

Lake Tahoe Interagency Monitoring Program: Tributary Sampling Design, Sites, and Periods of Record

INTRODUCTION

Lake Tahoe is a natural resource famous for its alpine setting and deep, clear waters. Reported decreases in water clarity of about 1 foot per year (Goldman and Byron, 1986) have prompted major efforts to preserve the water quality of Lake Tahoe. This decrease in clarity is attributed mainly to human activities, which have increased dramatically in the Lake Tahoe Basin since 1960.

Increased nutrient concentrations within Lake Tahoe are considered the primary cause of increased algal growth and resultant loss of clarity in the lake (Goldman and Byron, 1986). Suspended sediment delivered to the lake by tributaries also is of concern, because some nutrients, such as organic nitrogen and phosphorus, tend to be transported with sediment particles. Tributary streamflow in the Lake Tahoe Basin is suspected of being one of the major pathways for nutrient and sediment transport to the lake (Goldman and Byron, 1986). Increased development has accelerated this transport through urbanization of wetland areas and erosion from construction on moderate to steep slopes within the basin (Byron and Goldman, 1989).

Public concern over water-quality degradation in Lake Tahoe has led to extensive monitoring activities in the lake and its tributary watersheds. One of the largest monitoring activities is the Lake Tahoe Interagency Monitoring Program (LTIMP). The purpose of this report is to describe the data collection activities of LTIMP.

LAKE TAHOE INTERAGENCY MONITORING PROGRAM, 1978-87

Since the early 1970's, prior to the formation of LTIMP, the Tahoe Regional Planning Agency (TRPA), the U.S. Geological Survey (USGS), the Tahoe Research Group (TRG) of the University of California, Davis, and State and local agencies had been monitoring the Lake Tahoe Basin for lake and tributary water-quality conditions. In 1978, LTIMP was formed to conduct collaborative monitoring and research efforts in the Lake Tahoe Basin. Participants of LTIMP include TRPA, USGS, TRG, U.S. Forest Service, U.S. Environmental Protection Agency, California State Water Resources Control Board, Lahontan Regional Water Quality Control Board (RWQCB), California Department of Water Resources, California Department of Transportation, California Air Resources Board, California Department of Fish and Game, Nevada Division of Environmental Protection, and local counties and cities. LTIMP monitoring began in the 1979 water year¹ as a cooperative program with TRG and USGS and included four tributary sites in four Lake Tahoe Basin watersheds. The program was expanded to seven sites in seven watersheds in 1981 and continued through 1987 with various sites sampled. Tributary site locations are shown in figure 1. An overview of tributary sites for LTIMP is shown in figure 2.

LAKE TAHOE INTERAGENCY MONITORING PROGRAM, 1988-98

The current LTIMP tributary-monitoring program, a cooperative effort by TRPA, USGS, and TRG, began in the 1988 water year. The primary purpose of this program is to provide long-term data on tributary water quality. This program initially included 4 sites in 4 water-

¹ Water year is the 12-month period from October 1 through September 30, and is designated by the year in which the period ends (for example, water year 1979 began October 1, 1978, and ended September 30, 1979).

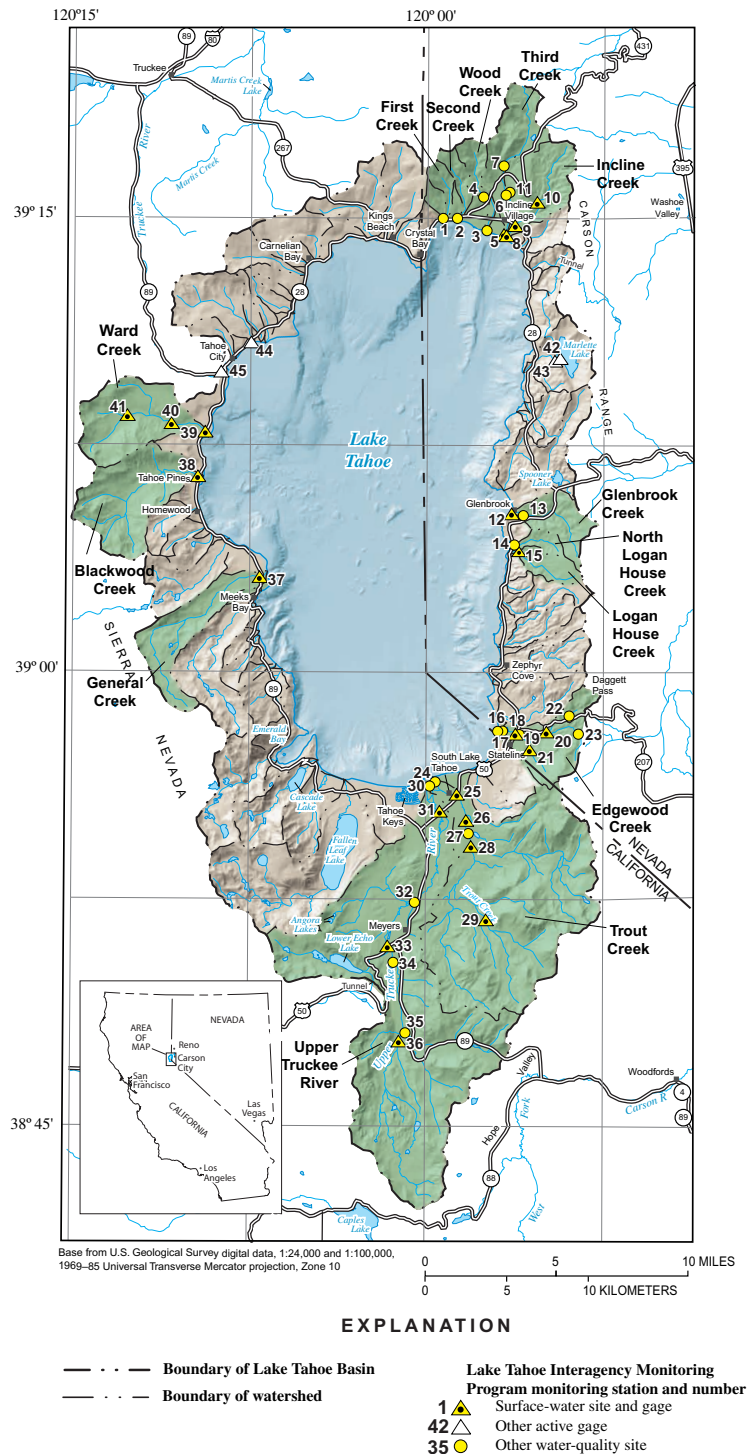


Figure 1. Geographic setting, hydrologic basins, and Lake Tahoe Interagency Monitoring Program sites in Lake Tahoe Basin, California and Nevada.

Table 1. Periods of record for streamflow, physical, nutrient, and sediment data collected at current U.S. Geological Survey/Lake Tahoe Interagency Monitoring Program stream network sites and other active USGS gaging stations in the Lake Tahoe Basin, California and Nevada

[Abbreviations: nr, near; abv, above; ck, creek, St., street; Dr., drive; Ave., avenue; Hwy., highway; —, not collected]

Site no.	Site name	Station no.	Site type ¹	Streamflow ²	Physical ³	Nutrients ⁴	Sediment ⁵
Lake Tahoe Interagency Monitoring Program Sites							
1	First Creek (at Hwy. 28) nr Crystal Bay, Nev.	10336688	m	misc: 70-73,91-current	field: 70-73,91-current	n,p: 70-73,79-81 n,p,i: 91-current	tot: 70-73,80,81 sus: 91-current
2	Second Creek at Lakeshore Dr. nr Incline Village, Nev.	10336691	m	misc: 91-current	field: 91-current	n,p,i: 91-current	sus: 91-current
3	Wood Creek at Lakeshore Dr. nr Incline Village, Nev.	10336694	m	misc: 70-73,91-current	field: 70-73,91-current	n,p: 70-73 n,p,i: 91-current	tot: 70-73 sus: 91-current
4	Wood Creek above Jennifer St. nr Incline Village, Nev.	10336692	m	misc: 91-current	field: 91-current	n,p,i: 91-current	sus: 91-current
5	Third Creek (at Lakeshore Dr.) nr Crystal Bay, Nev.	10336698	b	gage: 70-73,75,77-current	field: 70-73,78-85,88-current	n,p: 70-73,80-87 n,p,i: 88-current	tot: 70-73,81-85 sus: 88-current
6	Third Creek at Village Blvd. at Incline Village, Nev.	103366965	m	misc: 89,91-current	field: 89,91-current	n,p,i: 89,91-current	sus: 89,91-current
7	Third Creek below unnamed tributary nr Incline Village, Nev.	103366958	m	misc: 89,91-current	field: 89,91-current	n,p,i: 89,91-current	sus: 89,91-current
8	Incline Creek (above Lakeshore Dr.) nr Crystal Bay, Nev.	10336700	b	misc: 67-69,74-75 gage: 70-73,88-current	field: 70-73,78-81,88-current wt: 98-current	n,p: 70-73,78-80 n,p,i: 88-current	tot: 70-73,78-80 sus: 88-current
9	Incline Creek at Hwy. 28 at Incline Village, Nev.	103366995	md	gage: 90-current	field: 90-current	n,p,i: 90-current	sus: 90-current
10	Incline Creek abv Tyrol Village nr Incline Village, Nev.	103366993	ad	gage: 90-current	field: 90-current	n,p,i: 90-current	sus: 90-current
11	Incline Creek Tributary at County Club Dr. nr Incline Village, Nev.	103366997	m	misc: 89,91-current	field: 89,91-current	n,p,i: 89,91-current	sus: 89,91-current
12	Glenbrook Creek at Glenbrook, Nev.	10336730	b	misc: 67-71 gage: 72-75,88-current	field: 71-74,88-current wt: 98-current	n,p: 71-74,87 n,p,i: 88-current	tot: 71-74,87 sus: 88-current
13	Glenbrook Creek at Old Highway nr Glenbrook, Nev.	10336725	m	misc: 72-74,89,91-current	field: 72-74,89,91-current	n,p: 72-74,89,91-current	tot: 72-74 sus: 89,91-current
14	North Logan House Creek at Hwy. 50 nr Glenbrook, Nev.	10336735	m	misc: 91-current	field: 91-current	n,p,i: 91-current	sus: 91-current
15	Logan House Creek nr Glenbrook, Nev.	10336740	b	gage: 84-current	field: 83-current	n,p,i: 88-current	sus: 84-87, 88-current
16	Edgewood Creek at Lake Tahoe nr Stateline, Nev.	10336765	m,ig	gage: 84-85,89-92 misc: 93-current	field: 84-85,89-current	n,p: 84-85, n,p,i: 89-current	sus: 84-85, 89-current
17	Edgewood Creek Tributary abv Clubhouse nr Stateline, Nev.	385758- 119564401	u	misc: 95-current	field: 95-current	n,p,i: 95-current	sus: 95-current
18	Culvert into Edgewood Creek abv Hwy. 50 at Stateline, Nev.	385758- 119561101	u	misc: 95-current	field: 95-current	n,p,i: 95-current	sus: 95-current
19	Edgewood Creek (at Hwy. 50) at Stateline, Nev.	10336760	b	misc: 67-80 gage: 93-current	field: 67-80,92-current	n,p,i: 92-current	sus: 92-current
20	Edgewood Creek at Palisade Dr. nr Kingsbury, Nev.	103367585	md	gage: 90-current	field: 90-current	n,p,i: 90-current	sus: 90-current
21	Eagle Rock Creek nr Stateline, Nev.	103367592	ad	gage: 90-current	field: 90-current	n,p,i: 90-current	sus: 90-current
22	Edgewood Creek Tributary nr Dagget Pass, Nev.	10336756	m,ig	gage: 81-83 misc: 91-current	field: 81-83,91-current	n,p: 81-83, n,p,i: 91-current	sus: 81-83, 91-current
23	Edgewood Creek below South Benjamin Dr. nr Dagget Pass, Nev.	10336750	m	misc: 89,91-current	field: 89,91-current	n,p,i: 89,91-current	sus: 89,91-current
24	Trout Creek nr mouth—east off Bellevue/El Dorado Aves.	10336795	t	misc: 96-current	field: 96-current wt: 98-current	—	—
25	Trout Creek (at Hwy. 50) at South Lake Tahoe, Calif.	10336790	b,t	misc: 93-current	field: 72-74,89-current wt: 72-74,89-92, 98-current	n,p: 79-85,87-92 n,p,i: 93-current	dai: 72-74,81-85, 88-92 sus: 93-current
26	Trout Creek (at Martin Ave.) nr Tahoe Valley, Calif.	10336780	m,g,t	gage: 61-current	field: 61-current wt: 72-74,78,80-85,88, 98-current sc: 81-83	—	dai: 72-74,78, 80-85,88
27	Cold Creek at mouth nr South Lake Tahoe, Calif.	10336779	t	misc: 96-current	field: 96-current wt: 98-current	—	—

Table 1. Periods of record for streamflow, physical, nutrient, and sediment data collected at current U.S. Geological Survey/Lake Tahoe Interagency Monitoring Program stream network sites and other active USGS gaging stations in the Lake Tahoe Basin, California and Nevada—Continued

Site no.	Site name	Station no.	Site type ¹	Streamflow ²	Physical ³	Nutrients ⁴	Sediment ⁵
28	Trout Creek at Pioneer Trail nr South Lake Tahoe, Calif.	10336775	md,t	gage: 90-current	field: 90-current wt: 98-current	n,p,i: 90-current	sus: 90-current
29	Trout Creek at USFS Rd. 12N01 nr Meyers, Calif.	10336770	ad,t	gage: 90-current	field: 90-current wt: 98-current	n,p,i: 90-current	sus: 90-current
30	Upper Truckee River nr mouth off Venice Dr. nr S Lake Tahoe, Calif.	10336612	t	—	field: 96-current wt: 98-current	—	—
31	Upper Truckee River (at Hwy. 50) at South. Lake Tahoe, Calif.	10336610	b,t	gage: 72-74,77,78, 80-current	field: 72-74,78,80-current wt: 72-74,78,80-92,98-current sc: 81-83	n,p: 77-92 n,p,i: 93-current	dai: 72-76,78,81-92 sus: 93-current
32	Upper Truckee River at Hwy. 50 below Meyers, Calif.	103366098	t	misc: 96-current	field: 96-current wt: 98-current	—	—
33	Upper Truckee River at Hwy. 50 above Meyers, Calif.	103366092	md,t	gage: 90-current misc: 89	field: 89,90-current wt: 98-current	n,p,i: 89, 90-current	sus: 89,90-current
34	Upper Truckee River nr Meyers, Calif.	10336600	m,ig	gage: 61-86 misc: 96-current	field: 61-86, 96-current	—	—
35	Grass Lake Creek at Grass Lake Rd. nr Meyers, Calif.	10336593	t,ig	gage: 72-74 misc: 96-current	field: 72-74,96-current wt: 98-current	—	sus: 72-74
36	Upper Truckee River at South Upper Truckee Rd nr Meyers, Calif.	10336580	ad,t	gage: 90-current	field: 90-current wt: 98-current	n,p,i: 90-current	sus: 90-current
37	General Creek (at Hwy. 89) nr Meeks Bay, Calif.	10336645	b	gage: 80-current	field: 80-current wt: 81-92 sc: 81-83	n,p: 80-92 n,p,i: 93-current	dai: 82-92 sus: 93-current
38	Blackwood Creek (at Hwy. 89) nr Tahoe City, Calif.	10336660	b	gage: 61-current	field: 61-current wt: 75-78,80-92 sc: 81-83	n,p: 74-92 n,p,i: 93-current	dai: 75-78,80-92 sus: 93-current
39	Ward Creek at Hwy. 89 nr Tahoe Pines, Calif.	10336676	b	gage: 73-current	field: 73-current wt: 73-78,79-92 sc: 81-83	n,p: 73-92 n,p,i: 93-current	dai: 73-92 sus: 93-current
40	Ward Creek at Stanford Rock Trail crossing nr Tahoe City, Calif.	10336675	md	gage: 92-current	field: 91-current	n,p,i: 91-current	sus: 91-current
41	Ward Creek below confluence nr Tahoe City, Calif.	10336674	ad	gage: 92-current	field: 91-current	n,p,i: 91-current	inst: 91-current
Other active U.S. Geological Survey sites							
42	Marlette Lake near Carson City, Nev.	10336710	g	lake level: 74-current	—	—	—
43	Marlette Creek near Carson City, Nev.	10336715	g	gage: 74-current	field: 74-current	—	—
44	Lake Tahoe at Tahoe City, Calif.	10337000	g	lake level: 1900-current	chem: 69,78,79	—	—
45	Truckee River at Tahoe City, Calif.	10337500	g	gage: 1895-1896, 1900-current	field: 1900-current wt: 93-94	—	—

¹ Site type: b, base (near mouth); md, mid-development; ad, above-development; m, miscellaneous; g, other active gage; ig, inactive gage; t, water temperature; u, urban runoff.

² Streamflow: misc, instantaneous flow measurements only; gage, flow measurements, continuous recording gage, and daily flows.

³ Physical: field, field measurements; wt, daily water-temperature record; sc, daily specific-conductance record; chem, chemical.

⁴ Nutrients: n, nitrogen; p, phosphorus; i, iron.

⁵ Sediment: tot, total; sus, suspended; dai, daily; inst, instantaneous.

sheds in 1988 and expanded to 13 sites in 7 watersheds in 1990. The number of stations in the network was increased again in 1991, 1993, and 1996, adding 21 additional sampling sites in 7 additional watersheds. The purpose of expanding the data network was to support the assessments of the effects of land use and development in the Lake Tahoe Basin on water quality.

In 1998, a 12-site water-temperature (WT) monitoring network (7 existing and 5 new sites) was installed in the Upper Truckee River and Trout Creek watersheds. In 1998, WT monitors were added to Incline Creek near Crystal Bay, Nev., and Glenbrook Creek at Glenbrook, Nev. The purpose of the WT network is to provide information for groundwater/surface-water interaction studies and for manmade organics studies.

The current LTIMP sampling network includes 32 tributary sites in 14 Lake Tahoe watersheds in California and Nevada (fig. 1) and was described previously by Boughton and others (1997) and Rowe and Stone (1997). Table 1 describes the period of record for current and historical data collection for the 34 sites plus 2 other active USGS streamflow gage sites, 2 lake level gage sites, 5 USGS water temperature only sites, and 2 urban-runoff sites. The longest periods of record are 1900-current for lake levels of Lake Tahoe, 1961-current for streamflow, 1961-current for water-quality field measurements, and 1973-current for nutrients and sediment.

Current collection in the LTIMP program is streamflow, physical, sediment, and nutrient data (table 2) and is divided into three sampling schedules. The primary sites (table 1) include continuous streamflow gages and about 30-40 samples collected per year at 10 base (near-

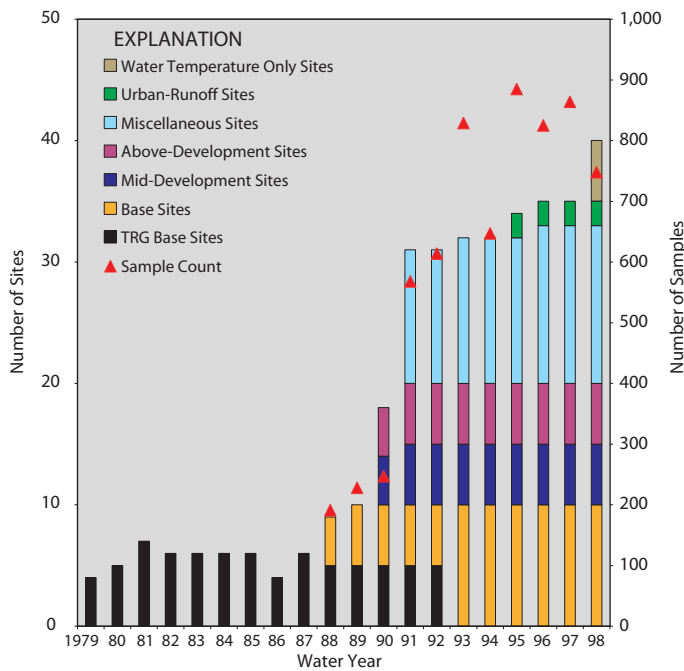


Figure 2. History of Lake Tahoe Interagency Monitoring Program in Lake Tahoe Basin, California and Nevada. (See Table 1 footnotes for site definition.)

mouth) sites in 10 watersheds in California and Nevada. The secondary sites (table 1) include continuous streamflow gages and about 25 samples collected per year at the 10 mid- and above-development sites on 5 of the 14 watersheds in California and Nevada. Throughout the year, collection of routine monthly baseline sampling with an extra emphasis on snow-melt runoff and storm runoff periods is done at the primary and secondary sites. The remaining 14 miscellaneous sites (table 1) are monitored but ungaged in Nevada. Data collection on these sites includes 6-10 samples per year, mainly during snow-melt runoff and storm-runoff events.

—Timothy G. Rowe

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- Goldman, C.R., and Byron, E.R., 1986, *Changing water quality at Lake Tahoe—The first five years of the Lake Tahoe Interagency Monitoring Program*: Tahoe Research Group, Institute of Ecology, University of California, Davis, 12 p.
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Table 2. Lake Tahoe Interagency Monitoring Program stream network sample analysis

Constituent	
Nutrients	
Total organic plus ammonium nitrogen (TKN)	
Dissolved ammonium nitrogen (DNH ₄)	
Dissolved nitrite plus nitrate nitrogen (DNO ₂ +NO ₃)	
Total phosphorus (TP)	
Dissolved orthophosphate phosphorus (SRP)	
Total biologically reactive iron (TFE)	
Sediment	
Suspended-sediment concentration	
Suspended-sediment discharge	
Sand break (higher concentrations only)	
Physical	
Water temperature	
Air temperature	
Gage height	
Discharge	
Specific conductance	
Weather	
Hydrologic event	
Stage conditions	
pH	
Dissolved oxygen	
Barometric pressure	
Dissolved oxygen percent saturation	
Quality Control	
Sample method	
Sampler type	
Sample collecting agency	
Sample analyzing agency	

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