Critical to the completion of an integrated water resource management (IWRM) model is to develop a common vision of the questions to be answered and desired outcomes of the project. Based on input from the Technical Committee (TC) at the project kickoff meeting and subsequent interviews of the TC members, this brief white paper has been prepared to articulate the vision and objectives, and serve as the guiding set of principles for the Great Salt Lake IWRM Model project.

BACKGROUND

A recurring challenge that State agencies face is first defining and then understanding how critical factors in Great Salt Lake's watershed can influence the lake's water levels and salinity and subsequently the resources the lake supports. An IWRM model for the Great Salt Lake watershed will allow State agencies to understand these relationships, understand the potential changes and risks Great Salt Lake and its resources may encounter, incorporate these findings into planning efforts, and sustainably manage the lake's economic and ecological resources. The Great Salt Lake Advisory Council initially recommended the development of an IWRM model for Great Salt Lake in 2012. Their recommendation echoed similar recommendations found in the Division of Water Quality's *2012 Great Salt Lake Water Quality Strategy*, the Advisory Council's *2012 Definition and Assessment of Great Salt Lake Health*, and the Division of Forestry, Fire and State Land's *2013 Great Salt Lake Comprehensive Management Plan Revision*. Each recommendation was based upon the premise that "understanding changes in future water supply and its relationship to Great Salt Lake levels is central to sustainable economic benefits from the lake and is important to sustain critical habitat and a healthy ecosystem" (GSLAC 2013). Such a model would help State agencies characterize and evaluate linkages between the Great Salt Lake watershed and the resources the lake provides and support the State's mandate for sustainable resource management. The cost for developing an IWRM model for Great Salt Lake was included in the Governor's proposed budget and was approved by the 2014 Utah State Legislature.

VISION

Develop a tool that will help clarify the relationship between Great Salt Lake water levels and salinity and potential changes in the lake and its watershed.

PURPOSE

Great Salt Lake's natural resources and the economic and ecological benefits that are derived from them are directly related to water levels and salinity in the lake which, in turn, are directly related to inflows to and withdrawals from the lake. A tool is needed that integrates available water resources information/data within Great Salt Lake and its watershed to enable an understanding of how future changes in the watershed may influence the resources of Great Salt Lake. The purpose of the Great Salt Lake IWRM model project is to provide State agencies with a tool that **1) describes how changes in Great Salt Lake and its watershed could impact the lake's water levels and salinity, 2) could be used to evaluate potential impacts to and changes in the lake's resources, 3) will serve as a foundation for addressing future management challenges,** and **4) could be used as a public outreach tool to communicate lake responses to changes in water management or availability.**

OBJECTIVES

The central question that is to be answered by the IWRM model is: *How is the water level and salinity of Great Salt Lake influenced by potential changes in inflow to and withdrawals from the lake?* This question represents the overall objective the IWRM should address.

Objectives for the Great Salt Lake IWRM model include:

1. Allow agencies to complete a planning level analysis of projects, policy, and projected conditions in the lake.
2. Characterize in-lake processes (e.g., water and salt balance) and infrastructure (e.g., causeways, impoundments) that define water level and salinity in each of Great Salt Lake's four bays: Bear River Bay, Farmington Bay, Gilbert Bay (South Arm), and Gunnison Bay (North Arm).
3. Predict the water and salt balance, water level, and salinity in each of Great Salt Lake's four bays including salinity in the upper and deep brine layers where they form.
4. Characterize the following interconnected parameters in the watershed, how they may change, and how they may change inflows to Great Salt Lake:
    a. Land use
    b. Population
    c. Water supplies and development
    d. Water demands and depletions

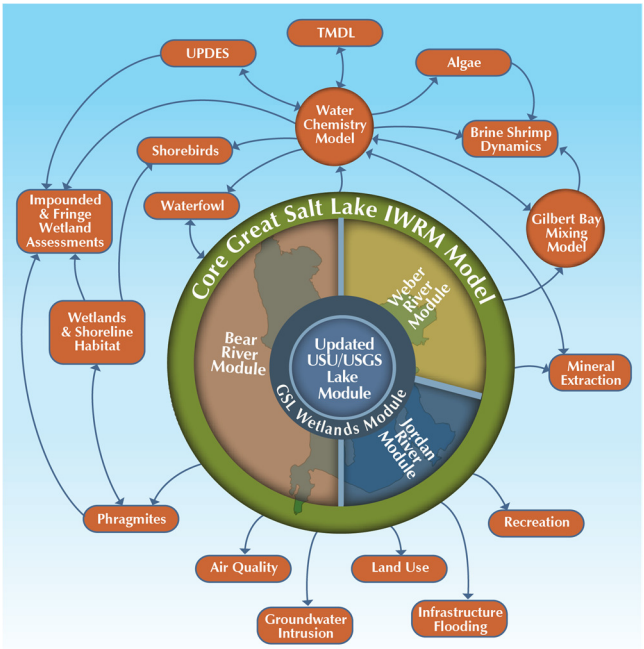
e. Irrigation return flows/storm water runoff
f. Climate (e.g., drought)
g. New and/or changing infrastructure
h. Water conservation strategies
i. Inter-basin transfers
j. Water management strategies and decisions
k. Mineral extraction activities
l. Impounded wetland (e.g., duck club) water management
m. Shifts in vegetation, e.g., *Phragmites* removal

5. Characterize impacts from mineral extraction operations as they may affect water levels, mineral concentrations in the water column, and mineral storage within lake brine and lake bed.
6. Include linkages to the GSL Management Plan Matrix, health indicators, and economic study.
7. The model should be readily and practically adopted by state agencies for use as a communication, planning, management and regulatory tool. Model execution and modification of inputs should require limited staff training, the model should run on a platform available to agencies at a reasonable cost, and the model should run simulations in a reasonable amount of time and with reasonable computational resources.
8. Provide flexibility to enable further development and/or addition of new modules to address topics such as socio-economic, ecological health, and water quality.
9. Facilitate improved public outreach and coordination and cooperation among agencies that are responsible for managing the resources of Great Salt Lake.

Potential Questions to be Answered

While the purpose of the current project is to describe how changes in Great Salt Lake and its watershed could impact the lake's water level and salinity, it is useful to envision potential questions the IWRM model may help answer in the future. These questions may not be answered directly by this project, but the IWRM model will be developed with the flexibility and the intent that future efforts to answer these questions could build upon this model. Foremost, the model should support the State agencies' mandate for sustainable management of Great Salt Lake. Members of the TC identified the following anticipated management challenges that the IWRM could be used to address in the future:

- How could the following potentially affect water levels and salinity in Great Salt Lake?
  - Long-term drought
  - Conversion of agricultural water use to municipal and industrial (M&I) uses
  - Increasing water demands due to population growth
  - Wastewater reuse
  - Water conservation
  - Changes to the causeways in the lake
  - Development of and withdrawal of additional waters for expanded mineral extraction operations within Great Salt Lake
  - Development of new water supply projects
- How could changing water levels and salinities in Great Salt Lake impact the brine shrimp and mineral extraction industries? Waterfowl and shorebird habitat? Recreational use of the lake? Land use along the margins of the lake? Air quality along the Wasatch Front?
- How could changing water levels and salinities in Great Salt Lake impact the economic benefit the lake provides to the State of Utah?
- How could changing water levels and salinities in Great Salt Lake impact the lake's mixing patterns and water chemistry? How might that impact Total Maximum Daily Loads (TMDLs) and Utah Pollution Discharge Elimination System (UPDES) permits developed within the Great Salt Lake watershed?
- How does water management in Great Salt Lake wetlands (e.g., migratory bird and waterfowl management areas, duck clubs, etc.) or of invasive species such as *Phragmites* impact the quantity of water that reaches the open waters of Great Salt Lake?



The proposed GSL IWRM model will provide a central platform for the future development of additional detail, functionality, interfaces, and modules.