

## MANTUA RESERVOIR



### Introduction

Mantua Reservoir is a moderate impoundment at the top of Box Elder Canyon East of Brigham City. Close proximity to urban areas make this large reservoir a popular location for all season water recreation. It is pronounced "man' a way", and is also known as Brigham

City Reservoir. Mantua Reservoir was created in 1961 by the construction of an earth-fill dam. The reservoir shoreline is 100% publicly owned and administered by Brigham City. Public accessibility is 100% open, but access by vehicle is limited. Water is used for recreation,

#### Characteristics and Morphometry

Lake elevation (meters / feet)	1,572 / 5,159
Surface area (hectares / acres)	224.19 / 554
Watershed area (hectares / acres)	2250 / 5559
Volume (m <sup>3</sup> / acre-feet)	
capacity	12,887,997 / 10,450
conservation pool	
Annual inflow (m <sup>3</sup> / acre-feet)	
Retention time (years)	
Drawdown (m <sup>3</sup> / acre-feet)	3,700,506 / 3,000
Depth (meters / feet)	
maximum	6.09 / 20
mean	4.27 / 14
Length (km / miles)	1.809 / 1.12
Width (km / miles)	1.64 / 1.02
Shoreline (km / miles)	3.4 / 2.1

#### Location

County	Box Elder
Longitude / Latitude	111 55 57 / 41 30 12
USGS Map	Mantua, 1991, Mount Pisgah, 1955
DeLorme's Utah Atlas & Gazetteer™	Page 60, B-3
Cataloging Unit	Lower Bear-Malad (16010204)

boating, water skiing, fishing, swimming, water storage for irrigation use, wetlands for birds and aquatic animals, waterfowl habitat and refuge, and hydroelectric generation. Water use is not expected to change in the foreseeable future.

An EPA Section 314 Clean Lakes project was started in 1992 at a cost of \$143,000 to assess the water quality and trophic state of Mantua Reservoir. It will identify the

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causes of the existing decline in water quality, evaluate possible solutions to existing or potential pollution problems, recommend the most feasible cost effective alternatives to restore or preserve the quality of the reservoir, and maximize the public benefits associated with water quality and restore the beneficial uses of the water. The project will be completed in 1995, and a report should be published in early 1996.

**Recreation**

Mantua Reservoir is accessible from US 89 between Brigham City and Logan. It is on the Brigham City side of Sardine Summit at the top of Box Elder Canyon, east of Brigham City. It is only about two miles long and the reservoir is very visible from the highway. At the top of the canyon, turn off the highway into the community of Mantua, (if you miss this turn, go another mile and make a hard right at the north end of town) turn left at a "T" intersection, and the reservoir is on the right.

There are presently no facilities at the reservoir, but there is a wide, gravelly area that is used as a boat ramp. Fishing, boating, sailing, sailboarding, swimming, camping, picnicking, ice fishing, and water skiing are all possible. It is a popular place, with ice fishing contributing to increased usage during the winter.



**Watershed Description**

Mantua Reservoir is in a small valley that drains out through a small gap in the Wasatch Front. The watershed is entirely visible from the reservoir. While the valley floor is very flat (and the reservoir correspondingly shallow), the valley walls rise with slopes in excess of 50% in most directions.

The watershed high point, Perry Peak, located southwest of the reservoir, is 2,501 m (8,207 ft) above sea level, thereby developing a complex slope of 17.9% to the reservoir. The average stream gradient for Maple Creek above the reservoir is less than 1% (37 feet per

mile). Inflows include an unnamed stream to the northeast, groundwater pump discharge, Dam Creek, Spring #1, Spring #2, Spring #3, Rock Spring, Maple Creek, and an unnamed stream above Maple Creek. It appears that water may also be diverted from Box Elder Creek through Mantua Reservoir. There are no upstream impoundments.

The watershed is made up of mountains and mountain valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sagebrush-grass, cottonwoods, willows, and scattered conifers. The watershed receives 64 cm (25 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

Estimated land uses within the watershed as percent or relative composition are: Grazing - 86%; irrigated agricultural - 13%; and dairy operations and barnyards - 1%.

**Limnological Assessment**

The water quality of Mantua Reservoir is poor with

<b>Limnological Data</b>			
Data averaged from STORET sites: 490044, 490045, 490046			
<b>Surface Data</b>	<u>1980</u>	<u>1990</u>	<u>1991</u>
Trophic Status	H	E	E
Chlorophyll TSI	-	58.37	61.04
Secchi Depth TSI	73.20	45.38	45.38
Phosphorous TSI	57.34	61.02	68.04
Average TSI	65.27	54.93	58.05
Chlorophyll <i>a</i> (ug/L)	-	17.6	65.4
Transparency (m)	0.29	2.8	2.4
Total Phosphorous (ug/L)	33.4	52	95
pH	-	9.7	9.1
Total Susp. Solids (mg/L)	23	<3	<3
Total Volatile Solids (mg/L)	-	-	7
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	17/63	23/74	19/67
Conductivity (umhos.cm)	312	252	244
<b>Water Column Data</b>			
Ammonia (mg/L)	0.08	0.04	0.09
Nitrate/Nitrite (mg/L)	0.47	0.03	0.02
Hardness (mg/L)	146	141	141
Alkalinity (mg/L)	139	133	131
Silica (mg/L)	4.0	-	8.0
Total Phosphorous (ug/L)	42	57	100
<b>Miscellaneous Data</b>			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	8	6.5	3.9
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	7	5	5.0

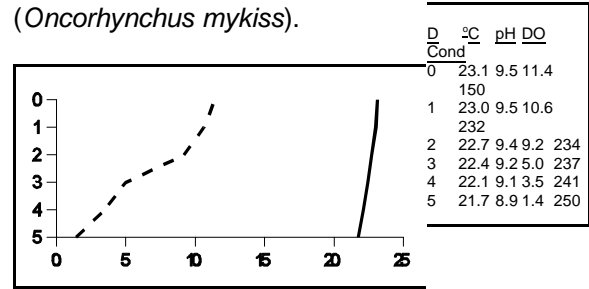
LAKE REPORTS

significant water quality impairments present. It is considered to be moderately hard with a hardness concentration value of approximately 143 mg/L (CaCO<sub>3</sub>). Those parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, dissolved oxygen, temperature and pH. The average concentration of total phosphorus in the water column increased from 42 ug/L (1981) to 100 ug/L (1991). These concentrations have consistently exceeded the recommended pollution indicator for phosphorus of 25 ug/L. The excessive nutrient loading to the reservoir has increased the productivity to a point that water quality is impaired in the reservoir. As a result a Clean Lakes Phase I study is currently underway to assess impairments and to develop a feasibility plan to control sources of nutrients in the watershed. The high level of nutrients not only drives the production of large blue-green algal blooms but supports the production of extensive macrophytes in the reservoir. They are so abundant that it restricts boating and impairs the fishery. This high state of productivity and the reservoirs shallow nature are responsible for depletion of dissolved oxygen in the water column as indicated in the August 13, 1991 profile. There is a significant loss of dissolved oxygen in the summer and winter. Loss of oxygen results from respiration during the nocturnal period and the decomposition of organic matter (algae and macrophytes) during winter under ice coverage. These conditions are detrimental to the fishery. In addition the temperature regime exceeds the state standard of 20°C for a cold water fishery. The other violation of state standards is excessive pH concentrations which are indicative of high production of algae and the increase associated due to the process of photosynthesis.

Typically the reservoir does not stratify due to the shallow nature of the reservoir. Current data indicates that the reservoir is a nitrogen limited system and in a state of eutrophic to hypereutrophic conditions. Although the data isn't totally conclusive it appears that the nutrient loading to the reservoir have gradually increased in recent years.

According to DWR there were frequent trout fish kills during the 1960's and partial winter kills still occurring. Carp (*Cyprinus carpio*) and other fish were chemically removed in 1983. Largemouth bass (*Micropterus salmoides*), bluegil (*Lepomis macrochirus*), and Utah chub (*Gila atraria*) were re-introduced in addition to trout to develop a warm water fishery. According to DWR since 1987 avion predators displaced by the flooding on the Great Salt Lake have had a detrimental effect on the bass and bluegill population. Until the birds return to the recovering marshes they may continue to have a detrimental impact on the fishery in Mantua. Recent stocking reports also indicate that the reservoir is stocked annual with 1,000 catchable rainbow trout

(*Oncorhynchus mykiss*).



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm <sup>3</sup> /liter)	% Density By Volume
<i>Aphanizomenon flos-aquae</i>	191.2	0.8
<i>Fragilaria crotonensis</i>	0.458	0.24
Total	191.658	
Shannon-Weaver [H']	0.02	
Species Evenness	0.02	
Species Richness	0.04	

The phytoplankton community is dominated primarily by blue-green algal indicative of the highly eutrophic conditions and the impaired water quality.

**Pollution Assessment**

Nonpoint pollution sources include grazing, recreation, construction activities, and agricultural runoff. Agricultural land is predominant in the watershed with some small feedlots and dairies within the watershed area. Agricultural activities contribute to the nutrient loading by movement of soils from erosion and animal waste materials in the reservoir.

There is one point source of pollution, Mantua Fish Hatchery, that discharges into Maple Creek, a tributary of Mantua Reservoir. An additional discharge to the reservoir is a pump station on the northern end of the reservoir. Preliminary indication show the water is high in nutrient concentrations. It results from Brigham City pumping agricultural runoff into the reservoir. This source of nutrients is receiving further attention. The cessation of this practice should result in improving water quality of Mantua Reservoir

**Beneficial Use Classification**

The state beneficial use classifications include: culinary water (1A), boating and similar recreation (excluding swimming) (2B), cold water game fish and

aquatic life (3A) and agricultural uses (4).

The fishery and other recreation uses are considered moderately impaired with occasional severe acute impacts evident. The fishery is impaired due to extensive algal blooms and macrophyte production. The fishery and other recreational components are impacted due to the high enrichment of the waters of the reservoir. These high levels of nutrients lead to high algal production and macrophyte development. High algal production reduced dissolved oxygen concentrations and create other problems associated with the fishery. Lake summer and fall macrophyte conditions inhibit recreational uses, not only as a fishery but other recreational uses typically supported at the reservoir.

If restoration is to be effective, a watershed management program should address primary pollutants currently or potentially affecting the ecosystem, mass loads of the selected contaminant(s), and the sources of these loads. Some idea of the amount of load reduction possible through available control methods is also necessary. Control efforts should be directed at those sources which are most significant and cost effective.

#### Information

##### **Management Agencies**

Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

##### **Recreation**

Golden Spike Empire Travel Region (Ogden)	627-8288
Brigham City Chamber of Commerce	723-3931

##### **Reservoir Administrators**

Brigham City	723-3146
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