

## ***Citizen Monitoring Day 2008 Results***

Water quality standards are established to protect the beneficial uses identified for each of the State's waters. When a standard is established for a given parameter, the beneficial uses sensitive to each parameter are identified. Then, criteria are established based on the levels needed to protect the sensitive uses.

Beneficial uses identified by the Idaho Department of Environmental Quality (IDEQ) for the lower Boise River are defined in the *Idaho Administrative Code*. The Idaho Water Quality Standards designate the lower Boise River from Lucky Peak to Veteran's State Park (river mile 50) for use for cold water biota, primary contact recreation, domestic water supply, and as a special resource water. Special resource waters possess a characteristic that is desirable to protect, such as exceptional quality, ecological or recreational significance, or are designated as such simply to maintain the current beneficial use. Salmonid spawning is also a designated use from Diversion Dam to Veteran's State Park. From Veteran's Park to its junction with Indian Creek in Caldwell, the river is designated for use for cold water biota, salmonid spawning, and primary contact recreation. From the junction of Indian Creek to its mouth, the Boise River is designated for use for cold water biota and primary contact recreation.

Beneficial uses identified by IDEQ for Lake Lowell are cold and warm water aquatic life, primary contact recreation, and a special resource water.

Indian Creek has various designations, depending on the reach. The reach that was sampled is designated as a modified community, with secondary contact recreation use.

The ponds associated with the lower Boise River system are managed by the Parks and Recreation Department specifically for recreational use. These water bodies do not have beneficial uses designated by IDEQ.

In the Boise River and associated ponds and lakes, propagation of cold water fish (i.e., trout, mountain whitefish) is a designated beneficial use of the water. Numeric and narrative water quality standards generally are set at levels that will support the beneficial use of a cold water fishery. Generally, cooler temperatures are required. Cold water fisheries require a higher dissolved oxygen content than water in streams and lakes that do not have a cold water fishery as a designated beneficial use. Mountain whitefish are the most abundant native species found in the lower Boise River. A study performed by the USGS in 2006 (*Fish Communities and Related Environmental Conditions of the Lower Boise River, Southwestern Idaho, 1974-2004*) identified twenty-two species representing seven families of fish in the lower Boise River.

- ◆ 3 salmonids (trout and whitefish)
- ◆ 2 cottids (sculpins)
- ◆ 3 catostomids (suckers)
- ◆ 7 cyprinids (minnows)
- ◆ 4 centrarchids (sunfish)
- ◆ 2 ictalurids (catfish), and one cobitidae (loach).

Of these, 13 are native species, 5 are cold water species, 9 are cool water species, and 8 are warm water species.

The ideal temperature range for mountain whitefish is 8.9 to 11.1 degrees Celsius, although they can survive in a much wider range of temperatures.

Habitat characteristics can be monitored but do not typically have numeric standards associated with them. However, numeric standards are associated with water quality parameters that can be measured and are directly related to habitat characteristics, such as flow, water temperature, pH, dissolved oxygen, turbidity, and total suspended solids (TSS). Cold water fish also require habitat characteristics that promote spawning (clear gravel beds, riffles), rearing habitats (glides and pools), and adequate food sources such as macroinvertebrates (mayflies, nymphs, stonefly nymphs, and caddisfly larvae). Macroinvertebrates are believed to be a primary indicator of stream health as related to fisheries.

Water quality standards have been established for the lower Boise River. These standards are listed in the table below (from the USGS publication *Water Quality and Biological Conditions in the Lower Boise River, Ada and Canyon Counties, Idaho, 1994-2002*). To summarize the standards for the samples obtained during this sampling event, no averaged value for any sample location exceeded an applicable water quality standard. Most regulated parameters were not sampled during this sampling event.

**Table 9.** Standards, criteria, recommended levels, and background concentrations for water-quality properties and constituents in the lower Boise River, Idaho

[C, Celsius; mg/L, milligrams per liter; mg/m <sup>2</sup> , milligrams per square meter; mL, milliliters; NTE, not to exceed; AD, average daily; SS, salmonid spawning period (lower Boise River mountain whitefish spawning between October 15 and March 15); NMT, no more than; d, days; NAWQA, National Water-Quality Assessment; --, no comparison used; PC, primary contact, May 1 through September 30; SC, secondary contact, year-round]						
Property or constituent	EPA criteria	State of Idaho water-quality standard	Lower Boise River site-specific requirement	Recommended level	Background concentration	NAWQA national median
Temperature (degrees C)	--	NTE 22, AD 19, SS NTE 13, SS AD 9 <sup>a</sup>	--	--	--	--
Dissolved oxygen (mg/L)	--	--	SS 6 <sup>a</sup>	--	--	--
Dissolved oxygen saturation (percent)	--	--	SS 75 <sup>a</sup>	--	--	--
pH (standard units)	--	6.5 - 9.5 <sup>a</sup>	--	--	--	--
Total nitrogen (mg/L)	--	--	--	0.3 <sup>g</sup>	2 (as nitrate) <sup>c</sup>	1.0 <sup>f</sup>
Flow-adjusted total nitrogen (mg/L)	--	--	--	--	--	0.26 <sup>g</sup> 2.0 <sup>d</sup>
Total phosphorus (mg/L)	0.1 <sup>f</sup>	--	--	0.02 <sup>g</sup>	0.006 <sup>i</sup>	--
Flow-adjusted total phosphorus (mg/L)	--	--	--	--	--	0.02 <sup>d,e</sup>
Orthophosphorus (mg/L)	--	--	--	--	--	0.01 <sup>d,e</sup>
Suspended sediment (mg/L)	--	(proposed) <sup>b</sup> 50 NMT 60d, 80 NMT 14d	--	--	--	--
Fecal coliform (organisms/100 mL)	--	PC, NTE 500 SC, NTE 800	--	--	--	--
<i>E. Coli</i> (organisms/100 mL)	--	PC, NTE 406 SC, NTE 576	--	--	--	--
Chlorophyll- <i>a</i> (mg/m <sup>2</sup> )	--	--	--	100 <sup>h</sup>	20 <sup>h</sup>	--
a Idaho Department of Environmental Quality, 2001, accessed March 5, 2003.						
b Rowe and Essig, 1999; Idaho Department of Environmental Quality, 1999.						
c Boyle, 2001.						
d National Water-Quality Assessment national analysis of nutrient concentrations in streams and rivers <a href="http://water.usgs.gov/nawqa/nutrients/datasets/nutconc2000/#SW">http://water.usgs.gov/nawqa/nutrients/datasets/nutconc2000/#SW</a>						
e Clark and others, 2000.						
f U.S. Geological Survey, 1999.						
g Watson and Gestring, 1996.						
h Nordin, 1985; Welch and others 1987; Watson and Gestring, 1996.						
i Smith and others, 2003.						

## Flow

Flows during the sampling event in the Boise River were recorded at United States Geological Survey (USGS) gages. Data for the gage located at the Glenwood Bridge (Sampling Site 16) indicated that the discharge at 10:00 am on 9/13/08 was 664 cubic feet per second (cfs), and the gage height was 4.70 feet. Data were obtained from the USGS website, listed below.

[http://waterdata.usgs.gov/id/nwis/uv?cb\\_00060=on&cb\\_00065=on&format=html&period=60&site\\_no=13206000](http://waterdata.usgs.gov/id/nwis/uv?cb_00060=on&cb_00065=on&format=html&period=60&site_no=13206000)

Data were also available for the USGS gage located on the Boise River South Channel at Eagle, ID near Sample Site 20. The discharge was reported to be 450 cfs at 10:00 am on 9/13/08, with a gage height of 3.02.feet, using the USGS website:

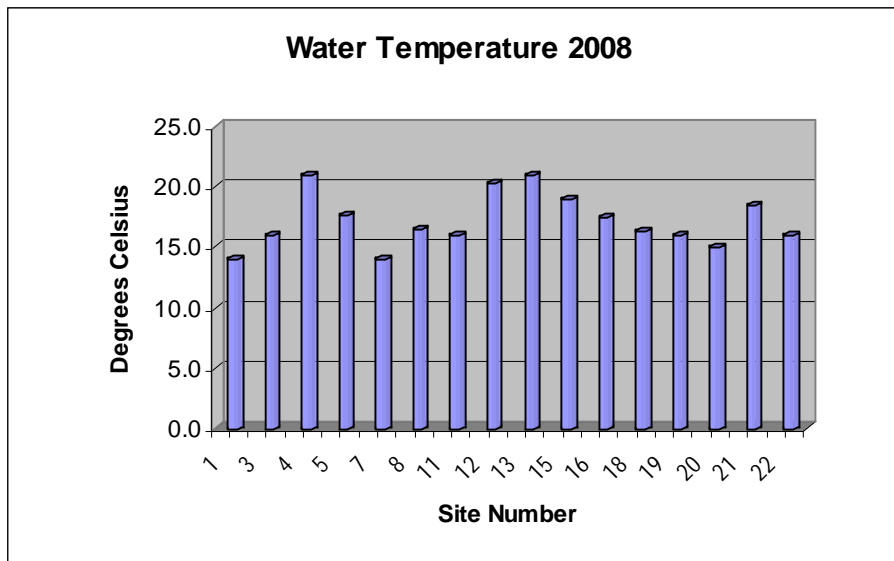
[http://waterdata.usgs.gov/id/nwis/uv?cb\\_00065=on&cb\\_00060=on&format=html&period=60&site\\_no=13206305](http://waterdata.usgs.gov/id/nwis/uv?cb_00065=on&cb_00060=on&format=html&period=60&site_no=13206305) )

## **Water Temperature**

Generally, cooler water temperatures are considered better habitat for aquatic life in mountain streams, lakes, and rivers, since colder water contains more dissolved oxygen. Dissolved oxygen is essential for fish and invertebrates. Higher water temperatures promote nutrient solubility. Since growth and survival of aquatic organisms is seasonal, they are adapted to specific temperature ranges. If temperatures are outside the optimal range for prolonged periods of time, aquatic organisms become stressed and can die. Long-term shifts in temperature can also result in a change in the composition of organisms that make a river or stream their home.

Higher water temperatures can occur as a result of low flow (shallow) conditions affected by solar heating, and/or a lack of canopy (tree) cover along banks which can shade and thus prevent solar heating. Lakes and ponds with minimal surface mixing exhibit high temperatures for these reasons. Discharges of higher temperature water into the water body, such as urban stormwater or an influx of groundwater, can elevate the water body's temperature. Impoundments also can act to modify a river's temperature.

Water temperature for the Boise River and associated lakes and ponds measured during the sampling event ranged from 14 to 21 degrees Celsius. The highest temperatures were measured in the Park Center and Veteran's Memorial Park ponds. The lowest temperature was measured in the Boise River at Discovery Park. Average water temperature values recorded for each site monitored are provided in the chart below.



## pH

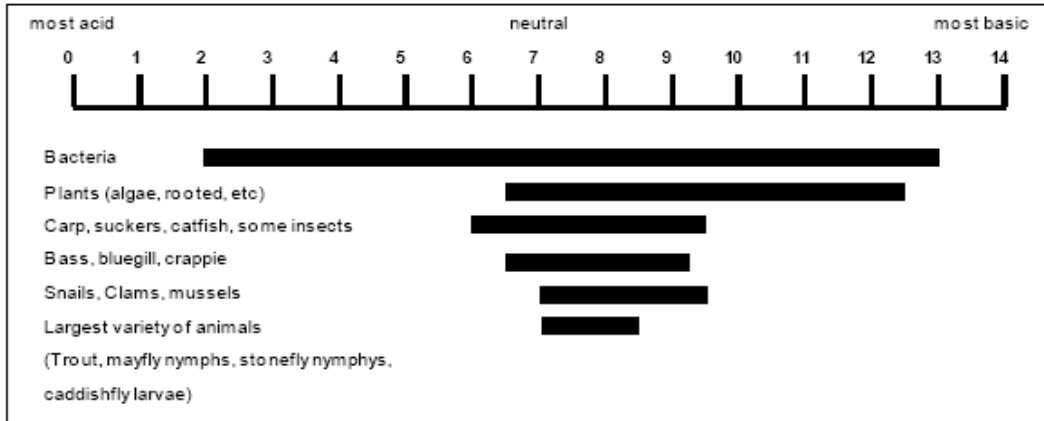
pH is a measure of how acidic or basic water is. pH is important because it controls many chemical and biological processes that occur in the water. pH is measured on a scale that ranges from 0 to 14, with 7 considered neutral. Values of pH less than 7 are acidic, while values higher than 7 are basic. pH can be used as a proxy of water quality conditions since water pH is easily changed by chemical pollution.

Examples of pH for natural waters are as follows:

- ◆ 6.5 to 8.5 optimal for streams and groundwater
- ◆ fresh rain water 5.5 to 6.0
- ◆ alkaline soils 8.0 to 8.5
- ◆ seawater ~8.0

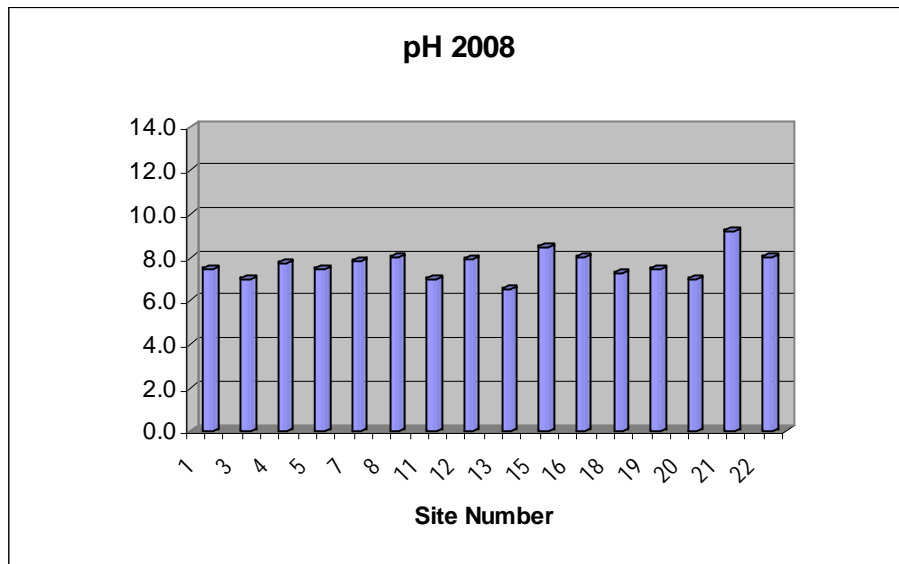
Aquatic organisms can only tolerate very narrow pH ranges within a family or species. Fluctuations in pH decrease the survival of aquatic organisms and lead to loss of ecosystem diversity. High pH levels can occur when algae and aquatic vegetation use carbon dioxide for photosynthesis. Low pH can be caused by respiration of aquatic vegetation, or from bacterial decay of organic matter in the water producing high levels of carbon dioxide. Low pH can allow toxic chemicals to become mobile and available for uptake by aquatic plants and animals. Conditions can become toxic, especially to sensitive species like salmonids.

The range of pH tolerated by organisms which may be found in the sampled water bodies is shown in the table below.



pH ranges that support aquatic life.

Averaged pH values for the sample locations fell between 6.5 at the WWMD to 9.25 at Lake Lowell. Observed pH values are generally acceptable for the types of aquatic life and beneficial uses associated with each sampled water body. However, the value of 9.25 is on the high end of what can be tolerated by some forms of aquatic life. Average values recorded for each site monitored are provided in the chart below.



## Dissolved Oxygen

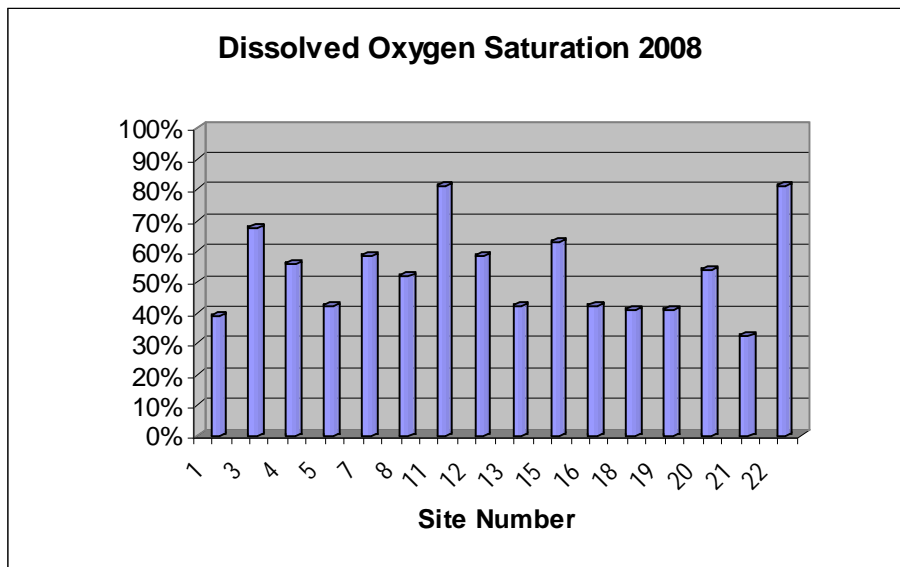
Dissolved oxygen is a measure of the amount of oxygen in water that is available for use by aquatic organisms. Dissolved oxygen is important for the survival of certain microorganisms and higher organisms, such as zooplankton and fish. Most of the oxygen in water is derived from the atmosphere by the churning action of water as it flows. Water flowing over rocks and waterfalls also help oxygenate stream water. Rapidly moving water, such as in the lower Boise River, tends to contain a lot of dissolved oxygen, while stagnant water, such as the Park Center Pond, contains little. Changes in the dissolved oxygen levels in water can be caused by aquatic vegetation. When aquatic vegetation photosynthesizes, dissolved oxygen levels in water

increase. When aquatic vegetation respire, oxygen is used and carbon dioxide is produced. Streams can also lose oxygen due to the decomposition of organic matter by bacteria and from chemical reactions that consume oxygen.

The temperature of water also controls the amount of dissolved oxygen in water. Cold water can dissolve more oxygen, producing a higher percent saturation. Low oxygen can result from pollution from discharge of urban runoff and wastewater. Other sources of oxygen-consuming include failing septic systems and agricultural runoff. Thermal pollution raises the temperature of water and decreases the solubility of oxygen.

Cold, clean water usually has levels of dissolved oxygen averaging greater than 6.0 mg/L. Single measurements below 5.0 mg/L are considered dangerous for cold water aquatic life. A range of 6.0 to 8.0 mg/L is usually required to support cold water fish. Active cold water species such as trout use more oxygen than less active species.

The range of dissolved oxygen values measured during the sampling event ranged from 3 to 8 mg/L. Numerous difficulties were reported with the analytical method used. **These results are not believed to be representative of actual conditions at the time sampling occurred.** Average dissolved oxygen values recorded for each site monitored were used to calculate the corresponding percent saturation at the water temperature observed at that site. This information is provided in the chart below.



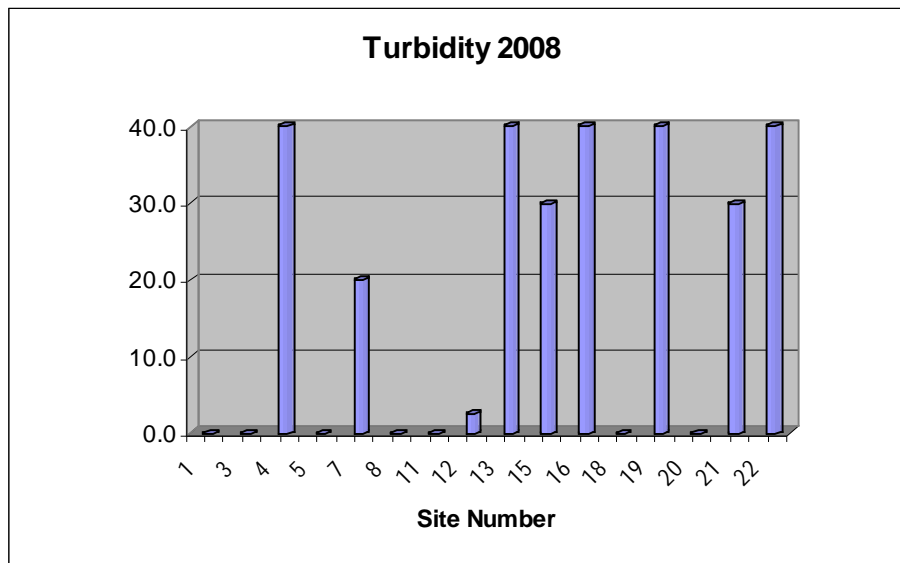
## Turbidity

Turbidity is a measure of the amount of suspended particles in water. Algae, suspended sediment, organic matter, and some pollutants can cloud water, making it more turbid. Suspended particles diffuse sunlight and absorb heat, which can increase temperature and reduce light available for algal photosynthesis. If the turbidity is caused by suspended sediment, it can

be an indicator of soil erosion, either natural or manmade. High sediment loads can clog the gills of fish, foul gravel beds and smother fish eggs and benthic insects. Sediment can also carry pathogens, pollutants, and nutrients.

Turbidity may be measured in Units of Nephelometric (NTU) or Jackson Turbidity Units (JTU). Both are roughly equivalent (U. S.EPA 1983a). The LaMotte water quality testing kit turbidity measurement methods use JTU's on a scale of 0 - 100. Higher JTU values indicate poorer water clarity. State water quality standards dictate that turbidity in Idaho should not be greater than 50 NTU instantaneous or 25 NTU for more than 10 consecutive days above baseline background (Idaho Department of Environmental Quality n.d.a.).

Values ranged from 0 to 40 JTU. Generally, values were lower upstream and higher downstream, with some exceptions. Average turbidity values recorded for each site monitored are provided in the chart below.



## Summary

The Tier 3 data collected by citizens provided us with a snapshot of the lower Boise watershed's water quality.

- Water temperature ranged from 14 - 21 °C. All river sites met NTE water quality standards in sections with designated uses.
- pH ranged from 6.5 to 9.25 SU. All sites met state water quality standards except Lake Lowell.
- Turbidity ranged from 0 - 40 JTU. All sites met instantaneous water quality standards. Generally, values were lower upstream and higher downstream, with some exceptions.

- DO ranged from 3 – 8 ppm, or 30-80% saturation. Due to numerous difficulties reported with the dissolved oxygen analytical method, results are not believed to be representative of actual conditions at the time sampling occurred. A new test method should be used next CMD.

In summary, volunteers learned about their watershed, water quality issues, how streams function, and how to assess stream health. By learning more and helping to promote environmental stewardship, volunteers create an informed public voice that can influence decisions that affect our environment and subsequently our water resources. Results were submitted to WWMD and to participants and were summarized in October 2008 in a general report. Monitoring data will be used to determine potential problem areas and to document background conditions for future studies.