Assessment of Potential Costs of Declining Water Levels in Great Salt Lake

Executive Summary | Revised November 2019
Prepared for the Great Salt Lake Advisory Council

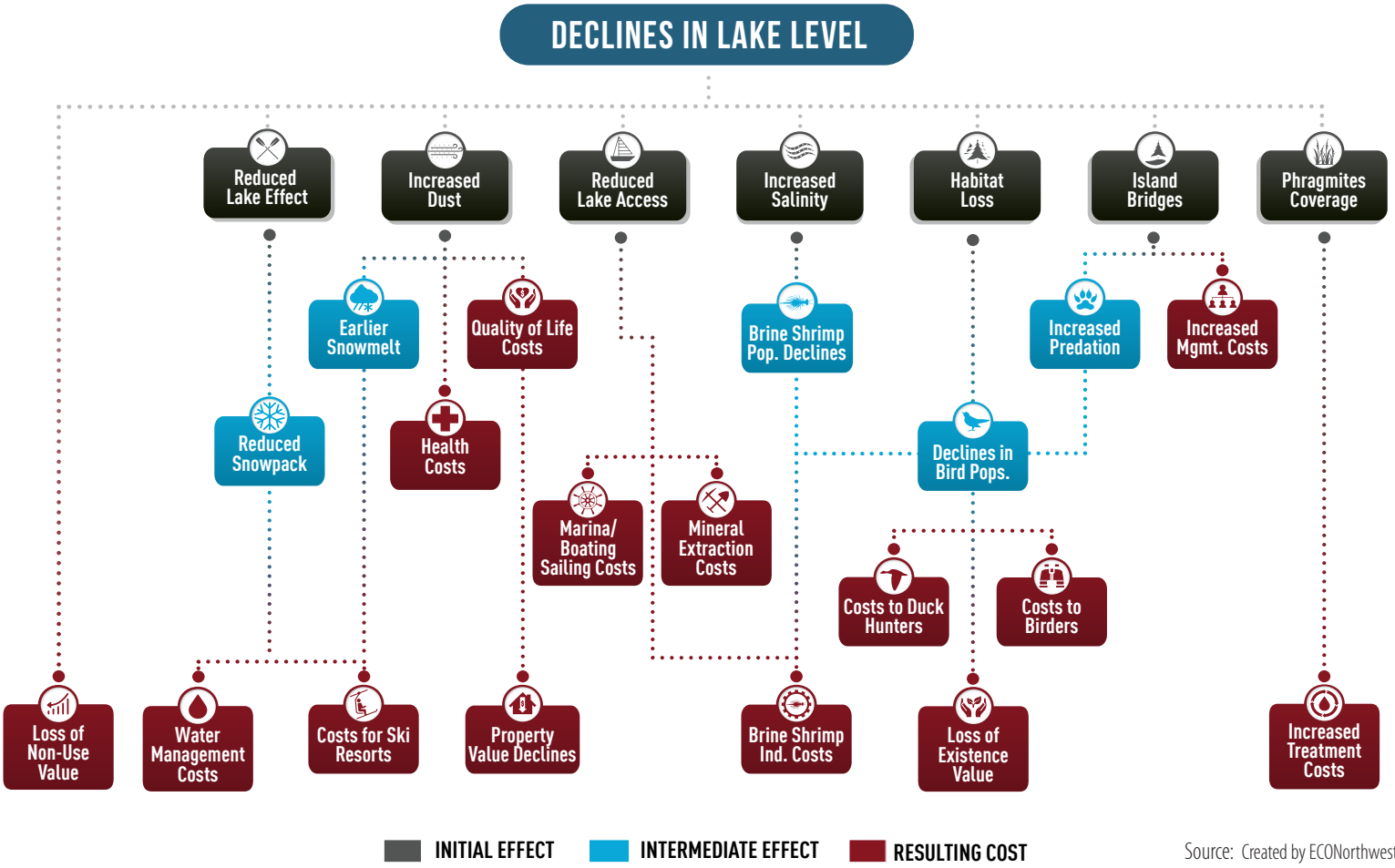
Water levels at Great Salt Lake have been on a sustained downward trend. Further declines, particularly those over a long period, could result in losses totaling $1.69 billion to $2.17 billion per year and job losses of over 6,500 positions, as well as reductions in the quality of life for residents and visitors of Northern Utah.

The purpose of this report is to assess the potential costs of declining water levels in Great Salt Lake and its wetlands. A multitude of people, systems, and wildlife rely on Great Salt Lake and value the services it provides. Declines in lake levels threaten current uses, imposing risks to livelihoods and lake ecosystems. This report synthesizes information from scientific literature, agency reports, informational interviews, and other sources to detail how and to what extent costs could occur at sustained lower lake levels.

Water diversions from the rivers that feed Great Salt Lake have driven historical declines in lake levels. Current and future water stressors, without intervention to protect or enhance water flows to Great Salt Lake, have the potential to deplete water levels even further. Declines in lake levels threaten the business, environmental, and social benefits that Great Salt Lake provides and could result in substantial costs to surrounding local communities and the state.

This report traces the pathways and resulting costs that could arise due to declines in water levels in Great Salt Lake. The potential costs evaluated in this report include those caused by reduced lake effect, increased dust, reduced lake access, increased salinity, habitat loss, new island bridges, and the spread of invasive species (Exhibit 1).

EXHIBIT 1. COSTS CREATED BY DECLINING WATER LEVELS AT GREAT SALT LAKE



Source: Created by ECONorthwest.

SUMMARY OF COSTS

Each of the effects and resulting costs of declining water levels in Great Salt Lake are described in detail in this report. Some resulting costs have sufficient information that the magnitude of the effect can be measured and quantified. Where possible, costs are also monetized. The costs evaluated in this report fall into three categories:

1. **Monetized Costs:** These estimates should be used to inform the magnitude of the potential cost that could result from a drying Great Salt Lake, rather than the specific dollar amount. Each type of monetized cost occurs at a different lake elevation. The extent of the cost could vary depending on water management and policy decisions.
2. **Quantified Costs:** Unlike the costs that could be monetized, quantified costs lack sufficient information about either the change that could occur or the costs that could arise from declining water levels at Great Salt Lake. These non-monetary values represent opportunities for further study and should be applied with caution.
3. **Non-Quantified Costs:** Costs that resist quantification either because of a lack of available information or because the value is not something that should be quantified are included in this category.

MONETIZED COSTS

The monetized potential costs of a drying Great Salt Lake could be as much as **$1.69 billion to $2.17 billion per year and over 6,500 job losses.** Over 20 years these costs could be as high as $25.4 billion to $32.6 billion (discounted using a three percent discount rate). These values do not include coordination, planning, or legal costs that could arise due to declines in water levels at Great Salt Lake.

EXHIBIT 2.
MONETIZED COSTS OF DECLINES IN WATER LEVELS AT GREAT SALT LAKE

TYPE OF COST	POTENTIAL ANNUAL COST	POTENTIAL 20-YR COSTS	POTENTIAL JOB LOSSES
Loss of Mineral Extraction Output	$1.3 billion	$19.3 billion	5,368
Landscape Mitigation Costs	$191.5 million to $610.4 million	$2.8 billion to $9.1 billion	N/A
Loss of Lake Recreation Output	$81.1 million	$1.2 billion	615
Loss of Brine Shrimp Industry Output	$67 million	$1.3 billion	574
Loss of Recreation Economic Value	$33.8 million to $81.9 million	$502 million to $1.2 billion	N/A
Health Costs	$6.6 million to $22.3 million	$98.2 million to $331.8 million	N/A
Loss of Ski Resort Spending	$5.8 million to $9.6 million	$86.3 million to $142.8 million	>0

Source: Created by ECONorthwest

Note: The potential 20-year cost estimates use a 3 percent discount rate and assume output for industries has constant capital and labor ratios throughout the time period. ECONorthwest recognizes that projecting economic contribution output in the future using IMPLAN, rather than a dynamic input-output model, is not a best practice and provides this estimate for illustrative purposes only.

The types of costs comprising the potential annual costs of $1.69 billion to $2.17 billion would arise at different lake elevation levels, so the magnitude of the effect could vary at different points in time. Temporal considerations are also important because the longer that water elevations remain at low levels, the more difficult it could be to reverse the impacts and costs. Exhibit 3 provides a summary of the lake elevations and the relative magnitude of the annual costs that might be incurred. The figure below demonstrates how costs are expected to be larger at lower lake elevations.

EXHIBIT 3. ILLUSTRATIVE EXAMPLE OF ANNUAL MONETIZED COSTS CHANGES WITH LAKE LEVELS

Lake Elevation	Mineral Extraction	Mitigation Costs	Lake Recreation (Output, Recreation Economic Value)	Brine Shrimp	Health Costs	Ski Resort Spending
Matrix Green Range[1]						
Low Levels[2]	$$$$$$$$$$	$$	$$$		$	$
Below Historic Low	$$	$$$$$	$$$$$	$	$$	$
Far Below Historic Low	$$$ $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$	$$$$$$$$$$$$$$$$$ $$$$$$$$$$$$$$$$$ $$$$$$	$$$$$$$$$$$$ $$$$$	$$$$$$$	$$$	$
Near-Dry	$$$ $$$ $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$	$$$$$$$$$$$$$$$$$$ $$$$$$$$$$$$$$$$$$ $$$$$$$$$$$$$$$$$$ $$$$$$$	$$$$$$$$$$$ $$$$$$$$$$$ $$$$	$$$$$$$	$$$$	$$

Source: Created by ECONorthwest

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[1] The "Matrix Green Range" generally corresponds to the green "beneficial for resource" category in the GSL Lake Level Matrix from the Final Great Salt Lake Comprehensive Management Plan from Utah Department of Natural Resources, Utah Division of Forestry, Fire & State Lands (2013). However, it should be noted that different levels can be beneficial for some resources, while not beneficial for other resources. The *Final Great Salt Lake Comprehensive Management Plan* is available at https://ffsl.utah.gov/index.php/state-lands/great-salt-lake/great-salt-lake-plans

[2] Lake elevations in 2019 would fall into the "Low Level" category. The 2019 elevation of Great Salt Lake ranged between 4,192 feet and 4,195 feet.

Note: Each dollar sign represents approximately $10 million. The "Near-Dry" condition portrays the $2.17 billion annual cost estimate. Costs at specific elevation levels were not evaluated in this report, so the magnitude of costs at elevation levels other than "Near-Dry" are estimates for illustrative purposes only.

MINERAL EXTRACTION INDUSTRY COSTS

Declines in water levels could result in costs to adjust operations for the mineral extraction industry at Great Salt Lake. Uncertainty and large fluctuations in water levels from year to year could also impose costs to this industry. If water levels are not sufficient to meet the water rights held by these companies, the industry at Great Salt Lake could be jeopardized. The potential loss of the mineral extraction industry at Great Salt Lake could result in an annual loss of $810 million in direct output, $1.3 billion in total output, $365 million in total labor income, as well as a loss of 5,368 total jobs.

LANDSCAPE MITIGATION COSTS

Other terminal lakes that have experienced water level declines have incurred significant costs for mitigation to prevent the adverse effects of a drying lake, including habitat loss and increased dust. The potential costs to mitigate future dust loads could rise to $191.5 million to $610.4 million per year, including mitigation for the acres currently exposed by the dry lakebed at Great Salt Lake. Costs will vary based on the area of land mitigated and mitigation treatment implemented. Responsibility to pay mitigation costs is unknown.

LOSS OF BRINE SHRIMP INDUSTRY OUTPUT

Brine shrimp harvesting is a valuable industry at Great Salt Lake, and it could be reduced or completely eliminated if brine shrimp populations decline. The potential loss of the brine shrimp industry would result in an annual loss of $40.1 million in direct output, $67.0 million in total output, $23.9 million in total labor income, as well as a loss of 574 total jobs supported by the industry.

Source: Don Leonard

LOSS OF LAKE RECREATION OUTPUT

Recreation to Great Salt Lake could be reduced by over 50 percent due to declines in water levels. This decline in recreational use represents a loss of spending by recreationists on a variety of activities, including bird watching, hunting, sightseeing, boating, and sailing. If these recreation visits are lost the potential costs could be $44.5 million in direct spending, $81.1 million in total output, $15.4 million in total labor income, and 615 total jobs.

LOSS OF RECREATION ECONOMIC VALUE

In addition to the spending and job losses that could occur with declining water levels at Great Salt Lake, lower visitation also reduces the recreational-use value for recreationists. This value is equal to what recreationists would be willing to pay minus what they actually paid. The potential loss of recreational-use value from declining water levels at Great Salt Lake is $33.8 million to $81.9 million per year. This value range includes only monetized recreation for birding, duck hunting, boating and sailing, and ski resorts. Sightseeing, hiking, picnicking, and other recreation are not quantified but also anticipated to experience losses.

HEALTH COSTS

Increased dust and the resulting poor air quality are associated with a suite of adverse health effects that often affect sensitive populations the most, such as children, the elderly, and people with existing health conditions. Great Salt Lake is already contributing to dust loads, the cost of which is estimated as $3.2 million to $13.6 million per year based on values from the literature on the cost of particulate matter pollution. With further declines in lake levels, the potential health costs from dust from Great Salt Lake could rise to between $6.6 million to $22.3 million per year.

LOSS OF SKI RESORT SPENDING

If Great Salt Lake no longer contributes to lake effect snow, average annual snowpack could decline approximately 5.1 to 8.4 percent. Snowmelt could accelerate by approximately 1 week sooner due to increased dust. From these changes, we estimate that ski resort visits in Northern Utah could decline by 18,000 to 30,000 user days per year. As a result of the visitation decline, the potential lost spending at ski resorts could result in $5.8 million to $9.6 million per year in reduced recreation revenue. This value does not include costs to snowmobilers, backcountry skiers, and other snow-related recreationists, suggesting that the total potential costs to the industry and recreationists is likely even higher.

QUANTIFIED COSTS

WATER MANAGEMENT COSTS & IMPACTS TO WATER RIGHTS

Due to declines in the surface area and water level of Great Salt Lake, snowpack could be affected by both lower amounts of snow from reduced lake effect and earlier snowmelt from decreased albedo. In addition to impacting the ski industry, water managers, and water users along the Wasatch Front that rely on snowpack could be impacted.

PROPERTY VALUE REDUCTIONS

The homes near Great Salt Lake could experience a reduction in property value from the increased dust, reduced recreational opportunities, and other costs from declines in water levels at Great Salt Lake. Studies suggest increases in particulate matter air pollution can reduce property values by 0.2 to 1.1 percent. These reductions in property value would also impact property tax revenue for local taxing authorities.

IMPACTS TO BIRD POPULATIONS

As water levels decline in Great Salt Lake we expect negative impacts to populations of many bird species due to the potential reduction in brine shrimp, brine flies, and other macroinvertebrates. Land bridges can increase predation at island nesting sites and loss of both quantity and quality of habitat could also adversely affect bird populations. Based on survey values from other locations, the willingness to pay by people in Utah for migratory bird protections could be as high as $27.8 million per year.

Source: Scott Baxter

INVASIVE SPECIES COSTS

Phragmites, a state-listed noxious weed, has populated large areas of Great Salt Lake. Declines in water levels at Great Salt Lake could increase the spread of this invasive species in some areas and decrease its presence in others. Costs to mitigate for phragmites are approximately $500-$1,000 per acre for three years. The Utah Department of Natural Resources currently budgets approximately $500,000 per year to control phragmites.

LOSS OF NON-USE VALUE

People value Great Salt Lake even if they do not visit or obtain value from it directly. The amount people are willing to pay to preserve an environmental resource like Great Salt Lake is known as a non-use value or passive use value. Based on estimates for Mono Lake, the potential loss of non-use value for Great Salt Lake could be as high as $328 million to $746 million per year for all households in Utah.

NON-QUANTIFIED COSTS

LOSS OF CULTURAL AND SPIRITUAL VALUES

Great Salt Lake is a cultural resource to Utah and part of the state's identity. Water level declines at Great Salt Lake would change the landscape and aesthetics of Northern Utah. Current and future Utahns would be impacted by the cultural and spiritual losses resulting from a declining Great Salt Lake.

Source: Scott Baxter

INCREASED COSTS FOR AGRICULTURE

Increased dust from a dry lakebed could create costs to agriculture by reducing yields and crop productivity due to interference with rates of transpiration and photosynthesis, as well as changes to soil composition.

AIRPORT OPERATION DISRUPTIONS

Dust storms have delayed and canceled flights at SLC International Airport. Increases in dust levels from a dry Great Salt Lake could increase the frequency of these disruptions, creating costs to the airline industries and reducing the attractiveness of the airport to travelers.

INCREASED WILDLIFE MANAGEMENT COSTS

The land bridges to islands created by declines in water levels at Great Salt Lake could increase management costs for the terrestrial species of Antelope Island and costs for predation management at other islands. Fencing or predator control costs could be incurred for wildlife management.

OUTMIGRATION & REDUCTION IN BUSINESS ATTRACTION & RETENTION

Quality of life could be reduced due to water level declines at Great Salt Lake, primarily due to impaired air quality, reduced recreation opportunities, and the degraded environment. As a result, businesses and residents might leave Utah, or decide not to locate in the state.

POLICY IMPLICATIONS

Policy solutions and investments in water for Great Salt Lake now can prevent future costs to the region. The magnitude of potential consequences, $25.4 billion to $32.6 billion over twenty years, suggests that major interventions are likely warranted. The science review and economic analyses in this study indicate that reduced lake levels at Great Salt Lake are already imposing adverse conditions and economic costs on the regional community and economy. The continued trajectory of declining lake levels will likely only increase the magnitude and expand the categories of costs imposed on Utahns.

The experience of other terminal lake systems suggests that proactive approaches to water management and investments to protect a lake and its wetlands can be at least an order of magnitude less in costs than eventual restoration or mitigation after conditions are allowed to significantly deteriorate. Maintaining the full array of benefits that Great Salt Lake provides to the region will directly or indirectly return value to both residents and visitors.

This study did not find that conditions are beyond salvage or repair. The variety of costs and incremental nature of their relationship to lake conditions suggest that any policy solutions and improvements in lake level from current lows that ensure continued water flows can provide benefits for the region. Similarly, any incremental declines that can be avoided will have benefits. Reversing the current trend by allocating sufficient efforts and resources now to prevent declining lake levels could provide tens of billions of dollars in benefits over the coming decades and protect the quality of life in Northern Utah.

Source: Scott Baxter