UTAH DEPARTMENT *of* ENVIRONMENTAL QUALITY

WATER QUALITY

Development of Statewide Water Quality Standards for Utah Wetlands

Project Summary for Wetland Program Development Grant FY2016-17 CD-96852601

TABLES AND FIGURES

FREQUENTLY USED ABBREVIATIONS

ADR – Antidegradation Review

CAP – Conservation Action Planning

DO – Dissolved oxygen

EPA – Environmental Protection Agency

GSL – Great Salt Lake

KEA – Key Ecological Attribute

SAV – Submerged aquatic vegetation

TMDL – Total Maximum Daily Load

TNC – The Nature Conservancy

UAA – Use Attainability Analysis

UAC – Utah Administrative Code

UDWQ – Utah Division of Water Quality

UGS – Utah Geological Survey

WPDG – Wetland Program Development Grant

WQS – Water Quality Standards

INTRODUCTION

The goal of the Utah Department of Environmental Quality-Utah Division of Water Quality (UDWQ) FY16-FY17 Wetland Program Development Grant (WPDG) was to develop a designated use category and appropriate narrative criteria for Utah wetlands based on previously developed water resource and wetland planning tools. The project described here addresses the Water Quality Standards component of the Environmental Protection Agency's (EPA) Core Elements Framework (EPA, 2009). Two tasks were completed in support of this goal. First, Conservation Action Planning meetings gathered feedback from stakeholders on wetland classes to be included in water quality standards (WQS), measureable characteristics of those wetlands, and the major threats to wetlands. Second, UDWQ benchmarked Utah's standards against those of other states, regions, and tribes to develop implementation strategies for updating Utah's WQS based on stakeholder input and other state's experiences. A third, related objective was to update Utah's five-year Wetland Program Plan through 2023, which was accepted by the EPA in December, 2017 (UGS and UDWQ, 2017).

This document is the WPDG project deliverable that summarizes Conservation Action Planning (CAP) meetings, Water Quality Standard benchmarking, and proposed wetland water quality standards for Utah.

The following outputs were anticipated from the work in this proposal and reported here:

1. Development of a Wetland Water Quality Standard Strategy document describing the stakeholder-supported process (see pages 14-27 in this report and UDWQ, 2018b)
2. Stakeholder-supported definitions of major wetland classes statewide translated into wetland designated use classes (see pages 51-52)
3. Use-specific narrative and/or numeric water quality criteria for at least two wetland classes that are incorporated into a stakeholder-supported assessment framework (see page 52)
4. Plan for development of Assessment Frameworks for the remaining statewide wetland classes (see page 54)

Several Environmental Outcomes were anticipated to come from the work in this proposal, including:

1. Improved communication among individual stakeholders and stakeholder groups in support of consistent WQS for wetlands
2. Increased appreciation among stakeholders for the diversity of wetlands and desired wetland conditions in Utah
3. Greater diversity of stakeholders engaged in statewide wetland discussions
4. Improved alignment of voluntary conservation and regulatory activities across agencies, providing for establishment of consistent water quality goals
5. Increased understanding of how Utah's WQS and assessment tools are developed
6. Incorporation of wetland WQS into state rules

Water quality standards (WQS) are goals for a body of water and have three main components: beneficial uses, criteria, and antidegradation. Designated beneficial uses specify the goals and expectations for how the water body is used. Water quality criteria describe the minimum level of water quality that must be maintained in order to protect the beneficial use. Numeric criteria specify the maximum concentration of specific pollutants allowable for a water body while narrative criteria describe the desired condition of a water body in terms of the unallowable pollution or ambient conditions to maintain (EPA, 2018a). All Waters of the State of Utah are protected from pollutant discharges that affect water quality by Narrative Standards (see Utah Administrative Code (UAC) R317-2-7.2). Broadly, discharges shall not become offensive or cause undesirable conditions for human health or aquatic life. In addition, some particularly sensitive classes of waters are further protected from deleterious effects of specific pollutants by application of Numeric Criteria to designated (beneficial) uses for that water body. Antidegradation rules define the allowable level of deviation of water quality from ambient or reference conditions for broad water body classes or geographic areas.

The Clean Water Act requires states to establish WQS for all waters within the state. For a variety of scientific, regulatory, and management reasons, WQS for wetlands have developed more slowly than for lakes and streams, most notably because of confusion about whether and which wetlands count as waters protected by the Clean Water Act and because highly variable conditions within wetlands that make establishing water quality criteria difficult. Several biological definitions of wetlands exist and all focus on three features: shallow flooding or saturated soils, hydrophytic vegetation, and hydric soils (Brinson, 1993; Mitsch and Gosselink, 2015; Smith et al., 1995). Legal definitions are more narrow than biological definitions, often requiring all three features (water, soils, and vegetation) to be present for specific times, which exclude some types of sparsely vegetated and ephemeral wetlands (USACE, 2008).

The dynamic and diverse nature of wetlands makes them highly productive ecosystems that supply critical ecosystems services. Wetlands provide habitat for migratory birds, refuge for fish, recreation opportunities for people, and within watersheds healthy wetlands can enhance downstream water quality, attenuate floods, and mitigate droughts (Mitsch and Gosselink, 2015). Wetlands often lie between deeper aquatic systems like lakes and rivers and dry uplands and have characteristics of both. Determining which wetlands are aquatic enough to be considered Waters of the State or have strong enough influences on classified waters is an ongoing source of research and federal rule making, though the science is clear: wetlands have a strong impact on downstream water quality (EPA, 2015).

To help states develop WQS for the diverse variety of wetlands throughout the nation, the EPA (2018b) has identified five steps to apply WQS to wetlands:

1. Define wetlands as Waters of the State
2. Designate uses for all wetlands
3. Adopt aesthetic narrative and appropriate numeric criteria protective of wetland uses
4. Apply biological criteria to assess wetlands are attaining their use
5. Apply antidegradation policy and implementation methods to wetlands

Some of Utah's current WQS apply to some portions of wetlands, so rather than starting from scratch, the goal of this project is to develop a wetland-specific designated use and narrative water quality criteria more clear and appropriate for Utah's wetlands.

Applying WQS to Utah wetlands has been challenging for many reasons. First, wetlands (especially wetlands in the desert) have highly variable seasonal flooding, changing within and between years, which makes measuring water quality and determining natural conditions difficult (UDWQ, 2015). Due to dynamic hydrology, wetland area and habitat type shift between years according to water availability so wetland type classifications could change over time. Biological assessment methods to monitor the ability to support current uses in wetlands are in the process of being tested in some types of wetlands in Utah (UDWQ, 2016). Finally, it is likely that declines in water quality in wetlands are often due to "pollution" rather than individual "pollutants." A pollutant is a single, measurable parameter like salinity or lead, while pollution refers to harmful changes in the chemical, physical, or biological integrity of an ecosystem (Kusler and Christie, 2012). For example, selenium is a pollutant with numeric criteria: selenium concentration of 4.6 milligrams per liter of water or more violates Utah's aquatic life criteria because selenium higher than 4.6 mg/l can cause deformities in waterfowl embryos. Harmful algae blooms are a type of pollution that has a variety of effects and is measured in many ways, from bacterial cell counts to chlorophyll-a concentration, and caused by multiple changes, including elevation nutrient pollution, hydrologic changes, and elevated temperature.

Since 2004, UDWQ has been conducting work with WPDG funds on research and stakeholder engagement in support of developing WQS for Utah wetlands. This WPDG project utilizes the existing research conducted in Utah wetlands, stakeholder knowledge, and examples from other states to develop strategies for implementing our own WQS. Specifically, we used CAP meetings and benchmarking with state and tribal WQS to address the following questions:

- What are the dominant wetland classes that are considered Waters of the State?
- What are the physical, chemical, and biological characteristics of dominant wetland classes, including major functions, services and values that support development of a specific Wetland Designated Use category?
- What are the potential future stresses and how can these systems be best protected?

UTAH WETLANDS AND WATER QUALITY STANDARDS

Utah is the 2nd driest state in the United States, so it doesn't have many wetlands. In fact, wetlands represent just 1% of total land area but support a much larger diversity of resident and migratory wildlife (Emerson and Hooker, 2011). The majority of Utah's wetland area is found around Great Salt Lake (GSL) where the Bear, Weber, and Jordan River deltas form critical stopover habitat for migratory waterfowl and shorebirds (Wilsey et al., 2017). Millions of migratory birds from more than 260 species visit GSL wetlands every year. Outside GSL, wetlands are not as concentrated but remain important ecosystems. High elevation meadows, fens, and riparian wetlands protect water quality and provide habitat for rare wildlife species like boreal toads (Menuz et al., 2016). In desert regions, spring-fed wetlands are important refugia for birds, mammals, and rare macroinvertebrates (Jones et al., 2014).

Utah wetlands face threats from decreased water availability, impaired water quality, invasive species, and land use changes caused by growing shifting populations (UDWQ, 2014b). GSL wetlands, which are located at the terminus of large watersheds, experience changes in the timing and amount of water available as rivers have been appropriated and diverted (Wurtsbaugh et al., 2016). Additionally, GSL wetlands are located downstream of the Wasatch Front, where most of Utah's population lives, and receive treated wastewater and sporadic storm water discharges associated with dense development. Where populations are less dense, West Desert and high elevation wetlands experience impacts from cattle grazing, mining, and water diversions (EPA, 2016; Menuz et al., 2016). Invasive species, especially introduced plant species, also threaten all wetland ecosystems and the functions they provide (Long et al., 2017; Rohal et al., 2018). The relative scarcity of wetlands in Utah makes the functions they provide even more valuable, so protecting wetlands in a comprehensive and consistent way is important.

The following sections detail what Utah WQS currently exist, found in Utah Administrative Code (UAC, 2017) R317: Environmental Quality, Water Quality, and where regulations need to be updated to consistently protect wetland water quality.

Utah Wetland Definition

The definition of Waters of the State found in the Definitions and General Requirements section (R317-1) does not include the term wetlands, though it does include "marsh" and "pond," which are common terms for two types of wetlands.

> "Waters of the state" means all streams, lakes, ponds, marshes, water-courses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private,

which are contained within, flow through, or border upon this state or any portion thereof, except that bodies of water confined to and retained within the limits of private property, and which do not develop into or constitute a nuisance, or a public health hazard, or a menace to fish and wildlife, shall not be considered to be "waters of the state" under this definition (UAC R317-1-1).

While wetlands are not explicitly included as Waters of the State, GSL impounded wetlands are defined in UAC as "wetland ponds which have been formed by dikes or berms to control and retain the flow of freshwater sources in the immediate proximity of Great Salt Lake (UAC R317-1-1)."

Outside the general statute definitions, the rules for the Utah Pollution Discharge Elimination System (UAC R317-8) append the definition of Waters of the State with, "Waters of the State includes "wetlands" as defined in the Federal Clean Water Act" (UAC R317-7-1.5(59))." UPDES code also defines wetlands as:

> [...] those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (UAC R317-8-1.5 (60))

Utah Designated Beneficial Uses

Currently Utah has five designated beneficial use categories: water source for domestic systems, recreational use and aesthetics, aquatic wildlife, agricultural use, and Great Salt Lake (UAC R317-2-6). Within those five categories are 14 subcategories of beneficial uses. Utah WQS apply designated beneficial uses to some wetlands according to geographic location or ownership as seen in **Figure 1**.

- The Transitional Lands of Great Salt Lake use (5E) applies to all lands (mostly wetlands) adjacent to GSL below an elevation of 4,208 feet. Wetlands that support the 5E use are 'Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain (UAC R317-2-6.5 e).'
- Wetlands within three national wildlife refuges (Bear River, Fish Springs, and Ouray) as well 12 state waterfowl management areas (Farmington Bay, Brown's Park, Clear Lake, Desert Lake, Harold Crane, Howard Slough, Locomotive Springs, Powell Slough, Public Shooting Grounds, Salt Creek, Stewart Lake, and Timpie Springs) are all classified to support secondary contact recreation (Class 2B), and two aquatic life uses: warm-water (3B), cold-water (3A) or non-game (3C) fisheries and waterfowl and shorebirds (3D). The fishery use and criteria depend on the specific area and were chosen by wildlife managers (UAC R317-2-13.11).
- According to the rules for unclassified waters (UAC R317-2-13.13), the remaining Utah wetlands that are Waters of the State support secondary contact recreation (2B) and waterfowl, shorebirds, and other water-oriented wildlife (3D). However, it presumptive, rather than explicit, that wetlands are considered Waters of the State, leaving many important, privately owned wetland complexes like hunting clubs, mitigation lands, and TNC lands with implicit, default water quality standards, which causes confusion for the regulated community. Furthermore, default 2B/3D uses may not be the appropriate uses for wetlands.

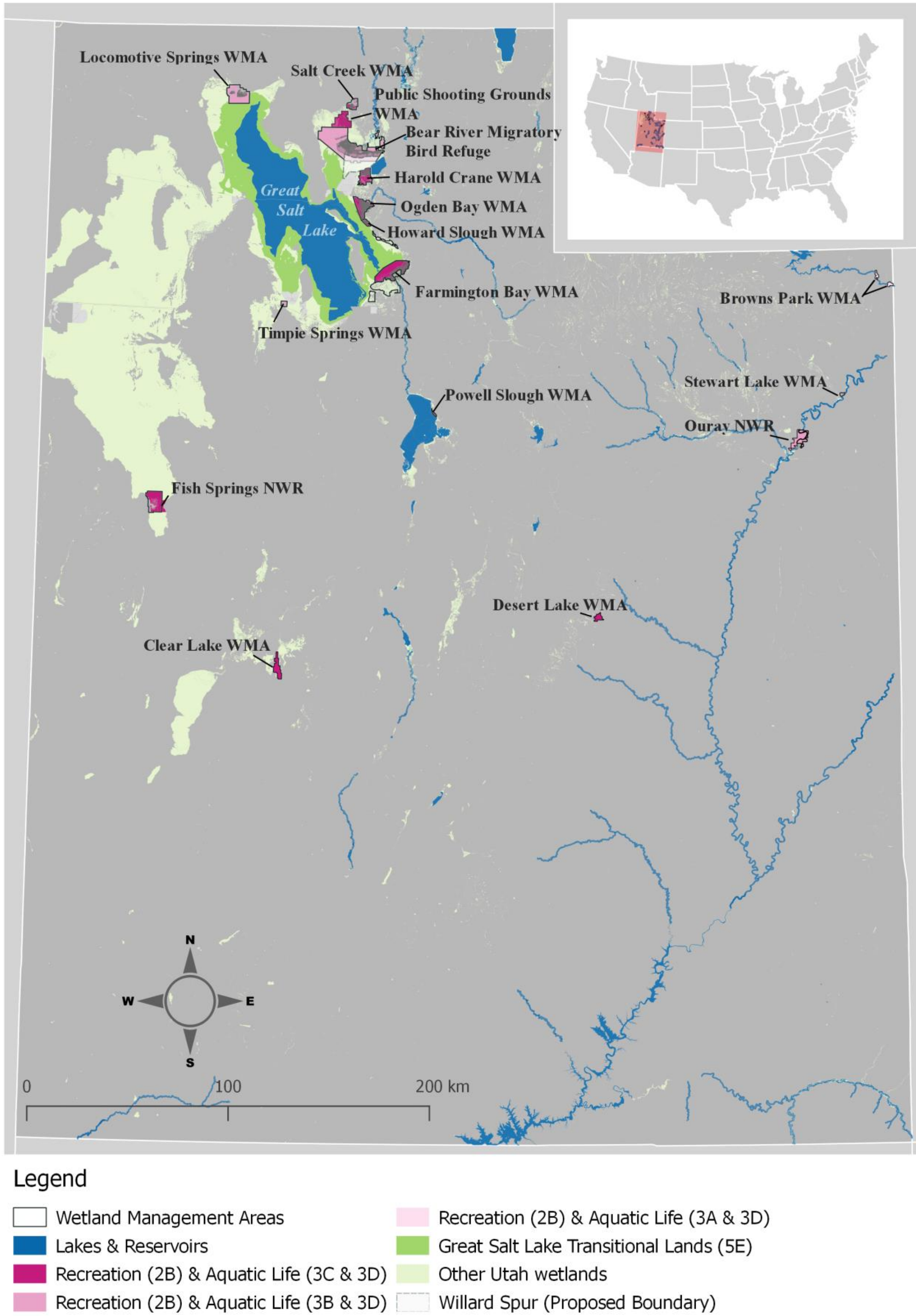


Figure 1. Designated beneficial uses applicable to Utah wetlands according to UAC R317-2-13.11

A single wetland-specific beneficial use applicable to all wetlands, the goal of this project, would clear up confusion on the part of regulators about what WQS apply to wetlands, provide certainty to the regulated community, and improve conservation of important wetland ecosystems.

Utah Water Quality Criteria

Utah has a narrative standard applicable to all Waters of the State that prohibits degradation to aesthetics, the development of toxic conditions, and change to the biological community:

> It shall be unlawful, and a violation of these rules, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures; or determined by biological assessments in Subsection R317-2-7.3 (UAC R317-2-7.2).

Numeric criteria for bacteriological, physical, inorganic, and organic pollutants have been developed for the recreation and aquatic life uses that state and federally-managed wetlands support (UAC R317-2-14). However, aquatic life criteria contain footnote 2a which excludes applying aquatic life dissolved oxygen (DO) and pH criteria to GSL impounded wetlands until ecological integrity assessment methods have been developed (UAC R317-2- Table 2.14.2). Due to their dynamic hydrology (cycling between flooded and dry stages) and high biological productivity, conditions in wetland may naturally exceed water quality criteria developed for other aquatic ecosystems, especially criteria for pH, DO, and nuisance algae, yet failing to apply some numeric criteria may leave systems vulnerable to impacts from pollution. Narrative criteria are an option to protect water quality in complicated and dynamic ecosystems because they are broad enough to describe a range of acceptable natural conditions and address the types of stressors relevant to wetlands (like drought and physical modifications), rather than discrete pollutants.

Utah Antidegradation

The goal of Utah's antidegradation policy is to protect existing uses of state waters and maintain high-quality waters. Utah has three antidegradation categories, Category 1 waters receive the most stringent protections and Category 3 waters have the most permissive permitting rules. Ambient conditions must be maintained in Category 1 waters, thus no discharges that would alter a water body's assimilative capacity are allowed. Limited or temporary discharges are allowed in Category 2 waters, which have modest amounts of assimilative capacity available for consumption by point-source discharges. All other waters fall under Category 3 rules, which allow some discharges and degradation in water quality (UAC R317-2-3).

Antidegradation reviews (ADR) are required as part of water quality permitting processes to ensure that permitted actions do not unnecessarily impair water quality and that steps to mitigate water quality impacts are taken. An ADR accounts for the costs and benefits of a proposed project. A Level I review is the initial level of review and requires that any proposed activity not impair the water quality uses supported by a water body (i.e., the existing uses of a water body). In waters where water quality is better than the criteria for the designated uses it supports, a more involved Level II ADR is required. Level II reviews require stating economic and social importance of proposals, determining water quality parameters of concern, analyzing alternative actions, and public notification (UDWQ, 2019).

Utah Wetland Monitoring and Assessment

This project and subsequent standards are built on many years of WPDG-supported monitoring projects and UDWQ studies. Significant resources have been expended specifically to monitor and assess GSL wetlands in support of updating Utah's water quality standards. Utah's biological assessment rules state:

> Quantitative biological assessments shall use documented methods that have been subject to technical review and produce consistent, objective and repeatable results that account for methodological uncertainty and natural environmental variability (UAC R317-2-7.3.c).

A footnote in UAC specifically addresses monitoring in wetlands, stating:

> These criteria [dissolved oxygen for aquatic life] are not applicable to Great Salt Lake impounded wetlands. Surface water in these wetlands shall be protected from changes in pH and dissolved oxygen that create significant adverse impacts to the existing beneficial uses. To ensure protection of uses, the Director shall develop reasonable protocols and guidelines that quantify the physical, chemical, and biological integrity of these waters. These protocols and guidelines will include input from local governments, the regulated community, and the general public. The Director will inform the Water Quality Board of any protocols or guidelines that are developed (UAC R317-2 Table 2.14.2 Footnote 2a).

The first wetland monitoring work at UDWQ was developed in response to stakeholder concerns that nuisance algae growth was harming wetland-dependent bird habitat (Miller and Hoven, 2007). Three rounds of impounded wetland assessments – a targeted sample of Farmington Bay wetlands, a probabilistic survey of GSL-wide impoundments, and a survey of reference impoundments in the wider GSL desert watershed – have resulted in a four-part assessment method that relies on key features of nuisance algal mats, submerged aquatic vegetation (SAV), variations in water chemistry, and the abundance and composition of aquatic macroinvertebrates (UDWQ, 2014b). However, detecting thresholds in water quality that lead to expansive algal mats or declines in SAV condition has been elusive due in part to the confounding effects of dynamic wetland hydrology, the rapid life cycle of algae, and active wetland management activities (UDWQ, 2015). Potential issues with eutrophication also drove an intensive study of one GSL wetland complex, the Willard Spur portion of Bear River Bay. Results of that study found that Willard Spur wetlands have a high capacity for nutrient cycling, but that they are sensitive to decreases in water availability that may lead to diminished water quality and nutrient-related functions (UDWQ, 2017).

Assessments of impounded wetlands and the Willard Spur, and existing WQS for GSL wetlands, have historically focused on the most permanently flooded wetland type, which is most sensitive to and threatened by water quality impairments. As our understanding of wetland complexes has improved through WPDG programs, UDWQ has begun the process of evaluating other wetland types and seeks to address the most important classes of Utah wetlands both within and outside of the GSL watershed. Initial surveys of fringe wetlands – expansive herbaceous wetlands outside impoundments – identified potential plant-community indicators of wetland condition, a critical step toward developing an assessment method for a new wetland class (UDWQ, 2016).

The Utah Geological Survey (UGS), UDWQ's partner in the Utah Wetlands Program, has conducted detailed studies of hydrology in West Desert spring-fed wetlands, high-elevation boreal toad habitat, and spring snail abundance in wetlands. Wetland monitoring conducted by UGS addresses potential reference quality wetlands to anchor GSL wetland assessments, characterization of Utah's wetland hydroperiods, linking wetland condition to habitat quality for sensitive aquatic species, and the impacts of water withdrawal. UGS is also responsible for updating Utah's wetland inventory, including determining dominant wetland classes. Rapid functional wetland assessments developed by UGS also provide much needed information on the stressors relevant to Utah's wetlands. Through this collaboration, UGS has identified important classes of wetlands and landscape-level threats, providing the groundwork for UDWQ to conduct intensive wetland monitoring projects on the ecological characteristics of the most important wetland types. As Utah's wetland WQS are developed, monitoring and assessment in wetlands can be targeted specifically at developing quantitative and repeatable biological assessment methods that can be used in 305(b) Integrated Reports and address numeric DO criteria.

Expected Outcomes

Given the number of unknown factors with regard to wetlands and water quality and the urgency with which EPA would like Utah to address WQS, UDWQ chose to conduct CAP Meetings and research other state and tribal wetland WQS in order to update Utah rules in a timely and comprehensive way.

UDWQ developed three products from this project:

- Background materials on how wetland WQSs can be applied in Utah and an integrated stakeholder response to these scenarios (see pages 27-48).
- Report, including conceptual models, CAP workbook and workgroup summaries, describing key definitions, the structure for WQS for wetlands, proposed wetland designated uses based on dominant wetland classes, and proposed water quality criteria for at least two wetland classes (see pages 12-26 and Appendix A).
- Utah's Wetland Program Plan (WPP) update through 2021. The Utah's WPP for 2018 to 2023 was approved by the EPA and can be found online (UGS and UDWQ, 2017).

Improving Utah's WQS for wetlands will improve UDWQ's regulatory abilities by providing a baseline for evaluating impacts to wetland water quality, identifying what condition assessment data is needed, maintaining momentum in developing assessment methods, and ultimately 305(B) Integrated Report monitoring.

CONSERVATION ACTION PLANNING MEETINGS

UDWQ hosted a set of Great Salt Lake Wetlands Conservation Action Planning Workshops on March 21-22, 2018 and May 23-24, 2018 at the Utah Department of Environmental Quality in Salt Lake City, Utah. Thirty-seven participants representing 20 agencies and organizations with a high level of interest in conserving GSL wetlands took part in the meetings (**Appendix A**). Meeting participants brought expertise in a wide range of subjects, including wetland science and management, natural resource monitoring and assessment, and law and policy practitioners.

The objectives of the workshops were three-fold:

1. Provide hands on advice and assistance to UDWQ on developing narrative water quality standards for GSL wetlands beneficial uses.
2. Help stakeholders understand UDWQ's regulatory authority for protecting wetland water quality at GSL.
3. Explore other conservation action strategies – beyond water quality standards – that might be developed and applied by stakeholders to enhance GSL wetland health and/or to abate potential future threats to beneficial uses.

Conservation Action Planning

Conservation Action Planning (CAP) is a process initially developed by The Nature Conservancy (TNC) that has been used to tackle a variety of conservation issues across the globe (TNC, 2007). CAP is a 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 in Utah for the Bear River and Willard Spur. The CAP framework focuses on five steps:

1. Identify conservation targets (ecosystems or species)
2. Assess conservation target health based on key ecological attributes
3. Assess stress and sources that threaten target health
4. Develop conservation strategies
5. Measure success

Some CAP terminology used in this report includes:

- **Targets** are the ecosystems or species to conserve through CAP
- **Nested Targets** are the species or assemblages that depend on the health of the ecosystem's *targets*
- **Key Ecological Attributes** (KEA's) are the processes or traits that are important to the long-term health of *targets*
- **Indicators** are the measurable characteristics of *ecological attributes*
- **Rating scales** are the narrative interpretations of *indicators* that describe very good, good, fair, and poor condition classes
- **Health** is the integrity or viability of a target or nested target
- **Rankings** are the *health* categories of each target: very good, good, fair, and poor

- **Stresses** are those things that negatively impact key ecological attributes, thereby impairing the *health* of targets
- **Sources** are the causes of *stress* (e.g., if altered hydroperiod is a stress, upstream water use might be a source)
- **Strategies** are courses of action with specific objectives that decrease threats or increase target viability

Greg Low of Applied Conservation, who played a leading role developing the CAP methodology, facilitated the GSL Wetlands workshops. **Figure 2** illustrates the steps in the CAP process and their anticipated alignment with the features of wetland WQS.

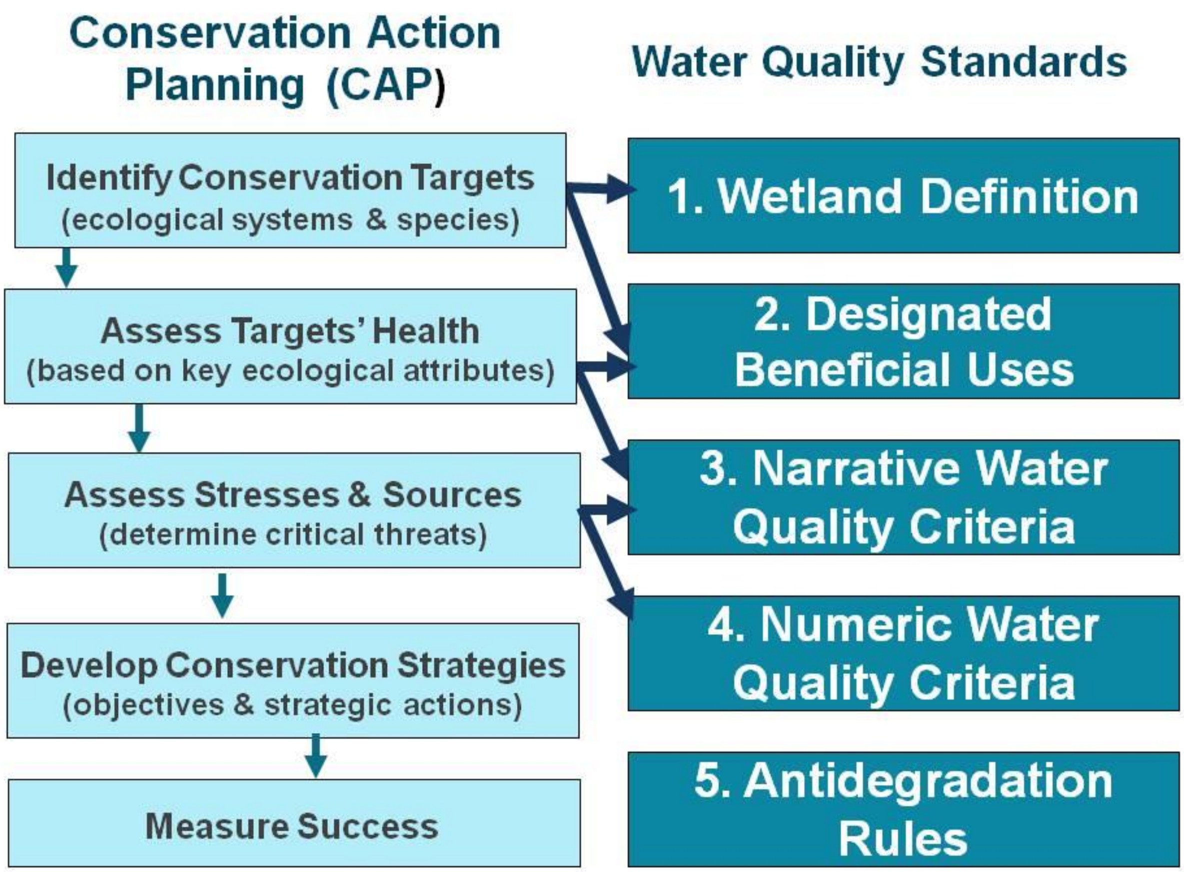


Figure 2. Steps in Conservation Action Planning (left-side column) and the anticipated water quality standards features (right-hand side) associated with each step.

Background Materials

In preparation for the 2018 CAP meetings, which were more abbreviated than a traditional CAP, UDWQ gathered background materials from multiple sources to inform discussion of targets, attributes, and threats and how those could inform wetland WQS. Three previous CAP processes laid the ground work for an expedited GSL wetland CAP with the specific wetland WQS goals we had. Early CAP processes provided important information on points of agreement and conflict as well as issues that required more data to be addressed. Previous CAPs also highlighted the range of interests relevant to GSL wetlands which helped in compiling a list of stakeholders to include.

1. The Definition and Assessment of Great Salt Lake Health was conducted in 2011-2012 for the Great Salt Lake Advisory Council (SWCA Environmental Consultants and Applied Conservation, 2012). This science-based assessment divided GSL into 12 targets, including three wetland targets. The Science Panel concluded that GSL was generally in good health and was supporting migratory birds, brine shrimp, and stromatolites; however, there was high uncertainty about the health of wetland targets.
2. A one-day follow-up Great Salt Lake Wetlands CAP was conducted in 2015 that elaborated on the KEA's and indicators of three wetland targets: impounded wetlands, fringe wetlands, and playa/mudflats (UDWQ, 2017). Participants developed hydrologic, physical, biological, and chemical indicators for each wetland target and highlight several issues that needed to be researched further.
3. A two-day Willard Spur CAP workshop was held in January, 2018. The Willard Spur is a large wetland complex at the northern end of GSL where a three-year intensive study of ambient wetland conduction was conducted. The CAP meetings followed up on recommendations from Willard Spur Science and Steering Panels. The CAP meetings found that while the indicators of health differed for the Willard Spur when it was in the flooded state vs. a drawdown summer state, overall the Willard Spur is in good health (Applied Conservation and UDWQ, 2018).

UDWQ used the outcomes from these meetings to assemble a draft list of targets, nested targets, and KEA's. We then brought together UDWQ studies, regional agency and university reports, and broad peer-reviewed wetland ecology studies that would support further development of KEA's, indicators, and ratings. UDWQ studies included data on ambient water quality and biological communities in GSL wetlands. Local management plans identified the avian nested targets and long-running issues in wetland management. Peer-reviewed literature was helpful in identifying links between stressors and health, particularly nutrient cycles and the science of playa wetlands.

Together the results of early CAPs provided a framework for classifying and assessing GSL wetlands and highlighted issues of persistent concern and uncertainty. In preparation for the GSL Wetland WQS CAP, UDWQ compiled the data we have gathered, studies from state and federal wildlife agencies, and peer-reviewed literature to support further definition of wetland classes, the characteristics of health in each class, and the major threats to wetlands.

Conservation Targets, Nested Targets & Beneficial Uses

The geographic scope of these CAP workshops encompassed the wetlands of Great Salt Lake (GSL), which account for 75% of the wetlands in the state of Utah, encompassing approximately 425,000 acres of freshwater and brackish wetlands (Emerson, 2014). Wetlands are located primarily below an elevation of 4,218 feet where the deltas of the Bear, Weber, and Jordan Rivers meet the flat bed of GSL (**Figure 3**). The area wetlands cover expands and contracts according to the elevation of GSL; when GSL water level declines the area of wetlands expands. These wetlands are distributed primarily across three bays: Bear River Bay, Ogden Bay and Farmington Bay. They include both publicly and privately managed lands. Public lands include the federal Bear River Migratory Bird Refuge and several state Waterfowl Management Areas (WMA's). Private lands include nature preserves managed by TNC and the Audubon Society, as well as numerous private hunting clubs and other ownerships.

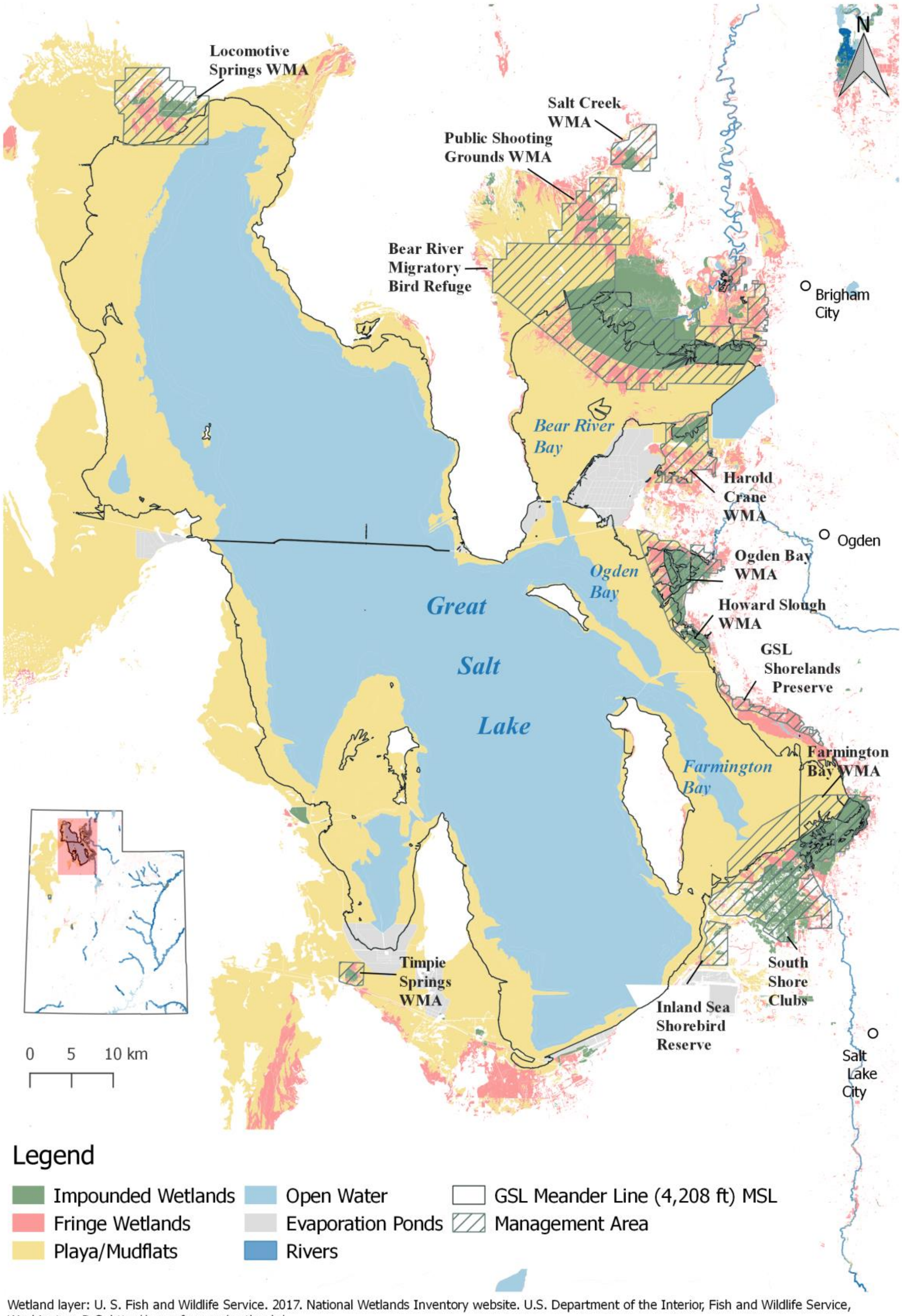


Figure 3. Great Salt Lake wetland targets: impounded, fringe, and playa/mudflat wetlands.

The first step in the CAP process is to determine which ecological systems represent an area's biological diversity and define these targets spatially within the area. Conservation 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 UDWQ, these targets are also useful for the development of WQS, 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 the GSL wetlands. Different types of wetland ecosystems provide habitat for different bird guilds, which are of greatest conservation interest at GSL and represent its primary water quality beneficial uses. Three broad types of wetland ecosystems were identified in previous CAP workshops as the focal conservation targets: Impounded Wetlands, Fringe Wetlands, and Playa/Mudflats.

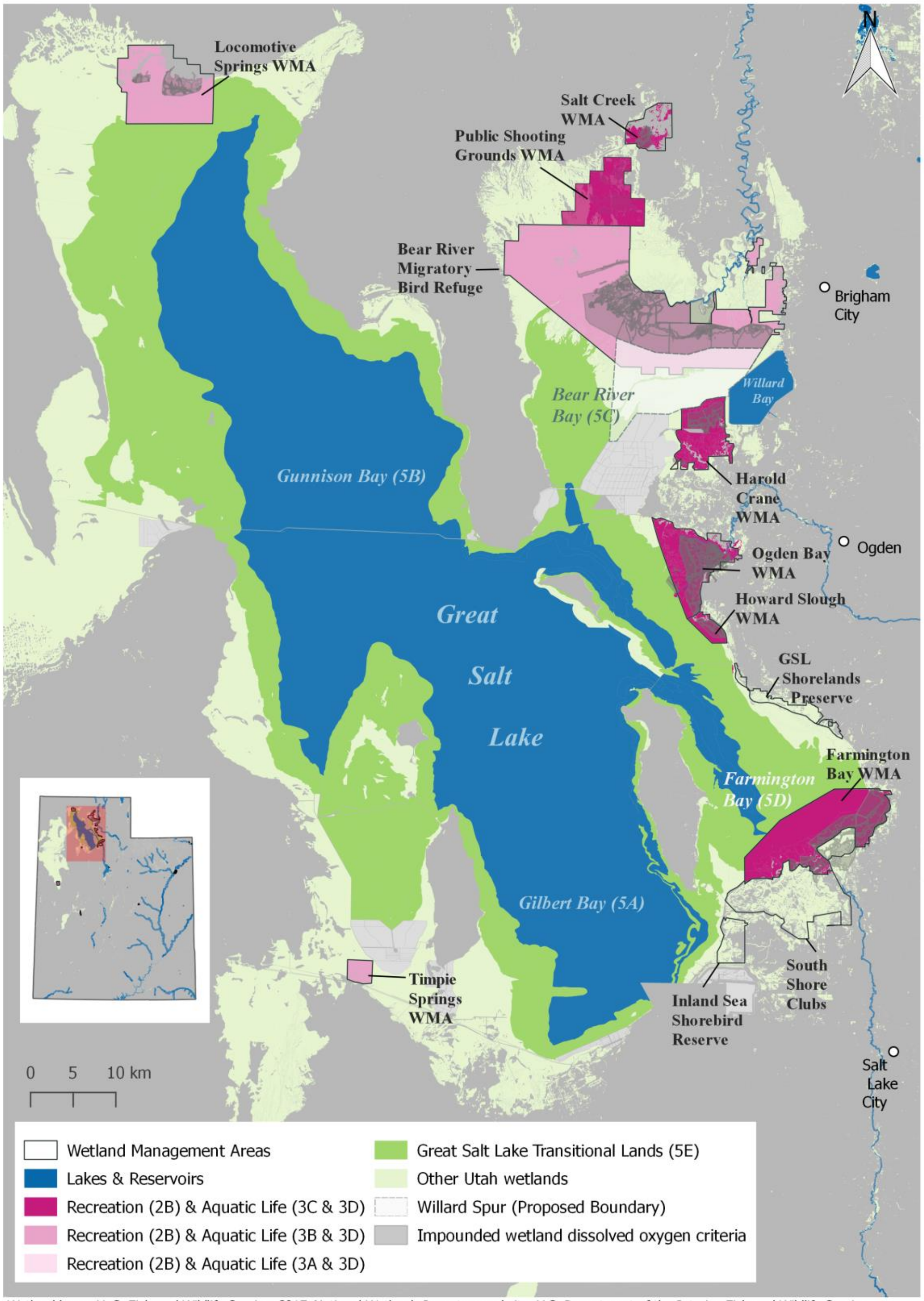
Nested targets are species or assemblages of particular ecological importance that depend on the health of the ecosystem targets. More than 250 species of migratory birds visit GSL wetlands every year during their spring and fall migrations. Utah's Division of Natural Resources has published two reports that helped to define nested targets for GSL wetlands. The Wildlife Action Plan lists species of greatest conservation need, including several species of birds, mollusks and amphibians that should be given careful consideration in conservation planning efforts (Utah Wildlife Action Plan Join Team, 2015). In addition, the Great Salt Lake Waterbird Survey identified several species that are of regional or hemispheric importance (Paul and Manning, 2002). While these bird populations are not immediately threatened, conservation efforts should nevertheless attempt to ensure their protection due to the vital importance of GSL wetlands in maintaining their populations.

The diversity of wetland-dependent species visiting GSL can be divided into three guilds: waterfowl, shorebirds, and waterbirds. Waterfowl are large-bodied aquatic birds; they include ducks, geese, and swans. Historically, GSL impounded wetlands have been managed to support habitat for and hunting of waterfowl. Shallower wetland habitats are utilized by shorebirds: smaller-bodied birds with long legs and bills that allow foraging for macroinvertebrates in shoreline habitats. Waterbirds are a diverse group that includes piscivorous birds, colonial nesting birds, and other wetland-dependent birds that don't fit within other guilds.

In this workshop, participants refined definitions of impounded wetlands and playa/mudflats and clarified how bird guilds and species of interest utilized each target (**Table 1**). Discussions of wetland targets and nested targets support the development of a single wetland-specific designated use that applies to all targets, rather than the existing uses based on ownership (**Figure 4**).

Table 1. Great Salt Lake Wetland Target and Nested Targets. Wetland ecosystem targets represent the wetland classes that should be covered within a regulatory definition of wetlands and nested target bird guilds are the wildlife species that should be included within a wetland-specific designated beneficial use.

	Target Description	Nested Targets
Impounded Wetlands	Impounded wetlands are large, primarily open water wetlands that are typically managed to grow SAV, which provides forage and shelter for migratory birds and habitat for aquatic macroinvertebrates and fish. These wetlands are most often diked and equipped with water control structures that alter the flow of water to deepen and extend flooding. Elevation, salinity, and hydrologic gradients within impounded wetlands support a mosaic of wetland types, from deeply flooded submergent wetlands to shallowly flooded meadows and mudflats during drawdown. This mosaic is spatially and temporally dynamic, shifting according to flooding depth and duration. Impounded wetlands do not include industrial or salt-extraction evaporation ponds.	<u>Waterfowl</u>: Dabbling and diving ducks, geese, and swans loaf and feed in SAV-dominated wetlands and nest in emergent and meadow wetlands. Species of interest include *Cinnamon Teal, Redheads*, and *Tundra Swans*. <u>Shorebirds</u>: Shorebirds forage in shallow waters and nest along dikes. Significant populations of *American Avocets, Black-necked Stilts,* and *Wilson's Phalaropes* are found in this system. <u>Waterbirds</u>: Deeper water is foraging habitat for piscivorous birds, including significant populations of *American White Pelicans, Great Blue Herons,* and *Snowy Egrets*. Islands provide protected nesting habitat for colonial birds like *Franklin's Gulls* and *Black Terns*. *Forster's Terns* and *Eared Grebes* build floating nests on the open water.
Fringe Wetlands	Fringe wetlands are large, shallow, intermittently to semi-permanently flooded wetlands dominated by a mix of emergent vegetation and SAV. Spatial and temporal variation in salinity and hydrology create a mosaic of habitat types in fringe wetlands. Mudflats, meadows, emergent marsh, and submergent wetlands can be found in fringe complexes. Fringe wetlands are located near sources of freshwater, including streams and impounded wetland outlets. Fringe wetland area and habitat types within them expand and contract according to annual water availability.	<u>Waterfowl</u>: The mix of emergent and submergent vegetation provides nesting, loafing, and foraging habitat for large and small waterfowl. Fringe wetlands support significant nesting populations of *Cinnamon Teal*. <u>Shorebirds</u>: Meadow habitat provides foraging and nesting habitat for shorebirds. Large populations of *Black-necked Stilts* and *American Avocets* feed here. <u>Waterbirds</u>: Fringe wetlands provide breeding and foraging habitat for a portion of the largest global breeding population of *White-faced Ibis*
Playa /Mudflats	Playa/mudflats are temporarily flooded saline wetlands created by inter-annual or seasonal GSL and local water table fluctuations as well as precipitation. These flat, depressional wetlands dominate the GSL shoreline and support communities of freshwater and saltwater macroinvertebrates that provide seasonal food for migratory birds. Playa/mudflats are mostly devoid of vegetation yet remain important for nesting birds. Small or ephemeral patches of halophytic ('salt-loving') plant species are an important component of playa/mudflats. The specific locations of this habitat changes as GSL expands and contracts.	<u>Waterfowl</u>: Short halophytic vegetation provides foraging and loafing habitat for migrating waterfowl, including *Canada Geese*. <u>Shorebirds</u>: Expansive flat and salty playas and mudflats provide breeding and foraging habitat for many types of shorebirds. Significant populations of *Snowy Plovers, Black-necked Stilts, American Avocets, Long-Billed Dowitchers, Marbled Godwits, Western Sandpipers,* and *Long-billed Curlews* feed and nest here.



Wetland layer: U. S. Fish and Wildlife Service. 2017. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/
Beneficial Uses: Utah Administrative Code. 2018. R-317.2.13.11 National Wildlife Refuges and State Waterfowl Management Areas, and other Areas Associated with Great Salt Lake. https://rules.utah.gov/publicat/code/r317/r317-002.htm#T15

Figure 3. Existing and proposed beneficial use classes that apply to GSL wetlands

Key Ecological Attributes, Indicators and Ratings

A foundational element of CAP is the identification of Key Ecological Attributes (KEA's), indicators, and a rating scale that are used to assess the current health of the Targets. KEA's are broad ecological characteristics that define healthy conditions for a conservation target. Indicators are more narrow elements of a KEA that are used to monitor and assess the status of KEA's. 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, weight) 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. For an example of refining CAP features over time see the Lower Bear River CAP, which has been running for 10 years (TNC, 2010).

There are several ways in which KEA's and their associated indicators can inform the development and interpretation of WQS for GSL wetlands. They can be used both to help define language that describes desirable conditions—the "shalls", or the converse—the "shall nots"—for narrative water quality criteria. The indicator health rankings can be used to inform the development of biological assessments that measure whether a body of water is supporting its beneficial uses or if water quality criteria have been exceeded. However, before such assessments are conducted, UDWQ will be required to develop and solicit comment on the assessment methods, which will be more detailed than those initially developed through the CAP process.

Participants at the CAP workshops divided into three break-out groups (one group for each target) to refine the KEA's and indicators for the GSL wetland targets. The final KEA's and indicators for the three wetland targets are the third version, which began as a 'straw dog' (i.e., draft) of attributes and indicators assembled based on the work of previous GSL CAP meetings. Substantial revisions were made during the first CAP workshop, and the attributes and indicators were refined in the second one.

Table 2 describes the final hydrologic, chemical, and nutrient regimes, size, and plant and macroinvertebrate communities of each wetland target. Descriptions of hydrologic and nutrient regimes and indicators for each target will support the development of wetland-specific narrative water quality criteria. All three groups included indicators of toxic substances, which suggest that numeric criteria for toxic substances already established for aquatic communities may be important to protect wetland uses. The details of the plant and macroinvertebrate communities will be an important guide in the future when DWQ refines its monitoring and assessment methods.

Table 2. Key Ecological Attributes and Indicators for GSL Wetland Targets. Attributes and indicators represent potential descriptions of a wetland-specific designated use and narrative criteria.

	Key Ecological Attributes	Impounded Wetland Indicator	Fringe Wetland Indicator	Playa/Mudflat Indicator
Physical	Hydrologic Regime	Water available to meet management objectives, including: water level, residence time, pond flushing, & habitat size & diversity. Water to maintain connectivity to other wetland targets	Flood timing & depth adequate to maintain multiple habitat types	Patterns of flooding & drying supportive of nested target needs
Chemical	Chemical Regime	Toxic substances, including nutrients, remain below concentrations harmful to aquatic life	Toxic substances remain below concentrations harmful to aquatic life	Toxic substances remain below concentrations harmful to aquatic life
	Chemical Regime			Soil & water salinity within a range supportive of nested target food webs
	Nutrient Regime	Algal mats or Harmful Algal Blooms do not adversely affect aquatic life or impede recreational uses	Soil & water nutrient bioavailability favor native plant community	Nutrients cycle between soil, water, plants, macroinvertebrates & birds
Biological	Invasive species	Invasive species abundance does not adversely affect the populations of native aquatic plant & animal species		
	Macro-invertebrates	Macroinvertebrate diversity & biomass supports nested targets & management goals	Healthy macroinvertebrate community supports nested targets; follows seasonal dynamics & salinity gradients	Adequate macroinvertebrate biomass to support nested targets
	Plants	Dominance of native plant species	Dominance of native plant species	Vegetated area dominated by native halophytes
	Plants	Healthy plant community (submerged & emergent) provides adequate habitat structure to support waterfowl & other nested targets		Bare ground & vegetated areas present
	Size		Wetland area below 4,218 feet adequate to support nested targets	Adequate mudflat habitat area near fresh or brackish water & higher elevation playa refugia

Rankings

Preliminary narrative ratings were presented by UDWQ for several indicators using the CAP scoring framework of Very Good, Good, Fair and Poor (Parrish et al., 2003). These narrative ratings were discussed and refined at the two CAP workshops. Workshop participants were asked to focus on developing narrative statements for the "Good" and "Poor" ratings, as these two levels serve as primary benchmarks for assessing ecosystem health. See **Appendix A** for narrative descriptions of "Good" and "Poor" ratings.

As a final step in the KEA process, workshop participants were asked to use the draft KEA's and rating scales to rank the current health of the three GSL wetland targets, looking at their distribution along the eastern shoreline where most GSL wetlands are located. Because the key attributes often have variable conditions over such a large geographic extent, the rating scale was extended beyond the basic four-grade scale to reflect these variable conditions. In addition, rankings were first estimated by three shoreline regions: Bear River, Ogden, and Farmington Bays; regional rankings were then rolled up into a single rank for each target. The draft rankings in **Table 3** were developed by the three target breakout groups. It should be noted that these ratings were done as a relatively quick exercise, based upon the collective expert opinion of the three groups, and have not been further vetted. The purpose was to give the workshop participants the opportunity to develop a first approximation, for the purposes of helping to inform conservation strategies.

Table 3. Indicator Rankings for Key Ecological Attributes of GSL Wetland Targets

Key Ecological Attributes	Impounded Wetland Indicator	Fringe Wetland Indicator	Playa/Mudflat Indicator
Hydrologic Regime	Fair	Poor/Fair	Poor
Chemical Regime – Toxic Substances	Good/Fair	Good	Fair
Chemical Regime – Salinity	NA	NA	Unknown
Nutrient Regime	Fair	Fair	Unknown
Invasive species	Fair	NA	NA
Macroinvertebrates	Good	Unknown	Good
Plants – Native Species	Fair/Good	Poor/Fair	Fair
Plants – Structure	Good	NA	Good
Size	NA	Good	Good

Potential Threats

After assessing current health, potential sources of stress that could impair the future health of the targets were identified. Sources and stresses are the two parts of a threat to our conservation targets. Stresses are the inverse of the KEA's – 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 GSL wetlands. Similarly, these threats can also be used by UDWQ to identify or prioritize statements that should be included in narrative water quality criteria.

Following the threat ranking exercise, a rapid threat assessment was done via voting by the participants, with the goal of developing strategies to address the highest rated threats. Each participant was asked to indicate what they thought to be the ten highest potential sources of stress that might emerge over the next decade, with votes distributed as desired across the three targets. The voting tally is presented in **Table 4**. Two potential sources of stress stood out in both the health ranking and threat voting: (1) altered hydrologic regime from upstream water withdrawal; and (2) altered vegetation composition from invasive species (i.e., Phragmites). These two predominant threats were followed by threats of excessive nutrients from point source discharges, altered hydrologic regime from land use conversion, and reduced wetland size from land use conversion.

While water quantity and invasive species are not traditionally viewed as water quality issues (and thus concerns best addressed by WQS), there is a clear ecological link between those threats and water quality. The ecological link between water availability and water quality is most easily seen in the fact that water source determines natural water quality and that alterations to natural flooding patterns can impair water quality by delivering pollutants with flood waters or concentrating pollutants during drought (Zedler and Kercher, 2005). Legally, courts in California and Washington have noted that lack of sufficient water is a form of pollution because it impairs beneficial uses and that hydrology is a controllable factor (California Water Resources Control Board, 1995; Jefferson Country vs. Washington Department of Ecology, 1994). The literature on invasive species management has demonstrated that invasive species are able to take advantage of poor water quality in two ways: by tolerating a wider range of conditions than native species (e.g., carp and oxygen) and by thriving in poor quality environments (e.g., Phragmites and nutrients) (Hazelton et al., 2014; Jester, 1992).

Table 4. Sources and Stresses to wetland targets according to CAP voting. Stresses (in rows) and sources (in columns) tallied for all wetlands (ALL GSL), impounded wetlands (IW), fringe wetlands (FR), and playa/mudflats (PL). Sources and stresses represent potential water quality criteria (narrative or numeric) needed for Utah's wetlands.

	Select Greatest Potential Sources of Stress									
Stresses	Point Source Discharges	Upstream Water Withdrawal	Manage-ment of Dams & Diversions	Invasive species	Land Use Conversion	Other Nonpoint Sources	All GSL	IW	FR	PL
Altered hydrologic regime	7	**52**	15	7	17	0	**98**	27	40	31
Excessive toxicity	2	0	0	0	1	4	**7**	3	2	2
Excessive nutrients	17	1	0	4	0	7	**29**	17	10	2
Reduced macro-invertebrates	0	9	1	5	2	3	**20**	6	7	7
Altered plant composition	0	12	1	**33**	0	4	**50**	14	27	9
Altered SAV	3	2	0	3	1	2	**11**	11	-	-
Reduced Size	0	12	1	2	15	0	**30**	-	16	14
All GSL	**29**	**88**	**18**	**54**	**37**	**17**				
Total IW	18	22	4	20	6	8				
Total FR	7	39	7	23	16	10				
Total PL	4	27	7	11	14	2				

Strategies

The last step in the CAP process is to develop strategies that address potential threats or to enhance the health of the conservation targets. In CAP, strategies include three elements: Objectives, Strategic Actions and Action Steps. The development of effective strategies can be challenging and time consuming. The goal of the GSL Wetlands CAP was to develop a credible first iteration of strategies to address the two most critical threats. Break-out groups met during the second workshop to develop strategies to address threats from upstream water withdrawal and invasive species. A third group met to address issues regarding wetland size and dynamics, with the goal of integrating this work into the strategies.

The two strategic objectives established by the break-out groups and refined by large-group discussion were as follows:

1. Maintain sufficient water flow (acre/feet) and a "minimum dynamic area" (acres) of GSL wetlands and bays so that they are in "Good" condition.
2. Decrease Phragmites cover around GSL by 50% (~13,000 acres) by 2028.

The Strategic Actions proposed to achieve the objectives are presented in Appendix A. The 'wetland size' breakout group developed two recommendations, which were used in addressing the strategies above. First, they developed the idea of a 'minimum dynamic area' to reflect the fact that GSL wetlands are an ever-changing mosaic of habitat types between seasons and years, but that there is a minimum area required to support the health of targets and nested targets. Second, water availability measured as acre-feet (a water rights-specific unit of measure) is the driver of wetland size.

Wetland WQS Enforcement

Participants in the CAP workshop asked important questions about the effectiveness of narrative water quality criteria in protecting wetlands. One frequently mentioned benefit of using narrative criteria to protect water quality in complicated and dynamic ecosystems is that they are broad enough to describe a range of acceptable conditions (like the regimes described in KEA's) and prohibit classes of pollution relevant to wetlands (like drought and physical modifications), rather than discrete pollutants. However, alternative approaches are required when narrative criteria are exceeded because that is often caused by pollution (e.g., altered hydrology, nuisance algae), rather than a single, identifiable pollutant (e.g., copper). UDWQ has established processes for monitoring and assessing lakes and streams, determining if beneficial uses are being supported, and developing water quality management plans for impaired waters; these will need to be amended in order to be appropriate for wetlands. UDWQ monitors water quality and the biological community of lakes and streams across the entire state and reports these results in biennial Integrated Reports. For waters that have been identified as impaired (i.e., not supporting their beneficial use), a Total Maximum Daily Load (TMDL) study is conducted to identify the sources of pollutants and minimize point and non-point sources.

When it comes to detecting impairments and coming up with solutions to limit pollution, enforcing narrative standards require alternative approaches, as exemplified by UDWQ's approach to dealing with harmful algae blooms (HABs). The statewide narrative standard prohibits pollution that causes "undesirable human health effects" and "scum," both of which are the effects of HABs. In recent years UDWQ has developed an assessment method to quantitatively determine when HABs cause the recreational use to not be met on a water body. The assessment evaluates three lines of evidence: cyanobacteria cell density, cyanotoxin concentrations those cells produce, and the duration of a HAB-related recreational advisory. A similar approach could be adapted for monitoring and detecting impairments of narrative water quality criteria in wetlands.

Recommendations to UDWQ

The CAP workshop discussions provided data to address our proposed questions:

1. What are the dominant wetland classes considered Waters of the State?
    - Any definition of wetlands needs to be broad enough to include all impounded, fringe, and playa/mudflats on public and private lands
2. What are the physical, chemical, and biological characteristics of dominant wetland classes, including major functions, services and values to support a Wetland Designated Use category?
    - Develop a clear wetland use based on supporting wetland-dependent bird species and the physical, chemical, and biological characters that support birds. Include all three guilds that utilize GSL wetlands: waterfowl, shorebirds, and waterbirds.
    - Protect hydrologic, chemical, and nutrient regimes (patterns over time) as well as macroinvertebrate and plant communities.
3. What are the potential future stresses and how can these systems be best protected?
    - Update narrative criteria for wetlands to address threats from nuisance algae, invasive aquatic species, and hydrologic regime change.
    - A combination of narrative and numeric criteria specific to wetlands, appropriate class-specific assessment methods, and TMDL alternatives.

WPDG Environmental Outcomes

In addition to helping develop water quality standards for Utah wetlands, CAP meetings with wetland stakeholders also produced several of the anticipated environmental outcomes for this WPDG project.

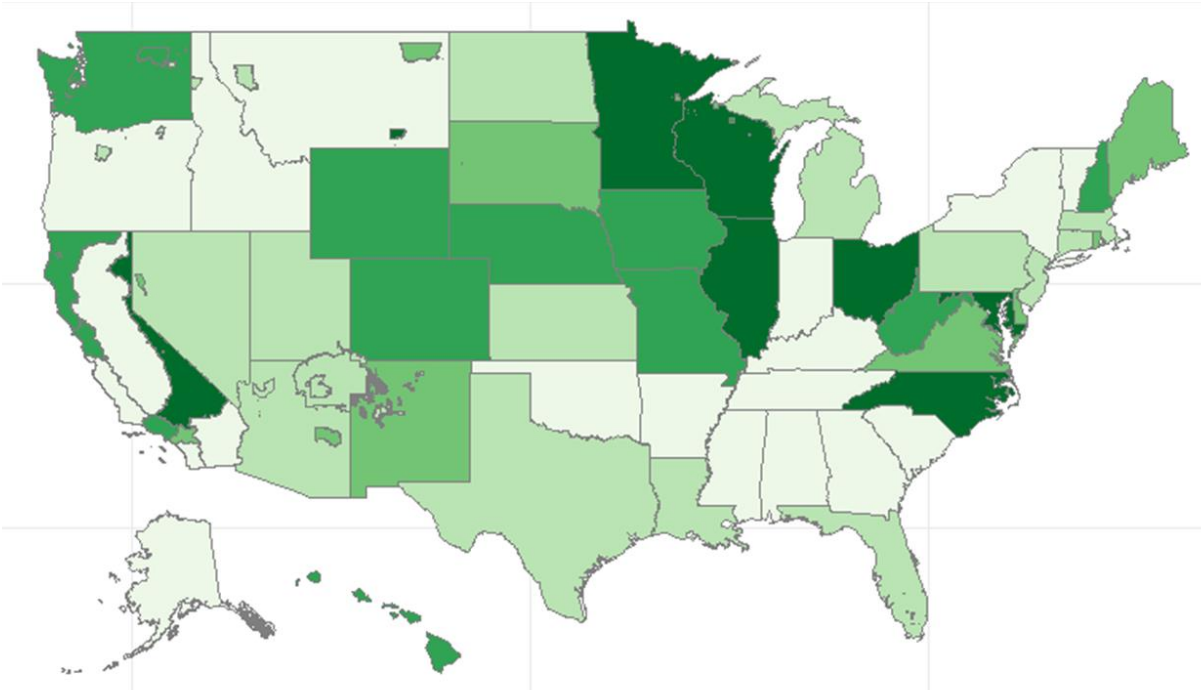
1. Improved communication among individual stakeholders and stakeholder groups in support of consistent WQS for wetlands
2. Increased appreciation among stakeholders for the diversity of wetlands and desired wetland conditions in Utah
3. Greater diversity of stakeholders engaged in statewide wetland discussions
4. Improved alignment of voluntary conservation and regulatory activities across agencies, providing for establishment of consistent water quality goals
5. Increased understanding of how Utah's WQS and assessment tools are developed

BENCHMARKING WITH OTHER STATES

GSL Wetland CAP meetings defined important wetland classes, the biological, physical, and chemical features that should be part of a wetland-specific designated use, and the conditions and stressors water quality criteria should protect against. Benchmarking current Utah WQS against the WQS of 81 states, regions, and tribes provided potential strategies to protect wetland ecosystems already in practice. WQS from 34 states, 5 water quality regions, and 42 tribes that address wetlands to some degree are summarized here. A small group of states and tribes have wetland WQS that address all aspects the EPA (1994) recommends – definitions, uses, narrative and numeric criteria, and antidegradation – and are considered most effective because they are most complete. Reports by the Environmental Law Institute (2008) and the Association of State Wetland Managers (Kusler and Christie, 2012) noted that California (Regional Water Quality Boards), Colorado, Hawaii, Illinois, Iowa, Maine, Massachusetts, Minnesota, Nebraska, North Carolina, Ohio, Washington, Wisconsin, and Wyoming all had complete wetland WQS. Sixty-four tribes (of 635 recognized reservations) also had EPA-promulgated standards, which were not included in those reports. Further, wetland WQS are in active development in many states. Because of this, we benchmarked not only the states with complete wetland WQS, but also with states in the initial stages of standard development as well as tribes in order to get a more comprehensive view of the strategies available for Utah. **Appendix B** contains the relevant portions of all the state and tribal WQS included in benchmarking: definitions, designated uses, narrative and numeric criteria, and antidegradation.

States and tribes have a tremendous amount of variability in how they have chosen to address wetlands in their water quality rules. While not all are easily comparable in the pieces included or the methods, four general stages of wetland WQS development mirroring EPA (1994) guidance could be seen and are mapped in **Figure 5**. Forty-five states and tribes, including Utah, mention wetlands in some form as Waters of the State but have not defined specific wetland uses or criteria. Fourteen states and tribes have developed wetland-specific designated beneficial uses. Sixteen states and tribes have gone beyond uses and developed narrative criteria for wetlands or identified that narrative criteria apply to wetlands, and ten have developed at least one numeric criterion for wetlands.

The following subsections explore the strategies states, regions, and tribes have taken in developing definitions, uses, criteria, and antidegradation rules for wetlands. An important caveat with benchmarking data: the information included here is only what is included in water quality statutes, but cannot truly mark effectiveness. While rules may have been adopted by states and tribes, it's not possible to tell from the text which are effectively implemented or legally challenged.



Legend		#
	No wetland WQS	
	Wetlands defined as Waters of the State	45
	Wetland-specific designated beneficial use	14
	Wetland specific use & narrative criteria	16
	Wetland specific use & narrative & numeric criteria	10

Figure 5. State and tribal wetland water quality standard development.

Defining Wetlands in WQS

As mentioned earlier, legal and biological definitions of wetlands are not the same. WQS need to clearly state that wetlands are legally protected by standards by defining the term 'wetland' and identifying which biological wetland types or classes are considered Waters of the State. To meet those requirements, most states include wetlands within their definition of Waters of the State and a separate definition of wetlands which may mention regionally important wetland classes.

Almost all states and tribes included the term "wetlands" in their list of water body types that qualify as Waters of the State or Reservation as well as a clear definition of what a wetland is. Utah's definition of Waters of the State includes two classes of wetlands - ponds and marshes - but does not explicitly address or define wetlands: "Waters of the state" means all streams, lakes, ponds, marshes, water-courses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water [...](UAC R317-1-1).

The most common definition of wetlands included in statutes is the 40 CFR §116.3 definition:

> (iv)*Wetlands*. The term *wetlands* means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in

saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Code of Federal Regulations, 1978).

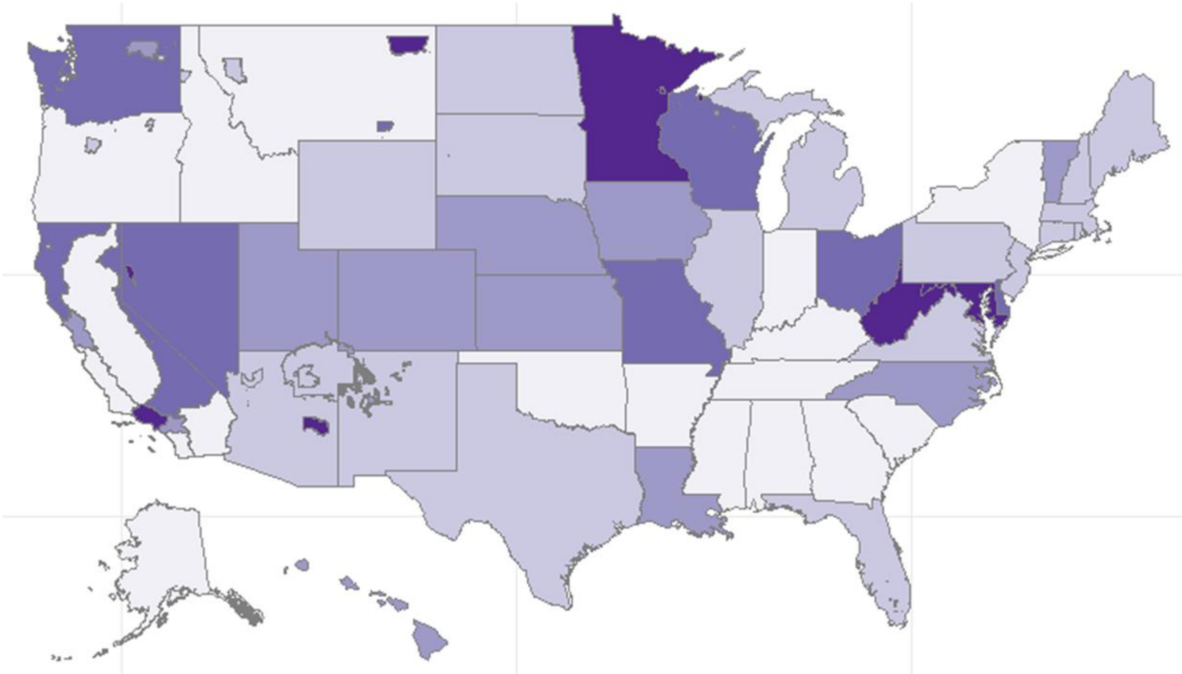
Some states and tribes expanded their Waters of the State or wetlands definition to include special regional wetland types. The Lahontan and San Francisco Bay regulations state wetland types commonly referred to as dike baylands, vernal pools, and playa lakes fall within the scope of their standards (see California Regional Water Quality Board Lahontan Region, 1995; San Francisco Bay Regional Water Quality Control Board, 2018). The Hopi Tribe (2010), Hualapai Tribe (2013), and Pueblo of Acoma (2005) all address desert wetland types called cienagas and tinajas within their wetland definitions. Regional types of wetlands in Utah, specifically around GSL, that may merit mention in any definition added to the code include impounded wetlands, fringe complexes, and playa wetlands. Those wetland types make up the majority of wetland classes around GSL and regulations will apply there first. Outside of GSL, desert spring-fed wetlands as well as high elevation riparian wetlands, meadows and fens are important wetland types for aquatic and semi-aquatic wildlife and plant diversity (Jones et al., 2014; Menuz et al. 2016).

In addition to making clear what wetlands are Waters of the State, wetland WQS definitions can also identify water body types that aren't protected by states. Most states and tribes exclude constructed wetlands or wetlands created specifically for stormwater or wastewater treatment from their standards. Kansas WQS only apply to wetlands on public lands or private hunting lands, similar to Utah's current classification (Kansas Department of Health and Environment, 2005). Some states have focused on classifying and applying designated beneficial uses to specific geographic regions, similar to the way Utah's policy focuses on GSL. The Chesapeake Bay of Maryland, Everglades Protection Area in Florida, and Las Vegas Wash in Nevada are geographically specific wetland classifications that are the only protected wetland areas within those states (Code of Maryland Regulations, 2018; Florida Administrative Code, 2016; Nevada Administrative Code, 2016). The goal of our project is to develop statewide wetland standards, but it is possible that specific uses may need to be applied to GSL wetlands, effluent-dependent wetlands, or the Willard Spur.

Wetland Designated Uses

Wetlands provide many unique ecosystem services that can be protected or monitored through the use of a wetland-specific beneficial use. For example, providing habitat for wetland-dependent birds, attenuating floods, and improving downstream water quality are functions recognized in wetland-specific beneficial uses (Kusler and Christie, 2012). Wetlands are also critical parts of watersheds, regulating the flow of water and nutrients between water bodies, and one of many aquatic ecosystems integral to the life cycle of aquatic organisms that travel between wetlands, streams, and lakes, which suggests that some existing designated uses for lakes and streams might be applicable to wetlands as well. States and tribes have addressed wetland designated uses in a variety of ways from applying existing stream and lake uses to wetlands or deriving uses specific to wetlands (**Figure 6**).

Thirty-nine states and tribes explicitly state that wetlands support the same uses as the water bodies they are adjacent to or associated with, rather than giving different uses to wetlands. While that approach does include wetlands within WQS, applying uses from other aquatic waters is a shaky proposition in wetlands, which have different water quality regimes than the water bodies they are associated with and it addresses only riparian waters, not isolated wetlands or large complexes of wetlands. Twenty-five states and tribes have specified which existing beneficial uses (uses that also apply to streams and lakes) are applicable to wetlands; Utah is among those states, where subcategories of recreation and aquatic life uses have been applied to some wetlands. Twenty states have developed wetland-specific beneficial uses; ten of those twenty also apply existing uses to wetlands in addition to their specific use. UDWQ proposed to follow the last example.



Legend		#
	No wetland WQS	
	Wetlands support any designated uses of associated waterbodies	45
	Wetlands support specified existing designated uses	14
	Wetland-specific designated use applies	16
	Wetland-specific & existing designated uses apply	10

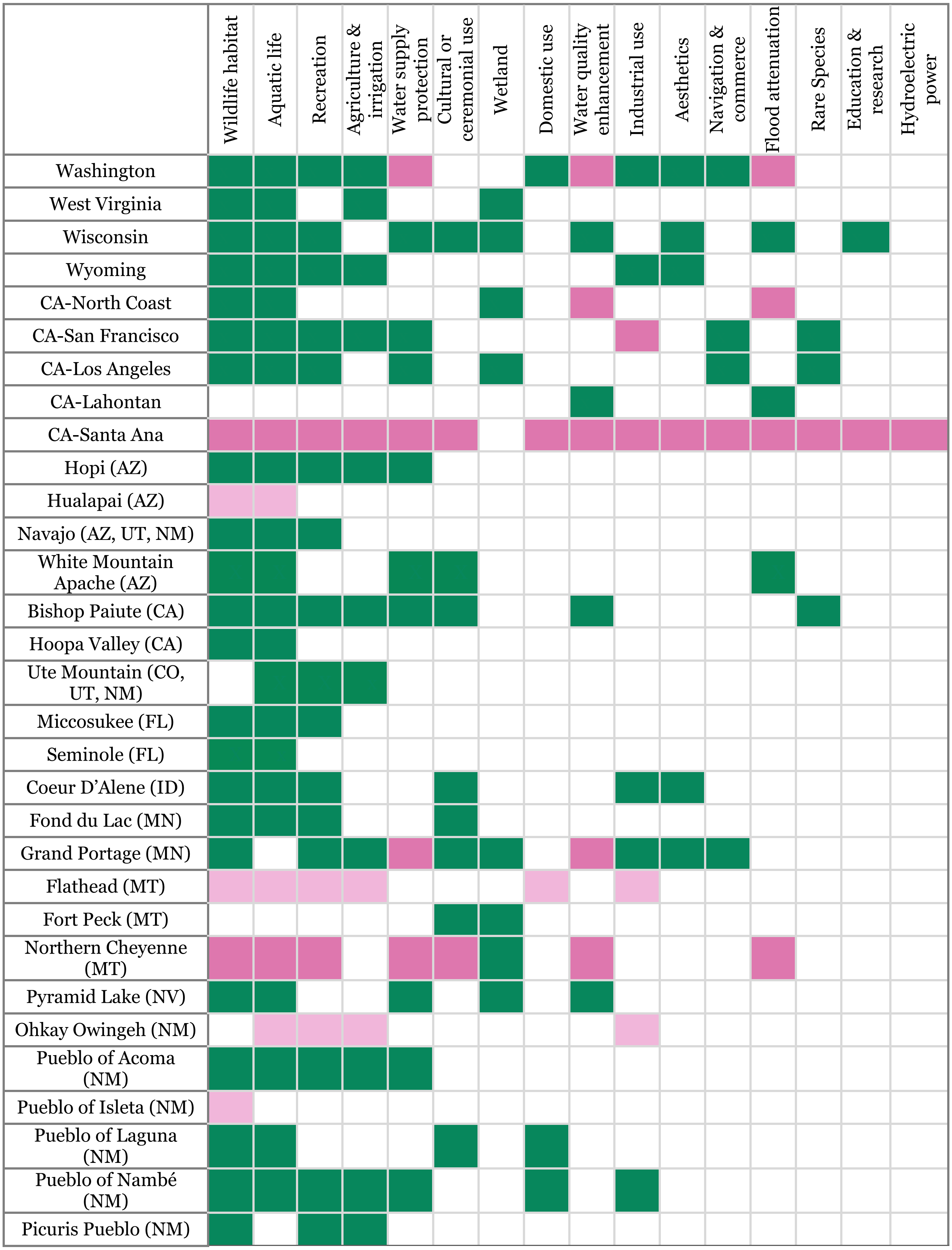
Figure 6. State and tribal designated beneficial uses applied to wetlands.

Once wetlands are classified as Waters of the State or Tribe, there are many options for the types of designated beneficial uses that apply to wetlands, which are listed in **Table 5**. The most common type of use applied to wetlands is a wildlife-based beneficial use, followed by aquatic life use and recreation. The distinction between wildlife and aquatic life is not always explicitly stated, but generally wildlife refers to birds, mammals, and amphibians living on or near the water while aquatic life refers to fishes and other gilled organisms that live in the water. Some states and tribes call the use that wetlands support 'wetlands' and define the functions wetlands provide within that use (see Colorado Water Quality Control Commission, 2017; Grand Portage Band of Chippewa, 2017; Ohio Administrative Code, 2017). A smaller number of states and tribes (n = 22) apply functions wetlands provide, like flood attenuation or water quality enhancement, as designated beneficial use categories. Often function-based wetland uses were identified as 'potential uses' that do not currently have criteria for assessment.

Utah may follow the examples of Minnesota or the Northern Cheyenne Tribe, where wetlands hold a wetland-specific use (either a new use or Class 3D waterfowl and shorebirds) as well as an aquatic life use focused on fish when appropriate and recreation uses (Minnesota Administrative Rules, 2017; Northern Cheyenne Environmental Protection Department, 2013). In this way, a consistent use and appropriate criteria are applied to all wetlands, most critically to GSL wetlands that have no numeric criteria, and uses that currently apply to state and federal wildlife management areas would not need to be removed, which requires a Use Attainability Analysis (UAA).

Table 5. Designated beneficial use categories* supported by wetlands. Green cells indicate existing designated, uses, dark pink cells denote potential uses (light pink is potential uses that were implied), and blue cells indicate a water body class.**

	Wildlife habitat	Aquatic life	Recreation	Agriculture & irrigation	Water supply protection	Cultural or ceremonial use	Wetland	Domestic use	Water quality enhancement	Industrial use	Aesthetics	Navigation & commerce	Flood attenuation	Rare Species	Education & research	Hydroelectric power
Arizona	Green	Green	Green	Green												
Colorado	Pink	Pink	Pink	Pink	Pink	Pink	Green	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink
Connecticut	Green	Green	Green	Green				Pink		Green		Green				
Delaware							Green									
Florida	Green	Green	Green													
Hawai'i	Green	Green	Green	Green			Blue c	Green		Green	Green				Green	
Illinois	Green	Green	Green	Green						Green	Green			Green		
Iowa	Green	Green					Blue c									
Kansas	Green	Green	Green	Green	Green		Blue c	Green								
Louisiana	Green	Green	Green													
Maine		Green	Green	Green				Green		Green		Green				Green
Maryland	Green	Green	Green				Green									
Massachusetts	Green	Green	Green					Green			Green					
Michigan	Green	Green	Green	Green						Green		Green				
Minnesota	Green	Green	Green	Green	Green		Green		Green	Green	Green		Green	Green		
Missouri	Green		Green		Green	Green	Green				Green		Green	Green	Green	
Nebraska	Green	Green		Green							Green					
Nevada							Green		Green							
New Hampshire	Green	Green	Green													
New Jersey	Green	Green	Green	Green				Green		Green						
New Mexico	Green	Green	Green													
North Carolina	Green	Green			Green		Green		Green				Green			
North Dakota		Pink	Pink				Blue c									
Ohio	Pink	Pink	Pink		Pink		Green		Pink					Pink	Pink	
Pennsylvania	Green	Green	Green	Green				Green		Green	Green					
Rhode Island	Green	Green	Green	Green						Green	Green					Green
South Dakota	Light pink	Light pink	Light pink													
Utah	Green	Green	Green													
Vermont		Green														
Virginia	Green	Green	Green						Pink							


Wildlife habitat
Aquatic life
Recreation
Agriculture & irrigation
Water supply protection
Cultural or ceremonial use
Wetland
Domestic use
Water quality enhancement
Industrial use
Aesthetics
Navigation & commerce
Flood attenuation
Rare Species
Education & research
Hydroelectric power
Washington
West Virginia
Wisconsin
Wyoming
CA-North Coast
CA-San Francisco
CA-Los Angeles
CA-Lahontan
CA-Santa Ana
Hopi (AZ)
Hualapai (AZ)
Navajo (AZ, UT, NM)
White Mountain Apache (AZ)
Bishop Paiute (CA)
Hoopa Valley (CA)
Ute Mountain (CO, UT, NM)
Miccosukee (FL)
Seminole (FL)
Coeur D’Alene (ID)
Fond du Lac (MN)
Grand Portage (MN)
Flathead (MT)
Fort Peck (MT)
Northern Cheyenne (MT)
Pyramid Lake (NV)
Ohkay Owingeh (NM)
Pueblo of Acoma (NM)
Pueblo of Isleta (NM)
Pueblo of Laguna (NM)
Pueblo of Nambé (NM)
Picuris Pueblo (NM)

	Wildlife habitat	Aquatic life	Recreation	Agriculture & irrigation	Water supply protection	Cultural or ceremonial use	Wetland	Domestic use	Water quality enhancement	Industrial use	Aesthetics	Navigation & commerce	Flood attenuation	Rare Species	Education & research	Hydroelectric power
Pueblo of Pojoaque (NM)	□				□											
Pueblo of Sandia (NM)	■	■	■													
Pueblo of Santa Ana (NM)	■															
Santa Clara Pueblo (NM)	■	■	■	■	■			■		■						
Pueblo of Taos (NM)	■	■	■	■	■	■		■								
Pueblo of Tesuque (NM)	■	■	■	■	■											
St. Regis (NY)	□	□	□			□										
Umatilla (OR)	□	□	□			■			□							
Warm Springs (OR)	□	□									□					
Chehalis (WA)	■	■	■			■		■				■				
Colville (WA)	■	■					■									
Kalispel (WA)											■					
Lummi (WA)	■	■	■			■		■				■				
Makah (WA)	■	■	■			■		■				■				
Port Gamble (WA)		■	■			■										
Puyallup (WA)	■	■	■	■		■		■		■		■				
Spokane (WA)	■	■	■	■		■		■				■				
Swinomish (WA)	■	■	■			■		■			■					
Bad River (WI)	■	■	■		□	■	■		□			■				
Lac du Flambeau (WI)	■	■	■	■		■				■						
Sokaogon (WI)	■	■	■	■		■		■				■				
Total	71	70	60	32	23	23	22	21	16	20	16	14	10	7	4	2

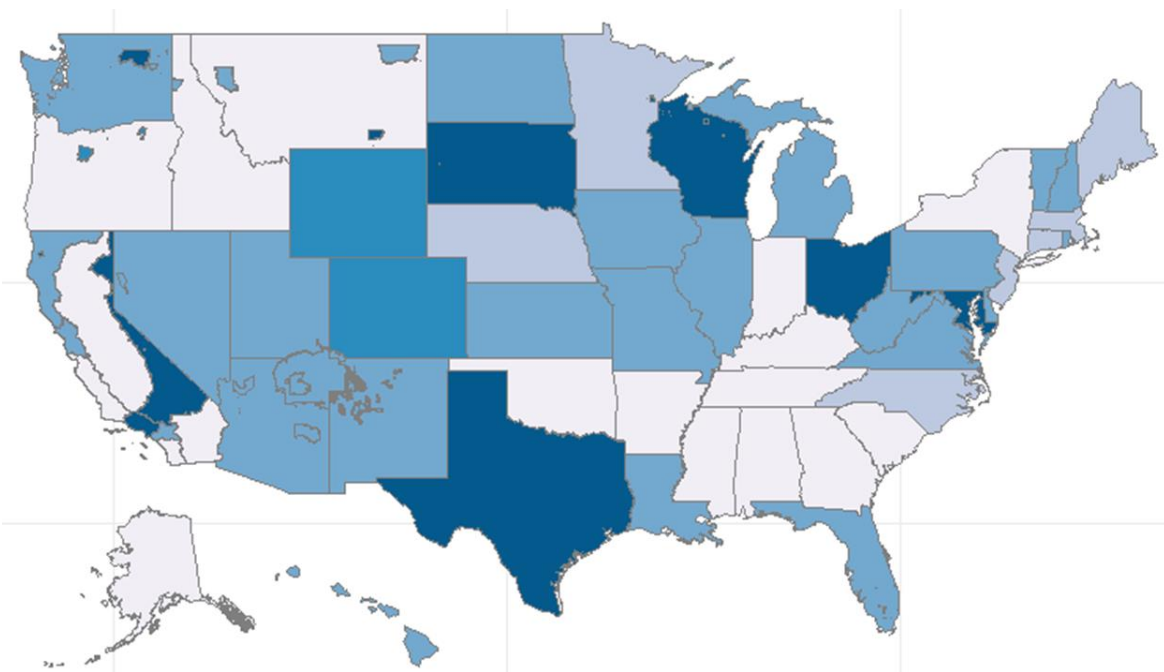
*The categories listed in columns here are general terms for similar types of designated beneficial uses. States and tribes have unique terminology for their uses.

** Instead of designated use classes, waters are classified as different water body types (e.g., lakes, streams, wetlands) and each class supports of group of specified uses.

Narrative Wetland Standards and Criteria

The natural water quality regime of wetlands, which changes over time according to hydrology, makes detecting human-caused impairments to water quality difficult. Threats to wetland water quality presented by the diversion of water, addition of fill material, and expansion of invasive species require protections not often addressed in WQS for lakes and streams. Narrative criteria are considered the best first step in protecting wetland water quality because they are broad enough to cover the range of natural conditions in wetlands and the types of threats wetlands face from pollution rather than discrete pollutants (EPA, 2016). This is particularly important for wetlands natural variation in water quality is expected.

As with establishing designated uses, states followed a number of strategies in developing narrative criteria for wetlands. A few states (n=9) have developed narrative standards specific to water body types like wetlands, lakes and streams. The majority of states and tribes (n=53) have a single narrative standard that applies to all waters of the state, including wetlands. Several states (n=17) have additional narrative criteria that apply only to wetlands, in addition to the criteria that apply to all state waters. Additional criteria may be included in the narrative or general criteria of the main water quality statute or in a separate wetland policy. Few states (n=6) identify only a subset of the larger state narrative standard that applies to wetlands (**Figure 7**).



Legend		#
	No wetland WQS	
	Individual narrative standards for each waterbody class	9
	Single narrative standard applies to all waters	53
	A subset of the full narrative criteria apply to wetlands	6
	Extra narrative criteria apply to wetlands	17

Figure 7. State and tribal strategies for applying narrative water quality criteria to wetlands.

Thirty-one potential categories of narrative criteria were applied to wetlands, which are listed in **Table 6**. Nearly all states and tribes prohibited aesthetic changes to waters (floating material, oil and scum, etc.) and the discharge of harmful materials like known toxic substances, pesticides, and pathogens organisms. Approximately half of narrative standards prohibited changes to the biological community. A smaller group of states and tribes addressed changes to conventional numeric criteria like pH and DO, often by prohibiting change from natural conditions or specifying a range of acceptable conditions in wetlands.

Utah's current narrative standard addresses the most common narrative criteria but could be updated to include wetland-specific criteria based on the issues identified in monitoring and assessment research, CAP workshops, and common criteria other states and tribes have developed. The biggest concerns in Utah wetlands that are not addressed by the current narrative standard are hydrologic alterations, invasive species, and eutrophication. Many states and tribes have addressed these issues, but they are controversial. The narrative standards of Los Angeles (2014), Maine (2017), Missouri (2014), North Carolina (2017), Ohio (2017), and Wisconsin (2015) state that protecting the hydroperiod is critical to maintaining the biological, chemical, and physical integrity of wetlands, which provides a template for addressing issues brought up by stakeholders in CAP meetings.

- Hydrology: UDWQ research has shown that the hydroperiod is the factor most critical to protecting wetland condition and water availability (UDWQ, 2015; UDWQ, 2018a). Seventeen WQS prohibited changes to wetland hydrology.
- Eutrophication: Concerns about algal mats caused by eutrophication are a major concern to wetland stakeholders in Utah. In most wetlands, including impounded wetlands around GSL, a wide range of nutrient concentrations can be observed and links between nutrient concentration and wetland condition are difficult to disentangle from impacts caused by drought and other pollution (UDWQ, 2014a). 45 state and tribal standards prohibit biostimulatory substances (also called plant nutrients or specified as nitrogen and phosphorus). Developing a narrative standard provides a means for protecting against undesirable algae conditions without relying on potentially un-enforceable numeric criteria.
- Invasive species: Phragmites australis, an invasive wetland grass, was added to Utah's noxious species list and gobbles up almost $1 million in public funds to treat annually. 61 standards addressed nuisance aquatic life, some of which specifically mention algal mats and invasive plant species.

Table 6. Narrative standard criteria* applied to wetlands (i.e. there shall be no/no change).

	Aesthetics								Harmful Materials				Biological			Specific Criteria									Miscellaneous					
	Floating material	Settleable material	Oil & Grease	Suspended material	Turbidity	Color	Unsightliness	Odors & Tastes	Toxics	Radioactivity	Pathogenic organisms	Bioaccumula-tion /pesticides	Biological community	Nuisance aquatic life	Biostimulatory substances	Temperature	pH	Oxygen	Gasses	Salinity	Ammonia	Sulfide/Sulfate	Chlorine	Sedimentation	Hydrology	Junk & refuse	Fish Migration	Physical Habitat	Foaming substances	Mixing Zones
Arizona	■	■	■	■		■		■	■				■	■												■			■	
Colorado						■		■	■					■			■													
Connecticut		■		■	■	■		■	■		■		■		■	■	■	■						■						
Delaware	■	■	■	■		■		■	■	■	■			■		■								■					■	
Florida	■	■	■		■	■		■	■					■		■		■												
Hawai'i	■	■	■		■	■		■	■	■	■	■		■		■								■						
Illinois	■	■	■		■	■		■						■				■												
Iowa	■	■	■		■	■	■	■	■		■			■																
Kansas	■	■	■	■	■	■		■	■	■	■				■	■						■	■		■	■			■	
Louisiana	■	■	■		■	■	■	■	■	■			■	■	■										■				■	
Maine											■		■	■	■										■			■		
Maryland	■	■	■		■	■	■	■	■	■				■		■	■	■												
Massachu-setts	■	■	■	■	■	■					■					■	■	■												
Michigan	■	■	■	■	■	■		■	■	■				■	■	■	■	■		■									■	■
Minnesota	■	■	■	■		■		■					■	■			■	■	■	■		■	■					■		
Missouri	■	■	■		■	■	■	■	■				■												■	■		■		
Nebraska	■	■	■	■	■	■		■	■				■	■	■			■		■	■		■			■				
Nevada	■	■	■		■	■	■	■	■	■	■	■				■														
New Hampshire	■	■				■		■	■	■				■															■	
New Jersey	■	■		■	■	■		■	■		■	■			■	■	■	■		■		■								
New Mexico	■	■	■	■	■	■		■	■	■	■		■	■	■	■			■					■						
North Carolina	■		■	■		■	■	■	■	■			■		■	■	■	■	■						■		■			
North Dakota	■	■	■			■	■	■	■				■												■	■				
Ohio	■	■	■	■		■		■	■		■		■	■	■	■	■	■							■		■	■		

	Aesthetics								Harmful Materials				Biological			Specific Criteria									Miscellaneous					
	Floating material	Settleable material	Oil & Grease	Suspended material	Turbidity	Color	Unsightliness	Odors & Tastes	Toxics	Radioactivity	Pathogenic organisms	Bioaccumulation /pesticides	Biological community	Nuisance aquatic life	Biostimulatory substances	Temperature	pH	Oxygen	Gasses	Salinity	Ammonia	Sulfide/Sulfate	Chlorine	Sedimentation	Hydrology	Junk & refuse	Fish Migration	Physical Habitat	Foaming substances	Mixing Zones
Pennsylvania	X	X	X		X	X	X																							
Rhode Island	X	X	X			X	X	X		X			X	X	X				X									X		
South Dakota	X	X	X			X	X	X		X			X	X			X		X							X		X		
Texas	X	X	X	X	X	X	X	X	X	X					X	X		X		X		X	X					X	X	
Utah	X	X	X			X		X	X				X	X																
Vermont		X	X	X		X		X	X	X					X	X	X													
Virginia	X	X	X			X		X	X		X	X		X	X	X														
Washington							X	X	X	X																				
West Virginia	X	X	X	X		X		X	X	X	X		X	X														X	X	
Wisconsin	X	X	X	X		X	X	X	X				X	X	X	X	X		X						X		X	X		
Wyoming	X	X	X	X		X	X	X					X	X		X	X	X	X							X				
CA-North Coast	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X						X					X	
CA-San Francisco	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X		X	X	X		X					X	
CA-Los Angeles	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X		X		X		X	X	X	
CA-Lahontan	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X		X	X		X	X						
CA-Santa Ana	X	X	X	X	X	X		X	X		X		X	X	X	X	X	X		X	X	X	X						X	
Hopi (AZ)	X	X	X		X	X		X	X	X	X			X	X	X	X	X		X								X		X
Hualapai (AZ)	X	X	X			X		X	X					X	X															
Navajo (AZ, UT, NM)	X	X	X		X	X		X	X			X	X	X												X				
White Mtn Apache (AZ)	X	X	X		X	X		X	X	X	X			X	X	X	X	X	X	X			X							X
Bishop Paiute (CA)	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X		X	X		X	X						
Hoopa Valley (CA)	X	X	X	X	X	X		X	X	X		X	X		X					X				X				X		
Ute Mountain (CO, UT, NM)	X	X	X		X	X		X	X				X	X																

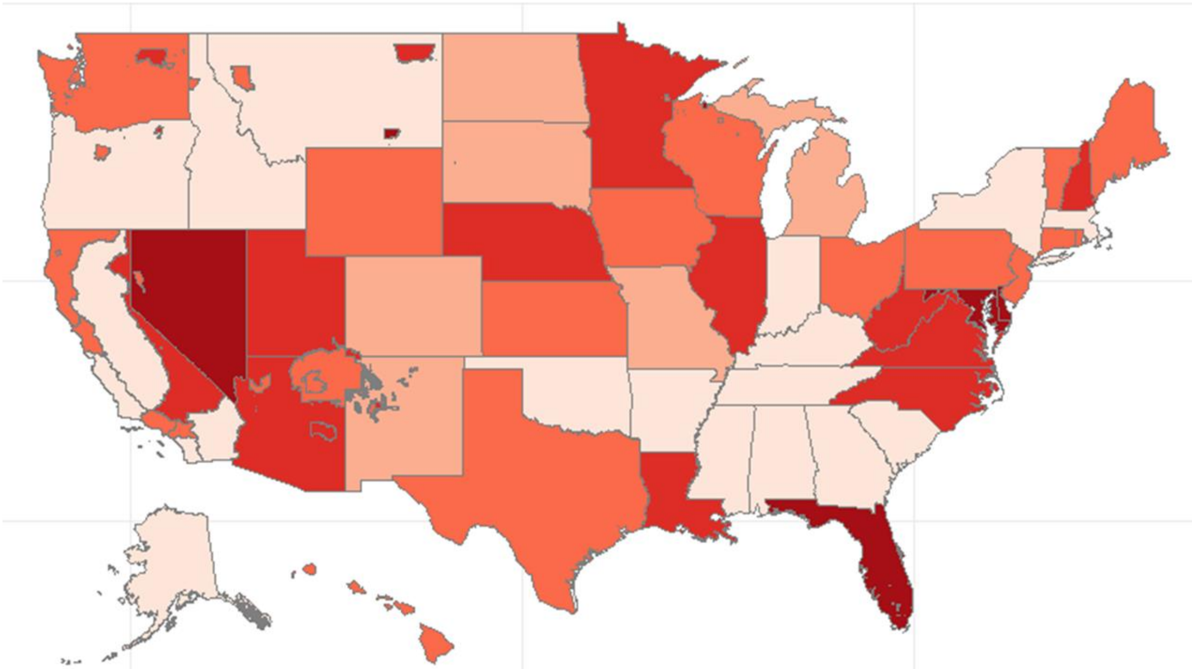
	Aesthetics								Harmful Materials				Biological			Specific Criteria									Miscellaneous					
	Floating material	Settleable material	Oil & Grease	Suspended material	Turbidity	Color	Unsightliness	Odors & Tastes	Toxics	Radioactivity	Pathogenic organisms	Bioaccumula-tion /pesticides	Biological community	Nuisance aquatic life	Biostimulatory substances	Temperature	pH	Oxygen	Gasses	Salinity	Ammonia	Sulfide/Sulfate	Chlorine	Sedimentation	Hydrology	Junk & refuse	Fish Migration	Physical Habitat	Foaming substances	Mixing Zones
Miccosukee (FL)	■	■	■		■	■		■	■		■		■	■	■	■	■	■		■										
Seminole (FL)	■	■	■		■	■		■	■				■																	
Coeur D'Alene (ID)	■	■	■		■	■		■	■					■																
Fond du Lac (MN)	■	■	■	■	■	■	■	■	■	■			■	■	■	■	■	■		■		■						■		
Grand Portage (MN)	■	■	■	■		■	■	■	■	■	■		■	■	■	■	■	■		■		■								
Flathead (MT)	■	■	■			■		■	■					■			■	■												
Fort Peck (MT)	■	■	■		■	■		■	■					■																
Northern Cheyenne (MT)	■	■	■			■	■	■	■				■	■			■	■	■					■	■		■			
Pyramid Lake (NV)	■		■		■	■		■	■	■	■	■	■		■	■				■				■						
Ohkay Owingeh (NM)	■	■	■		■	■		■	■	■	■			■	■	■	■	■		■										■
Pueblo of Acoma (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■										■
Pueblo of Isleta (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■		■								■		■
Pueblo of Laguna (NM)	■	■	■	■	■	■		■	■	■	■		■	■		■				■						■		■		
Pueblo of Nambé (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■										■
Picuris Pueblo (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■					■					■
Pueblo of Pojoaque (NM)	■	■	■		■	■		■	■	■	■			■	■	■	■	■	■	■										■
Pueblo of Sandia (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■				■						■
Pueblo of Santa Ana (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■				■						■

	Aesthetics								Harmful Materials				Biological			Specific Criteria									Miscellaneous					
	Floating material	Settleable material	Oil & Grease	Suspended material	Turbidity	Color	Unsightliness	Odors & Tastes	Toxics	Radioactivity	Pathogenic organisms	Bioaccumulation /pesticides	Biological community	Nuisance aquatic life	Biostimulatory substances	Temperature	pH	Oxygen	Gasses	Salinity	Ammonia	Sulfide/Sulfate	Chlorine	Sedimentation	Hydrology	Junk & refuse	Fish Migration	Physical Habitat	Foaming substances	Mixing Zones
Santa Clara Pueblo (NM)	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■					■					■
Pueblo of Taos (NM)	■	■	■	■	■	■		■	■				■	■		■				■								■		■
Pueblo of Tesuque (NM)	■	■	■		■	■		■	■	■	■			■	■	■	■	■	■	■					■					■
St. Regis (NY)	■	■	■	■	■	■		■		■	■			■	■	■	■	■		■					■	■		■		
Umatilla (OR)	■	■	■			■	■	■	■					■					■											
Warm Springs (OR)					■	■		■	■	■	■					■		■		■										
Chehalis (WA)					■		■		■	■	■					■			■											
Colville (WA)	■	■	■		■	■		■	■	■	■			■		■	■	■	■											
Kalispel (WA)	■	■	■		■	■		■	■					■																
Lummi (WA)	■	■	■	■		■		■						■	■									■						
Makah (WA)	■	■	■		■	■		■						■										■						
Port Gamble (WA)	■	■	■		■	■		■						■																
Puyallup (WA)					■		■	■	■	■	■					■	■	■	■											
Spokane (WA)	■	■	■		■	■		■						■	■									■						
Swinomish (WA)	■	■	■		■	■		■					■	■																
Bad River (WI)	■	■	■		■	■		■	■	■		■	■	■	■	■	■	■		■		■		■	■		■	■		
Lac du Flambeau (WI)	■	■	■			■		■	■	■			■	■	■	■	■	■							■		■			
Sokaogon (WI)	■	■	■	■		■		■	■	■	■	■	■	■	■	■	■	■							■			■		
Total	75	75	74	31	57	79	20	79	69	46	41	13	44	61	45	50	42	42	21	32	6	9	9	17	17	10	7	19	12	14

* General terms used in categories, states and tribes used a variety of terms for similar criteria.

Numeric Wetland Criteria

The majority of states and tribes that have some wetland WQS have not yet developed numeric water quality criteria specifically for wetlands. Several states address pH, DO, temperature, and salinity regimes through narrative criteria (pH & DO = 42, temperature = 50).



Legend		#
	No wetland WQS	
	Wetland uses are potential uses only, no criteria	10
	Narrative criteria alone apply to wetlands	45
	Narrative criteria & numeric criteria at "background levels" apply	19
	Narrative and numeric criteria specific to wetlands apply	8

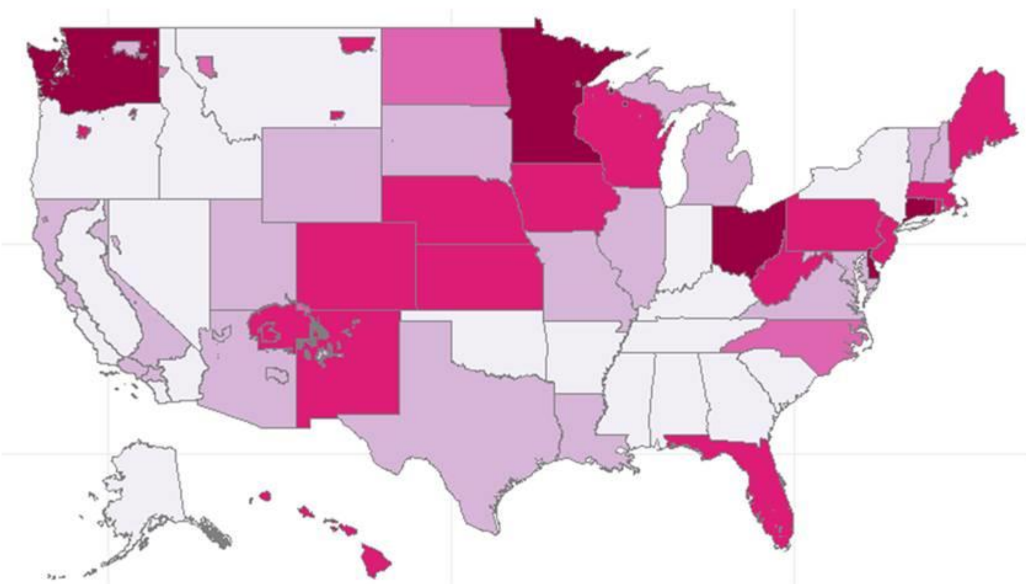
Figure 8. State and tribal strategies for applying narrative and numeric criteria to wetlands.

In 19 tribes and states, wetland numeric criteria are relative to 'ambient,' 'natural,' or 'background' conditions (**Figure 8**), most often DO and pH (See Minnesota Administrative Code, 2017; Missouri Code of State Regulations, 2014). Multiple strategies within that category have been pursued, like stating that criteria will be added on a site by site basis (see Lahontan California Regional Water Quality Control Board, 1995) or that certain criteria, most often DO, do not apply for a use if supported by a wetland (see Nebraska Administrative Code, 2014). Some have stated that numeric criteria are goals, rather than standards (see North Dakota Century Code, 2001).

In the standards used for benchmarking, toxic substance criteria (metals, PCB's, and others) remain applicable in wetlands, even if some criteria for conventional pollutants are found to be inappropriate for wetlands. While the goal of this project is focused on defining a beneficial use and narrative criteria for wetlands, appropriate numeric criteria are important. GSL wetlands and the lake itself have no numeric criteria, which is a non-protective assumption: pollution is allowed until regulators can conclusively demonstrate that designated uses are not being attained and that non-attainment is caused by pollution, rather than preventing pollution proactively (personal communication, Jake Vander Laan).

Antidegradation

The EPA guidance on wetland water quality standards lists wetland antidegradation rules as one of the final steps in developing WQS. Most states and tribes with wetland WQS do not address wetlands explicitly in their antidegradation statutes (n = 39). Only ten states and tribes have a specific wetland antidegradation rule (**Figure 9**). Commonly (n = 23), wetlands are implicitly covered when federal and state parks and refuges are defined as Outstanding Natural Resources or Tier 1 waters because many wildlife refuges and management areas are predominantly wetlands. The other way antidegradation rules address wetlands is by stating that wetlands are Waters of the State and the antidegradation rules apply to them like any other water (n = 12). Utah does not address wetlands explicitly in their antidegradation rules, but it does not exclude wetlands and because wetlands are implicitly Waters of the State antidegradation policies should apply to wetlands (UAC R317-2-3).



Legend		#
	No wetland WQS	
	Some wetland WQS, no explicit wetland antidegradation rules	39
	Antidegradation applies to Waters of the State, including wetlands (explicitly)	12
	Waters in refuges and parks are Outstanding Natural Resources	23
	Wetland-specific antidegradation rules	10

Figure 9. Strategies for addressing wetlands in antidegradation rules.

Special Implementation Rules

Some water quality rules found in benchmarking with state and tribal wetland WQS fall outside categories of definitions, uses, criteria, and antidegradation discussed above. Special policies for implementing wetland WQS may address low-flow or no-flow conditions common in dynamic aquatic ecosystems, water rights, effluent-dominated wetlands, mixing zones, and §404 dredge-and-fill permits. The rules described below address issues likely to come up as Utah modifies its wetland WQS and are only included as issues to keep in mind outside of implementation strategies.

- **Low or No Flow.** Water availability in wetlands, particularly in semiarid Western states, makes monitoring and assessment water quality difficult. Dry conditions, natural and otherwise, can cause a violation of water quality criteria or make assessing water quality challenging. Regulators have followed two general strategies for dealing with this: specifying that numeric criteria are not applicable when flow is outside normal conditions or writing narrative criteria to protect against disruptions in the hydroperiod. Kansas and Nevada as well as the Kalispel Tribe state that when stream flow is below a specified discharge, only the narrative criteria apply to waters in that watershed (Kalispel Tribe of Indians, 2003; Nebraska Administrative Code, 2014). Eastern states like North Carolina and Ohio and western tribes like the Santa Clara Pueblo and Northern Cheyenne Tribe have narrative criteria that prohibit change to the hydroperiod of wetlands. Maine and North Dakota go farther toward protecting against drought conditions by requiring the establishment of minimum flows protective of beneficial uses.

  - Before rules addressing low-flow conditions can be established, average or normal flows in rivers and wetlands must be known. Such data is not available for Utah wetlands. However, wetland monitoring and other research conducted in Utah is filling in this data gap.

- **Water rights.** In the Western U.S. the right to use water is regulated under the rules of prior appropriation, which are much older than water quality rules. Ecologically, it's well understood that water quality and quantity are linked, but legally the two issues are regulated by different agencies and through different legal frameworks. One strategy Western states have to mitigate conflict over jurisdiction is extra guidance in regulations on the priority of water quality and quantity. Colorado and California have developed additional language in their water quality rules that specify that water quality rules will not be interpreted in ways that infringe upon existing water rights (Colorado Water Quality Control Commission, 2017; Pueblo of Laguna Code, 2014; Pueblo of Taos, 2002). Nevada and Wyoming take a different route, stating that in order to protect wetland water quality, water quality agencies will monitor and comment on new water diversion proposals (Nevada Administrative Code, 2016; San Francisco Bay Water Quality Control Board, 2018; Wyoming Administrative Rules, 2013). The Umatilla tribe noted in their rules that protecting Tier 3 (analogous to Category 1) waters may require the maintenance of natural flow regimes, which could be an option in the future to address stakeholder concerns about water quantity.
  - Protecting wetland water quality is ineffective if there is no water in wetlands to protect. However, the perception that a water quality agency is trying to regulate water availability would be highly controversial and potentially distract from or derail efforts to update wetland WQS.
- **Effluent-dominated wetlands.** Some wetlands are primarily dependent on point source discharges for their water, either seasonally during base-flow periods or throughout the growing entire year. This is problematic when effluent pollution levels exceed criteria because it can create incentives to eliminate point source discharges that act as water supplies to wetlands. This is further complicated in the case of wetlands incidentally created by effluent. New Mexico and Arizona and the tribes within those states have the most to say on this, including uses specific to effluent-dependent waters.
  - The issue of effluent supplying water to wetlands has come up around GSL as wastewater dischargers work to meet the requirements of Utah's Technology Based Phosphorus Limit and meet the needs of growing communities upstream of GSL. Addressing effluent-dominated waters is a relatively recent water quality standards development and it is unknown thus far if the strategies above have been effective.
- **Mixing zones.** Often point sources of pollution discharge water with higher concentrations of pollutants than WQS allow, but that pollution is diluted by the lakes or streams they discharge to. In wetlands, mixing zones are excluded because wetlands are small water bodies with very slow

flow, so they have limited capacity to dilute pollution. It is EPA Region 8's policy to not allow mixing zone in wetlands.
    - Utah's Mixing Zone rules can be updated to explicitly state that no mixing zones are permitted in Utah wetlands.
- **CWQ §404 Permits**. Until the development of wetland WQS, §404 of the Clean Water Act, which requires a permit to dredge or fill in a wetlands, was the primary means of conserving wetlands through requirements to avoid impacts to wetlands or to mitigate for damages done. The permit program is run by the U.S. Army Corps of Engineers (USACE), but two states (New Jersey and Michigan) have developed their own §404 permitting programs to complement their WQS and wetland conservation goals.
    - Compared to many other states, Utah has relatively few §404 permit applications and it is likely a function best maintained by USACE, who consults with UDWQ on wetland water quality issues when necessary.
- **Wetland Classification**. Once a wetland-specific designated use has been defined, waters that support that use need to be added to classification tables in the UAC (R317-2-6; R317-2-13). Currently, GSL wetlands below an elevation of 4,208 feet and wetlands within state and federal wildlife management boundaries are assigned designated uses (i.e., have been classified), which leaves approximately 80% of Utah wetlands without a specified use (see **Figure 1**). Benchmarking identified a few means for classifying wetlands in regulations:
    - Only named wetlands have uses and are listed in classification tables: Kansas, Lahontan-California, Florida
    - Maps of water bodies, including wetlands, and their uses: Connecticut, Massachusetts
    - All wetlands that meet the USACE/40 CFR 166.3 definition have wetland use: Ohio, New Jersey
    - Uses apply to wetlands according to state-defined wetland types: fresh or saline water, high or low elevation (Hawaii); emergent or meadow wetlands (Bishop Paiute); wastewater treatment wetlands (Louisiana); freshwater, tidal, swamp, or unique wetlands (North Carolina); Upland or Valley, Riparian or Herbaceous(Hoopa Valley); hydrogeomorphic classification (Swinomish) (see **Appendix B** for details)
    - Wetlands tributary to or connected to named water bodies have uses: Maryland (Chesapeake Bay and tidal tributaries), Nevada (Lake Tahoe tributaries)
    - Specify uses for unlisted waters (in addition to any listed): Rhode Island, Minnesota
        - Addressing classification in standards simultaneously with created use categories would be putting the horse before the cart. In the words of the Utah Standards Coordinator, "First you need a bin (i.e., a beneficial use), then you need to put things in the bin (classify waters)."

Figures 10a-10e highlight unique and potentially useful pieces of wetland WQS from states and tribes.

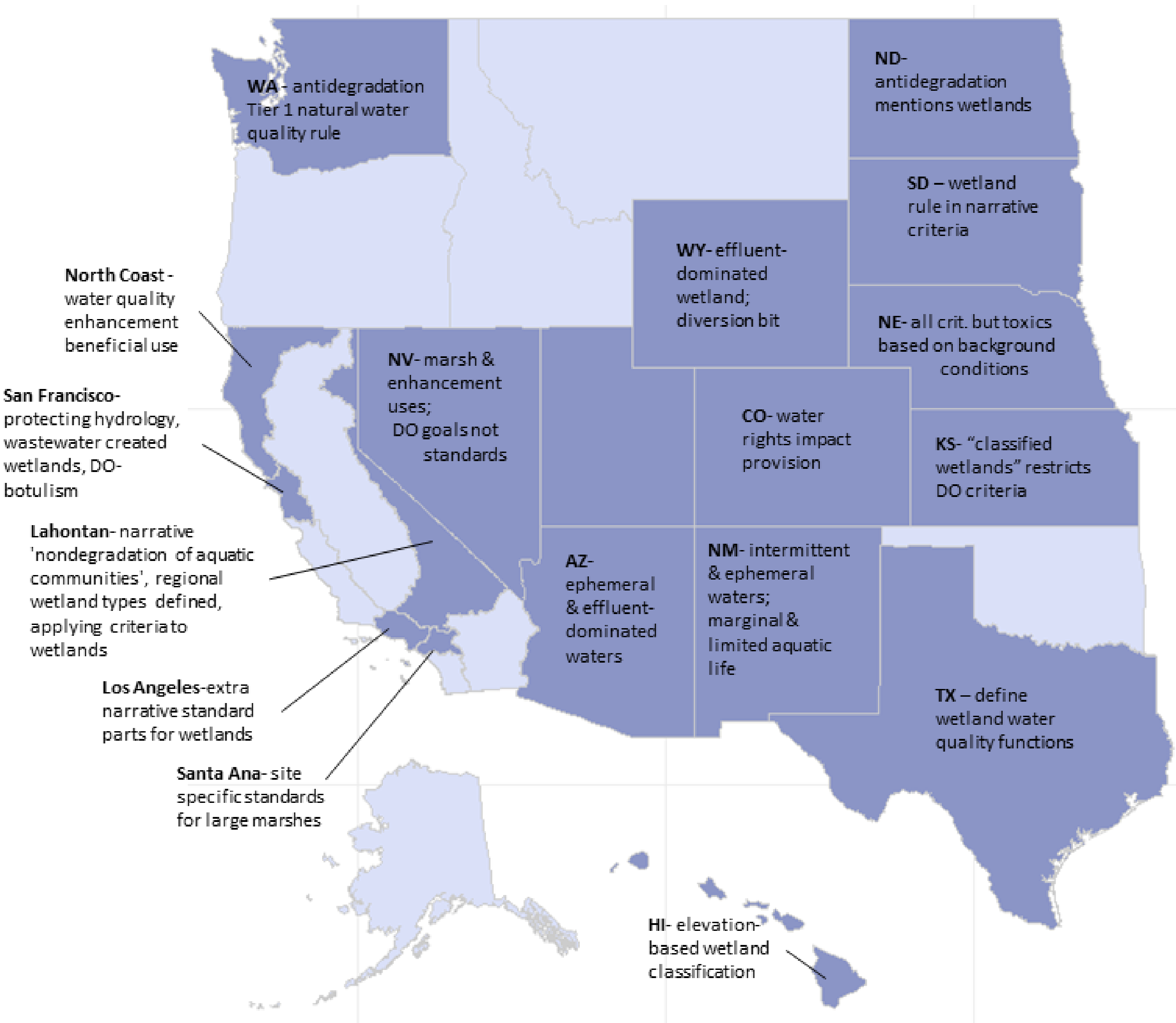


Figure 10a. Interesting parts of Western state wetland water quality rules that might be relevant to Utah.

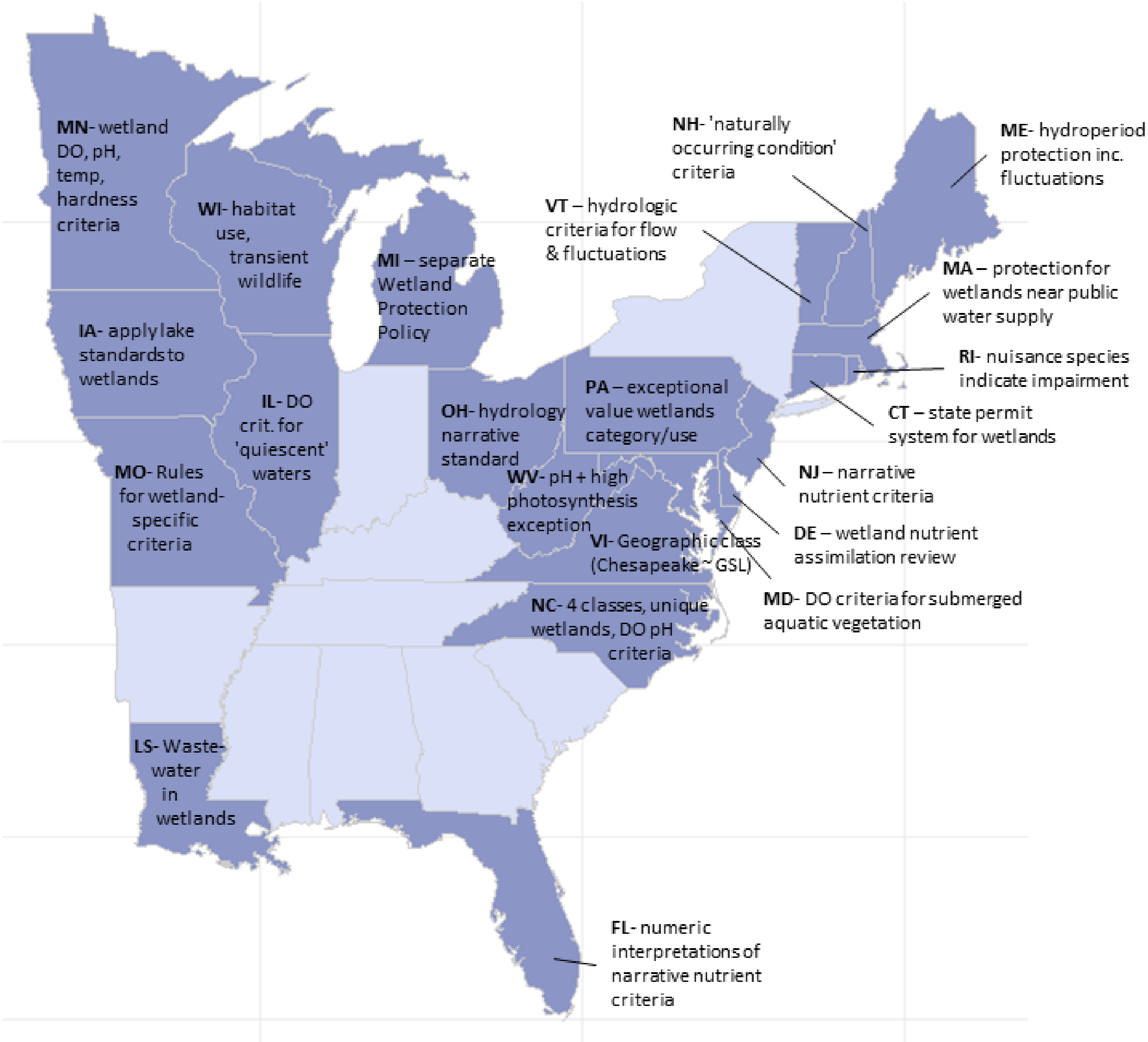


Figure 10b. Interesting parts of Midwestern and Eastern state wetland water quality rules that might be relevant to Utah.

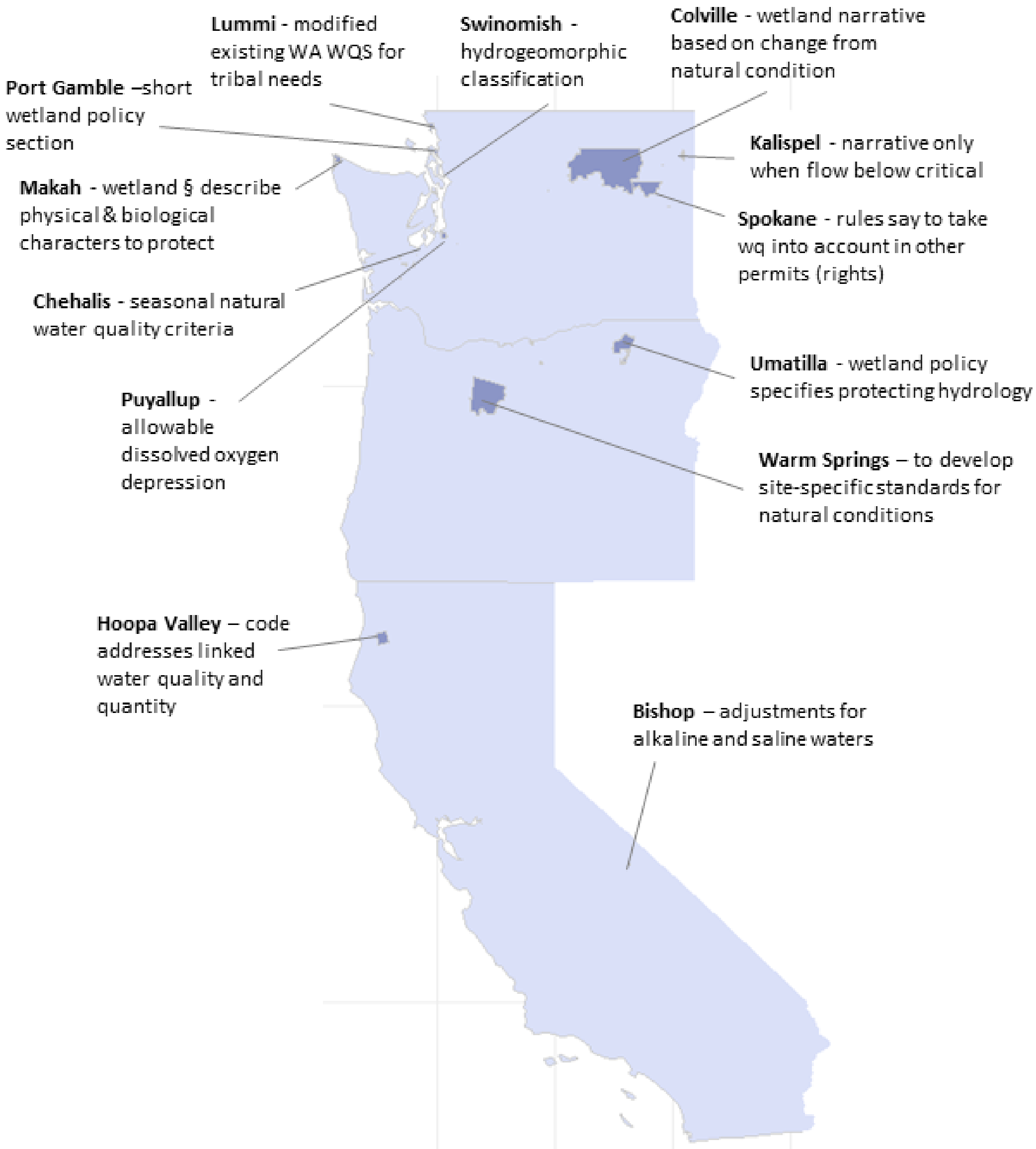


Figure 10c. Interesting parts of West coast tribal wetland water quality rules that might be relevant to Utah.

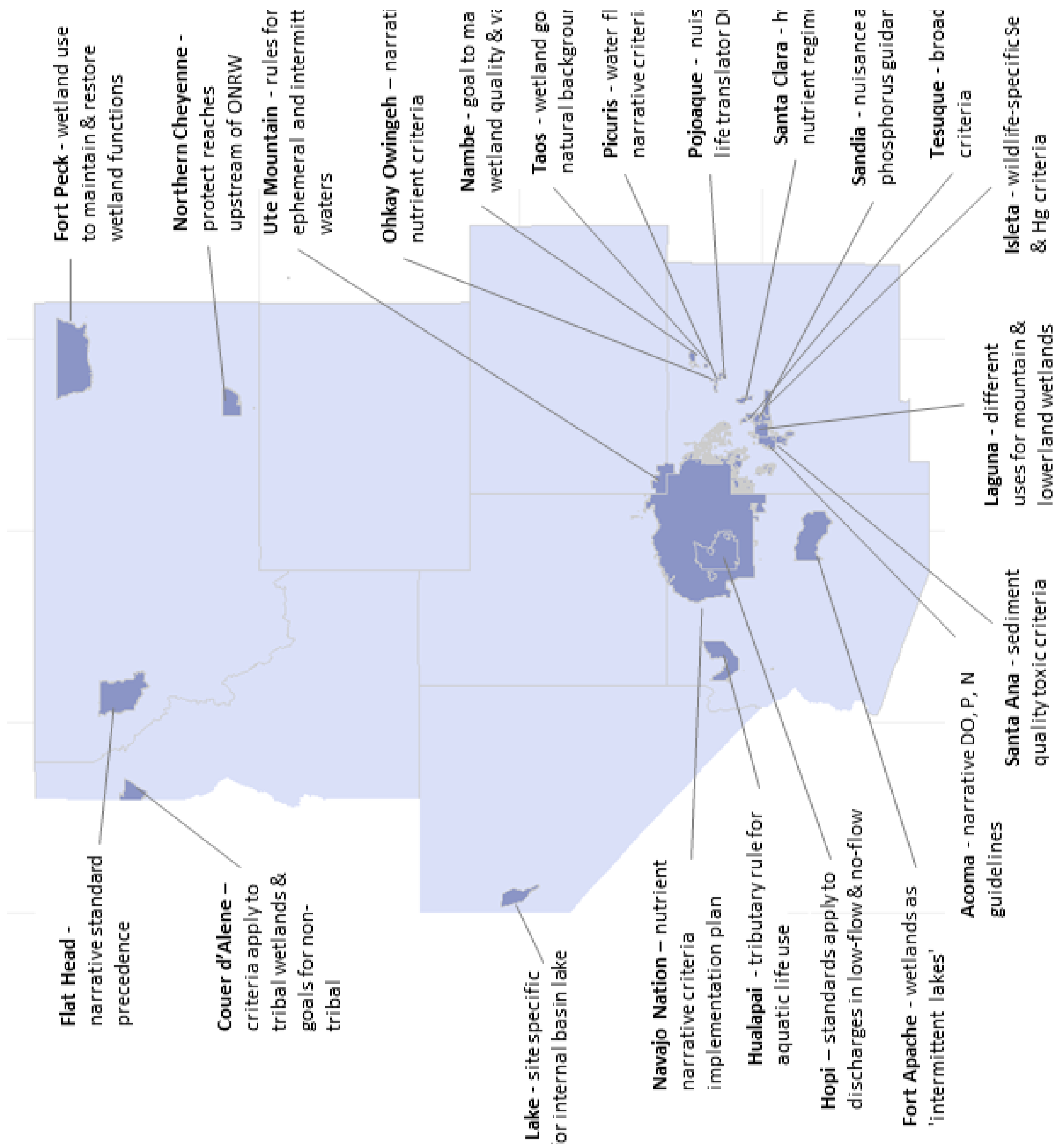


Figure 10d. Interesting parts of Western tribal wetland water quality rules that might be relevant to Utah.

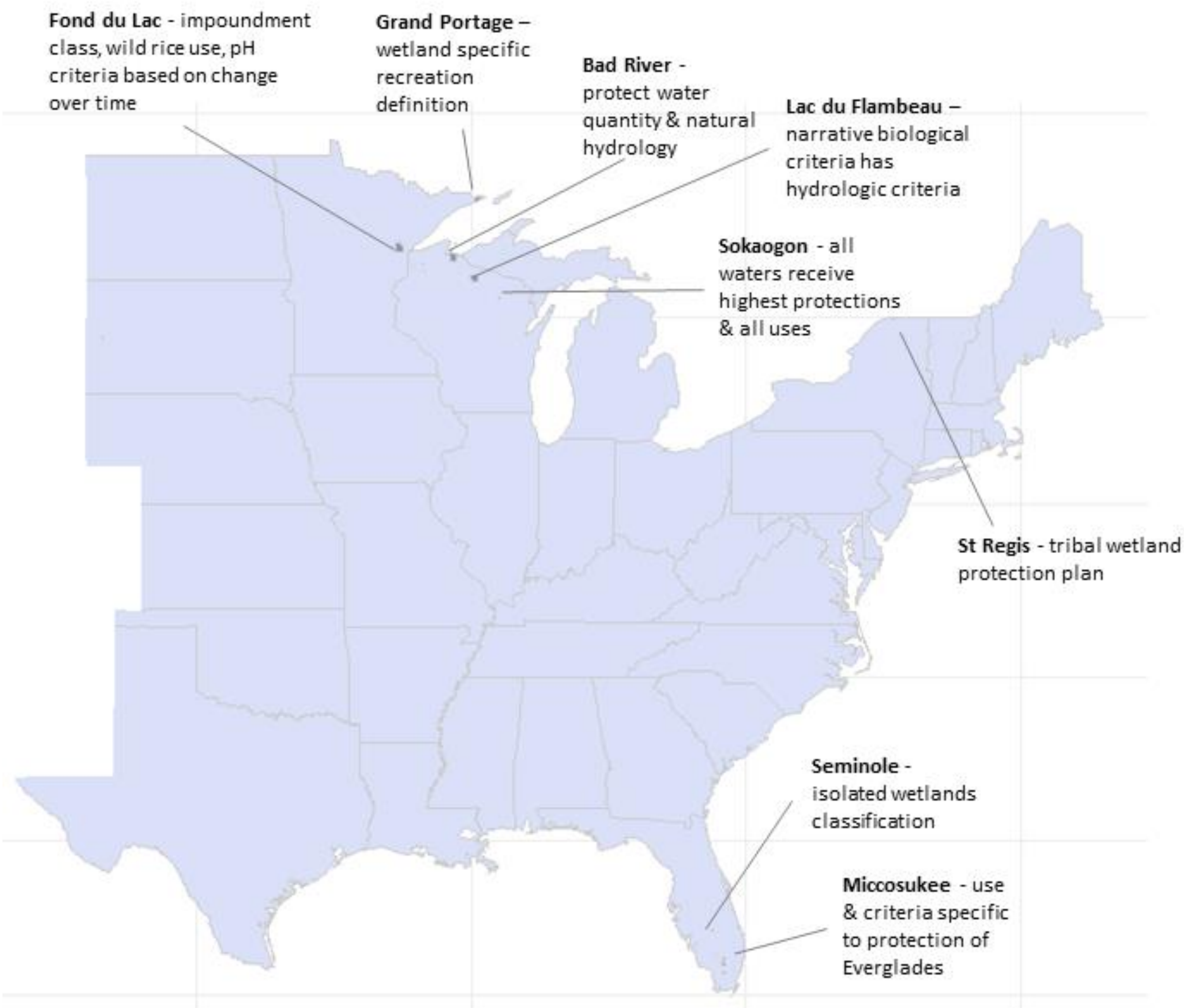


Figure 10e. Interesting parts of Midwestern and Eastern tribal wetland water quality rules that might be relevant to Utah.

IMPLEMENTATION OPTIONS

The goal of conducting Wetland WQS CAP workshops and benchmarking against other states was to develop a single wetland-specific designated use applicable to all wetlands statewide and updated narrative criteria that will adequately protect wetland water quality. Currently, Utah has designated uses that apply to wetlands in close proximity to GSL and within state and federal wildlife management areas, which leaves approximately 80% of Utah's wetland area without specified water quality rules (**Table 7**). The different uses applicable to GSL wetlands do not distinguish between biologically meaningful classes like those discussed in CAP workshops (impounded, fringe and playa/mudflats) and divide wetland complexes based on land ownership (see **Figure 3**).

Table 7. Area of regulatory and biological wetland classes in Utah.

	Classification	% of total area*	Inclusion criteria	Current designated beneficial use and applicable criteria
Designated Beneficial Use	5e Transitional lands	11%	Wetlands near GSL between 4,195 - 4,208 feet in elevation	5E, narrative criteria only
	State and federal management areas	6%	Wetlands within refuge and wildlife management area boundaries	2B - secondary contact recreation 3D - waterfowl and shorebirds 3A/3B/3C - aquatic life Numeric (excluding DO & pH in impoundments) & narrative criteria
	Other wetlands	82%	All other NWI wetlands in Utah (no lakes or evaporation ponds)	Presumptive uses 2B (secondary contact recreation) 3D (waterfowl and shorebirds) Numeric and narrative criteria
Biological Classification	Impound wetlands	4%	NWI modifier "h", no evaporation ponds	All uses and criteria listed above may apply
	Fringe wetlands	11%	L2AB, L2USF-K, PUB, PAB, PEM	All uses and criteria listed above may apply
	Playa/mudflat wetlands	83%	L2US, PUSA-C	All uses and criteria listed above may apply
	Other wetlands	2%	All other NWI wetlands in Utah, primarily forested	All uses and criteria listed above may apply

**Important note on maps: maps and estimates of wetland acreage in each state are based on the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI). While this is an appropriate layer for estimating the relative area of wetlands in each state and potential proportions of different wetland types, the NWI is not a regulatory dataset (USFWS, 2018).*

Based on benchmarking with other states, Utah's rules need a definition of wetlands that is broad enough to include, at a minimum, the wetland targets discussed in CAP workshops (impounded, fringe, and playa/mudflat wetlands). Following examples from states and tribes, DWQ can develop a designated beneficial use for Utah wetlands that protects wetland dependent wildlife, specifically the nested targets from CAP workshop discussions (waterfowl, shorebirds, waterbirds) and the biological, physical, and chemical conditions necessary to support feeding and nesting (defined as the KEA's of each wetland target, see **Tables 1** and **2**). Few states and tribes have developed narrative standards specific to wetlands, as UDWQ had originally proposed, but there are examples of additional state-wide criteria that address the pollution issues relevant to Utah wetlands (see **Tables 4** and **6**). CAP workshop participants showed a strong interest in conserving critical habitat around GSL, which is often addressed in state and tribal rules through the designation of Tier 1 or Outstanding Resource waters. However, CAP participants and research also recognize that GSL wetlands are extremely impacted by upstream water use and adjacent land uses and may not qualify as high-quality waters.

These additional issues need to be kept in mind as Utah WQS are updated:

- Utah has five designated beneficial use categories – drinking water, recreation, aquatic life, agriculture, and Great Salt Lake. For some of the criteria that are protective of these uses, for example pH and pH-related criteria, some functional wetlands may have natural background ranges outside of these criteria. Therefore, criteria will need to be developed that characterize the natural background conditions of various wetland types. For wetlands that have these "conventional" criteria already applied, a UAA will need to demonstrate that the proposed criteria are protective of the uses.
- UDWQ has proposed to adopt wetland-specific narrative criteria, which is a common strategy for other states and tribes as well. Specifying expected wetland conditions in a narrative is an important first step to establish a quantitative assessment method. However, having designated beneficial uses without numeric criteria, like GSL uses, complicates regulation.

The following sub-sections highlight preferred options as Utah updates water quality-based protections for wetlands.

New Utah Wetland Definition

The definition of **Waters of the State** comes from the Utah Water Quality Act and cannot be changed by the Water Quality Board, which is responsible for water quality standard changes. However, the current definition is quite broad: "…all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, which are contained within, flow through, or border upon this state…" Adding **a definition of wetlands** in R317-1-1, preferably the 40 CFR §116.3 definition of wetlands, would clarify that wetlands are Waters of the State, which is a point of confusion among regulators and stakeholders. Adding a definition of wetlands to the water quality standards rules would also define which wetland types are flooded long or deeply enough to be considered water bodies or accumulations of water. Some classes may be dry for too much of their annual cycle to be considered water bodies or Waters of the State.

> "Wetlands" means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. All wetlands which are not constructed wetlands (used for the repository or treatment system for wastes from human sources) are considered Waters of the State.

Wetland Designated Use

A single wetland beneficial use class – Class 6 – that defines the use as supporting wetland-dependent wildlife and associated food web, following the nested target and key ecological attribute discussions in the CAP workshop could be applied to all Utah wetland in place of the patchwork of assigned and presumptive uses currently in place.

> R317-2-6.6 Class 6 – Wetlands – Protected for wetland-dependent wildlife, including waterfowl, shorebirds, waterbirds, and other water-oriented wildlife, and the necessary physical and chemical structure and aquatic organisms in their food web.

For wetlands in state and federal wildlife management areas that have designated beneficial uses, the wetland use should be added in addition to the aquatic life and recreation uses they support (similar to Minnesota rules). If future research finds that the narrative or numeric criteria for wetlands differ between different classes, then subcategories can be added. Subcategories of wetland uses can be added based on elevation (like Hawai'i), connection to other water bodies (like Colorado), or watershed (following tribal examples).

Criteria

A separate wetland narrative standard is rare, though it is what we proposed (See **Appendix C** for an example of a Utah wetland water quality standard using EPA Wetland Narrative Standard Templates). An updated narrative standard or additional narrative criteria that apply only to wetlands, can include pollution of concern identified by UDWQ research, CAP workshops, and benchmarking. Such pollution includes nuisance algae, undesirable biological communities or other effects from excessive biostimulatory substances, and hydroperiod alteration. Specific metrics for these stressors or an index that quantifies the condition of the wetland can then be developed for formal water quality assessment. One potential example, following criteria from Ohio, West Virginia, and Illinois:

[*Subsection of narrative criteria, UAC R317-2-7-a*]. For waters in wetlands:

(1) The hydrology necessary to support the biological and physical characteristics naturally present in wetlands shall be protected to prevent significant adverse impacts on:

- (a) Water currents, erosion or sedimentation patterns;
- (b) Natural water temperature variations;
- (c) Chemical, nutrient and dissolved oxygen regimes of the wetland;
- (d) The movement of aquatic fauna;
- (e) The pH of the wetland; and
- (f) Water levels or elevations, including those resulting from ground water recharge or discharge.

The **numeric criteria** for aquatic life in Table 2.14.2 – metals, inorganics, and organics – are appropriate for wetlands. Existing aquatic life criteria for pH, DO, and temperature based primarily on the needs of fishes are often exceeded in Utah wetlands under natural low water or high productivity conditions. Creating a wetland-specific designated use will be important in setting future wetland-specific criteria for pH, DO, and temperature or developing monitoring guidelines for sampling.

Antidegradation

Wetlands that are Waters of the State are subject to Utah's Antidegradation Policy. Making clear that wetlands are considered Waters of the State through the addition of a wetland definition would make clear that wetlands are to be considered in Antidegradation Reviews. Benchmarking shows there is precedence for establishing Outstanding Natural Resource Waters for wetlands within the boundaries of parks and refuges, analogous to Utah Category 1 Waters. However, Utah's wetlands are concentrated around GSL, where anthropogenic impacts are very high and condition is degraded.

Special Implementation Rules

Once wetland uses have been established, it will likely be necessary to address issues of low water conditions, water rights, effluent-dominated wetlands, and special arid-region wetland classes; given that Utah is the second driest state in the nation. However, the best means for addressing such complex and contentious issues may be best addressed through TMDL processes, updated UDWQ monitoring protocols, or collaboration with other agencies, rather than through changes to water quality standards. Revising water quality standards is a long process and it is important to be thorough when suggesting revisions, but covering all potential issues in a single revision is inadvisable because particularly contentious issues (like water rights) could derail much-needed and less controversial revisions.

Strategies

Following CAP meetings, benchmarking, and internal UDWQ discussions, three basic strategies are considered for updating Utah's wetland WQS.

Proposed Strategy (Wetland Use + Wetland-specific Narrative Standard)

- **Steps** – Add a wetland definition, wetland designated use (both following the definitions and use above), and a wetland-specific narrative standard into existing narrative criteria (see Appendix C). The additions to standards under this proposal could be part of a single wetland section that also addresses special wetland considerations like differences in antidegradation policy, mixing zones, low water conditions, and special Utah wetland types, similar in structure the Wetlands chapter in Wisconsin's WQS.
- **Pros** – Specific, separate rules for applying WQS to wetlands would make clear that wetlands are Waters of the State and create a space for subsequent additions to wetland WQS. Consistent designated uses applied to wetlands statewide.
- **Cons** – A separate section of WQS would take up a lot of space within Utah's standards for some redundant material, like narrative standards. Creating a use class without numeric criteria has proven difficult to regulate around GSL. If narrative-only criteria are applied to wetlands that have previously been classified as supporting aquatic life and recreational uses, it will likely require a UAA because narrative criteria are less stringent than existing numeric criteria.

New Wetland Use Class

- **Steps** – Add a wetland definition, wetland designated use, and additional wetland narrative criteria (following the options listed in the previous section). Apply Class 6-Wetlands use to all classified and unclassified wetlands. Apply numeric aquatic life criteria for 3D-Waterfowl and Shorebirds for Class 6. Numeric DO and pH established initially as ambient. Add monitoring guidance for when to monitor water quality in wetlands to address seasons when wetlands are expected to be dry and for when field parameters (pH and DO) are appropriate to measure. The wetland designated use applies to all currently classified wetlands. Remove the 5E –Transitional Lands of GSL use. Update Utah's mixing zone policy to explicitly disallow mixing zones in wetlands.
- **Pros** – Wetlands clearly identified as Waters of the State through definition and use class. Consistent designated uses applied to wetlands statewide. Numeric criteria and wetland-specific narrative criteria applicable to wetlands address pollution relevant to wetlands and stakeholder concerns.

- **Cons -** UAA's may be required if 6-Wetlands criteria is considered less stringent than current criteria of classified wetlands. Numeric criteria set to 'ambient' would require additional research to determine what ambient is for wetlands. Updating multiple sections of WQS complicates revision of standards.

Designate existing Aquatic Life Use (ALU) and Recreational Classes for wetlands statewide

- **Steps –** Add a wetland definition. Designate ALU class 3D-Waterfowl and Shorebirds and Recreation use class 2B-Secondary Contact Recreation to all wetlands unless otherwise specified. Add wetland-specific narrative criteria into the existing narrative criteria. Remove 5E-Transitional Lands of GSL designated use. Modify DO and pH footnote (Table 2.14.2 2A) to apply to all wetlands: those criteria are not applicable to wetlands. Update Utah's mixing zone policy to explicitly disallow mixing zones in wetlands.
- **Pros –** Explicitly includes wetlands within standards without making extensive changes. Simplifies designated beneficial use categories. May not require a UAA for wetlands without designated beneficial uses.
- **Cons –** Does not address stakeholder concerns about wetland-specific designated uses and criteria. Leaves less flexibility in developing numeric criteria specific to wetlands.

Future Steps

UDWQ's subsequent WPDG projects involve wetland monitoring and assessment, which have important implications for WQS. Explicitly including wetlands within Utah's WQS will facilitate monitoring wetlands along with other state waters for Utah's Integrated Report and Total Maximum Daily Loads report and subsequent WPDG activities will monitor broader wetland condition for the 305(b) portion of the Integrated Report. Integrated monitoring and reporting of wetlands will meet the fourth anticipated output on this project to develop assessment frameworks for all wetland classes statewide. In 2019 and 2020 UDWQ will test condition assessment protocols in two important wetland classes around GSL. Simultaneously, the UGS will begin mapping and rapid assessment of wetlands in the Rocky Mountain ecoregion, which will identify important classes of wetland types that UDWQ will develop monitoring protocols for in future surveys (UGS and UDWQ, 2017).

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