

BEAR LAKE



Introduction

Bear Lake is a large natural lake on the Utah/Idaho border. It is a popular place for all forms of water recreation. It has a small natural watershed, but water from the Bear River is diverted into the north end of the lake via a canal system through Dingle Marsh. Historically, Bear River water never entered the lake until a canal was constructed in the

early 1900's. As water passes through Dingle Marsh the water quality is improved as the sediment and nutrient loads are reduced through settling and assimilation. The outlet from Bear Lake is regulated to allow for diversion of irrigation water downstream to meet agricultural and electrical generation needs.

The west and south shores are primarily privately owned with summer home development, while the east shore is mostly state owned with multiple access points. Impounded water is used for irrigation and power generation,

Characteristics and Morphometry	
Lake elevation (meters / feet)	5,924 / 1,805
Surface area (kilometers ² / miles ²)	282 / 109
Watershed area (hectares / acres)	2,372,706 / 5,862,957
Volume (m ³ / acre-feet)	
capacity	8.01 x 10 ⁹ / 6.5 x 10 ⁶
conservation pool	none
Annual inflow (m ³ / acre-feet)	
tributary	3.5 x 10 ⁷ / 28,000
Bear River diversion	3.75 x 10 ⁸ / 304,000
Retention time (years)	19.6
Vertical fluctuation (meters / feet)	3.2 / 10.5
Depth (meters / feet)	
maximum	63 / 208
mean	28.4 / 94
Length (kilometers / miles)	29.5 / 18.3
Width (kilometers / miles)	11.3 / 7.1
Shoreline (kilometers / miles)	77.2 / 48

Location	
County	Rich
Longitude / Latitude	111 20 20 / 42 00 00
USGS Map	Bear Lake South, Utah 1969
DeLorme's Utah Atlas & Gazetteer™	Page 63, B-5
Cataloging Unit	Bear Lake (16010201)

and in dry years the drawdown is such that the shoreline retreats hundreds of meters from the high water line. Water use is not expected to change significantly

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in the foreseeable future.

Recreation

Bear Lake is accessible from U-30 between Lakeville and Garden City and US-89 from Garden City into Idaho. A gravel road provides access to the east shore from Laketown. The road proceeds north into Idaho and intersects with an asphalt road which circumscribes the remainder of the lake.

"On water recreation" is extensive and diversified. Both Utah and Idaho maintain state parks. Activities include sail and motor boating, water skiing, swimming, and fishing. Sailboat regattas are held periodically, averaging 50 to 100 participants per event, not to mention spectators. Plus, numerous commercial resort developments provide opportunity for "on water recreation" for their patrons. Bear Lake is one of the most attractive water playground in the intermountain area, drawing thousands yearly. In addition camping, picnicking, windsurfing, and winter sports are all popular.



There are three Utah State Parks on the lake. Bear Lake Marina is on US-89 two miles north of Garden City. Bear Lake Rendezvous Beach is on the south shore near Laketown, and Bear Lake Cisco Beach (Eastside) is 10 miles north of Laketown. The Marina is a well developed boating facility with 176 slips that can be rented by day or season, but has only 15 campsites and a small swimming area. Rendezvous Beach has 138 campsites, a mile of beach, concessionaires and small boat rentals. Cisco Beach has primitive camping, swimming, and bathroom facilities. It is much more remote than the other two. Toilets and showers are available at the Marina and Rendezvous only.

Idaho State Park is immediately north of the state line on the east side of the lake. Another Idaho State Park is located on the north end of the lake. Several private recreational areas offer boating, camping, lodging and convenience stores.

Watershed Description

Bear Lake rests in a graben valley between the Bear River Range and Lake Ridge to the west. The graben stretches from Laketown in the south to Soda Springs in the north. The lake has existed for at least 28,000 years, forming as the valley sinks faster than the surrounding hills deposit sediment into the basin.

Bear Lake's natural watershed is entirely visible from the lake. It is made up of relatively low mountains covered with sagebrush at lower elevations and southern exposures and fir-aspen forests at higher elevations and northern exposures. Vacation homes have been built along the shore since the early 1900's, and development is proliferating on hillsides away from the lake. While density is low, the piecemeal patterns of land development make watershed management difficult.

The watershed of the diverted Bear River includes drainage in eastern Utah, western Wyoming, and extreme southeastern Idaho. The headwaters are in the Hayden Peak area of the High Uintas, where barren peaks tower over lush meadows and lakes. The river flows into Wyoming, and maintains a low gradient from there to Bear Lake and eventually the Great Salt Lake. Much of the watershed in Wyoming is low hills with sagebrush vegetation. Soft shales and recent deposits erode easily, and this is compounded by overgrazing. Hence the inflow into Dingle Marsh is rich with nutrients and heavy with sediments.



The watershed high point, Lamotte Peak, is 3,060 m (10,039 ft) above sea level, thereby developing a complex slope of 1.6% to the lake. The average stream gradient of the Bear River is 1.0% (55 feet per mile) The primary inflow to Bear Lake is Bear River water, while other inflows include Big Creek, Fish Haven Creek, Indian Creek, Little Creek, Swan Creek, North Eden Canyon, South Eden Canyon, and Birch Creek. The outflow is a canal through Dingle Marsh and into the Bear River. Woodruff Narrows Reservoir is a major impoundment of the Bear River just downstream from Evanston, and there are small upstream impoundments on Birch Creek and both Eden Creeks.

The watershed is made up of mountains, plateaus, mountain valleys, and mountain foothills. The soil

associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sage-grass, spruce-fir pine, aspen, and alpine. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows (from largest percentage to smallest percentage): Grazing of domestic livestock on public and private lands, multiple use public lands, haylands and irrigated croplands, recreation, and urban. The watershed headwaters are protected as part of the High Uintas Wilderness.

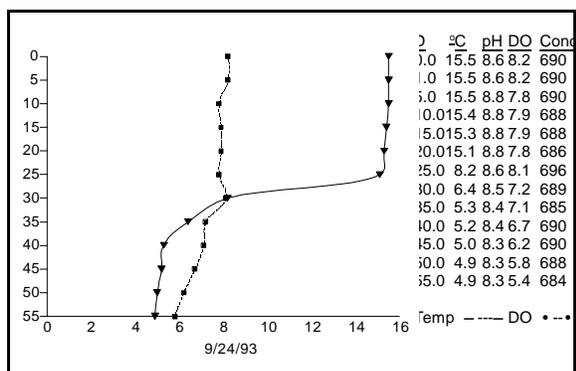
Limnological Assessment

Bear Lake is noted for the very high quality of its water. DWR (1981) reported that the water was considered hard with a concentration of 268 mg/L (CaCO₃). In 1975 it was surveyed as part of the USEPA National Eutrophication Survey (NES) and EPA awarded a grant to Idaho to conduct a Phase I, diagnostic/feasibility study in the early 1980's. The study was implemented by the Bear River Regional Commission. The Bear Lake ecosystem has been the focus of numerous studies in recent years. Individuals from governmental agencies, universities (Primarily Utah State University), and the private sector have expended considerable resources in an effort to understand the Bear Lake ecosystem and provide information in the protection of its water quality. The following information will be a summary of some of the data presented by Wurtsbaugh et al. (1990), the Bear Lake Preservation Project report from Ecosystem Research Institute (ERI) (1993), and DWQ. ERI under contract with BLRC has been conducting studies for a number of years. From water quality monitoring conducted on the lake in 1991-92 they reported the following: (1) Minimum and maximum values for total phosphorus were 12-15 ug/L and 60 ug/L; (2) average values for total phosphorus and orthophosphorus were 30 ug/L and 6 ug/L; (3) average values for total phosphorus have increased from 10 ug/L (1980) to 30 ug/L (1993); (4) secchi disk transparency readings ranged from 1.8 to 12 meters (the deepest secchi disk value since 1975); and (5) the lake has changed from a phosphorus limited system (pre-1983) to a nitrogen limited system (post-1983). The report by Wurtsbaugh et al. (1990) was based on data obtained during late 1986 and 1987. The following conclusion were extracted from their report: (1) the lake is stratified during the summer with surface temperature reaching 19 degrees C; (2) Chlorophyll-a concentrations were the highest during fall and winter mixing with a mean summer chlorophyll-a concentration of 0.5 mg/m³ indicating that Bear Lake is very oligotrophic; (3) the zooplankton

assemblage was dominated by the calanoid copepod *Epischura nevadensis* and other small crustaceans and rotifers with a mean annual biomass of 0.42 g dry weight/m² which is the lowest yet recorded for a temperate zone lake; (4)

Limnological Data			
Data sampled from STORET site: 490696, 490698, 490700, 490715, 490716, 490717 and 490718			
Surface Data	1975*	1981	1993
Trophic Status	O	O	O
Chlorophyll TSI	28.41	28.6	20.8
Secchi Depth TSI	35.70	36.8	37.9
Phosphorous TSI	44.40	47.3	39.4
Average TSI	36.17	37.5	32.7
Chlorophyll <i>a</i> (ug/L)	0.8	-	1.2
Transparency (m)	5.4	-	5.0
Total Phosphorous (ug/L)	16.3	-	26
pH	8.8	-	-
Total Susp. Solids (mg/L)	-	-	-
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-	-	-
Temperature (°C / °f)	14/57	-	-
Conductivity (umhos.cm)	579	-	-
Water Column Data			
Ammonia (mg/L)	0.02	-	-
Nitrate/Nitrite (mg/L)	0.02	-	-
Hardness (mg/L)	-	-	-
Alkalinity (mg/L)	375	-	-
Silica (mg/L)	-	-	-
Total Phosphorus (ug/L)	16	-	-
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	-	-
Stratification (m)	-	-	-
Limiting Nutrient	-	-	-
Depth at Deepest Site (m)	-	43	-
* Data provided is a summary of 1975 NES.			

the benthic invertebrate community was characterized by low densities of small organisms with chironomid larvae and ostracods dominate in the littoral zone and oligochaetes dominant in the profundal areas with a whole-lake mean annual biomass of 0.34 g dry wt/m²; and (5) thirteen species of fish were captured in the lake, four of which are endemic with 99% of the fish captured as natives. As can be assumed due to the limited productivity of the lake, fish production is also limited. The Bonneville cisco (*Prosopium gemmiferum*), Bonneville whitefish (*Prosopium spilonotus*),



Bear Lake whitefish (*Prosopium abyssicola*), and Bear Lake sculpin (*Cottus extensus*) are endemic to Bear Lake. Bear Lake cutthroat (*Oncorhynchus clark*) and lake trout (*Salvelinus namaycush*) are managed by the Division of Wildlife Resources through a stocking program. Also found in the lake are rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), Utah sucker (*Catostomus ardens*), Utah chub (*Gila atraria*), carp (*Cyprinus carpio*), yellow perch (*Perca flavescens*) and redbreast shiner (*Richardsonius balteatus*), a native forage fish. The lake has not been chemically treated by the DWR, so the populations of endemic fishes are still present in the lake. Macrophytes typically have never been a problem at Bear Lake. However, during late summer as the lake is drawn down bull rushes and cattails can hamper shoreline usage of the lake, especially on the eastern side.

Phytoplankton in the euphotic zone collected on September 24, 1993 include the following taxa (in order of dominance):

Species	Cell Volume (mm ³ /liter)	% Density By Volume
Lagerheimia ciliata	0.167	64.40
Oocystis sp.	0.083	32.20
Chlamydomonas sp.	0.004	1.72
Ankistrodesmus falcatus	0.004	1.69
Total Cell Volume	0.258	
Shannon-Weaver Index	0.79	
Evenness	0.57	
Richness	0.16	

The phytoplankton community is dominated by the presence of green algae and flagellates indicative of good water quality and low productivity.

Pollution Assessment

Nonpoint pollution sources include the following: grazing, urban runoff, agricultural runoff, feedlots, and logging

(in the Uintas).

Before the Bear River was diverted into the lake, water chemistry was different. The lake was fed by clear mountain streams with a retention time of many years. Currently, large amounts of water from the Bear River are diverted into the lake with large quantities of water drained each summer. During spring runoff as the level of the lake and the water level in Dingle Marsh reach equilibrium, Utah Power and Light pumps additional water into the lake.

As summer irrigation and power demands increase water is released from the lake into the Bear River. Until the lake and canal come to equal elevations the process occurs naturally. After a state of equilibrium is reached Utah Power and Light pumps then pump water from the lake into the Bear River. Because of this type of operation there is a large fluctuation of water levels in the lake on an annual basis. Recreation activities and aesthetics are severely affected. This has become a very controversial issue in recent years. Currently, private land owners, recreationalists and downstream water uses are attempting to resolve the conflict that is present and develop a management policy that is equitable for all parties involved.

This diversion of water into Bear Lake allows for a greater input of sediments and nutrients into the lake and reduces the overall retention period of water in the lake. This has resulted in an increased productivity for the lake and increased the potential for water quality impairments for this system. Natural inflows to the reservoir have also deteriorated since the valley has been used for intensive agriculture. In addition, winter feedlots for livestock have

Information	
Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	479-5143
Division of Water Quality	538-6146
Recreation	
Bear Lake Regional Commission	(208) 945-2333
Bridgerland Travel Region (Vernal)	752-2161
Garden City Chamber of Commerce	946-2901
Bear Lake State Park	946-3343
Ideal Beach (resort)	946-8735
The East Shore	946-3208
Rendezvous Beach	946-3208
KOA	9463454
Reservoir Administrators	
Bear River Water Conservancy District	723-7034

destroyed streams that once spawning grounds for cutthroat trout.

The valley floor is composed of lake deposits in the form of layers of permeable sand and impermeable clay, which

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drain agricultural runoff directly into the lake rather than allow them to disperse.

There are no discharging point sources of pollution in the immediate watershed. However, there are point source discharges into the Bear River prior to its diversion into the lake. One major discharger is the Evanston Wastewater Treatment Plant in Evanston, Wyoming.

Beneficial Use Classification

The state beneficial use classifications include: swimming and similar recreation (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).