveness of stormwater BMPs on reducing impacts (Granato 2013). Another report conducted in 2015 on four watersheds along Interstate 95 in Connecticut revealed that of the five variables that best explain peak specific conductance following deicing, number of "State operated road lane miles divided by watershed area" and amount of Cl in deicer applied to those roads per lane mile are significant (Brown, et al., 2015).

With the above, we propose to adjust the narratives in scoring the Salinity Element, #16, using the following additional indicators (see Appendix G). Note many of these require additional evaluation of GIS data to evaluate presence or proximity to different sources, as these are not necessarily visible from within the assessment site.

For scores of 8 to 10, look for the following:

- No wilting, bleaching, leaf burn, or stunting of riparian vegetation;
- No streamside salt-tolerant vegetation present
- Little or no development in basin upstream, little or no deicing of impervious surfaces (e.g., seasonal use highways only, or plowing only)
- Little or no irrigation agriculture return drainage upstream

For scores of 5 to 7, look for the following:

- Minimum wilting, bleaching, leaf burn, or stunting of riparian vegetation;
- Some salt-tolerant streamside vegetation
- Some development with impervious surfaces upstream, small settlements only with deicing of roads, bridges and parking areas, villages without heavy industry
- No direct roadside drainage or bridge crossings
- Some stormwater or deicing control (bridge washing with removal, covered sand and salt storage, stormwater treatment BMPs)
- Little or no irrigation agriculture return drainage upstream

For scores of 3 to 4, look for the following:

- Riparian vegetation may show significant wilting, bleaching, leaf burn, or stunting;
- Dominance of salt-tolerant streamside vegetation
- Significant urban development upstream and/or adjacent to stream, dense road networks and/or larger towns or urban areas, industrial areas and extensive areas needing deicing
- Direct roadside drainage or bridge crossings
- No stormwater controls or BMPs
- Direct irrigation agriculture return drainage

For scores of 0 to 2, look for the following:

- Severe wilting, bleaching, leaf burn, or stunting;
- Presence of only salt tolerant riparian vegetation is salt tolerant

- High rates of development or urbanization, no stormwater controls
- Significant direct drainage from roads, bridges and paved surfaces
- Direct irrigation returns combined with evidence of salt damages to vegetation or a significant refractometer direct reading

Barriers to Movement (Element 11)

As noted in GIS Preliminary data collection, taking a broader watershed view would provide a more complete representation of the impact of barriers in the watershed that may not be in the assessment reach. Many barriers can be documented using GIS methods, where culverts, bridges, head-cuts and even large woody debris jams may be seen in imagery or topography, particularly for larger streams or streams with less riparian vegetation cover. For species that migrate upstream, including fish, salamanders or turtles, any barriers that exceed passage height, length or velocity should be documented both within and downstream from the SVAP2 assessment reach.

For the purposes of application in NAE, off-site barriers downstream should be documented, especially if there are native species that could or would utilize the assessment reach if they could reach it. In particular, dam removal or culvert replacement/rehabilitation sites constitute a specific project type where the assessment should include the structure itself as a barrier to movement, even if the representative assessment reach does not include the structure, because removal of the structure will impact aquatic population conditions upstream and downstream. Alternatively, mitigation sites immediately upstream or downstream from a barrier may not achieve the same ecological lift if the barrier is left intact. If barriers comprise a limiting factor, noting the presence of a problematic culvert or debris jam, or the presence of one or more headcuts moving up the valley from downstream, might provide opportunities to coordinate with other agencies or property owners to address those problems at a larger scale, improving the overall success of mitigation actions in the assessment reach.

Known barriers outside the assessment reach do not necessarily need to be included in assessing the element score, since any impact of mitigation would be confined to the study reach itself and only those variables that can be influenced. The important consideration here is to maintain consistency in application, wherein documenting barriers upstream or downstream is important but will typically not be included in assessing a specific reach, except in rare cases. If there is a good reason to consider barriers outside an assessment reach, this exception must be carried through all future assessments of this reach or associated sites to preserve continuity of the method.