Great Salt Lake: Salinity, beneficial uses, and water quality standards

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Photograph Courtesy of Charles Uibel - greatsaltlakephotos.com
DWQ’s Vision for Great Salt Lake

Provide important recreational, ecological, and economic benefits for current and future generations.

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GSL Background

1. Ecological importance
   - Migratory and nesting bird habitat
   - Unique and valuable resident biota
     - Brine shrimp
     - Brine flies
     - Microbialites
     - Brackish communities
     - Wetlands

2. Economic importance ($1.3 billion annually)

3. Social/cultural value
Background

1. GSL is cooperatively managed:
   • Multiple state and federal agencies w/ management responsibilities
   • Highly engaged set of stakeholders providing input

2. Causeways divide the lake into 4 main bays, water chemistry and biota vary.
GSL Causeways and Salinity Gradients

- Gunnison Bay
- Bear River Bay
- Gilbert Bay
- Farmington Bay
GSL Causeways and Salinity Gradients

Gunnison Bay  Bear River Bay

Gilbert Bay  Farmington Bay
Causeway Opening 401 Water Quality Certification

Permitting background and current status
Great Salt Lake Culverts: 1960’s vs. 2012
Compensatory Monitoring and Mitigation Plan (CMMP)
UPRR Causeway Bridge Geometry

Figure 3-2. Proposed Bridge and Control Berm Plan View
UPRR Causeway Bridge Geometry

Figure 3-2. Proposed Bridge and Control Berm Plan View

Flow control berms
CMMP Performance Standards

Gilbert Bay Salinity
• Lake-level dependent ranges of salinity tolerances
• Within salinity ranges predicted by 2012 updated UPRR/USGS Water & Salt Balance Model

Causeway Opening Geometry
• Physical and hydrological state of the opening
• Within 10% of as built dimensions
Causeway Monitoring Permit Requirements

• 5 year monitoring period including:
  • Annual cross section measurements of opening and contours
  • Quarterly water depth measurement
  • Quarterly salinity measurements:
    1 location in Gunnison Bay
    3 locations in Gilbert Bay
• If not meeting performance standards, additional monitoring or adaptive management is triggered - restarts monitoring period.
Gilbert Bay Salinity Performance Standard

Figure 10. Final Monitoring Results Compared to UPRR/UGS Historic South Arm Salinity Range
Current permit status

Quarterly & Annual Reporting
UPRR submitted 2017 annual report to DWQ February 2018

Salinity
Observed Gilbert Bay salinities within modeled historic range

Opening geometry
Geometries within 10% of as built
How does GSL salinity effect water quality regulations?
GSL Beneficial Uses

1. Primary and secondary contact recreation

2. Waterfowl, shore birds and other water-oriented wildlife including their necessary food chain
Water Quality Standards

**Numeric Standard:**
Measurable level of a particular chemical or condition allowable in a water body
- Gilbert Bay Selenium egg tissue criterion (12.5 mg/kg dry wt)
- Others in development

**Narrative Standard:**
Narrative statement that establishes water quality goals and identifies significant negative impacts on water quality as unlawful.
Numeric Aquatic Life Use Criteria

DWQ currently developing numeric criteria for aquatic life use protection.

Who lives here? The basis for criteria development is the assemblage of organisms that live in a waterbody.

“Resident taxa” – defined as:
• Usually present at a site
• Present intermittently or seasonally
• Likely present in the past, by currently absent due to degraded water quality conditions

In GSL, salinity is a critical factor determining resident taxa.
Salinity and Aquatic Organisms

• Salinity is a two-sided stressor for aquatic organisms (i.e. too much or too little).
• Aquatic organisms must regulate their salt and water balances relative to their environment.
• Multiple types adaptations for salt management.
• High salinities in GSL have resulted in very specialized communities in certain bays.
GSL Resident Taxa

Hypersaline community

Saline community (brine flies and shrimp)

Fresh-brackish communities
Numeric Criteria – Current Status

GSL resident taxa database developed

Toxic pollutants prioritized

Toxicity testing for Gilbert Bay resident taxa
  • Acute testing wrapping up
  • Chronic testing in development
Tracking and interpreting effects on GSL
Lake Elevations

Gilbert Bay

Gunnison Bay
Gilbert Bay Salinity

![Graph showing salinity levels in Gilbert Bay over time, with data points for surface and deep samples.]
Considerations for the Salinity Advisory Committee

Challenges for tracking, interpreting, and managing GSL salinity:
1. Defining “salinity” – common currency
2. Harmonizing data
   • Analytical methods
   • Historic and future data
3. Harmonizing monitoring programs
   • Sample depth
   • Sample aggregation/averaging
QUESTIONS?