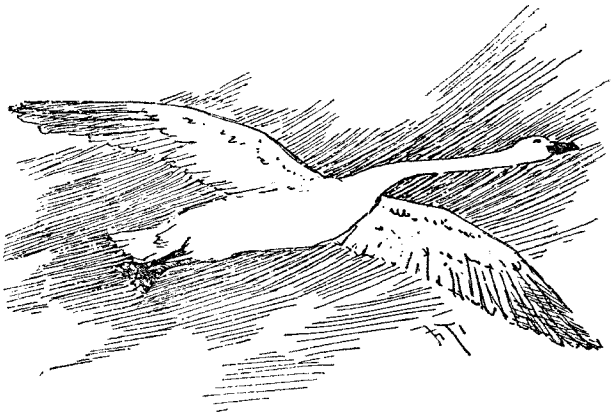
Monitoring and Research



Monitoring and Research

A substantial part of CMP implementation directly involves monitoring, primarily for determining the efficacy of implementation actions and/or assessing the need for further action.

Environmental monitoring and research is the key to developing sustainable resource allocation and in implementing effective management strategies. It is challenging to manage GSL for multiple-use and sustainability without a well developed, accurate, reliable and focused database. Decision-making is currently based on the best available information. Without existing data and monitoring resource allocation and decision-making would be haphazard.

Little information is currently available or evaluation of ecosystem function and health. A well-designed monitoring and research program would be of great value in assessing trends, understanding GSL's natural range of variability, and behavior of ecosystems.

It is impossible to bridge all gaps in information and understanding due to the dynamic nature of the lake and its environs, the various time scales involved in ecosystem function and degradation and limited funding available for research and monitoring. It is more important to focus on the quality of data rather than the quantity.

DNR will coordinate with other agencies and stakeholders to develop a list of gaps in information and compile a list of GSL research topics for state universities to consider for graduate and doctorate studies. Improved research and monitoring coordination will help managers focus research on critical needs and build a GSL information database. DNR will seek funding partnerships with the U.S. Environmental Protection Agency (EPA), other agencies and stakeholders.

The overall goal for research and monitoring is to compile data sufficient for development of specific ecological, hydrological, and public trust objectives in support of the CMP.

There are two goals for the specific monitoring or research activities: 1) compile data sufficient for identification of scientifically-based ecological conditions necessary for long-term sustainability, and 2) determine the interrelationships between habitat conditions and wildlife productivity sufficient for development of quantifiable maintenance or restoration activities.

As monitoring and research activities continue and expand, it is recommended that a monitoring and research subcommittee of the GSLTT be convened on a regular basis. This subcommittee could be charged with the coordination and oversight of data gathering activities on the lake. In addition, they would ensure that the collected data is shared with, and/or analyzed by, all research and monitoring participants. Once the non-proprietary data has been verified and analyzed, it should be made available to the public. Following are descriptions and costs of Current Monitoring and Research, Phase I top priority, and Phase II proposed monitoring.

Current Monitoring and Research Activities

This section lists the monitoring and research activities which are currently underway on GSL. Each item gives a brief summary of the activity.

Agriculture

Grazing Impacts

Monitoring is conducted through observations of nesting habitat in grazing areas made by DWR personnel incidental to other duties. No official grazing transects have been established. The Nature Conservancy (TNC) informally monitors grazing impacts on sovereign lands under permit to them and on TNC's private land. DWR's monitoring is conducted in the normal course of business, without readily identifiable costs.

Biology

Brine Shrimp Monitoring

The DWR's Great Salt Ecosystem Project (GSLEP) administers a brine shrimp monitoring program in GSL. Two different groups collect, enumerate and analyze the data. GSLEP personnel do a portion of the work and have contracted USGS to do the other portion; that agency also contributes matching funds. Some of the enumeration and interpretation of the data is done jointly. Sampling is done by personnel using boats on the lake; enumeration is done in the laboratories and data analyses is completed at the respective offices. All of this effort yields information on the shrimp population that guides management decisions such as how much brine shrimp egg can be harvested.

Brine Shrimp Harvest Monitoring

The commercial brine shrimp harvest is monitored by GSLEP staff to quantify the amount of eggs taken from the lake, where they were harvested, and the condition of the eggs. This information is used to manage the brine shrimp population and the fishery itself.

Brine Shrimp Egg Survival Monitoring

Studies are being done to determine what portion of the shrimp eggs in the lake survive the winter and are able to hatch in the spring. This information is critical in determining how much brine shrimp egg can be harvested. Naturally occurring eggs, and eggs in special research vessels, are collected from the lake over the course of the winter and analyzed. Utah State University (USU) is contracted by DWR to conduct a portion of this research.

GSL Algae Study

USU is contracted by DWR to conduct a phytoplankton study of GSL algae.

Brine Shrimp Population Model

USU is contracted by DWR to develop a mathematical model to predict brine shrimp population dynamics performance in GSL. This model will be used along with monitoring data to predict how the shrimp population is doing and how much can be harvested.

Remote Monitoring Feasibility Study

USU is contracted by DWR to conduct a feasibility study to determine if it is technologically possible to accurately quantify the amount of brine shrimp eggs in the lake using remote sensing techniques. The results of this study may have application in the collection of data on wetlands and algae production.

Eared Grebe Population Monitoring

The GSLEP conducts annual bird surveys to monitor Eared grebes at GSL. These birds rely on brine shrimp for food; proper management of the shrimp population must reserve enough shrimp for their survival. Understanding bird population dynamics will allow DWR to make good management decisions.

GSL Waterbird Counts

The GSLEP conducts, coordinates, and manages a lake-wide waterbird count. This count has been conducted over the past three years and will continue for at least two more. To date, it is the most comprehensive waterbird count undertaken around the lake. Knowing what species populate the area; when, where, in what numbers, and their relation to habitats is essential to successfully conserve these bird resources. As many as 90 volunteers participate in this effort. Personnel costs would be prohibitive if these dedicated people were compensated for their efforts.

Eared Grebe Energetics Research

USU is contracted by DWR to conduct field work and laboratory analysis of Eared grebes from GSL. The purpose of this monitoring is to determine how many brine shrimp each grebe needs daily to sustain itself. The information will be used along with the grebe monitoring data to determine how many brine shrimp cysts are needed to feed the birds.

Waterfowl Census of GSL

Waterfowl (including swans) are counted at regular intervals during the year to determine their population numbers and use areas around the lake. This information is used nationally to manage these migrating birds.

Waterfowl Management Areas

DWR owns and manages eight WMAs on and around GSL to conserve marsh habitats and the birds that utilize them. These areas are literally an oasis to the millions of birds that use them.

Bird Banding

Birds are banded annually by DWR to collect data on survival rates and migration patterns. This information is critical to managing GSL bird resources.

Chemistry

Salinity Sampling

UGS and DWQ, with assistance from DPR, conducts biannual brine sampling at four sites on the lake to determine chemical composition. DEQ also collects samples at the same sites, but analyzes them for a more extensive set of parameters. The data gathered is combined with hydrologic data collected at the gages to compute water budgets and chemical mass balances.

Mineral Production

DFFSL monitors the production of minerals from the lake in conjunction with the collection of royalty payments from producers. Monitoring is conducted in the normal course of business, without readily identifiable costs.

Commercial and Industrial

Access Conflicts

Monitoring for this activity is conducted primarily in response to complaints received by the DNR. Since there is no division specifically assigned monitoring responsibilities, the response usually involves a determination of facts, assignment of primary responsibility to deal with the issue, an attempt at an amicable resolution, followed by administrative or legal action, if

necessary. In this context, monitoring is conducted in the normal course of business, without readily identifiable costs.

Hydrology

Stream Gaging

Currently, there are five sites upstream of the lake where inflows are measured, and one within the lake where intra-lake flows are measured. The first four sites measure the vast majority surface flows into the lake and are used to develop water budgets and compute mass balances for various chemical constituents in the water column. These sites are crucial for understanding lake hydrology. The Locomotive Springs site is maintained by DWR for purposes of managing the WMA. It may be possible to correlate the collected data with regional climatic data to estimate springflow and diffuse seepage to the lake. The last site measures the flow through the breach in the railroad causeway and is used to compute water budgets and salt balances for the two arms of the lake. The following gages are those currently in use: Bear River near Corinne, Weber River near Plain City, Jordan River at Salt Lake City, Surplus Canal at Salt Lake City, Locomotive Springs WMA, and the Union Pacific Railroad northern causeway breach and culverts.

Lake Level

Currently, two gaging sites on the lake maintained by USGS and DFFSL measure water surface elevations. This data, combined with the lake's elevation-volume tables, is used to compute water budgets and chemical mass balances. The gages currently used are: Great Salt Lake at Boat Harbor and Great Salt Lake at Saline.

Weather Monitoring

The GSLEP is a partner with the University of Utah (Uof U) Meteorology Department in collecting weather and water data on GSL**.** The Wood's Hole Oceanographic Institute is one of the many other partners involved in this effort. This data is used to understand how lake algae grow and is related to shrimp population performance.

Current DNR Costs			
Plan Section	Activity	Cost	Type
Agriculture	Grazing Impacts	NA[1]	Ann[2]
Biology	Brine Shrimp Population Monitoring	$137,425	Ann
	Brine Shrimp Harvest Monitoring	$31,000	Ann
	Brine Shrimp Egg Survival Monitoring	$31,220	Ann
	GSL Algae Study	$3,000	Ann
	Brine Shrimp Population Model	$43,031	Proj[3]
	Remote Monitoring Feasibility Study	$59,340	Proj
	Eared Grebe Population Monitoring	$10,000	Ann
	GSL Waterbird Counts	$85,000	Ann
	Eared Grebe Energetics Research	$38,450	Ann
	Waterfowl Census	$54,000	Ann
	Waterfowl Management Areas	$790,000	Ann
	Bird Banding	$14,000	Ann
Chemistry	Salinity Sampling	$10,197	Ann
	Mineral Production	NA	Ann
Comm/Industrial	Access Conflicts	NA	Ann
Hydrology	Stream Gaging	$28,610	Ann
	Lake Level	$10,880	Ann
	Weather Monitoring	$3,500	Ann
Total		$1,349,653	

[1] Activity occurs in the normal course of business and has no readily identifiable costs.

[2] Annual agency cost of on-going activity.

[3] Agency share of total project cost.

Phase I Monitoring And Research Activities

Items in this section represent those activities which the Planning Team believes to be of highest priority for accomplishing the goals and objectives of the GSL CMP. Funds available to DNR divisions will effect the completion of these tasks.

Biology

Nutrient & Heavy Metal Inflow Monitoring

No data exists on the volumes and concentrations of waterborne nutrients and heavy metals entering GSL after it flows through the adjacent marshes. This data is essential to understanding how algae and other species are effected by these inflows to the lake. Algae feed brine shrimp and brine flies. The huge bird populations around the lake depend upon algae, shrimp and flies for food. The commercial harvesters depend upon the shrimp. This data does not exist and is the most critical information for lake managers at this time.

Chemistry

Salinity Sampling

Currently, UGS samples lake salinity twice a year at four sites; this corresponds to the lake's annual high- and low-stands. These lake-stands usually occur in the spring and fall. Collection of additional data during the summer and winter would afford a more complete look at salt loading and lake salinity dynamics throughout the year.

It is also advisable to take similar concentration measurements at the Newfoundland Weir, where brines return to the lake from the Newfoundland Pond, in order to have a complete record of brine movements.

Hydrology

Weir Flow Measurements

Water returns to the lake from the Newfoundland Pond via a weir located near Strong's Knob. Regular flow measurements need to taken at this weir.

Breach and Culvert Flow Measurements

The selected alternative for solving the salinity imbalance in GSL is to increase the exchange of brines between the north and south arms of the lake. This will be accomplished by deepening the existing breach at Lakeside and cleaning debris out of the existing culverts and ensuring they remain open and flowing at capacity.

Once the deepening of the breach is accomplished, a monitoring program will be initiated to ensure that the sill remains at the desired elevation. If siltation starts to effect water carrying capacity of the breach, newly deposited sediments will need to be removed.

At the current (February, 2000) lake elevation of 4203, the culverts are under water. When debris is cleaned out of the culverts, it is difficult to determine if, in fact, they are clean and transporting all the flow possible. Flow measurements must be made at the culverts and the breach to ensure that the water exchange is occurring to meet designed capabilities. Maximum flows will ensure that the highest return is being exacted for the dollars invested in the project.

USGS measures flows at the culverts and breach four times a year. To obtain a more complete record of lake flows, the frequency of these

measurements needs to be increased to eight times a year.

Land

Boundary Identification Survey

The degree of public access to north arm boat launch facilities is uncertain. There is an old, but usable, harbor at Little Valley on the west side of Promontory Point. Since a portion, or all of the harbor is on sovereign lands, a land survey needs to be conducted along the meander for roughly three miles near this harbor. Boundary identification will allow this public access issue to be resolved.

Projected DNR Costs			
Plan Section	Activity	Cost	Type
Biology	Nutrient & Heavy Metal Inflow	$50,000	Ann
Chemistry	Salinity Sampling	$10,197	Ann
Hydrology	Weir Flow Measurements	$8,000	Ann
	Breach & Culvert Flow Measurements	$21,000	Ann
Land	Boundary Identification Survey	$20,000	Proj
Total		$109,197	

Phase II Monitoring and Research Activities

Items in this section represent those activities which the Planning Team believes to be of secondary priority for accomplishing the goals and objectives of the GSL CMP. These activities will be initiated on an as-needed and funds-available basis.

Agriculture

Grazing Impacts

Grazing transects need to be established and monitored.

Biology

Habitat Encroachment

Due to population growth, it is necessary to monitor the extent to which non-wildlife activities are encroaching on habitat, and devise ways to mitigate the impacts on a case-by-case basis. Remote sensing technology can be used to collect this data.

Chemistry

Mineral Production

Data needs to be collected on both mineral production and the amount of sequestered, stockpiled, and waste minerals from the lake's environment.

Commercial/Industrial

Access Conflicts

Access conflicts need to be resolved and monitored among commercial interests.

OHV Impacts

An OHV Management Plan has been adopted by Box Elder County, SITLA and BLM. The area of sovereign land open to OHV use under the selected alternative was identified in the aforementioned plan. That process identified the need for DPR to secure

funding for a position to help enforce restrictions on OHV use. DPR's effort to secure the funding has not yet been successful. In the interim, monitoring should continue on an incidental basis by the Box Elder County Sheriff's Office and DWR personnel.

There is an opportunity to coordinate enforcement where unauthorized OHV activity occurs along the south shore in the vicinity of Saltair, the Inland Sea Shorebird Reserve and the Gillmor Sanctuary. A partnership could be created to hire someone to patrol this area. The area covered by the partnership could extend westward to monitor public trespass on private land on Stansbury Island.

Hydrology

Satellite Imagery

In partnership with the U of U's Center for Remote Sensing and Cartography, satellite imagery would be acquired on an annual basis to monitor urban encroachment on sovereign lands and wetland habitat around GSL and WMAs, determine lands which are flooded and/or exposed at various lake-stands, and give an accurate measure of the lake surface area for evaporation calculation.

Law Enforcement

Boundary Enforcement

A land survey should be undertaken to mark and monument the boundary between sovereign lands and adjoining parcels where this boundary is uncertain. This effort should begin on the east side of the lake where adjacent land development pressures are greatest and proceed to the west side as rapidly as resources become available. This survey will be conducted over a number of years.

Recreation

Recreation Impacts

Currently, AISP is under contract with USU for a social survey ($8,200) and Colorado State University for a wildlife study ($50,000 over three years). These are surveys that need to be addressed every five years. The National Park Service uses a Visitor Experience Resource Protection concept that GSL could implement to protect the visitor experience ($50,000).

Recreation Demands

Future demands and trends need to be determined relating to access and visitor use on GSL. This would be accomplished by surveys, visitation reports, sampling in areas of concern. This would be a $15,000 project conducted every five years.

User Conflicts

AISP would track complaints and conflicts to determine what types of problems are occurring. Additional study would be needed to expand this tracking to the whole GSL planning area. ($20,000)

Trends/Response

To determine the social carrying capacity of recreational facilities, AISP would track visitation and types of use. A more in depth study would assess GSL trends. State Comprehensive Outdoor Recreation Plan addresses state-wide issues and could address specific GSL needs. ($50,000)

Search & Rescue

Action Plans

There is a five county search and rescue action plan in place. The county planning committees recognize a need for an amphibious boat to address a major airliner disaster in shallow water on GSL. The U.S. Air Force should be a party to any planning effort on this subject.

Projected DNR Costs			
Plan Section	Activity	Cost	Type
Agriculture	Grazing Impacts	$5,000	Ann
Biology	Habitat Encroachment	$27,000	Ann
Chemistry	Mineral Production	NA	Ann
Comm/Industrial	Access Conflicts	$38,000	Ann
	OHV Impacts	$8,000	Ann
Hydrology	Satellite Imagery	$10,500	Ann
Law Enforcement	Boundary Enforcement	$75,000	Ann
Recreation	Recreation Impacts	$108,200	Proj
	Recreation Demands	$3,000	Ann
	User Conflicts	$20,000	Ann
	Trends/Response	$50,000	Ann
Search & Rescue	Action Plans	$60,000	Proj
Total		$404,700	

Total Current and Projected Costs	
Current Activities	$1,349,653
Phase I Activities	$109,197
Phase II Activities	$404,700
Total	$1,863,550

Potential Partners for Monitoring and Research Activities

Since planning efforts do not occur in a vacuum, the Planning Team has conducted extensive outreach activities to explain the GSL CMP and solicit comments from interested parties. In doing so, the Planning Team received information about other agencies and entities who could serve as potential partners in the various monitoring and research activities mentioned above. These entities could partner with DNR agencies and assist in management activities as sources of information, grants, and volunteers. Listed below are some of these entities.

Government Agencies

State (Governor's Office of Planning and Budget, Department of Environmental Quality, Department of Transportation, Automated Geographic Reference Center)

City (Salt Lake City Department of Airports)

County (Box Elder, Davis, Salt Lake, Tooele, and Weber)

Federal Agencies (Fish & Wildlife Service, Natural Resource Conservation Service, USGS, BLM, USAF)

Multi-governmental (Wasatch Front Regional Council, Salt Lake County Visitors Bureau, Utah Reclamation & Mitigation Commission)

Non-governmental Organizations

(Friends of GSL, Friends of Antelope Island, Gillmor Sanctuary, Inland Sea Shorebird Reserve, TNC, The Audubon Society)

Private Sector

(Mineral Producers, Brine Shrimp Industry, UPRR, Utah Power)