January 2017

GREAT SALT LAKE WETLAND CONSERVATION ACTION PLANNING WORKSHOP 2015 REPORT

Purpose: FY2012-EPA Region 8 Wetland Program Development Grant

Table of Contents

List of Tables

List of Figures and Maps

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

GREAT SALT LAKE WETLAND CONSERVATION ACTION PLANNING WORKSHOP 2015 REPORT

INTRODUCTION

The wetland habitats around the Great Salt Lake (GSL) host more than 250 bird species, 64 mammal species, 23 fish subspecies, 19 reptile species, and 8 amphibian species (FFSL, 2013). While we know that GSL wetlands provide critical habitat for many regionally significant bird species, relatively little is known about the health of the wetlands. In 2012 the Great Salt Lake Advisory Council and SWCA Environmental Consultants published the results of a GSL health assessment developed following the Conservation Action Planning (CAP) framework (SWCA, 2012). In that report, **ecological health** was defined as how well habitats functioned to support significant bird populations, brine shrimp, and stromatolitic structures. The report defined seven conservation targets that captured the biodiversity of the lake: open water of bays, unimpounded marsh complex, impounded wetlands, mudflats and playas, isolated island habitat, alkali knolls, and adjoining grass- and agricultural lands (SWCA, 2012). Most ecological targets were deemed in good overall health. However, the health of two out of three wetland habitat types (unimpounded marsh complex and impounded wetlands) could not be assessed due to insufficient data and high uncertainty. Gathering the information required to assess the health of GSL wetlands remains a high research priority.

Due to the successes achieved in stakeholder engagement and scientific input using the CAP process for GSL, EPA Wetland Program Development Grant funding was used to conduct a Great Salt Lake Wetland Health Workshop in May, 2015 to continue the initial effort. The workshop was led by an experienced CAP facilitator and participants were comprised of wetland professionals. The focus of the workshop was on three GSL wetland ecological targets: playa and mudflats, fringe wetlands, and impounded wetlands (Figure 1). The objectives of the CAP workshop were to:

1. Review the Conservation Action Planning (CAP) framework, definitions, and utility in GSL wetlands management.
2. Update the previously completed (2012) CAP for Great Salt Lake wetlands
3. Articulate how the Wetland Health CAP process can be used to support state wetland management goals

Though the Utah Division of Water Quality (UDWQ) originally proposed to use EPA's CADDIS (Causal Analysis/Diagnosis Decision Information System) framework to assess the causes of degradation to impounded wetlands around GSL, there was lack of stakeholder agreement about how to measure degradation in those systems. Instead, the UDWQ and the University of Utah

chose to conduct CAP meetings in order to seek input from relevant stakeholders on what the indicators of healthy or impaired wetlands may be before moving forward with CADDIS-type analyses.

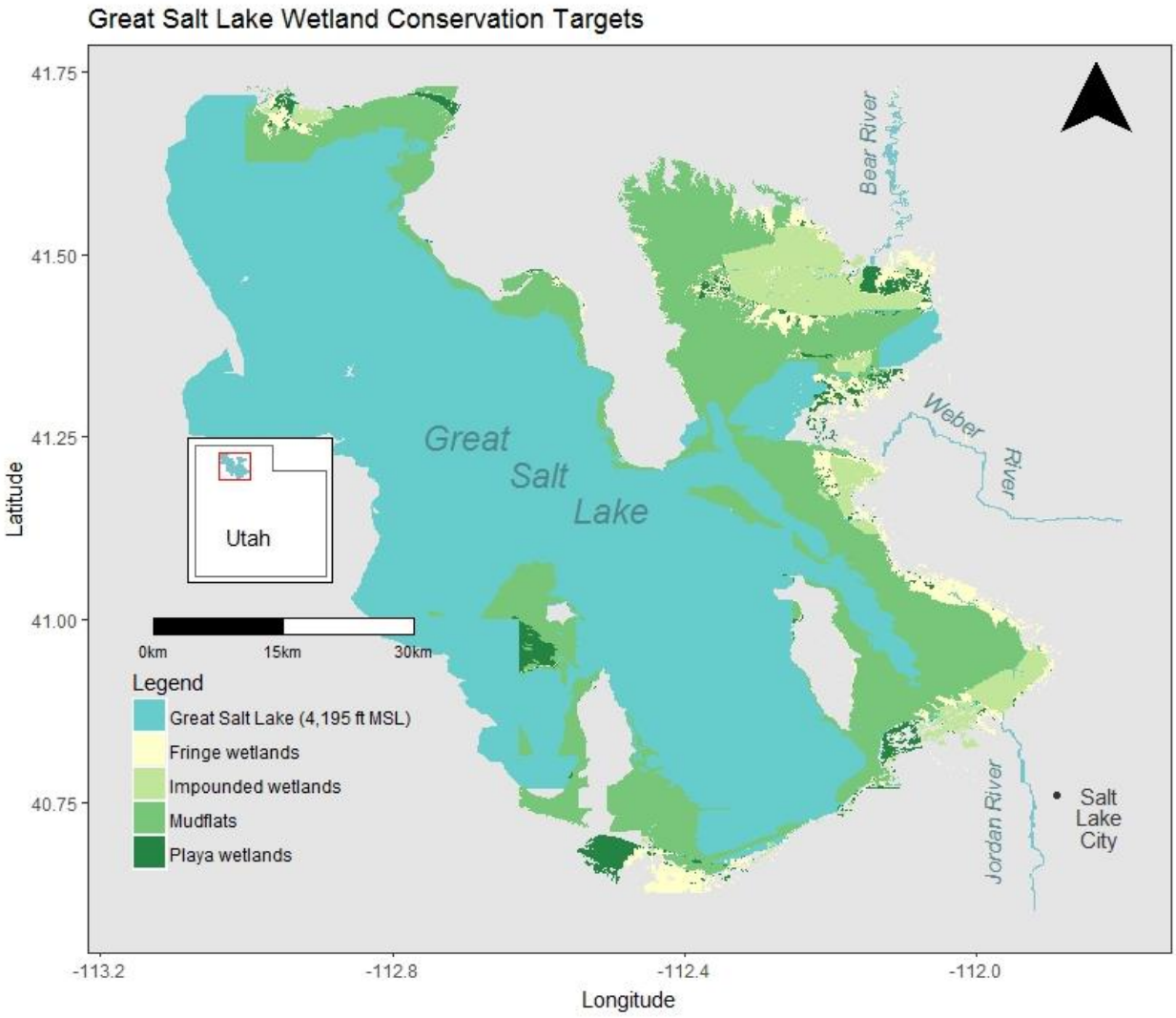

Figure 1. Great Salt Lake and wetland conservation targets

CONSERVATION ACTION PLANNING PROCESS

The Conservation Action Planning (CAP) Process is a well-developed approach to large-scale conservation projects developed and refined by The Nature Conservancy. Through facilitated workshops, scientists and stakeholders identify the scope and focus of conservation efforts, define attributes of healthy ecological targets and measurable indicators of health, rank the health or viability of targets and identify stresses, and use the information presented to generate conservation strategies (TNC, 2007). The 2015 workshop identified nested targets and updated key ecological attributes and indicators for three wetland ecological targets previously identified in the 2012 CAP process. Workshop attendees also refined stressors and estimated the overall health of GSL wetlands.

The CAP process has several specific terms to describe conservation goals. **Ecological targets** or focal conservation targets are the communities, species or resources to be conserved within a project area. Around GSL, the ecological targets are habitat types chosen to represent the biodiversity and services provided by the region. Each ecological target supports habitat uses by **significant species**, defined as a keystone species, species of concern, or species with significant global, national, or regional populations utilizing GSL wetlands. **Nested targets** are the species or communities whose needs fall under those of larger ecological targets. **Key Ecological Attributes** are the important processes and characteristics critical to ecosystem viability; they are aspects of a target's ecology that define health and if lost indicate degradation. **Indicators** are the characteristics of an attribute that can be measured and goals can be set for. One of four **ratings** can be given for the health or **viability** of each attribute: very good (ecologically desirable status that requires little intervention), good (within acceptable range of variability but maintenance intervention is required), fair (outside acceptable range of variation, requiring intervention) and poor (restoration is increasingly difficult) (TNC, 2007).

WORKSHOP PARTICIPANTS

Participants in the GSL Wetland Health Workshop represented a range of wetland interests from academic institutions, natural resource agencies, and consulting, conservation, and mining firms. The group present was invited because of their expertise in wetland conservation, the Great Salt Lake, and/or local conservation issues. The workshop was held at the University of Utah and led by Greg Lowe, an experienced facilitator from The Nature Conservancy. Workshop participants and the institutions they represent are listed below.

Participant	Organization
Howard Browers	US Fish & Wildlife Service
Casey Burns	Natural Resource Conservation Service
Chad Cranney	Utah Division of Wildlife Resources
Rich Emerson	Utah Geological Survey
Erica Gaddis	Utah Division of Water Quality
Jodi Gardberg	Utah Division of Water Quality
Ramesh Goel	University of Utah
Jimi Gragg	Utah Division of Wildlife Resources
Rich Hansen	Utah Division of Wildlife Resources
Toby Hooker	Utah Division of Water Quality
Heidi Hoven	The Institute for Watershed Science
Karin Kettenring	Utah State University
Pam Kramer	Utah Division of Wildlife Resources
Leone Lamars	Radbound University, The Netherlands
Greg Lowe (Facilitator)	The Nature Conservancy
Diane Menuz	Utah Geological Survey
Theron Miller	Farmington Bay Jordan River Water Quality Council
Chris Montague	The Nature Conservancy
Amir Motlagh	University of Utah
Tyler Murdock	Utah Division of Forestry, Fire and State Lands
John Neill	Great Salt Lake Ecosystem Program, Division of Wildlife Resources
Anne Neville	Rio Tinto
Jeff Ostermiller	Utah Division of Water Quality
Scott Peterson	University of Utah
David Richards	OreoHelix Consulting
Ella Sorenson	Audubon Society

DEFINITION OF HEALTH FOR ECOLOGICAL TARGETS AND SIGNIFICANT SPECIES

The 2015 GSL Wetland Health Workshop focused on three of the original eight GSL ecological targets: mudflats and playas, fringe wetlands, and impounded wetland complex. GSL wetland conservation has focused on waterfowl, shorebirds, and waterbirds because of the large number of those wetland-dependent birds that migrate through the region. GSL wetlands support globally significant populations of American Avocets (*Recurvirostra americana*), Black-necked Stilts (*Himantopus mexicanus*), Snowy Plovers (*Charadrius nivosus*), White-faced Ibis (*Plegadis chihi*), and Long-billed Curlew (*Numenius americanus*) (Paul and Manning, 2002).

All wetland ecological targets lie within a previously determined boundary – below a lake elevation of 4,218 feet (1,286 meters) above mean sea level (MSL). Some changes were made to the 2012 terminology and geographic divisions. Ecological targets within all bays of GSL (Gunnison, Gilbert, Bear, and Farmington) were assessed together, rather than individually as those divisions are less meaningful to wetland ecosystems. Fringe wetlands are now used to describe what previously was termed unimpounded marsh complex.

Workshop participants determined the current health rating for conservation targets. Prior to the meeting, key attributes had been determined and categorized according to the Viability Assessment groups of size, condition, and landscape.

Mudflats and Playas

Figure 2. GSL playa wetlands

The mudflat and playa conservation target encompass extensive saline habitats that are created by inter-annual or seasonal water fluctuations; these habitat types dominate the GSL shoreline. Mudflats and playas are both low-slope (i.e., flat) depressional habitats with differences in plant community and soils between the two. Playas are dominated by halophytic ('salt-loving') plant species and characteristic accumulation of alkaline salts at the soil surface while mudflats have little to no vegetation and negligible surface salts. Both mudflat and playa habitats (i.e., depressional wetlands) support communities of freshwater and saltwater macroinvertebrates that provide seasonal food for tens of thousands of migratory shorebirds, gulls, and waterfowl. Freshwater inputs to playa habitats drive the high productivity of vegetation and macroinvertebrates that support migratory shorebirds. Very flat topography and dynamic lake hydrology means that playas and mudflats expand and contract dramatically when GSL level changes (FFSL, 2013). The open water/mudflat interface is important for nesting birds and gets smaller as lake levels fall seasonally and inter-annually (FFSL, 2013).

Depressional wetlands provide breeding, foraging, and resting habitat for significant shorebird and waterfowl species. In particular, Snowy Plovers, Black-necked Stilts, and American Avocets all nest on playas. Thus the nested target for mudflats and playas is breeding and foraging habitat for those three species and other shorebirds of regional or national significance.

Mudflats and playas provide many other ecosystem services, including recreation, education, invertebrate biodiversity, dust abatement, waterfowl hunting areas, groundwater replenishment, flood attenuation, loafing area for birds, brine shrimp harvesting, mineral extraction, biodiversity, bird watching, aesthetics and sense of place, and sediment, carbon, and nutrient dynamics including sequestration and cycling.

Eight key attributes and indicators were proposed for playa and mudflats. Healthy playas and mudflats experience a water regime that supports invertebrate populations and nutrient cycling and minimized dust generation, indicated by the timing and extent of flooding. Minimal soil disturbance is an indicator that soil substrates are intact in healthier depressional wetlands. The presence of a healthy vegetation community relatively free of *Phragmites australis* (hereafter *Phragmites*) supported by sufficiently saline soils are attributes of healthy playa and mudflat condition. Finally, around GSL, depressional wetlands should have heterogeneous microhabitats and be located close to fresh waters in order to support significant species. The list of attributes discussed at the 2015 workshop was a significant expansion of the two attributes assessed in the previous CAP process (SWCA 2012). See Table 1 for a detailed explanation of depressional wetland attributes, indicators, and ratings.

Table 1. 2015 Detailed summary of attributes, indicators and current health of Great Salt Lake playa and mudflats

CATEGORY	KEY ATTRIBUTE	INDICATOR	RATING		CURRENT HEALTH
Mudflats and Playas					
Landscape Context	Hydrologic regime that supports a diversity of native invertebrates and nutrient cycling	Amount of area that is moist at the end of May.	Poor	Most of the area is dry throughout May or peak runoff most years OR most of the area is flooded for multiple years*	
			Fair		
			Good	Most of the area is moist through May or through peak runoff in most years and saturated at TBD depth*	
			Very Good		
	Intact physical substrate	Amount of soil compaction or disturbance	Poor	Compaction or disturbance of soils over most of the area	
			Fair		
			Good	Minimal (e.g. 10%) of the area is compacted or disturbed.	
			Very Good		
	Water on the mudflats sufficient to minimize dust generation		Poor		
			Fair		
			Good		
			Very Good		

CATEGORY	KEY ATTRIBUTE	INDICATOR	RATING		CURRENT HEALTH
Condition	Absence of *Phragmites*	Amount of *Phragmites*	Poor		Good
			Fair		
			Good	Hardly any *Phragmites*	
			Very Good	No *Phragmites*	
	Healthy native vegetation community in playas	Plant community fringing the playa	Poor	Non-halophytic species (e.g. upland invasive species) dominate system.	
			Fair		
			Good	Suite of native halophytic species fringing the playas*	
			Very Good		
	Maintenance of salt in sediment to control *Phragmites**		Poor		
			Fair		
			Good		
			Very Good		
Size	Heterogeneous habitat (microhabitats that include topography, salinity, hydrology, etc.)		Poor		
			Fair		
			Good		
			Very Good		
	Sufficient habitat near freshwater for Snowy Plover population and other shorebirds	Mudflat habitat acres within 100 meters of perennial freshwater	Poor	<13,000	Good
			Fair	13,000 - 18,000	
			Good	18,000 - 23,000	
			Very Good	23,000 - 25,000	

*Denotes indicators flagged as needing more information from specific participants; grey cells denote indicators that were not discussed

Fringe Wetlands

Figure 3. GSL fringe wetlands

Fringe wetlands (formerly unimpounded wetland complex) are large, shallow, intermittently to semi-permanently flooded palustrine wetlands dominated by a mix of emergent and submergent aquatic vegetation (SAV). Spatially and temporally variable salinity, and flooding depth and duration create a mosaic of habitat types in fringe wetlands. Meadows, emergent marsh, and submergent wetlands can all be found in fringe complexes. Fringe wetlands can be divided into high and low fringe based on their elevation – high fringe are irregularly

inundated by the lake and experience dry conditions when lake levels are low, low fringe may remain inundated for many years (FFSL, 2013).

Fringe wetlands provide foraging, breeding, and resting habitat for significant species of fish-eating birds, shorebirds, and waterfowl. The mosaic nature of fringe wetlands led to the development of four nested targets. The first is to provide breeding and foraging habitat for waterfowl of regional or national significance like Cinnamon Teal (*Anas cyanoptera*) and Redheads (*Aythya americana*). The second fringe nested target is adequate wet meadow habitat to serve as breeding and foraging habitat for a portion of the largest global breeding population of White-faced Ibis. Hemi-marsh habitat sufficient to support breeding and foraging habitat for a portion of the 65,000 Black-necked Stilts and 500,000 Wilson's Phalaropes *(Phalaropus tricolor*) found around GSL is the third target. Finally, fringe wetlands that provide foraging habitat for piscivorous birds like Western Grebes (*Aechmophorus occidentalis*) and Forster's Tern (*Sterna forsteri*) is the final target. The ecosystem services fringe marsh provides are education, invertebrate biodiversity, groundwater replenishment, flood attenuation, loafing area for birds, mineral extraction, biodiversity, carbon sequestration, tourism and recreation, waterfowl hunting areas, boating, photography, bird watching, aesthetics, and improving water quality for downstream users.

The functions mentioned above are reflected in the key attributes and indicators of healthy fringe wetlands. The landscape context attribute of very good fringe marsh is the delivery of high quality water at times corresponding to a natural water regime. The condition attributes of healthy fringe wetlands include the presence of a diversity of habitat types dominated by native plants, healthy populations of macroinvertebrates and native fish, and minimal contaminants in the soil and water. At least 11,000 acres of fringe wetland need to be maintained around GSL in order to support visiting wetland-dependent birds. As in previous CAP cycles, several of the fringe indicators need further development; see Table 2 for more details about attributes and indicators for fringe wetlands.

Table 2. Detailed summary of attributes, indicators and current health of Great Salt Lake fringe wetlands

CATEGORY	KEY ATTRIBUTE	INDICATOR	RATING CATEGORY		CURRENT HEALTH
Fringe wetlands					
Landscape Context	Delivery of high quality water by tributaries into marshes and eventually the lake.	Stream Visual Assessment Protocol score of streams throughout watershed feeding wetlands	Poor	0 – 6	
			Fair	6.1 – 7.4	
			Good	7.5 – 8.9	
			Very Good	9 – 10.4	
	Maintain natural hydrologic regime	Deviation from natural hydrograph for a given storm event*	Poor		
			Fair		
			Good		
			Very Good		
	Maintain natural hydrologic regime	Period in which complex is moist to inundated in most years	Poor	April – May or less	
			Fair	April – June	
			Good	April – early July	
			Very Good	Unaltered system*	

CATEGORY	KEY ATTRIBUTE	INDICATOR	RATING CATEGORY		CURRENT HEALTH
Condition	Bioavailability of nutrients in water column and soils*		Poor		
			Fair		
			Good	Sediments are a net sink for the water column during the growing season to avoid algal blooms; sediment concentrations that do not provide competitive advantage to invasive species	
			Very Good		
	Diversity and amount of habitat types	Presence of hemi-marsh, submerged aquatic vegetation, short & tall emergent, wet meadow	Poor	<3 present	Good
			Fair	3 – 4 present	
			Good	All 5 present	
			Very Good	All 5 present	
	Dominance of native and desirable nonnative plant species	Percent cover of native and desirable nonnative plant species	Poor	<50%	Fair
			Fair	50% – 75%	
			Good	75% – 90%	
			Very Good	>90%	
	Forage fish supportive of piscivorous birds	Fish biomass, preferably native*	Poor		
			Fair		
			Good	See impounded wetlands	
			Very Good		
	Healthy macroinvertebrate population supportive of waterfowl and other waterbirds	Total biomass g/m^2*	Poor		
			Fair		
			Good	1.5 – 2.5	
			Very Good		
	Minimized bioavailability of contaminants in soils and water column.		Poor		
			Fair		
			Good	Bioavailability of contaminants is below toxic thresholds	
			Very Good		
Size	Sufficient habitat to support nested targets (i.e. shorebirds, waterfowl, & other wetland dependent birds)	Acreage of habitat between 4,200 and 4,218	Poor	<6,000	Good
			Fair	6,000 – 8,000	
			Good	8,000 – 11,000*	
			Very Good	>11,000	

*Denotes indicators flagged as needing more information from specific participants; grey cells denote indicators that were not discussed

Figure 4. GSL impounded wetlands

Impounded Wetlands

Impounded wetlands are large open water wetlands ringed by emergent vegetation where the hydrology has been modified by dikes, canals, and headgates that extend and deepen flooding by controlling the inflow and outflow of water. Impounded wetlands do not include evaporation ponds, but do include naturally-occurring impoundments and open water within them. Impounded wetlands occur on a gradient from deep water on the downstream, diked side to wet meadow on or near water sources. Impounded wetlands are typically managed for submerged aquatic vegetation (SAV) which is an important nutritional and structural plant group that provides forage and shelter for waterfowl and water birds and habitat for macroinvertebrates and fish. The water control structures that create impounded wetlands prevent natural hydrologic fluctuations (e.g., flooding drought) that occurs in fringe wetlands. Instead, the stable, extended flooding in impoundments allows nesting, loafing and foraging habitat for all bird guilds and performs water purification and nutrient cycling functions.

The impounded wetland ecological target provides foraging, breeding, and resting habitat for significant species of piscivorous birds, shorebirds, waterfowl, and Eared Grebes (*Podiceps nigricollis*). The first nested target for impounded wetlands is to provide breeding and foraging habitat for waterfowl of regional or national significance, including Cinnamon Teal and Redheads. Wet meadows that provide breeding and foraging habitat for a portion of the largest global breeding population of White-faced Ibis and Franklin's Gulls (*Leucophaeus pipixcan*) is the second nested target. Providing breeding, foraging, and nesting habitat for shorebirds of regional or national significance, including American Avocets, Black-necked Stilts, and Wilson's Phalarope is the final nested target. The ecological services impounded wetlands provide include education, invertebrate biodiversity, groundwater replenishment, flood attenuation, loafing area for birds, mineral extraction, biodiversity, carbon sequestration, tourism and recreation, waterfowl hunting, bird watching and photography, aesthetics, and improvement of water quality for downstream waters.

The attributes of healthy impounded wetlands focus on the features required to support significant populations of birds. The landscape context attributes of healthy impounded wetlands include the delivery of a sufficient quantity of high quality water to support a diversity of habitat types within impoundments. Impounded wetlands in healthy condition have productive native fish and macroinvertebrate populations, and extensive cover of desirable species. SAV species are most desirable and when in the best condition, produce healthy quantities of drupelets, leaves and tubers. Healthy impoundments have minimal algal growth and low levels of soil and water contaminants. For more details on attributes and indicators of impounded wetland ecosystem health see Table 3.

Table 3. Detailed summary of attributes, indicators and current health of Great Salt Lake impounded wetlands

CATEGORY	KEY ATTRIBUTE	INDICATOR		RATING CATEGORY	CURRENT HEALTH
Impounded Wetland Complex					
Landscape Context	Delivery of high quality water by tributaries into marshes and eventually the lake.	Stream Visual Assessment Protocol score of streams feeding wetlands	Poor	0 - 6	
			Fair	6.1 - 7.4	
			Good	7.5 - 8.9	
			Very Good	9 - 10.4	
	Diversity and amount of habitats within the impoundments	Presence of open water, hemi-marsh, SAV, short & tall emergent, wet meadow	Poor		
			Fair		
			Good	Presence of all 6 with varying proportions, dominated by SAV across a complex.	
			Very Good		
	Water availability - duration, level of inundation, etc. Delivery of sufficient quantity water to flush ponds and maintain optimal residence times*		Poor		
			Fair		
			Good		
			Very Good		
Condition	Bioavailability of nutrients in water column and soils*		Poor		
			Fair		
			Good	Sediments are a net sink for the water column during the growing season to avoid algal blooms, sediment concentrations that do not provide competitive advantage to invasive species.	
			Very Good		
	Dominance of native and desirable nonnative plant species	Percent cover of native and desirable nonnative plant species	Poor	< 50%	Fair
			Fair	50% – 74%	
			Good	75% – 89%	
			Very Good	90 – 100%	
	Food supply supportive of fish, waterfowl, and other water birds	Fish biomass, preferably native (kg/m^2)	Poor		
			Fair		
			Good	Predominance of small fish; few carp; sufficient for piscivorous birds but not harmful to macroinvertebrate populations*	
			Very Good		

CATEGORY	KEY ATTRIBUTE	INDICATOR		RATING CATEGORY	CURRENT HEALTH
Condition	Food supply supportive of fish, waterfowl, and other water birds	Macroinvertebrate (non-gastropods) biomass (g/m^2) in upstream ponds in July/August*	Poor	<0.5	Very Good
			Fair	0.5 – 1.5	
			Good	1.5 – 2.5	
			Very Good	>2.5	
	Food supply supportive of fish, waterfowl, and other water birds	SAV drupelet biomass (g/m^2)	Poor	<5	Fair
			Fair	5 – 20	
			Good	20 – 29	
			Very Good	>29	
	Food supply supportive of fish, waterfowl, and other water birds	SAV tuber biomass (g/m^2)	Poor	<2.5	Poor
			Fair	2.5 – 12	
			Good	12 – 24	
			Very Good	>24	
	Forage fish supportive of piscivorous birds	Fish biomass, preferably native	Poor	TBD	
			Fair		
			Good		
			Very Good		
	Healthy macroinvertebrate population that includes diversity and functional feeding groups		Poor		
			Fair		
			Good	TBD - Macroinvertebrate index	
			Very Good		
	Healthy SAV Community	Algal growth on SAV, fouling on SAV	Poor		
			Fair		
			Good		
			Very Good		
	Healthy SAV community	SAV branch density (thousand leaves/m^2) in upstream ponds in July/August	Poor	<10,000	Poor
			Fair	10,000 – 35,000	
			Good	35,000 – 59,000	
			Very Good	>60,000	
	Minimized bioavailability of contaminants in soils and water column.		Poor		
			Fair		
			Good	Bioavailability of contaminants is below toxic thresholds.	
			Very Good		

*Denotes indicators flagged as needing more information from specific participants; grey cells denote indicators that were not discussed

CURRENT HEALTH

In order to assess the current health of GSL wetlands, workshop participants ranked the ecological attributes of wetlands amongst all GSL bays as good, fair or poor. Table 4 shows the **viability** of ecological targets, which is the status, health, ability of a target to withstand or recover from most natural or anthropogenic disturbances and thus to persist for many generations or over long time periods of each conservation target (TNC, 2007). Overall, mudflats and playas and fringe wetlands were ranked as being in good health, while impounded wetland complexes were determined to be in poor health.

Table 4. Current overall health of Great Salt Lake wetland targets

Conservation Targets	Attribute Category			2015 Overall Viability Rank	2012 Overall ranking
	Landscape Context	Condition	Size		
Mudflats and playas	-	Good	Good	Good	Good
Fringe	-	Fair	Good	Good	Not ranked
Impounded wetland complex	-	Poor		Poor	Not ranked

FUTURE STRESSES

Workshop participants also assessed the ecological target **stresses**, which are impaired key ecological attributes resulting from incompatible human activities (TNC, 2007). In future workshops the source of stresses will be identified and strategies for mitigation will be developed (TNC, 2007). Stresses are assessed according to their severity and scope. Stress **severity** is an estimate of the level of damage expected in the near future, from slight impairment to elimination of a conservation target. Stress **scope** is an estimate of how widespread an impact will be, from very localized to pervasive (TNC, 2007). The stresses considered and initial ranks are listed in Table 5. The most prominent stresses are loss of habitat and increased cover of undesirable plant species, primarily expanding populations of *Phragmites* and *Typha* (SWCA, 2012). Reduced period of inundation and reduced diversity are also problematic.

Table 5. Summary of Stresses to Great Salt Lake Wetland Ecological Targets

STRESSES	SEVERITY	SCOPE	STRESS RANK
Reduced period in which complex is moist to inundated	Medium	High	Medium
Reduced diversity and amount of habitat types	Very High	Medium	Medium
Increased undesirable plant cover	High	Very High	High
Reduced macroinvertebrate biomass			
More deviation from natural hydrograph for a given storm event			
Reduced quality of water delivered to wetlands	High		
Loss of habitat	Very High	High	High

LITERATURE CITED

[FFSL] Utah Division of Forestry, Fire and State Lands. 2013. Final Great Salt Lake Comprehensive Management Plan and Record of Decision. Utah Department of Natural Resources, Salt Lake City, UT. http://www.forestry.utah.gov/images/statelands/greatsaltlake/2010Plan/OnlineGSL-CMPandROD-March2013.pdf

Paul, D.S., and Manning, A.E. 2002. Great Salt Lake Waterbird Survey 1997-2001. Publication 08-38. Utah Division of Wildlife Resources, Salt Lake City, UT. https://wildlife.utah.gov/gsl/waterbirdsurvey/RPT07Importance.htm

SWCA Environmental Consultants. 2012. Definition and Assessment of Great Salt Lake Health. Available online: http://www.gslcouncil.utah.gov/docs/2012/Jan/GSL_swca.PDF

[TNC] The Nature Conservancy. 2007. Conservation Action Planning Handbook: Developing strategies, taking actions and measuring success at any scale. The Nature Conservancy, Arlington, VA. https://www.conservationgateway.org/Documents/Cap%20Handbook_June2007.pdf