NUTRIENTS AND PARTICLES

Sources of clarity-reducing pollutants

Previous research has quantified the primary sources of nutrients (nitrogen and phosphorus) and particulate material that are causing Lake Tahoe to lose clarity in its upper waters. Extremely fine particles, the major contributor to clarity decline, primarily originate from the urban watershed (70-75 percent), even though these areas cover only 10 percent of the land area. For nitrogen, atmospheric deposition is the major source (55 percent). Phosphorus is primarily introduced by the urban (39 percent) and non-urban (26 percent) watersheds. These categories of pollutant sources form the basis of a strategy to restore Lake Tahoe’s open-water clarity by agencies including the Lahontan Regional Water Quality Control Board, the Nevada Division of Environmental Protection, and the Tahoe Regional Planning Agency. (Data were generated for the Lake Tahoe TMDL Program and this figure also appeared in previous year’s State of the Lake Reports.)
Pollutant loads from seven watersheds

In 2012

The Lake Tahoe Interagency Monitoring Program (LTIMP) measures nutrient and sediment input from seven of the 63 watershed streams – a reduction of three streams since 2011. Most of the suspended sediment contained in the 7 LTIMP streams is from the Upper Truckee River, Blackwood Creek, Trout Creek and Ward Creek. Over 75 percent of the phosphorus and nitrogen comes from the Upper Truckee River, Trout Creek and Blackwood Creek. Pollutant loads from the west-side streams were a factor of four lower in 2012, compared with 2011. This was largely due to the drier year that the basin experienced. Blackwood creek suspended sediment loads, which had exceeded those of the Upper Truckee River for the last four years, dropped lower this year. For the eastside streams, Incline Creek pollutant loads fell relative to Third Creek particularly for nitrogen.

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N = Nitrogen
P = Phosphorus
DIN = Dissolved Inorganic Nitrogen
SRP = Soluble Reactive Phosphorus
TON = Total Organic Nitrogen
SS = Suspended Sediment
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Nitrogen contribution by Upper Truckee River
Yearly since 1989

Nitrogen (N) is important because it, along with phosphorus (P), stimulates algal growth (Fig. 9.1 shows the major sources of N and P to Lake Tahoe). The Upper Truckee River is the largest of the 63 streams that flow into Lake Tahoe, contributing about 25 percent of the inflowing water. The river’s contribution of dissolved inorganic nitrogen (nitrate and ammonium) and total organic nitrogen loads are shown here. The year-to-year variations primarily reflect changes in precipitation. For example, 1994 had 16.6 inches of precipitation and a low nitrogen load, while 1995 had 60.8 inches of precipitation and a very high nitrogen load. Similarly 2012 had 22.48 inches of precipitation and 2011 had 51.78 inches of precipitation. This below-average precipitation in 2012 resulted in a nitrogen load that was almost one quarter of the previous year’s. (One metric ton = 2,205 pounds.)
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Phosphorus contribution by Upper Truckee River
Yearly since 1989

Soluble reactive phosphorus (SRP) is that fraction of phosphorus immediately available for algal growth. As with nitrogen (Fig. 9.3), the year-to-year variation in load largely reflects the changes in precipitation. Below average precipitation in 2012 resulted in a factor of three reduction of the phosphorus load over the previous year. Total phosphorus is the sum of SRP and other phosphorus, which includes organic phosphorus and phosphorus associated with particles. (One metric ton = 2,205 pounds.)

Water year

Metric tons

Soluble reactive phosphorus
Other phosphorus
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Suspended sediment contribution by Upper Truckee River

Yearly since 1989

The load of suspended sediment delivered to the lake by the Upper Truckee is related to landscape condition and erosion as well as to precipitation and stream flow. Certainly, inter-annual variation in sediment load over shorter time scales is more related to the latter. Below average precipitation in 2012 resulted in a factor of three decrease of the suspended sediment load compared with the previous years. This and the previous two figures illustrate how greatly changes in hydrological conditions affect pollutant loads. Plans to restore lake clarity emphasize reducing loads of very fine suspended sediment (less than 20 microns in diameter). Efforts to restore natural stream function and watershed condition focus on reducing loads of total sediment regardless of size.
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**Nutrient concentrations in rain and snow**

*Yearly since 1981*

Nutrients in rainwater and snow (called wet deposition) contribute large amounts of nitrogen, but also significant phosphorus, to Lake Tahoe. Nutrients in precipitation have been measured near Ward Creek since 1981, and show no consistent upward or downward trend. Annual concentrations in precipitation of dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) vary from year to year. In 2012, concentrations of DIN and SRP increased significantly over the previous year. This may be due to the lower precipitation in 2012.
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Nutrient loads in rain and snow
Yearly since 1981

The annual load for wet deposition is calculated by multiplying the concentration of dissolved inorganic nitrogen (nitrate and ammonium) and soluble reactive phosphorus (in the previous graph) by total annual precipitation. While nitrogen and phosphorus loads from precipitation have varied from year to year at the Ward Creek monitoring site, no obvious long-term trend has emerged. In 2012, the nitrogen and phosphorus loads were within the range seen in previous years.
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Lake nitrate concentration

Since 1980, the volume-weighted annual average concentration of nitrate-nitrogen has remained relatively constant, ranging between 13 and 19 micrograms per liter. In 2012, the volume-weighted annual average concentration of nitrate-nitrogen was 18 micrograms per liter. These measurements are taken at the MLTP (mid-lake) station. Water samples could not be collected in March or September 2012 due to weather conditions. However, the two collections in October (10/2/12 and 10/18/12) were representative of the Sept-Oct 2012 period.
NUTRIENTS AND PARTICLES

Lake phosphorus concentration
Yearly since 1980

Phosphorus naturally occurs in Tahoe Basin soils and enters the lake from soil disturbance and erosion. Total hydrolyzable phosphorus, or THP, is a measure of the fraction of phosphorus algae can use to grow. It is similar to the SRP that is measured in the streams. Since 1980, THP has tended to decline. In 2012, the volume-weighted annual average concentration of THP was approximately 1.8 micrograms per liter, a slight decrease over the previous year. Water samples could not be collected in March or September 2012 due to weather conditions. However, the two collections in October (10/2/12 and 10/18/12) were representative of the Sept-Oct period.