Willard Spur CAP Workshop

January 17 & 18, 2018

Summary Report

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Introduction

The Utah Division of Water Quality (DWQ) hosted a Willard Spur Conservation Action Planning (CAP) Workshop on January 17-18, 2018 at the Bear River Migratory Bird Refuge. Participating in the workshop were over 25 individuals representing 16 agencies and organizations (Appendix A), including numerous members of the Willard Spur Steering Committee and Science Panel.

The objectives of the workshop were four-fold:

- Provide "hands on" advice and assistance to DWQ on developing narrative water quality criteria for Willard Spur's beneficial uses—to supplement and complement DWQ's numeric criteria for toxics.
- Explore other conservation action strategies—beyond water quality standards – that might be developed and applied by stakeholders to enhance Willard Spur's water quality and/or to abate potential future threats to the beneficial uses.
- Review and provide comments to DWQ on the application of Bear River Migratory Bird Refuge (BRMBR) Category 3B, 3D Designated Beneficial Use numeric criteria to the rest of the Willard Spur boundary area.
- By hands-on application of the CAP framework for Willard Spur narrative standards, help DWQ staff discern what modifications or enhancements might be required for Willard Spur and for broader application for Great Salt Lake wetlands.

Conservation Action Planning (CAP)[1] is straightforward and proven approach for planning, implementing and measuring success for large landscapes or other conservation projects. CAP is science-based, strategic and collaborative, and has been applied at over 1,000 conservation projects, including the Bear River. Greg Low, who played a leading role developing the CAP methodology, facilitated the workshop.

The Willard Spur CAP workshop built upon the previous efforts of the Willard Spur Science Panel and Steering Committee, the *Definition and Assessment of Great Salt Lake Health*[2] conducted in 2011-2012 for the Great Salt Lake Advisory Council, and a follow-up Great Salt Wetlands CAP workshop in 2015. While DWQ primarily initiated the meeting to inform the development of water quality standards for Willard Spur, the workshop was also intended to help facilitate the transfer of knowledge gleaned from

[1] https://www.conservationgateway.org/Documents/Cap%20Handbook_June2007.pdf

[2] https://documents.deq.utah.gov/water-quality/standards-technical-services/great-salt-lake-advisory-council/Activities/DWQ-2012-006862.pdf

the Willard Spur project to inform broader conservation planning efforts for this ecosystem.

Proposed Willard Spur Boundary

Overview

An important step, particularly for state rulemaking, is a definition of the water body boundaries. DWQ presented a preliminary definition for a Willard Spur boundary for consideration. Several workshop participants commented that a firm delineation of Willard Spur was complicated by the constantly changing nature of the ecosystem. DWQ subsequently revised the definition to emphasize the fact that the boundaries were approximate. Additional detail on the ecologically dynamic nature of the ecosystems encompassed within these boundaries will be described in the narrative criteria that will accompany the boundary language that is ultimately proposed for inclusion in rule.

Workshop participants also discussed several options for the delineation of Willard Spur in water quality standards (UAC R317-2), including: identifying Willard Spur as a water body in existing tables, designation as a subclass of Great Salt Lake designated beneficial uses, designation as a subclass of wetland uses (under development), designation as an entirely new aquatic life use, or some combination of these options. Regardless of which option is selected it was discussed that DWQ intends to apply the numeric water quality criteria currently assigned to protect the designated beneficial uses of (UAC R317-2-6) warm water fisheries (Class 3B) or for waterfowl, shorebirds and other water oriented wildlife (Class 3D), with the exception of parameters that are currently exceeded due to naturally occurring conditions (e.g., Dissolved Oxygen, pH).

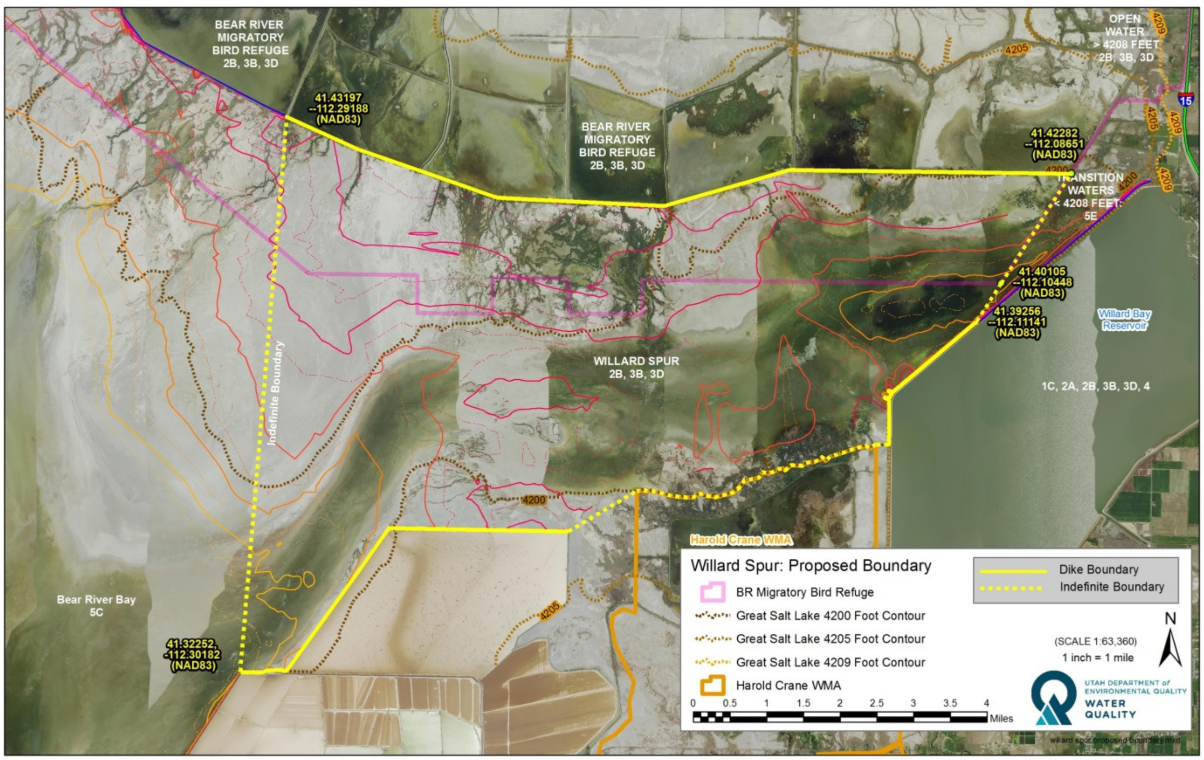
Description

Because the size of Willard Spur is constantly changing, the proposed boundaries of the spur are explicitly stated as approximate, to be interpreted based on the current ecological context, as follows:

> *A freshwater wetland estuary to Bear River Bay of Great Salt Lake contained within the following approximate boundaries: beginning at the northwest corner of the Great Salt Lake Minerals evaporation pond at the point described as 41.32252°N, -112.30182, thence northerly at a bearing of 3.90 degrees for 7.57 miles to the Bear River Migratory Bird Refuge (BRMBR) dike where the southern dike of BRMBR units 2 through 5 (at 41.43197°N -112.29188) intersects the road*

between units 2 and 3, thence easterly along the southern BRMBR dike to where it meets the BRMBR outer boundary at 41.42282° N, -112.08651, thence southwesterly along the BRMBR boundary on bearing 211.72° to the extreme southeastern corner of the refuge at 41.40105° N, -112.10448 and continuing on that same bearing until it intersects with the Willard Bay reservoir dike at 41.39256°N, -112.11141, thence southwesterly and then southerly along this dike to the northeast corner of Harold Crane state WMA thence westerly along the northern boundary of Harold Crane state WMA and an indefinite boundary to the northeast corner of the GSL Minerals evaporation pond, thence westerly, then southwesterly, and again westerly along the outer GSL Minerals dikes to point of beginning.

Map of Proposed Boundary



Conservation Targets, Nested Targets & Beneficial Uses

Introduction

The first step of CAP is to identify a set of Conservation Targets. Targets are typically delineated as a limited number of ecological systems, species or groups of species that are representative and protective of the full biodiversity in a focal conservation area. In conservation planning, these targets help define future conservation actions and associated goals. For DWQ, these targets are also useful for the development of water quality standards, because they help define those ecological elements that require protection in order to ensure the long-term biological integrity of the ecosystem—the beneficial uses of Willard Spur.

Conservation Targets for Willard Spur

Typically CAP determines which ecological systems represent an area's biological diversity and defines these targets spatially within the area —that is, a given ecosystem type is fixed in its location. However, Willard Spur changes dramatically over the course of a typical year (and also between wet and dry years) primarily due to high vs. low water inflows from the Bear and Weber River systems. Therefore, in the case of Willard Spur, the CAP targets were defined temporally—essentially from a predominantly high water, flowing condition where the water is quite fresh to a predominantly shallow, isolated, low to no inflow condition where the water is turning brackish. These two different ecological conditions provide habitat for different associated bird guilds, which are of greatest conservation interest in this ecosystem and represent its beneficial uses.

One challenge in defining conservation targets temporally is that the observed ecological transitions, from one state to the next, are not discrete. For instance the flowing condition could be further subdivided into the wintertime where Submerged Aquatic Vegetation (SAV) is largely absent and the growing season where SAV is a keystone assemblage in the ecosystem. Similarly, the low water condition gradually changes from an ecosystem with open water to one consisting almost entirely of mud flats. This challenge was addressed in several ways: First, interim ecological targets were chosen to focus on the periods of greatest ecological interest and sensitivity to human-caused stress, resulting in two focal targets: Submerged Wetlands System (high-water/open-water, active SAV growth) and Fringe Wetlands System (low-water/isolated, SAV senescent). Once these targets were selected, workshop participants were asked to identify important attributes at the "peak" of the target (i.e., height of growing season with SAV in peak condition for the year). Finally, a decision was made to exclude the increasingly rare instances where Great Salt Lake elevation exceeds ~4211 feet, potentially creating hypersaline conditions in the ecosystem. If this condition occurs in the future, its influence on the attributes and indicators in the CAP will need to be evaluated.

“Nested targets” are species or assemblages of particular ecological importance that depend on the health of the ecosystem targets. Utah’s Division of Natural Resources (DNR) has published two reports that can be used to define nested targets for Willard Spur. The *Wildlife Action Plan*[3] identified a list of species of greatest need including a list of several species of birds, mollusks and amphibians that should be given careful consideration in conservation planning efforts. In contrast, the *Great Salt Lake Waterbird Survey*[4] identified several species that are of regional or hemispheric importance. While these populations are not immediately threatened, conservation efforts should nevertheless attempt to ensure their protection due to the importance of Great Salt Lake wetlands in the maintenance of their populations.

A summary of the two targets, including a description, associated nested targets and beneficial uses in provided in the table below:

[3] https://wildlife.utah.gov/wap/Utah_WAP.pdf

[4] https://wildlife.utah.gov/gsl/waterbirdsurvey/RPT07Importance.htm

Target	Description	Nested Targets	Example of Beneficial Uses
Submerged Wetlands System	The predominantly high-water, open-water system when inflows are high—occurring from the end of Spring runoff until hydrologic isolation from Bear River Bay. The predominant wetland vegetation type during this period is submerged aquatic vegetation (SAV). SAV provides forage for waterfowl and waterbirds and habitat for their prey (e.g., macroinvertebrates and fish). Emergent wetland vegetation may also be present in shallower locations and provides both forage and shelter.	• Waterfowl: breeding and foraging habitat for important waterfowl populations. • Shorebirds: breeding and foraging habitat for significant shore-bird populations. • Waterbirds: Breeding and foraging habitat for colonial nesting birds and fish-eating birds. • For all bird guilds particular attention should be paid to species of special conservation concern[3] or otherwise noted as noteworthy avian resources[4].	Waterfowl, shore birds and other water-oriented wildlife including other ecologically important organisms in their food web.
Fringe Wetlands System (was named Unimpounded Marsh Complex in GSL Health Assessment)	The predominantly low-water, isolated, brackish system that occurs in drier years once Willard Spur becomes hydrologically isolated from Great Salt Lake until the end of the irrigation season when it begins to fill with water again. May include five emergent wetland habitat types: 1) wet meadow, 2) tall emergent marsh, 3) short emergent marsh, 4) hemi-marsh (half emergent vegetation and half open water), and 5) exposed mudflats. The submerged aquatic vegetation (SAV) typically dies off during this period.	• Waterfowl: foraging habitat for adjacent waterfowl populations • Shorebirds: foraging habitat for significant shore-bird populations (e.g., Black-necked Stilts and White-faced Ibis) • Waterbirds: foraging habitat • For all bird guilds particular attention should be paid to species of special conservation concern[3] or otherwise noted as noteworthy avian resources[4].	Waterfowl, shore birds and other water-oriented wildlife including other ecologically important organisms in their food web.

Next Steps

This initial iteration of the conservation targets assumes that the protection of the conditions necessary to maintain the health of these two targets will also be protective of the biota during periods of the year that fall outside of target periods. If future work reveals that protection of any nested targets requires conservation actions to protect specific conditions outside of these periods, then it may be necessary to augment or edit these targets for conservation planning purposes.

With respect to the development of water quality standards for Willard Spur, these targets will be used to inform the development of aquatic life beneficial uses.

Key Ecological Attributes & Indicators

Introduction

A foundational element of CAP is the identification of Key Ecological Attributes (KEAs), indicators, and a rating scale that are used to assess the current health of the Targets. KEAs are broad ecological characteristics that define healthy conditions for a conservation target. Indicators are more narrow elements of the KEA that are used to monitor and assess the status of KEAs. The intrinsic assumption is that the combined indictors identified for a KEA provide a reasonable representation of the condition of the KEA. While it is true that indicators often may not measure every component of a KEA, they are useful because they provide a cost-effective way to measure the status of a KEA on an ongoing basis. By analogy, while a cardiogram is a more complete representation of cardiovascular condition, doctors generally rely on important indicators (e.g., blood pressure, cholesterol, BMI) that can be routinely measured over time. Rating scales help interpret indicators by placing potential observations into condition classes. Rating scales are often refined over time as more information about natural or acceptable variation in the selected indicators is better understood.

There are several ways in which KEAs and their associated indicators can inform the development and interpretation of water quality standards for Willard Spur. Both can be used to help define language that describes desirable conditions—the "shalls", or the converse—the "shall nots"—for narrative water quality criteria. The rankings can then be used to inform the development of biological assessments that measure either support or non-support of aquatic life uses or narrative water quality criteria assigned to Willard Spur. However, before such assessments are conducted, DWQ will be required to develop and solicit comment on the assessment methods (UAC R317-2-7.3(c)), which will likely be more detailed than those initially developed through the CAP process.

KEAs and Indicators

Participants at the workshop divided into four break-out groups (two groups for each target) to refine the KEAs and indicators for Willard Spur's two targets/conditions: Submerged Wetlands Systems and Fringe Wetlands Systems. A summary table of the KEAs and indicators across the two targets is presented below, followed by detailed tables with preliminary narrative rating scales for each target.

KEA and Indicators	Submerged Wetlands System	Fringe Wetlands System
Hydrologic Regime - "Flushing flow," connection to Bear River Bay and/or flooded area & duration	☑	☑
Chemical Regime of Water & Sediment – Toxic substances and water chemistry	☑	☑
Nutrient Regime – Sediment nutrient concentrations and water clarity	☑	
Submerged Aquatic Vegetation – SAV cover and condition	☑	
Wetland Vegetation Composition – Characteristic native plant assemblage and absence of invasive species		☑
Wetland Habitat Types – Diversity of types		☑
Macroinvertebrates – Diversity, abundance and/or biomass	☑	☑

Rankings

Preliminary narrative ratings were presented by DWQ for several indicators, using the CAP scoring framework of Very Good, Good, Fair and Poor. These narrative ratings were discussed and refined at the workshop. Formal ratings of current health using these measures were not assessed, but the *workshop participants' consensus was that Willard Spur's key attributes ranged from Good to Very Good health*. This assessment is consistent with the conclusions of the Willard Spur Science Panel and suggests that management activities should focus on protection as opposed to restoration objectives.

The following tables reflect the discussions regarding the indicators and rankings for both targets. However, there were several suggestions on ways in which the rankings might be improved or made more specific (quantitative) as they are incorporated into future monitoring and assessment programs; the next steps to follow-up on these suggestions are summarized after each table.

Submerged Wetland System

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Rating
Hydrologic regime	"Flushing flow" to Bear River Bay	Willard Spur remains isolated from Great Salt Lake year-round	"Non-flushing", hydrologic connection occurs and/or does not occur every year	Sustained "flushing flow" occurs seasonally every year, even if isolated from Bear River Bay seasonally	Sustained "flushing flow" occurs throughout the year, even during years of extreme drought	Good
Chemical regime	Toxic substances	Presence at concentration that is acutely toxic to people, animal or plant life	Presence of a human-caused substance, or combination of substances, at a concentration that may be above chronic levels for people, animal or plant life	Meeting water quality standards, but some loss of assimilative capacity	All toxic substances are present at concentrations below water quality standards	Good
Chemical regime	Water Chemistry: pH and DO	An alteration >10% in comparison with the current 3-year average	An alteration of 5-10% in comparison with the current 3-year average	Maintained within 5% of current 3-year average	Greater than 5% improvement over current 3-year average.	Good
Macroinvertebrates	Diversity and Biomass	An alteration >10% in comparison with the current 3-year average	An alteration of 5-10% in comparison with the current 3-year average	Maintained within 5% of current 3-year average.	Greater than 5% improvement over current 3-year average.	Good/Very Good
Nutrient Regime	Sediment Concentrations	An alteration >10% in comparison with the current 3-year average	An alteration of 5-10% in comparison with the current 3-year average	Maintained within 5% of current 3-year average.	Greater than 5% improvement over current 3-year average.	Good

Nutrient regime	Water Clarity	TBD	TBD	TBD	TBD	Very Good
Submerged Aquatic Vegetation	SAV condition: Biofilm-Diatoms-Sediment (BDS), branch density, etc.	An alteration >10% in comparison with the current 3-year average	An alteration of 5-10% in comparison with the current 3-year average	Maintained within 5% of current 3-year average	Greater than 5% improvement over current 3-year average.	Good
Submerged Aquatic Vegetation	SAV condition: Leaf attachment	<30% of leaves attached	30-65% of leaves attached	66-89% of leaves attached	>90% of leaves attached	Good
Submerged Aquatic Vegetation	SAV cover	Peak SAV cover over very little (e.g. 25%) of Willard Spur following Spring runoff, but before hydrologic isolation from the Spur	Peak SAV cover over some (e.g. 50%) of Willard Spur following Spring runoff, but before hydrologic isolation from the Spur	Peak SAV cover over most (e.g. 75%) of Willard Spur following Spring runoff, but before hydrologic isolation from the Spur	Peak SAV cover over almost all (e.g. 90%) of Willard Spur following Spring runoff, but before hydrologic isolation from the Spur	Very Good

Next Steps for Submerged Wetland System

Considerable progress was made in the development of KEA, indicators and rankings at the workshop. However, these will likely be developed over time and tailored for specific conservation actions. For instance, indicator rankings used for long-term action plans may differ from those used by DWQ for assessment purposes. Workshop participants provided some direction with respect to potential future improvements, including:

- Understand and incorporate more specific information into the “flushing flow” KEA such as optimal depth and duration.
- If numeric criteria for pH and DO are not applicable due to naturally occurring wetland conditions and are removed, it may be worthwhile to explore available background data to see if current, ambient conditions can be used to develop narrative criteria for these parameters.
- Several condition ratings are benchmarked against current conditions, which are currently defined as a departure from the current 3-year average; however, this was used as an example and the appropriate way to account for natural variation should be explored.
- Specific measures of macroinvertebrate diversity and biomass should be explored. The Phytophylous Macroinvertebrate Index (PMI) may be a better measure of SAV condition than a measure of the importance of macroinvertebrates to the food web. Biomass may be more directly tied to bird populations.
- A measure of water clarity might be useful, but the metric to capture this with existing data should be explored.
- A relatively simple measure of SAV condition is a recently developed leaf attachment metric; however, given that this was not included in previous research, another measure of SAV condition may need to be incorporated until background conditions can be established.

Fringe Wetland System

Key Attribute	Indicator	Poor	Fair	Good	Very Good
Hydrologic regime	Connection to Bear River Bay	Willard Spur remains isolated from Great Salt Lake year-round	Hydrologic connection occurs only during periods of average or greater precipitation	Hydrologic connection occurs during most years	Hydrologic connection occur yearly, even duri years of extreme drought
Hydrologic regime	Flooded area and duration of dry conditions	Dry period begins too early in the season or multiple years of extended drying		Less that 25% of WS area flooded; drying begins mid-summer and showed inter-annual variability	
Chemical regime of water and sediment	Toxic substances	Presence at concentration that is acutely toxic to people, animal or plant life	Presence of a human-caused substance, or combination of substances, at a concentration that may be above chronic levels for people, animal or plant life	All toxic substances are present at concentrations below 3B/3D water quality standards	All toxic substanc are present at concentrations below 3B/3D wat quality standards
Wetland vegetation composition	Characteristic native plant assemblage	Invasive species, particularly *Phragmites*, is dominant and extensive			Native species dominant

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Rating
Macroinvertebrates	Diversity and abundance		Decrease in a TBD multi-metric index (MMI) score, loss of sensitive species	A TBD MMI score; presence of sensitive species and important nested target diet species		Good
Macroinvertebrates	Biomass			High macroinvertebrate biomass capable of supporting large populations of nested target species		Good
Wetland habitat types	Diversity of habitat types: open water, wet meadow, tall emergent marsh, short emergent marsh, and exposed mudflats	< 3 types present and in poor condition	3-4 types present	All 5 types present and cover is even	All 5 types present with large mudflat area	Very Good
Invasive species	Cover of invasive species (Phragmites, tamarisk, *Frankenia*, carp)	>30% invasive species cover	20-30% invasive species cover	10-20% invasive species cover	<10 % invasive species cover	Very Good

Next Steps for Fringe Wetland System

Unlike the Submerged Wetlands groups, the breakouts for this target were less specific in ratings and more time was spent discussing the KEA's that were most appropriate for the Fringe Wetlands System. The groups also recommended ways in which the ecological attributes of Fringe Wetlands could be improved as they are incorporated into beneficial uses and ultimately into future assessments, such as:

- The hydroperiod of the Willard Spur during the Fringe Wetlands phase is dynamic and at least three indicators of the hydroperiod should be considered: connectivity to Bear River Bay, flooded area or depth of water remaining in this phase, and the timing of drying and re-flooding.
- The diversity of habitat types in the Fringe Wetlands System is important. In good conditions, five different types of wetland habitat are present and evenness is high. In considering vegetation metrics, the dominant species of all wetland types, not just emergent species, should be assessed.
- When assessing toxic substances in Fringe Wetlands Systems, the criteria for 3B and 3D beneficial uses (warm-water fisheries and waterfowl and shorebirds) should be sufficient, but sediment concentrations need to be considered as water is not always present in this phase.
- Macroinvertebrate indicators will be important to figure out. The biomass of species present will determine the size of avian populations Willard Spur can support while macroinvertebrate diversity is an important indicator of the avian diversity the Spur can support. Given the diversity of wetland types expected in the Spur when it is in good condition, figuring out the appropriate multi-metric indices could quickly become complicated.

Potential Threats

After assessing current health, CAP then identifies potential Sources of Stress (in other words, threats) that could impair future health. Stresses are the inverse of the KEAs – the adverse ecological impacts. Sources are the potential human causes of the stress. The identification and prioritization of future threats is integral in helping to identify and prioritize those management actions that are most likely to be protective of the Willard Spur ecosystem. Similarly, these threats can also be used by DWQ to identify or prioritize statements that should be included in the narrative water quality criteria.

A full-blown CAP process typically takes a day to complete a comprehensive threat ranking assessment; since the Willard Spur workshop was compressed in time, a rapid threat assessment was done via voting by the participants, with the goal of developing strategies on the second day to address the four highest rated threats. Each participant was asked to indicate what they thought to be the five highest potential sources of stress that might emerge over the next decade. Four potential sources of stress stood out in the voting: *(1) altered hydrologic regime from large-scale water withdrawal; (2) altered hydrologic regime from other water resource management; (3) altered vegetation composition from invasive species (i.e., Phragmites); and (4) altered nutrients from other upstream sources* (i.e., other than from the Perry-Willard Regional Wastewater Treatment Facility).

Stresses	Change in wastewater treatment	**Large-scale water withdrawal**	Reservoir develop-ment	**Invasive species**	**Other upstream sources**	**Water resource management**	Land use changes
Altered hydrologic regime – flushing, timing, depth	3	**11**	2	1		**10**	3
Excessive toxicity	1				2		
Altered nutrients: algal mats, blooms, sediment	3	1			**6**		1
Reduced SAV cover or altered condition		3			1	1	
Altered vegetation composition				**8**			1
Altered or reduced wetland habitat types		1	1	4		2	
Reduced macro-invertebrate diversity, abund-ance or biomass		2		1			
N Voting=14	7	18	3	14	9	13	5

Strategies

The CAP process then develops strategies to address potential threats or to enhance the health of the conservation targets. Because Willard Spur currently was judged to be in overall good condition, the CAP strategies focused on protection as opposed to restoration objectives. The development of effective strategies is a challenging process that can take a full day or longer in a full-blown CAP process; again, for Willard Spur the process was abbreviated, with the goal of developing a credible first iteration of strategies. Four break-out groups met on the second day to develop strategies for the four highest-ranked potential threats.

Strategies include three elements: Objectives, Strategic Actions and Action Steps. The Objectives established by the break-out groups were as follows:

1. Ensure that potential large-scale water withdrawal does not cause adverse effect on flushing flows and water regime of Willard Spur.
2. Maintain a healthy hydrology (TBD) that maintains a resilient (TBD) Willard Spur.
3. Bring invasive species (Phragmites) from current levels (~10%) to less than 1% cover of entire Spur.
4. Maintain sediment nutrients within the range of current concentrations (e.g., within 5% of 3-year average) so as to not negatively affect key ecosystem attributes.
5. Maintain algal mats and harmful algal blooms within the range of current concentrations (e.g., within 5% of 3-year average) so as to not negatively affect key ecosystem attributes.
6. Integrate Great Salt Lake and *Willard* Spur conditions into Lower Bear River CAP goals

The Strategic Actions to achieve the first four Objectives, along with initial Action Steps, are presented in Appendix B.

Summary and Next Steps

DWQ staff discussed the process for developing and adopting narrative water quality standards for the Willard Spur wetlands, including circulating the workshop results and subsequent recommendations to the Willard Spur Steering Committee. Various questions, suggestions and issues were raised by participants over the course of the workshop, which DWQ staff will take under advisement as they proceed to develop the standards.

There was also consensus among workshop participants that the Willard Spur CAP be continued, including integration with the Bear River CAPs and follow-through on implementation of strategies. Bob Barrett, the manager of the Bear River Migratory Bird Refuge, who has been involved in ongoing CAP efforts on the Lower Bear River, offered to assist in continuing this process.

Appendix A – Willard Spur CAP Workshop Participants

Participant	Representing	Email
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Appendix B – Willard Spur CAP Workshop Strategies

	Objectives, Strategic Actions and Action Steps
Objective	**Ensure that potential large-scale water withdrawal does not cause adverse effect on flushing flows and water regime of Willard Spur**
Strategic action	Maintain and develop private-public partnerships among stakeholders -- FFSL, DWR(C), DWQ, DWR(I), USFWS, WFWQC, conservation groups, industry -- throughout planning and development process (2075).
Action step #1	Get the partnership group going with 3 to 6 months: (1) develop MOU to form partnership; (2) continue this CAP process; (3) secure funds to implement strategies (e.g. hydrology assessment)
Strategic action	Define/characterize the hydrologic regime needed to avoid adverse effects (e.g., spread of *Phragmites*, other stresses to KEAs) - flushing flows, timing, duration and quantity of water needed
Action step #1	Data acquisition and synthesis
Action step #2	Determine data gaps and follow-up with studies
Strategic action	Communicate to policy makers and decision makers the importance and need for action - also to the public and stakeholders
Strategic action	Secure policy change for instream flow water rights/ water conservation pool for conservation or ecological purposes (Governor's 50 year water plan mentions this)
Strategic action	Public education and outreach regarding presence/beauty/uniqueness of Willard Spur and water conservation
Objective	**Maintain a healthy hydology (TBD) that maintains a resilient (TBD) Willard Spur**
Strategic action	Define healthy hydrology - variability, flushing flow, base flow
Strategic action	Optimize BRMBR water management: monitor
Strategic action	Secure additional water rights
Strategic action	Manage consumptive use
Strategic action	Break down regulatory barriers - e.g. siloed quantity and quality management
Strategic action	Define and maintain water budget and models - GSLIM; consider climate change

Appendix B – Willard Spur CAP Workshop Strategies

	Objectives, Strategic Actions and Action Steps
Strategic action	Integrated water resource management
Strategic action	Promote societal values of Great Salt Lake and Willard Spur
Objective	**Bring invasive species (particularly *Phragmites*) from current levels (~10%) to less than 1% cover of entire spur**
Strategic action	Coordinate with UDWR (Harold Crane WMA), USFWS (Bear River Refuge), and FFSL (sovereign lands) to ensure Willard Spur is treated within each agency's annual herbicide treatments.
Action step #1	1. Get Willard Spur in the UDWR, USFWS, and FFSL Phragmites spraying rotation
Action step #2	2. Figure out who represents the Spur going forward.
Action step #3	Note: This strategy Includes coordinating water management with UDWR and USFWS to try to prevent additional seeds from coming in and allowing equipment access.
Strategic action	Get a representative for the Willard Spur to invasive species working group meetings to get the most up-to-date science on treatment and restoration strategies.
Strategic action	Develop an active monitoring and detection strategy to find new species and expanding Phragmites.
Strategic action	Address the State of Utah burning policy, which currently prevents UDWR and USFWS from burning as much as they need to.
Objective	**Maintain sediment nutrients within the range of current concentrations (e.g., within 5% of 3-year average) so as to not negatively affect key ecosystem attributes (KEAs)**
Strategic action	Determine nutrient levels needed to maintain KEAs
Strategic action	Continue implementation of Lower Bear River TMDLs
Strategic action	Adaptively manage POTW and BRMBR waters to maintain KEAs
Strategic action	Explore conditions at other terminal lakes
Objective	**Maintain algal mats and toxic algal blooms within the range of current concentrations (e.g., within 5% of 3-year average) so as to not negatively affect key ecosystem attributes (KEAs)**

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