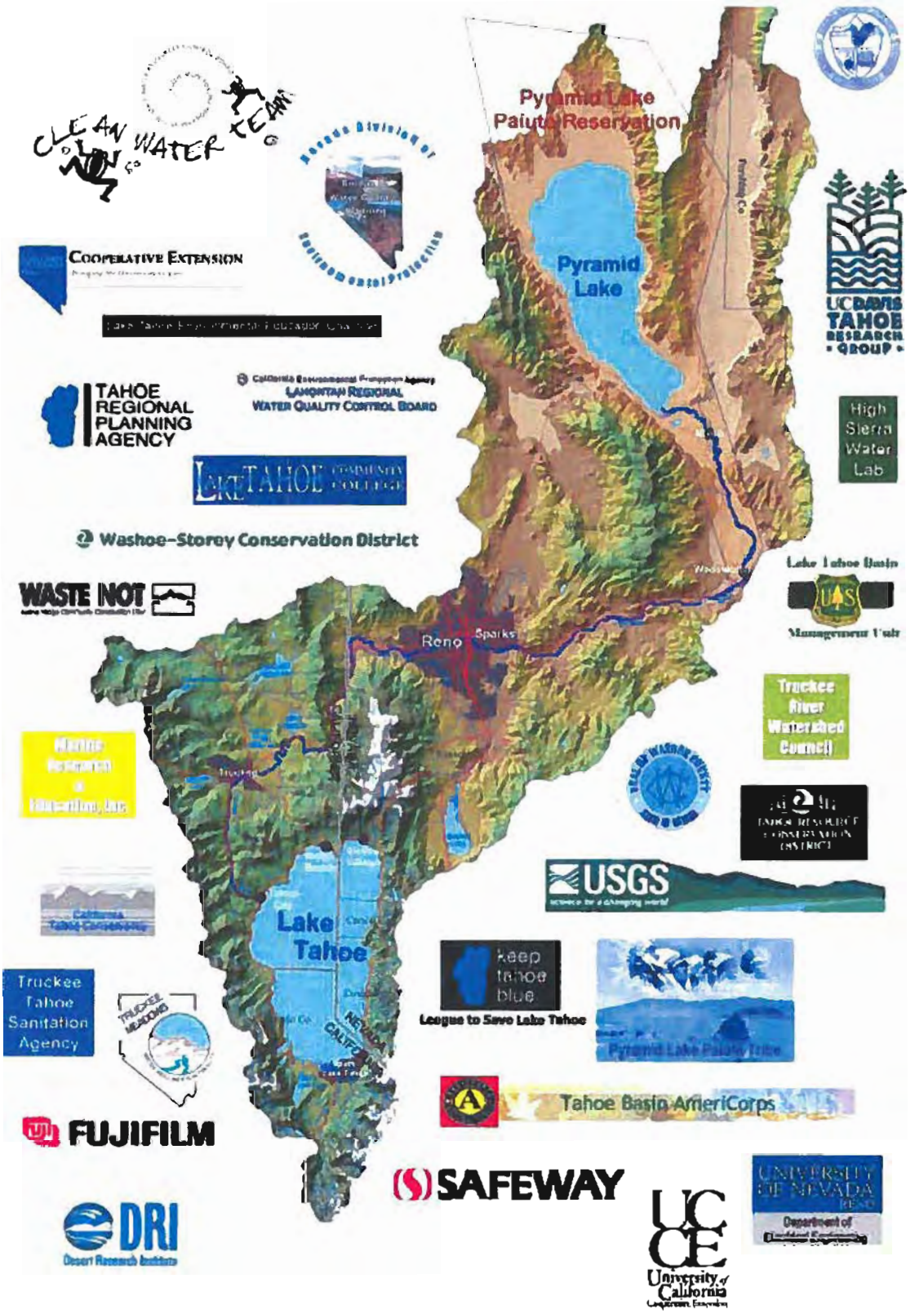
Lake Tahoe and Truckee Watershed Annual Snapshot Day



Introduction

The fifth annual Snapshot Day 2005 was held on May 21, 2005 in the Lake Tahoe and Truckee River watersheds. More than 227 committed citizen-volunteers, working closely with many water quality management agencies, participated in gathering water quality information in the form of visual assessments, photos, and water quality data at 105 locations (Table 1). This can be compared to 100 volunteers at 44 locations in 2001, 313 volunteers at 112 locations in 2002, 250 volunteers at 125 locations in 2003, and 244 volunteers at 119 locations.

Table 1: Snapshot Day 2005

	Volunteers	Locations
North Shore Lake Tahoe	37	34
South Shore Lake Tahoe	70	34
Lake Tahoe (lake sites)	8	3
Marina Sites	8	3
Middle Truckee River	56	22
Lower Truckee River	48	9
Totals for 2005	**227***	**105**
*excludes duplicate samplers		

This collaborative effort was planned and coordinated by the Citizen Monitoring Working Group of the Lake Tahoe Environmental Education Coalition (LTEEC). The Citizen Monitoring Working Group includes private citizens as well as representatives from non-profit organizations, agencies, and the academic community. Organizations involved in planning and operating this event included:

- California State Water Resources Control Board (SWRCB)
- Citizens at Fallen Leaf Lake
- Incline Village General Improvement District (IVGID)
- Lahontan Regional Water Quality Control Board (Lahontan)
- Lake Tahoe Community College (LTCC)
- Lake Tahoe Environmental Education Coalition (LTEEC)
- Marine Research and Education (MR&E)
- Nevada Division of Environmental Protection (NDEP)
- Nevada Division of State Lands (NDSL)
- Sierra Nevada College (SNC)
- Tahoe Regional Planning Agency (TRPA)
- Tahoe Resource Conservation District (TRCD)
- Truckee River Aquatic Monitors (TRAM)
- Truckee River Watershed Council (TRWC)
- U.S. Forest Service (USFS)
- UC Davis Tahoe Research Group (UCD TRG)
- University of California Cooperative Extension (UCCE)
- University of Nevada Cooperative Extension (UNCE)
- University of Nevada Reno (UNR) Electrical Engineering Department

The citizen-monitoring program of the California State and Regional Boards is the *Clean Water Team*, and the participating volunteers in the Lake Tahoe and Truckee River watersheds adopted that moniker as well. Volunteers from Lake Tahoe, Fallen Leaf Lake, Truckee and Reno joined together to make the Fifth Annual Snapshot Day event a watershed-wide effort.

What is Snapshot Day?

Snapshot Day is a one-day, volunteer-based event designed to collect watershed information during one point in time. Volunteer "team leaders" are trained, and these leaders accompany teams of volunteers to various pre-determined sites to collect information relative to the health of our watersheds. The purpose of this effort is two-fold: 1) to promote environmental education and stewardship, and 2) to collect valuable water quality information. While there is a great deal of high quality agency and university-sponsored monitoring taking place in the region, there is still insufficient information to adequately assess the status of all of the aquatic resources in the Truckee River and Lake Tahoe Basin watersheds. With proper training and quality assurance, community volunteers can help fill this void by providing valuable information for watershed management and pollution prevention.

For the last several years's volunteers in the Lake Tahoe watershed collected water samples from the mouth of the tributaries entering Lake Tahoe for particle size analysis by the University of California (see Particle Size Analysis for Snapshot Day – Lake Tahoe Basin, Rabidoux & Schladow, 2003, 2004). While the data collection for this effort did not continue into 2005, the Snapshot samples still provide valuable information for the Lake Tahoe Total Maximum Daily Load (TMDL), and the Regional Plan revision's by the TRPA, U.S. Forest Service and Lahontan. (For more information regarding this project, see Lahontan's website at http://www.swrcb.ca.gov/rwqcb6/TMDL/Tahoe/Tahoe_Index.htm.

Citizen Monitoring: The Clean Water Team

The mission of the Clean Water Team citizen monitors is to produce environmental information that is needed to protect the chemical, physical and biological integrity of aquatic resources within the Truckee River and Lake Tahoe Basin watersheds. The Citizen Monitoring Working Group of the Lake Tahoe Environmental Education Coalition and its partners realize that hands-on training will inform and engage the community in effective watershed stewardship. This team is one of the nine working groups of LTEEC whose goal is to support coordinated public outreach education efforts throughout the Tahoe Basin.

The goals of the Citizen Monitoring Working Group are to:

- Build awareness of water quality issues, aquatic resources and pollution prevention
- Screen for water quality problems, including the identification of sources of pollution and detection of illegal activities (i.e., chemical spills, filling of wetlands, diversions, illicit discharges, destruction of stream environment zones (SEZs), non-compliance with ordinances or regulations in place to protect natural resources, etc.)
- Assess the status and trend of valued biologic and ecologic resources within the watershed
- Provide water quality data that may be: 1) compared to TRPA's Environmental Thresholds and/or water quality standards set by the States of California and Nevada; or 2) used in long term trend analyses
- Provide baseline water quality data for un-monitored waters to determine how they compare to the water quality standards
- Provide data for evaluating the effectiveness of restoration activities (also called best management practices, or BMPs) and various other pollution control strategies

It is important to note that citizen monitoring is designed to supplement existing agency monitoring efforts; all information is provided to the regulatory and resource management agencies, whose responsibility it is to protect water quality.

Methods

Citizen monitoring "team leaders" were provided training during the month prior to Snapshot Day (May, 2005). Team leader trainings covered descriptions and protocols for visual observations, photo-documentation, water quality field measurements (temperature, pH, conductivity, dissolved oxygen), and water sampling (grab samples sent into the laboratory for subsequent analysis of nutrient, sediment concentrations, and turbidity). Each monitoring team leader was required to attend at least one session prior to the filed day. Training for the Lake Tahoe watershed team leaders was taught by Heather Segale, Lake Tahoe Environmental Education Coalition (LTEEC); and Rita Whitney, Tahoe Regional Planning Agency. Two training sessions were held at Lake Tahoe: one in South Lake Tahoe at the Lake Tahoe Community College (LTCC) and one in Incline Village at Sierra Nevada College (SNC). Training for the Middle Truckee River was led by Beth Christman of the Truckee River Watershed Council, and Heather Seagle of the Lake Tahoe Environmental Education Coalition, at the Sagehen Creek Field Station. The Lower Truckee River watershed team leader training was taught by Jason Kuchnicki, Danielle Henderson, and Mary Kay Riedl of the Nevada Division of Environmental Protection at the Washoe Country Regional Water office.

Visual observations and photo-documentation were performed according to the procedures provided by the SWRCB Clean Water Team. The standardized observation form, the *California Stream and Shore Walk Visual Assessment Form*, was slightly revised to better apply to the region. At least three photos were taken at each sampling site (bed conditions, view across stream and view upstream from the starting point). All stream-walks were initiated from a downstream position, traveling upstream.

A variety of instruments and kits were used on Snapshot Day by the volunteers. The majority of the monitoring teams were assigned armored Envirosafe thermometers (alcohol filled, 0.5° C resolution) or hand-held digital thermometers (0.1° C resolution), non-bleeding Whatman pH indicator strips (0.5 pH unit resolution), hand-held Oakton TDS Tester Conductivity meters (10 µS/cm resolution), and Chemet dissolved oxygen kits (colorimetric, indigo carmine dye reaction, 1 mg/L resolution below 6 mg/L and 2 mg/L resolution above 6 mg/L). Most of these instruments/kits were provided via funding from University of Nevada Reno (UNR) Electrical Engineering Department or through a Proposition 13 grant from the California SWRCB, with some other instruments/kits loaned from the California SWRCB, US Environmental Protection Agency (US EPA), LTCC, and others. Some of the monitoring teams were equipped with higher resolution instruments provided by California SWRCB, SNC, TRPA, TRAM, USFS, US Geological Survey (USGS), UCD TRG, and NDEP. Turbidity meters, to be used at the staging locations, were supplied by the USEPA and the USFS. All of the instruments and kits were calibrated and tested/standardized at a quality control session held one day prior to the event. There were also a few World Monitoring Day (WMD) kits used which relies on visual observations of test strips. The temperature and pH strips are comparable to other methods but the dissolved oxygen strips are only a screening tool for outliers as they only measure either 4 or 8 ppm, which limits their usefulness.

All observations, photos, field measurements and samples were taken between 9:00 a.m. and 12:00 noon on May 21, 2005. Samples were kept chilled with ice or blue ice in coolers from the point of collection until arrival at the lab for analysis. Coliform samples were collected in sterile Whirl-paks and nutrient and turbidity samples were collected in clean (acid rinsed) Nalgene® plastic bottles. Samples were brought to four centralized locations: LTCC, SNC, Truckee Regional Park, and the WSCD office. Coliform samples were transported from these drop off points and delivered to the U.S. Geologic Survey (Lake Tahoe and Middle Truckee River samples), and Truckee Meadows Water Reclamation Facility (Lower Truckee River samples) laboratories within 4 hours of collection. The analysis procedure for fecal coliform was initiated within 6 hours of sample collection. (Note: Those samples not received within the permitted time period were excluded from analysis.)

Turbidity samples were run from the grab samples on the afternoon of Snapshot Day, along with replicate testing of field measurements such as pH and conductivity. Nutrient samples were kept refrigerated and then analyzed by High Sierra Lab (Lake Tahoe and Middle Truckee River samples) and TMWRF (for the Lower Truckee River samples) within the allotted holding times for the various constituents.

Site Locations

Volunteers gathered data at 105 locations, including multiple reaches within some streams, in the Lake Tahoe and Truckee River watersheds (see maps in appendix) as follows:

Lake Tahoe (On Lake):

- South Shore Lake Tahoe, Ski Run Marina and in Lake
- South Shore at Bijou Creek outlet
- South Shore at Reagan Beach
- East Shore Lake Tahoe at Kahle Drive
- East Shore Lake Tahoe at Round Hill Pines Resort

Lake Tahoe Tributaries, South Shore:

- Angora, at Lake Tahoe Blvd., (2 locations in the SEZ project)
- Bijou Creek at mouth
- Bijou Creek at Fairway
- Bijou Creek at Pioneer
- Bijou Park Drainage, Culvert into Ski Run Marina
- Bijou Park Drainage, Culvert under Werner Salas Road
- Bijou Park Drainage blw Hansen's Resort
- Bijou Park Drainage at Verdon Rd.
- Burke Creek at mouth
- Cascade Creek abv Hwy 89
- Eagle Falls Creek
- Edgewood Creek at mouth
- Edgewood Creek abv Hwy 50
- Fallen Leaf Lake
- Glen Alpine Creek (Fallen Leaf Lake)
- Heavenly Creek abv confluence with Trout Creek
- Heavenly Creek abv Pioneer Trial
- McFaul Creek at mouth
- McFaul Creek blw Hwy 50
- Meek Creek at mouth
- North Zephyr Creek at mouth
- North Zephyr Creek, south tributary
- North Zephyr Creek, north tributary
- South Zephyr Creek at mouth
- Tahoe Keys, Marina and Lagoon
- Tallac Creek at mouth
- Taylor Creek at mouth
- Trout Creek near Grinding Rock
- Upper Truckee River at mouth
- Upper Truckee River abv Trout Creek
- Upper Truckee River, Xmas/Grass Valley

Lake Tahoe Tributaries, North Shore:

- Barton Creek at Hwy 28
- Barton Creek at Star Harbor
- Blackwood Creek at mouth
- Bonpland Creek at mouth
- Brockway Creek at Coon St. Beach ramp
- Burton Creek at Star Harbor (2 locations)
- Deer Creek above Incline
- Dollar Creek at mouth
- Griff Creek at mouth
- Griff Creek abv Hwy 28
- Homewood Creek at mouth
- Hatchery Creek (2 locations at Star Harbor)
- Incline Creek at mouth
- Lake Forest Creek at mouth
- Madden Creek at mouth
- Meeks Creek at mouth
- Polaris Creek at Star Harbor
- Polaris Creek at Lake Forest Rd.
- Quail Lake Creek at mouth
- Rosewood Creek above Third
- Secret Harbor Creek at mouth
- Slaughter House at the Lake
- Snow Creek at mouth
- Tahoe City State Park
- Tahoe City Urban Ditch at lake
- Third Creek at mouth
- Tunnel Creek at mouth
- Watson Creek at mouth
- Watson Creek abv Hwy 28
- Wood Creek at Lakeshore
- Wood Creek at Tanager (Crystal Bay Marina)

<u>Truckee River Watershed – Middle Truckee River:</u>

- Alder Creek
- Bear Creek
- Little Truckee River blw Boca Dam
- Little Truckee River at Boyington Mill
- Davies Creek
- Donner Creek at Hwy 89
- Donner at Donner Lake outlet
- Donner Lake west end
- Union Valley Creek
- Gray Creek
- Martis Creek at mouth
- Martis Creek at ACOE
- Pole Creek
- Prosser Creek
- Sagehen Creek

- Squaw Creek
- Truckee River at three different locations:
    - Big Chief Corridor
    - Regional Park
    - Near Tahoe City
- Trout Creek at mouth
- Trout Creek at Bennett Flat

Truckee River Watershed – Lower Truckee River:

- Alum Creek
- Bull Ranch Creek
- Chalk Creek
- Dry Creek
- Evan Creek
- Lewer's Creek
- Sunrise Creek
- Thomas Creek
- White's Creek

Table 2: Beneficial Uses of the State's Waters

Water quality standards are established to protect beneficial uses of each State's waters. The most common beneficial uses include drinking water, recreation and fisheries. When a water quality standard is established, the first step is to identify the beneficial uses sensitive to the parameter. Then criteria are established based on the levels needed to protect the sensitive uses.

In many Sierra streams, propagation of cold-water fish (i.e. trout or salmon) is a designated beneficial use of the water. In such streams, numerical and narrative water quality standards generally are set at levels that will "support the beneficial use" of a cold water fishery. Such streams generally require cooler temperatures (ranges adequate for Rainbow trout survival shown below) and higher dissolved oxygen content than water in streams and lakes that do not have cold-water fishery as a designated beneficial use. Cold-water fish also require habitat characteristics that promote spawning (clear gravel beds, riffles), rearing habitat (glides and pools) and adequate food sources such as macroinvertebrates (mayfly, nymphs, stonefly nymphs, and caddisfly larvae). Such characteristics can be monitored, but they do not usually have numeric standards.

(Note that dissolved oxygen, temperature, total suspended solids (TSS) and turbidity are parameters directly related to habitat for which most waters generally have standards. Because macroinvertebrates are believed to be a primary indicator of stream health as related to fisheries, both Lahontan and NDEP are in the process of developing an Index of Biologic Integrity (IBI). These are basically standards for benthic macroinvertebrates.)

Species	Growth	Maxima	Spawning*	Embryo Survival**
Rainbow Trout	19°C (66 °F)	24°C (75 °F)	9°C (48 °F)	13°C (55 °F)

* The optimum or mean of the range of spawning temperatures reported for the species.
** The upper temperature for successful incubation and hatching reported for the species.
Adapted from EPA's Draft Volunteer Stream Monitoring: A Methods Manual.

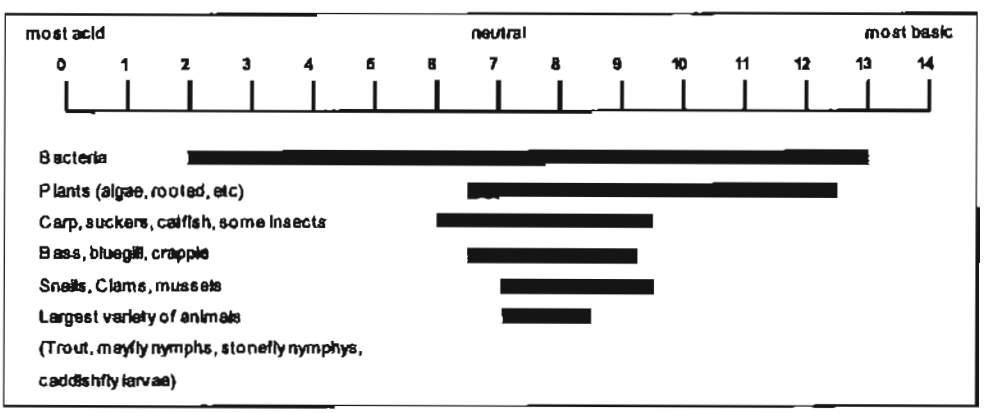
Results

Water temperature ranged from 2.2 to 16.7 ° Celsius (C). The highest measurement this year was again at Bijou Creek outlet to Lake Tahoe. The readings for the tributaries to North Zephyr Creek were also 16° C but the instrument was a test strip from the World Monitoring Day kits and not a true thermometer. Temperatures were lower than the past few years indicative the sampling day that was closer to peak flows for the year (Figure 3). Generally, cooler water temperatures are considered better habitat for aquatic life in mountain streams and lakes, it contains more dissolved oxygen, an essential ingredient for fish and invertebrates. Higher temperatures promote nutrient solubility and can occur as a result of low flow (shallow) conditions, and/or a lack of canopy (tree) cover along stream banks, which acts to shade and thus prevent solar heating of the water.

A majority of sites with measured **pH values** were within the range of 4.5 to 9.8, which is typical of fresh water streams or lakes in the Sierras. In fresh water, pH in the range of 6.5 to 8.5 should protect most organisms. Nevertheless, there were 38 out of 98 valid responses with a pH less than 6.5, not as many as last year when recent precipitation could have contributed to acidity.

The range of pH tolerated by organisms varies can be seen Table 3 below, from the *SWRCB Clean Water Team pH Fact Sheet.* An analysis of aquatic life (bio-assessment) might provide better information for determining if the pH is acceptable within these streams.

Table 3: pH Ranges that Support Aquatic Life



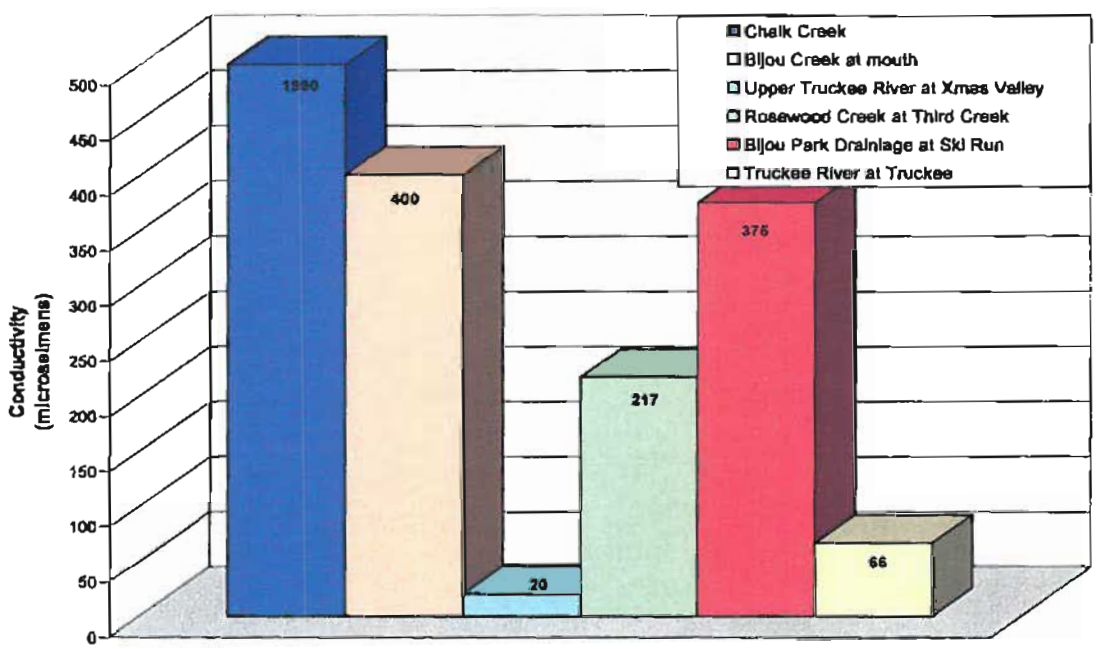
pH ranges that support aquatic life.

Dissolved oxygen measurements ranged between 4 and 12 mg/L. Cold, clean water usually has levels of dissolved oxygen averaging above 6.0 mg/L, and single-measurement levels below 5 mg/L are considered dangerous for (cold water) aquatic life. (Table 2). While water quality objectives for dissolved oxygen will vary from region to region, waters that support coldwater fishes usually

require that dissolved oxygen concentration shall not fall below 6 to 8 mg/L (while for waters that support warm water fishes, the objective requires that the dissolved oxygen concentration shall not fall below 5 to 6 mg/L). The low values of 4 were again taken with the WMD kits, and are probably unreliable. Several sites in the Tahoe Basin were 11 and the highest was Evan Creek in the Truckee-Pyramid watersheds, not unusual for the lower elevation streams.

Conductivity measurements ranged from 10 to 1990 µS/cm (micro Siemens per centimeter, the units used for conductivity measurements in fresh water). Conductivity is used as an indicator of dissolved solids (e.g., minerals or salts), with higher levels associated with degraded water quality. Conductivity will vary with water source inputs from natural sources such as groundwater seepage, springs and/or geothermal activity can affect the readings. Anthropogenic sources that may affect conductivity include drainage from agricultural fields, wastewater discharge, or inputs stemming from deicing materials on the roadways. Table 4 lists some common ranges for conductivity. There are not enough instruments to supply each site with a field conductance, so volunteers take a grab sample which is run for conductivity and turbidity back at the staging area. Generally conductance is lower with the higher flows in spring runoff, as seen in the readings this year. Bijou Creek area is consistently the highest around the Tahoe Basin at 4-500 µS/cm, with the highest overall this year at Chalk Creek in the Reno area at 1990 µS/cm up from last years reading of 730 µS/cm. The very high conductivity of Chalk Creek in the lower Truckee River area means this water would not pass for potable or irrigation water (Figure 1). Lake Tahoe is generally about 90 µS/cm lakewide but can be higher in turbid nearshore areas. Only seven out of 95 valid responses had measurements ≥ (greater than or equal to) 300 µS/cm, down from last several years when the runoff was not as great (Figure 1).

Figure 1: Snapshot Day Specific Conductivity



The numeric value of **total dissolved solids** (TDS) is roughly 65% of the numeric value of conductivity measurements however the direct relation is site specific. TDS is measured in milligrams per liter (mg/L) which are equivalent to parts per million (ppm), and is reported in the column next to the conductivity in the data tables. In regard to the Chalk Creek sample, State of Nevada water quality standards set for this water is a single value of less than or equal to 95.0 mg/l. Assuming the numeric value of TDS is roughly 65% of the conductivity, then the TDS far exceeds the standard. The high reading at Chalk Creek will be followed up with further sampling by the Nevada Division of Environmental Protection.

Table 4: Acceptable Ranges for Water Conductivity

Water Type	**Conductivity** µS/cm (micro Siemens per centimeter)
Distilled Water	0.5 - 3.0
Melted snow	2 - 42
Potable water in U.S.	30 - 1500
Irrigation Supply Water	< 750

Turbidity is a measure of the amount of suspended particles in the water. Algae, suspended sediment, organic matter and some pollutants, can cloud the 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 erosion, either natural or man-made. High sediment loads can clog the gills of fish, foul gravel beds and smother fish eggs and benthic insects. The sediment can also carry pathogens, pollutants and nutrients.

The US EPA's recommended criteria for turbidity in streams in Eco-Region II (forested mountains in the western U.S.), is at or below 1.3 NTU (Nephelometric Turbidity Units) or less (*US EPA Ambient Water Quality Criteria Recommendations).* Higher NTU levels indicate poorer water clarity. TRPA has a nearshore turbidity standard of 1-3 NTU's, which is rarely exceeded. Valid turbidity data from the grab samples was determined for 66 sites, 44 of which had levels $\geq$ 1.3 NTU, or more than half. This is an excellent indicator of how turbid the waters were due to spring runoff. Two of the samples were over 20 NTU, which is generally considered fairly turbid water. High turbidity was measured at Grey Creek that feeds into the Truckee River, 48 NTU, followed by White's Creek at 28 NTU. Reagan Beach on the south shore was also high at 18.7 NTU; however this sample site is on a shallow shelf in the lake and high turbidity there is not uncommon, and is not related to spring runoff.
The Lower Truckee sites in Reno had 8 out of 9 over 1.3 NTU, and 4 over 10 NTU. The Snapshot data continues to confirm the areas of elevated turbidity around the lakeshore and is valuable especially for areas near drinking water sources, such as Incline and Kingsbury areas, and Chalk Creek site).

Another way of measuring water clarity, primarily in lakes, bays and harbors, is by determining the transparency of the water using a Secchi disk. Some Secchi

disk measurements were taken on Snapshot Day, mainly in the marina areas (Table 5). The Secchi depth readings from Snapshot Day were comparable to past years, the Tahoe Keys Lagoon is usually less clear than the Keys marina, probably due to the greater boat activity and active harvesting of milfoil. It is interesting that the Ski Run Marina sample was of better clarity closer to the marina rather than 250 ft. out into the lake.

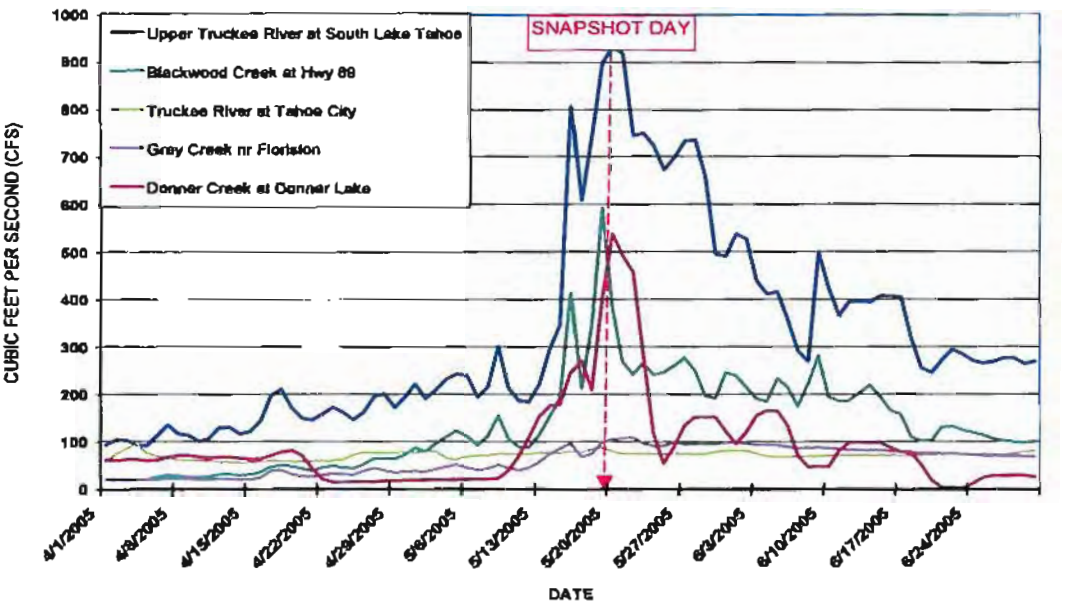
Table 5: Table Secchi Depth Measurements

Location	Secchi depth in meters
Lake Tahoe outside Ski Run Marina	10.9
Lake Tahoe at Ski Run 250 ft out	8.8
Tahoe Keys Lagoon	1.25
Tahoe Keys Marina	0.56
Fallen Leaf Lake	11.8

The Annual Average Secchi Depth for Mid Lake Tahoe as measured by Tahoe Research Group was 22.4 m., an improvement over 2003, and generally indicates low water years and low runoff. The Secchi for 2005 is not yet released but should be lower given the stream runoff was higher.

One of the major goals of Snapshot Day, besides the public involvement and education, is to gain information on the vast numbers of streams and creeks that are not routinely measured for water quality or streamflow (volume of water). The Tahoe Basin has about 25 streams that are measured out of 64. The Middle and Lower Truckee have even less. Stream flow data for those sites that are measured was obtained for May 21, 2004 was obtained from USGS gauging stations and is entered into the summary table in Appendix A. A hydrograph of the flow for sites in each region is found in Figure 2 below, showing how close to peak runoff the sampling was for this year.

Figure 2: Snapshot Day Streamflow



Average snow pack as of the *May 2005 NRCS Water Supply Outlook Report* for the Lake Tahoe Basin was 155 percent, with the Truckee River at 137 percent, and the Carson River at 156 percent. Reported **precipitation** was 87 percent of average in the Lake Tahoe Basin, 101 percent of average for the Truckee River and 90 percent of average for the Carson River. Reported **stream flow** forecasts were expected to be well above average for all three basins as of May 1, 2005, which is supported by the lower conductivity and higher turbidity seen in this year's measurements.

Visual observations at most of the study locations were indicative of generally good water quality conditions, with nothing unusual reported. Litter was reported at only 11 out of 89 sites with valid responses. Many locations (64 out of 117 sites) were reported with visible algae.

Valid **coliform bacteria** data was developed for 15 sites in the Tahoe and Middle Truckee watersheds. Fecal coliform bacteria are a group of bacteria that are mostly found in the feces of warm-blooded animals, including humans, pets, livestock, beavers, and birds. Most of the counts in the five years of sampling have been at or below detection, less than 1 count per 100 m/l, inductive of very clean waters. There have been a few sites that have had consistent 'hit's', some years higher than others. The first Snapshot Day was in early June of 2000 was a low water year and stagnant water was probably a contribution in the highest number ever, Hatchery Creek at 704 CFU/100ml. This extremely large count resulted in repeated sampling by Lahontan Water Quality Control Board to attempt to identify a source. Only one the 15 Tahoe sites in 2005 had fecal coliform levels in excess of 40 CFU/100 ml, Lake Forest Creek at the mouth, (CFU/ 100 ml are colony forming units, roughly equivalent to the number of bacteria cells, in 100 ml of sample water). This same area around Lake Forest has continued to see fecal counts and although no point source has been

identified, it is an area of heavy dog use. Other hotspots can also be attributed to local animal sources, geese at Edgewood Golf Course, perhaps beavers at Slaughterhouse Canyon, and of course the horse stables directly upstream of South Zephyr Creek. Although there is little that can be done on the wildlife impacts, dog uses can be controlled through education and waste receptacles. The Lower Truckee River measured fecal at all of the nine sites and there were positive results for all locations, with 5 of the nine too numerous to count (>120). The initial samples as run by the USGS did not have any dilution necessary for warmer, lower elevation streams. NDEP resampled all sites on May 26, 2005 and results ranged from 33-420 CFU/100 ml on the same five sample sites (Appendix A).

Nitrogen is required by all organisms for the basic processes of life to make proteins, to grow, and to reproduce. Nitrogen is very common and found in many forms in the environment. Inorganic forms include nitrate, nitrite, ammonia, and nitrogen gas. Organic nitrogen is found in the cells of all living things and is a component of proteins, peptides, and amino acids. Nitrogen is a nutrient that stimulates the growth of algae in streams and lakes. Algae include benthic forms, attached to the rocks and sediment of the streambeds (as observed by the monitors), as well as phytoplankton. Phytoplanktons are microscopic single cell algae that drift in the water and that can cause the water to have a green color. Benthic algae and phytoplankton are essential components to the ecosystem, but in relatively large concentrations of these organisms are known to reduce water clarity, or reduce oxygen levels during the evening (they consume oxygen at night). One cause for decreasing clarity in Lake Tahoe is an increase in phytoplankton populations as a result of increasing nutrient concentrations.

Ammonia is a reduced, toxic form of nitrogen and is usually associated with the decomposition of organic matter and wastes. Total ammonia consists of the un-ionized (NH_3) plus the ionized (NH_4^+) forms. Ionized ammonia is relatively nontoxic while un-ionized ammonia is toxic to fishes and aquatic invertebrates, even in low concentrations. Generally ammonia is very, very low in the Tahoe area, with only six out of 41 North/South Lake Tahoe and Middle Truckee River samples had ammonia nitrogen (measured as NH_4^+) concentrations greater than 10 µg/L (micrograms per liter, equivalent to parts per billion). Again Bijou Creek downstream of a golf course was measured at 307 µg/L. The Truckee River Water Reclamation Facility laboratory measured ammonia as NH3 and 4 samples in the Lower Truckee measured approximately 20 or 30 µg/L, with Alum Creek at 70 µg/L.

Fifty samples were analyzed for various **nutrient concentrations**, including ammonia (NH_3 and NH_4^+), nitrate (NO_3^-), phosphate (PO_4^{-3}) and total phosphorus (TP). We measured these because nitrogen and phosphorus determine the maximum amount of algae that can grow in virtually every water body. Excess nutrients lead to excess algae, odors, and discolored waters, loss of clarity, and nighttime oxygen depletion, which in turn can cause fish kills in extreme cases. Additional funding from Nevada State Lands allowed the organic portion of nitrogen (TKN) was analyzed in 2005 so for the first time total nitrogen could be calculated and is included in the appendix summary table. The California State Standard for Total Nitrogen ranges from 150-230 µg/L and all but three samples were over150 µg/L, and nineteen were over 230 µg/l. Nevada Standard is for dissolved nitrate and

ammonia, at 60 and 4 µg/l respectively. For Nitrate five of nine samples exceeded this limit, and 4 exceeded the ammonia standard. For the specific species analyzed and individual results see Appendix A.

Phosphorous is another nutrient that stimulates algal growth. Phosphorus pollution has been identified as a serious problem contributing to the degradation of water quality in Lake Tahoe and the Truckee River. Sediment entering streams and the lake from human caused erosion of soil along roads, or from residential or commercial properties, is a common source of phosphorous. This is why it is important to implement BMPs on your property; source control is the most effective means to control erosion and runoff. The TRPA Standard is for dissolved phosphorus or **soluble reactive phosphorous**, the form of phosphorous that is readily bio-available for the stimulation of algae growth. The standard is 100 µg/L, and there were no samples that exceeded that level. The Lahontan standard is Total Phosphorus between 15-30 µg/L, Bijou Creek at the mouth measured highest at 244 µg/L, and only three samples were below 15 µg/L. More results can be in found in Appendix A.

The State of Nevada standard for annual average total phosphorous for tributaries to Lake Tahoe is 50 µg/L. Two samples in the Lower Truckee were over twice that, Chalk and Dry Creek, 284, and 109 µg/L respectively. The Truckee River below Reno has been listed on the *State of Nevada's 2002 303(d) List* for total phosphorus so a TMDL will need to be developed for that reach of the river.

Discussion

It is important to remember that the measurements made on Snapshot Day were designed to represent a single point in time and do not necessarily represent average conditions. As mentioned in the results, the US EPA has recommended criteria for nutrients, Secchi depth, and turbidity. In addition Nevada, California and the TRPA have specific water quality standards and indicators generally more stringent in the Lake Tahoe Basin than of the Tahoe-Truckee region. Table 6 lists some of these standards.

Table 6: Examples of Lake Tahoe Water Quality Standards

Parameter	Standard
Temperature	Shall not exceed 15° C, surface waters of Fallen Leaf Lake (CA)
pH	7.0 - 8.4 in Lake Tahoe (CA and NV)
TDS	Shall not exceed 60 mg/L average in Lake Tahoe (CA and NV)
Dissolved Oxygen	Mean no less than 6.5 and minimum of 4.0 mg/L for Lahontan waters designated as "cold freshwater habitat" (CA)
Turbidity	Shallow water shall not exceed 3 NTU near tributaries and 1 NTU not directly influenced by streams (TRPA)
Secchi Depth	December-March average of not less than 33.4 meters for Lake Tahoe (TRPA), and a mean of 18.5 meters for Fallen Leaf Lake (Lahontan Region, CA)
Algae	Lahontan RWQCB waters shall not contain biostimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (CA)
Total Nitrogen	Mean of no more than 190 µg/L (CA)
Inorganic Nitrogen	Mean of no more than 25 µg/L for most tributaries to Lake Tahoe, Nevada side of Lake Tahoe (TRPA)
Total Phosphorous	Annual average of no more than 50 µg/L for most tributaries, Nevada side of Lake Tahoe (NV) and no more than 30 µg/L for most tributaries, California side of Lake Tahoe (CA)
Soluble Reactive Phosphorous	Mean of no more than 7 µg/L for Lake Tahoe, Nevada side (TRPA)
Fecal Coliform	Log mean of 20 CFU (30 day period) and maximum of 40 CFU, (Lahontan Region, CA)

In California the Lahontan RWQCB water quality standards are composed of the beneficial uses (Table 2) and objectives described in the Basin Plan. The Lahontan Basin Plan is approved by the USEPA, and includes many watershed specific standards. The Basin Plan takes into account the natural background levels of certain constituents. For example, concentrations of dissolved solids and nutrients are relative to natural geologic conditions; in other words, some water bodies have naturally higher levels of these substances. Likewise, the State of Nevada's Division of Environmental Protection has set water quality standards throughout Nevada that are specific to certain tributaries and their beneficial uses.

water quality-based control program mandated by the Clean Water Act. Water Quality Standards define the goals for a water body by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants. A water quality standard consists of four basic elements:

(1) designated uses of the water body (e.g., recreation, water supply, aquatic life, agriculture),

(2) water quality criteria to protect designated uses (numeric pollutant concentrations and narrative requirements),

(3) an antidegradation policy to maintain and protect existing uses and high quality waters, and

(4) general policies addressing implementation issues (e.g., low flows, variances, mixing zones).

For full and more detailed information on water quality objectives in California refer to the Lahontan Regional Water Quality Control Board *Basin Plan* at the following website: http://www.swrcb.ca.gov/rwqcb6/ and select "Available Documents." For water quality standards in Nevada see the following website: http://ndep.state.nv.us/nac/445a119.pdf or visit the NDEP Bureau of Water Quality Planning website at: http://ndep.state.nv.us/bwqp /stdsw.htm. For the Tahoe Regional Planning Agency (TRPA) water quality standards, see the following website: http://www.trpa.org/Documents.htm and select "Environmental Threshold Carrying Capacities."

The data results from the first 4 years of Snapshot Day were consistent in that all years were at or below average snowpack conditions. The 2005 sampling occurred at or near the peak in most watersheds as seen in Figure 2. This generally meant lower conductivity measurements from dilution, but high turbidity from increased sediment movement. Higher flows can contribute to increased erosion, higher loading of sediment into the streams, and ultimately increased levels of phosphorous that is attached to the sediment.

The majority of sites had nitrate and phosphorous within the TRPA surface discharge standards (total nitrogen of no more than 500 µg/L and total phosphorous of no more than 100 µg/L for surface water runoff which directly enters Lake Tahoe). However, there were a few notable outliers.

The following sampling sites were noteworthy for having poor readings in one or more water quality parameters:

- **Tahoe City State Park** had high total nitrogen concentrations (1725 µg/L), similar to the 2003 readings of 1556 µg/L. It was thought the high nitrate readings for Tahoe State Park in the past were due to very low flow and stagnant water. Even though the flows were higher this year, this drainage is in a marshy wetland setting and the nitrates are probably somewhat natural. However this is also surrounded by heavy urban and commercial development which could contribute to these high levels.

- The **Chalk Creek** sample in the Lower Truckee River watershed was by far the highest conductance at 1,990 µS/cm. Although unresolved, it is hypothesized that urbanization of the watershed is turning this ephemeral creek into more of a perennial system. In the process, runoff from lawn watering, golf courses and storm water are

transporting nutrients to the creek. This area will continue to be monitored by NDEP.

- **Bijou Creek** and **Bijou Park Drainage** continue to have elevated levels of most constituents, as seen in all Snapshot Day samples and other measurements made from urban runoff throughout the year. This area was the focus of a recent report on existing conditions prepared by engineering firm Lumos and Associates for the City of South Lake Tahoe. An Environmental Improvement Project for both watersheds in expected to be completed in the next several years.

- In past years both **Ski Run Marina** and **Tahoe Keys Marina Cove East** did not meet the EPA's recommended minimum criteria for Secchi depths in lakes in Eco-Region II. However this year the Ski Run Marina and outside the marina were much improved at 10.9 and 8.8 respectively.

Conclusion

The Lake Tahoe Environmental Education Coalition, Tahoe Regional Planning Agency, Truckee River Watershed Council and Nevada Division of Environmental Protection store all of the data and photos electronically. The reports are also available on the LTEEC and TIIMS websites. A summary of the field and laboratory data is available in the Appendix to this report. A separate *Snapshot Day 2004 Data Appendix* is also available upon request.

The results of this fifth year of Snapshot Day illustrate how successful engaging the public in active watershed stewardship can also provided much valuable data to the responsible agencies. Although this event has little established funding or permanent staff, the collaboration and support of many agencies and continued dedication of citizen volunteers makes the event happen. Many residents have committed to the sampling near their homes to insure high quality data is collected for the protection of the waters in our region. The successes of this type of event show how average homeowners and residents can provide invaluable data collection and have fun at the same time!

For more information about how to get involved with water quality monitoring activities contact the following agencies:

- *Lake Tahoe Basin* – Contact Leslie Allen, Lake Tahoe Environmental Education Coalition, (775) 832-4138 or Rita Whitney, Tahoe Regional Planning Agency, (775) 588-4547, ext. 258

- *Fallen Leaf Lake* – Grant Adams, Fallen Leaf Lake Research, (530) 541-8535

- *Incline Village* – Contact Sarah Tone, Incline Village GID Waste Not/Incline Village Clean Water Team, (775) 831-8603

- *Middle Truckee River (Tahoe City to Nevada State Line)* – Contact Beth Christman, Truckee River Watershed Council, (530) 550-8760

- *Lower Truckee River (Nevada Stateline to Pyramid Lake)* – Contact Mary Kay Riedl, Nevada Division of Environmental Protection, (775) 687-9454

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Water Supply Outlook, Natural Resource Conservation Service, May 1, 2004

Acknowledgements

2005 Snapshot Day "Clean Water Team" Sponsors:

California State Water Resource Control Board
Lahontan Regional Water Quality Control Board
Lake Tahoe Community College
Lake Tahoe Environmental Education Coalition (LTEEC)
Marine Research & Education, Inc.
Nevada Division of Environmental Protection
Nevada Tahoe Conservation District
Sierra Nevada College
Tahoe Regional Planning Agency
Tahoe Research Group
Tahoe Resource Conservation District
Truckee River Watershed Council
University of California Cooperative Extension
University of Nevada Cooperative Extension
University of Nevada Reno Electrical Engineering Department
USDA Forest Service
Waste Not, Incline Village General Improvement District

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Chuck Levitan (Sierra Nevada College)
Kim Melody (Tahoe Resource Conservation District)
Mary Kay Riedl (Nevada Division of Environmental Protection)
Heather Segale (Lake Tahoe Environmental Education Coalition)
Holly Sheradin (California State Water Resources Control Board)
Sarah Tone (Incline Village General Improvement District, WasteNot)
Rita Whitney (Tahoe Regional Planning Agency)

Equipment:

California State Water Resource Control Board
Carson Valley Subconservancy District
Environmental Protection Agency
Lake Tahoe Community College
Lake Tahoe Environmental Education Coalition (LTEEC)
Nevada Division of Environmental Protection
Sierra Nevada College
Tahoe Regional Planning Agency
Truckee River Aquatic Monitors
United States Geological Survey
University of California, Davis
University of Nevada, Reno
USDA Forest Service

Laboratory Analysis (Nutrients and Bacteria):

High Sierra Water Lab
Truckee Meadows Water Reclamation Facility
United States Geologic Survey (2 offices)

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And all the volunteers that made it happen!

Appendices

A. 2005 Summary of Field and Lab Data

B. Lake Tahoe Priority Watershed Map

C. Middle Truckee River Sub-Basin Map

Note: Data collected as part of the Snapshot activities is available electronically. Contact Leslie Allen, Lake Tahoe Environmental Education Coalition, University of Nevada Cooperative Extension, (775) 832-4138 or lallen@unce.unr.edu or visit http://www.lteec.org.

APPENDIX A: Snapshot Day 2005 Summary Field and Lab Data

Site Name and Description	Water Temperature (°C)	pH	DO (ppb)	Conductivity (µs)	Turbidity (NTU) (1)	Fecal Coliform No. of Colonies per 100 mL (4, 5)	Secchi Depth (m)	Rated Flow cfs (5)
Lake Tahoe "On Lake" Sites								
Lake Tahoe at Ski Run Marina	12.0	12.0	5.5	80	—		10.9	
Lake Tahoe at Ski Run 250 ft. out	8.0	8.0	—	80	—		8.8	
Lake Tahoe at Bijou Creek	7.8	7.8	—	80	—	1k		
Lake Tahoe at Reagan	11.9	11.9	—	40	18.7	47		
Lake Tahoe at Kahle Drive Intake	8.0	8.0	8.0	100	0.58	<1		
Lake Tahoe at Round Hill Pines	9.4	9.4	—	80	0.19	1k		
South Lake Tahoe Sites								
Angora Creek - D/S of Tahoe Blvd. Bridge	3.8	7		10	8.08			
Angora Creek - dnst of View Circle	4.0	6.6	—	10	0.37			
Bijou Creek at mouth	16.7	7	—	400	8.47			
Bijou Creek - Fairway & above	9.4	6.5	—	280	7.69			
Bijou Creek abv Pioneer	7.6	6.5	—	95	0.97			
Bijou Park Drainage at Ski Run	11.9	6.5	—	375	0.52			
Bijou Park Drainage at Werner Sales	8.7	7.0	—	420	—			
Bijou Park Drainage b/t Hansen's Resort	13.1	6.5	—	430	—			
Bijou Park Drainage @ Verdon Drive	8.3	6.5	—	500	7.02			
Burke Creek at mouth (nr Pump St @ end of Camp	10.0	6.5	9	200	0.53	40		
Cascade Creek	7.8	8	—	10	0.23			
Eagle Creek (Eagle Falls loop - just S/O bridge)	4.2	5.5	—	10	0.30			
Edgewood Creek at mouth	11.0	8	8	62*	1.75	8k		
Edgewood Creek abv Hwy 50	6.5	7.5	4	62*	1.80			10
Fallen Leaf Lake	8.2	7.0	9.5	19	—	<1	11.8	
Glen Alpine Creek at mouth	2.7	7.1	11.5	13	0.57	<1		
Heavenly Creek nr confluence @ Trout Creek	7.0	5	7	30	0.79	14k		
Heavenly Creek upstream Pioner Trail	3.2	5.5	7	30	—			
Lincoln Creek at mouth	8.9	6.0		38*	1.28			
McFaul Creek at mouth	8.2	6.5		45*	1.10	3k		
McFaul Creek blw Hwy 50		6.2		44*	—	<1		
Meeks Creek at mouth	8.0	5.5	—	10	—			
North Zephyr Creek at mouth	7.5	5.5	—	97	—			
North Zephyr Creek, south tributary	—	—	—	—	1.19			
North Zephyr Creek, north tributary	—	—	—	—	5.18			
South Zepher Creek at mouth	7.0	—	—	92	0.83	27		
Tahoe Keys Lagoons (East Channel)	9.0	9	9.5	100	0.86		1.25	
Tahoe Keys Marina (West Channel)	13.7	9.1	9.08	130	3.52	6k	0.58	
Tallac Creek at mouth	—	7.0	8.2	20	—			
Taylor Creek at mouth	—	8.9	8.6	20	—			
Trout Creek near grinding rock				30	8.34			144
Upper Truckee River at mouth	7.5	—	—	30	2.48			
Upper Truckee abv Trout	8.5	—	—	30	1.43			
Upper Truckee River at Xmas Valley	7.0	5	—	20	3.17	<1		

Site Name and Description	Ammonia NH3-N (ppb) (2,3)	Nitrate NO3-N (ppb) (2, 3)	Total Organic Nitrate (TKN) (ppb) (2)	Total Nitrogen (ppb)	Soluble Reactive Phos. SRP-P (ppb) (2, 3)	Total Phosphorus TP-P (ppb) (2, 3)	Total Suspended Sediment (mg/l)
Lake Tahoe "On Lake" Sites							
Lake Tahoe at Ski Run Marina							
Lake Tahoe at Ski Run 250 ft. out							
Lake Tahoe at Bijou Creek							
Lake Tahoe at Reagan							
Lake Tahoe at Kahle Drive Intake							
Lake Tahoe at Round Hill Pines							
South Lake Tahoe Sites							
Angora Creek - D/S of Tahoe Blvd. Bridge							
Angora Creek - dnst of View Circle							
Bijou Creek at mouth	307	55	2011	2373	79	244	
Bijou Creek - Fairway & above							
Bijou Creek abv Pioneer							
Bijou Park Drainage at Ski Run	7	76	298	381	20	45	
Bijou Park Drainage at Warner Salas							
Bijou Park Drainage b/l Hansen's Resort							
Bijou Park Drainage @ Verdon Drive							
Burke Creek at mouth (nr Pump St. @ end of Campg	3	2	283	288	3	25	
Cascade Creek							
Eagle Creek (Eagle Falls loop - just S/O bridge)							
Edgewood Creek at mouth	5	42	359	407	3	32	1.60
Edgewood Creek abv Hwy 50	4	142	327	473	6	40	
Fallen Leaf Lake							
Glen Alpine Creek at mouth							
Heavenly Creek nr confluence @ Trout Creek	3	11	216	230	14	37	
Heavenly Creek upstream Pioner Trail							
Lincoln Creek at mouth							
McFaul Creek at mouth	4	5	271	280	4	25	
McFaul Creek blw Hwy 50							
Meeks Creek at mouth	5	5	127	137	1	10	
North Zephyr Creek at mouth							
North Zephyr Creek, south tributary	—						
North Zephyr Creek, north tributary	—						
South Zepher Creek at mouth	6	39	246	291	3	20	
Tahoe Keys Lagoons (East Channel)							
Tahoe Keys Marina (West Channel)							
Tallac Creek at mouth	6	3	178	187	2	12	
Taylor Creek at mouth	5	2	210	217	1	13	
Trout Creek near grinding rock							
Upper Truckee River at mouth	5	35	221	261	7	47	13.08
Upper Truckee abv Trout							
Upper Truckee River at Xmas Valley							

Site Name and Description	Water Temperature (°C)	pH	DO (ppb)	Conductivity (µs)	Turbidity (NTU) (1)	Fecal Coliform No. of Colonies per 100 mL (4, 5)	Secchi Depth (m)	Rated Flow cfs (5)
North Lake Tahoe Sites								
Barton Creek at Hwy 28 (Fish Hatchery)	10.0	6.6	7.0	60.5	—			
Barton Creek at Hwy 28 (Fish Hatchery)	6.8	6.5	8	54.0	—			
Blackwood Creek at mouth	—	—	—	30.0	—			252
Bonpland Creek at mouth	5.0	6.5	—	60.0	6.8			
Brockway Creek at mouth (E/O Kings Beach boat n	14.0	6.5	4	180	—			
Burton Creek at Star Harbor, west	17.0	7	7.5	29	—	1k		
Burton Creek at Star Harbor, culverts	7.0	6.5	5.5	37	—	<1		
Deer Creek abv incline near Golf Course	6.0	6.5	10	172	6.5			
Dollar Creek at mouth	9.0	5	8	39	—			
Glenbrook Creek at mouth	8.3	7.8	—	158.8	—	8k		14
Griff Creek at mouth	5.8	6	10	40	—			
Griff Creek - a/o Hwy. 28, b/l pond	—	6.5	10	45	—			
Homewood Creek at mouth	5.0	5.1	8	40	—			
Incline Creek at mouth	6.0	6	11	50	7.9			27
Lake Forest Creek at mouth				30	—	53		
Madden Creek at mouth	5.0	6.5	8	81.5	—			
Polaris Creek at Star Harbor				48.5	—	4k		
Polaris Creek at Lake Forest Road				30	—	6k		
Quail Creek (lake side of culvert at Hwy. 89)	9.0	5	8	217				
Rosewood Creek at Third Creek	8.0	6.6	7	108.5	5.4			
Secret Harbor Creek	6.5	6.5	7	129.5	—			
Slaughter House Creek at mouth	6.8	7.5	5	95	2.3	1k		
Snow Creek, O/S of Hwy. 28	12.0	6.5	5.5	58	—			
Hatchery Creek nr Star Harbor	8.0	6.8	8	26	—	<1		
Hatchery Creek nr Star Harbor, east				265	—	<1		
Tahoe City State Park Campground				135	—			
Tahoe Creek Urban Basin at mouth	8.0	5.8	5.75	40	—	6k		
Third Creek at mouth	5.0	6.5	7	50	10.4			36
Tunnel Creek at mouth	8.0	6.3	5	85	0.3			
(Ucdavis) Fish Hatchery tap from spring					—	<1		
Watson Creek at mouth	4.0	6	9	39	—			
Watson Creek at mouth (follow-up)	4.0	6	9	33	—			
Watson Creek abv Hwy 28	4.0	6	9	32	—			
Wood Creek at mouth	5.0	7	9	45	13.5			
Wood Creek - b/n commercial boat / auto repair shi	8.6	7	7	40	—			

Site Name and Description	Ammonia NH3-N (ppb) (2,3)	Nitrate NO3-N (ppb) (2, 3)	Total Organic Nitrate (ppb) (2)	Total Nitrogen (ppb) (	Soluble Reactive Phos. SRP-P (ppb) (2, 3)	Total Phosphorus TP-P (ppb) (2, 3)	Total Suspended Sediment (mg/l)
North Lake Tahoe Sites							
Barton Creek at Hwy 28 (Fish Hatchery)							
Barton Creek at Hwy 28 (Fish Hatchery)							
Blackwood Creek at mouth							
Bonpland Creek at mouth		32	580	612	12	50	
Brockway Creek at mouth (E/O Kings Beach boat ramp)							
Burton Creek at Star Harbor, west		3	177	180	9	29	
Burton Creek at Star Harbor, culverts							
Deer Creek abv incline near Golf Course							
Dollar Creek at mouth		5	186	191	9	38	
Glenbrook Creek at mouth							
Griff Creek at mouth		6	207	213	7	41	
Griff Creek - a/b Hwy. 28, b/l pond							
Homewood Creek at mouth							
Incline Creek at mouth							
Lake Forest Creek at mouth		19	115	134	18	45	
Madden Creek at mouth							
Polaris Creek at Star Harbor							
Polaris Creek at Lake Forest Road		3	113	116	26	47	
Quail Creek (lake side of culvert at Hwy. 89)		41	112	153	2	21	
Rosewood Creek at Third Creek		5	219	224	12	46	
Secret Harbor Creek		4	347	351	5	39	
Slaughter House Creek at mouth							
Snow Creek, D/S of Hwy. 28		3	130	133	12	44	
Hatchery Creek nr Star Harbor							
Hatchery Creek nr Star Harbor, east							
Tahoe City State Park Campground		855	863	1718	21	98	
Tahoe Creek Urban Basin at mouth		125	190	315	13	48	
Third Creek at mouth							
Tunnel Creek at mouth							
(Ucdavis) Fish Hatchery tap from spring							
Watson Creek at mouth		8	179	187	5	28	
Watson Creek at mouth (follow-up)							
Watson Creek abv Hwy 28		2	115	149	12	31	
Wood Creek at mouth							
Wood Creek - b/h commercial boat / auto repair shop		21	497	558	13	63	

Site Name and Description	Water Temperature (°C)	pH	DO (ppb)	Conductivity (µs)	Turbidity (NTU) (1)	Fecal Coliform No. of Colonies per 100 mL (4, 5)	Secchi Depth (m)	Rated Flow cfs (5)
Middle Truckee River Sites								
Alder Creek	5.9	6.5	8.5	47	5.26	2k		
Bear Creek	10.5	5.5		37	2.49	<1		
Big Chief Corridor	5.5	5	9.6		4.79	<1		
		6.5	6.5	95	11.42			
Little Truckee River blw Boca Dam	9.3							
		6.9	9	57	1.08			
Little Truckee River at Boyington Mill	11.4							
Donner at Hwy 89	5.5	9.8	8	75	8.95	6k		
		6	9.9	90	0.49			
Donner at Donner Lake Outlet	8.9					2k	492	
		6.5	8.9	95	0.25			
Donner Lake West End	8.8					<1		
Davies Creek	8.2	6.9	7	93	—			
		6.5	8.5		3.85			
Union Valley Creek at Glenshire	9.9					11k		
Gray Creek	5.8	5.8	7	109	48.3		107	
		7.6	7	60	6.18			
Martis Creek at mouth	7.0					8k		
		7.4	8.8	50	5.34			
Martis Creek at ACOE	5.7					<1		
Pole Creek	4.0	5.5	8	53	8			
Prosser Creek	3.9	6.5	9.5	30	13.79			
Sagehen Creek	5.1	6.8	8	43	1.85			
Squaw Creek	4.8	5.5	7	62	9.79	1k		
Truckee River at Regional Park	6.3	5	8	56	9.01	6k		
Truckee River near Tahoe City		5.5		68	0.58	7k	72	
Trout Creek Lower	5.6	8.1	9.5	95	1.96	<1		
Trout Creek Upper at Bennett Flat	11.5	6.5	9.5	67	0.73	1k		
Upper Little Truckee River	6.0	6.5	8	33	4.38			
Lower Truckee River Sites								
Alum Creek	9	5	7	280	12.5	>120z		
Bull Run Creek	6.5	6	9	350	3.0	12		
Chalk Creek	10	5.5	7.5	1990	1.0	70k		
Dry Creek	13	6	7	380	15.0	>120z		
Evan Creek	13	7.8	12	260	15.0	>120z		
Lewer's Creek	9.5	5	8.5	170	3.5	151k		
Roberts Creek	10	5	8	105	3.0	30		
Thomas Creek	9	7.2	9	90	4.5	>120z		
White's Creek	7	5	9	90	28.0	>120z		
Minimum Value	**2.7**	**5.0**	**4.0**	**10**	**0.2**	**12.0**	**0.8**	
Maximum Value	**17.0**	**11.8**	**12.0**	**1,990**	**48.3**	**53.0**	**492.0**	
Count (# of valid responses)	69.0	91	67	94	66	6	6	

Notes:

Note 1: Turbidity (NTU) lab analysis conducted at the collection sites (Sierra Nevada College, Lake Tahoe Community College).

Note 2: Lake Tahoe and Middle Truckee River Watershed nutrient analysis conducted by High Sierra Water Lab. Concentrations in Parts Per Billion (PPB).

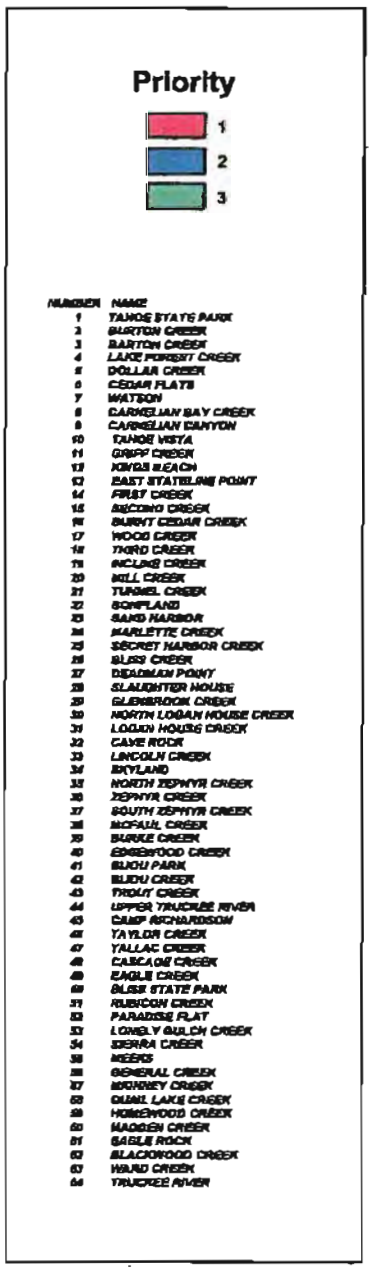
Note 3: Lower Truckee River Watershed nutrient analysis conducted by Truckee Meadows Water Reclamation Facility. Concentr 2-May-2006

Note 4: Fecal Coliform analysis conducted at U.S. Geological Survey (Carnelian Bay office for Tahoe/Middle Truckee, CarsonPrepared by R. Whitney

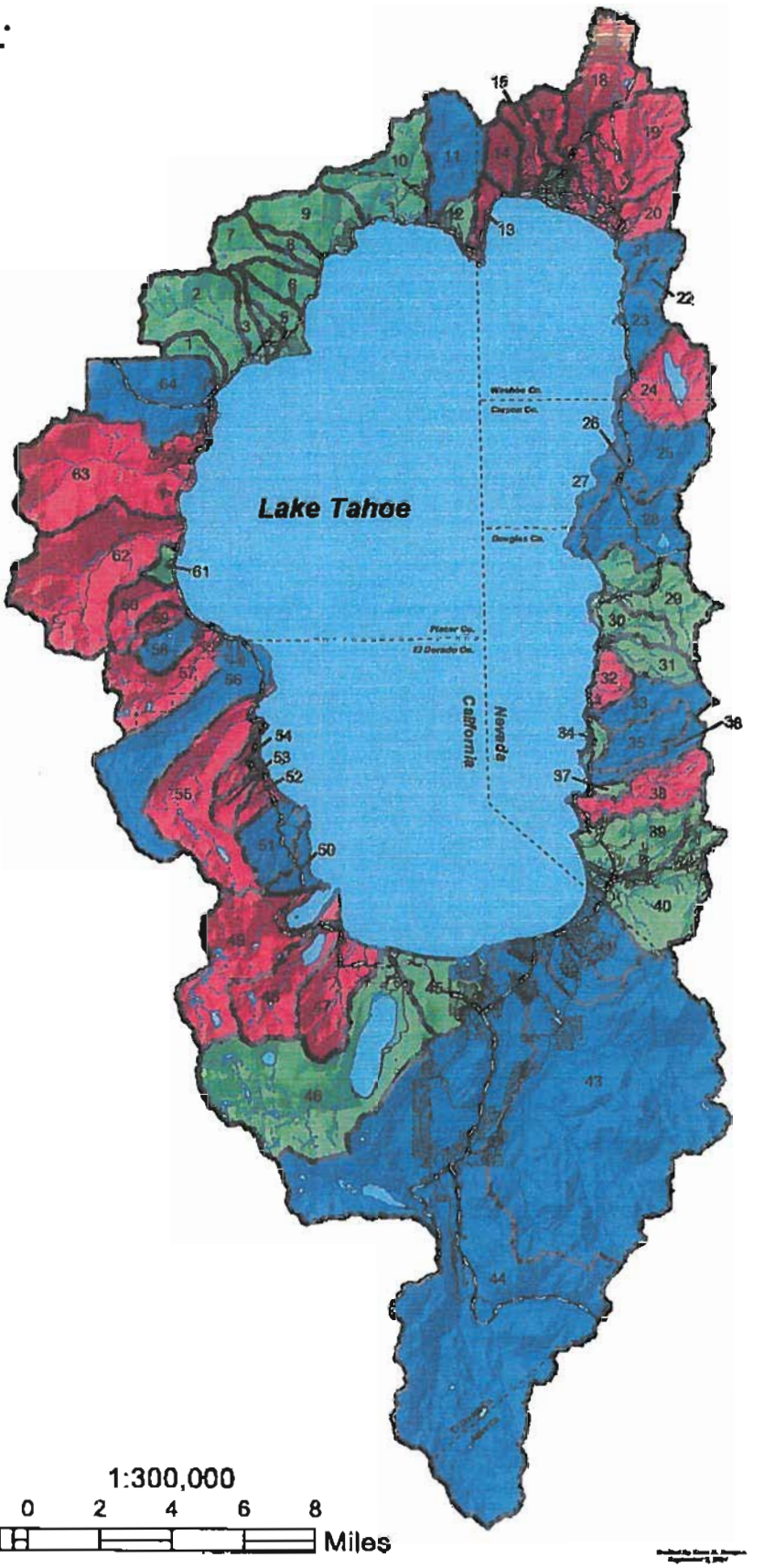
Note 5: Rated streamflow as reported May 21, 2005 by U.S. Geological Survey in cubic feet per second (cfs).

Site Name and Description	Ammonia NH3-N (ppb) (2,3)	Nitrate NO3-N (ppb) (2, 3)	Total Organic Nitrate (ppb) (2)	Total Nitrogen (ppb) (	Soluble Reactive Phos. SRP-P (ppb) (2, 3)	Total Phosphorus TP-P (ppb) (2, 3)	Total Suspended Sediment (mg/l)
Middle Truckee River Sites							
Alder Creek	8	117	170	347	6	42	
Bear Creek	5	55	137	236	6	30	
Big Chief Corridor	14	14	466	499	3	77	
Little Truckee River blw Boca Dam							
Little Truckee River at Boyington Mill							
Donner at Hwy 89	4	8	118	214	2	17	
Donner at Donner Lake Outlet	11	1	101	695	1	77	
Donner Lake West End	17	2	138	252	2	16	
Davies Creek							
Union Valley Creek at Glenshire	3	15	271	293	17	64	
Gray Creek							
Martis Creek at mouth	2	11	191	270	13	54	
Martis Creek at ACOE	2	17	171	245	12	48	
Pole Creek							
Prosser Creek							
Sagehen Creek							
Squaw Creek	3	121	265	481	4	54	
Truckee River at Regional Park	2	29	186	292	5	82	
Truckee River near Tahoe City	3	2	124	290	2	21	
Trout Creek Lower	5	2	167	271	6	32	
Trout Creek Upper at Bennett Flat	3	4	117	212	4	24	
Upper Little Truckee River							
Alum Creek	70	55			46		16
Bull Run Creek	0	9			36		7
Chalk Creek	0	1530			284		40
Dry Creek	30	1100			109		35
Evan Creek	20	242			71		23
Lewer's Creek	0	64			82		2
Roberts Creek	0	7			36		2
Thomas Creek	20	128			7		32
White's Creek	0	22			47		45
Minimum Value	0	1	101		1	16	
Maximum Value	307	1530	2811		284	244	
Count (# of valid responses)	35	50	41		50	41	

APPENDIX B:



NUMBER	NAME
1	TAHOE STATE PARK
2	BARTON CREEK
3	BARTON CREEK
4	LAKE FOREST CREEK
5	DOLLAR CREEK
6	CEDAR FLATS
7	WATSON
8	CARNELIAN BAY CREEK
9	CARNELIAN CANYON
10	TAHOE VISTA
11	GRIFF CREEK
12	KINGS BEACH
13	EAST STATELINE POINT
14	FIRST CREEK
15	SECOND CREEK
16	BURNT CEDAR CREEK
17	WOOD CREEK
18	THIRD CREEK
19	INCLINE CREEK
20	MILL CREEK
21	TUNNEL CREEK
22	SOMPLAND
23	SAND HARBOR
24	MARLETTE CREEK
25	SECRET HARBOR CREEK
26	BLISS CREEK
27	DEADMAN POINT
28	SLAUGHTER HOUSE
29	GLENBROOK CREEK
30	NORTH LOGAN HOUSE CREEK
31	LOGAN HOUSE CREEK
32	CAVE ROCK
33	LINCOLN CREEK
34	SKYLAND
35	NORTH ZEPHYR CREEK
36	ZEPHYR CREEK
37	SOUTH ZEPHYR CREEK
38	MCFAUL CREEK
39	BURKE CREEK
40	EDGEWOOD CREEK
41	ELKHORN PARK
42	ELKHORN CREEK
43	TROUT CREEK
44	UPPER TRUCKEE RIVER
45	CAMP RICHARDSON
46	TAYLOR CREEK
47	TALLAC CREEK
48	CASCADE CREEK
49	EAGLE CREEK
50	BLISS STATE PARK
51	RUBICON CREEK
52	PARADISE FLAT
53	LONELY GULCH CREEK
54	SIERRA CREEK
55	MEEKS
56	GENERAL CREEK
57	MEEKREEK CREEK
58	OMNI LAKE CREEK
59	HOMEWOOD CREEK
60	HAGGEN CREEK
61	EAGLE ROCK
62	BLACKWOOD CREEK
63	WARD CREEK
64	TRUCKEE RIVER



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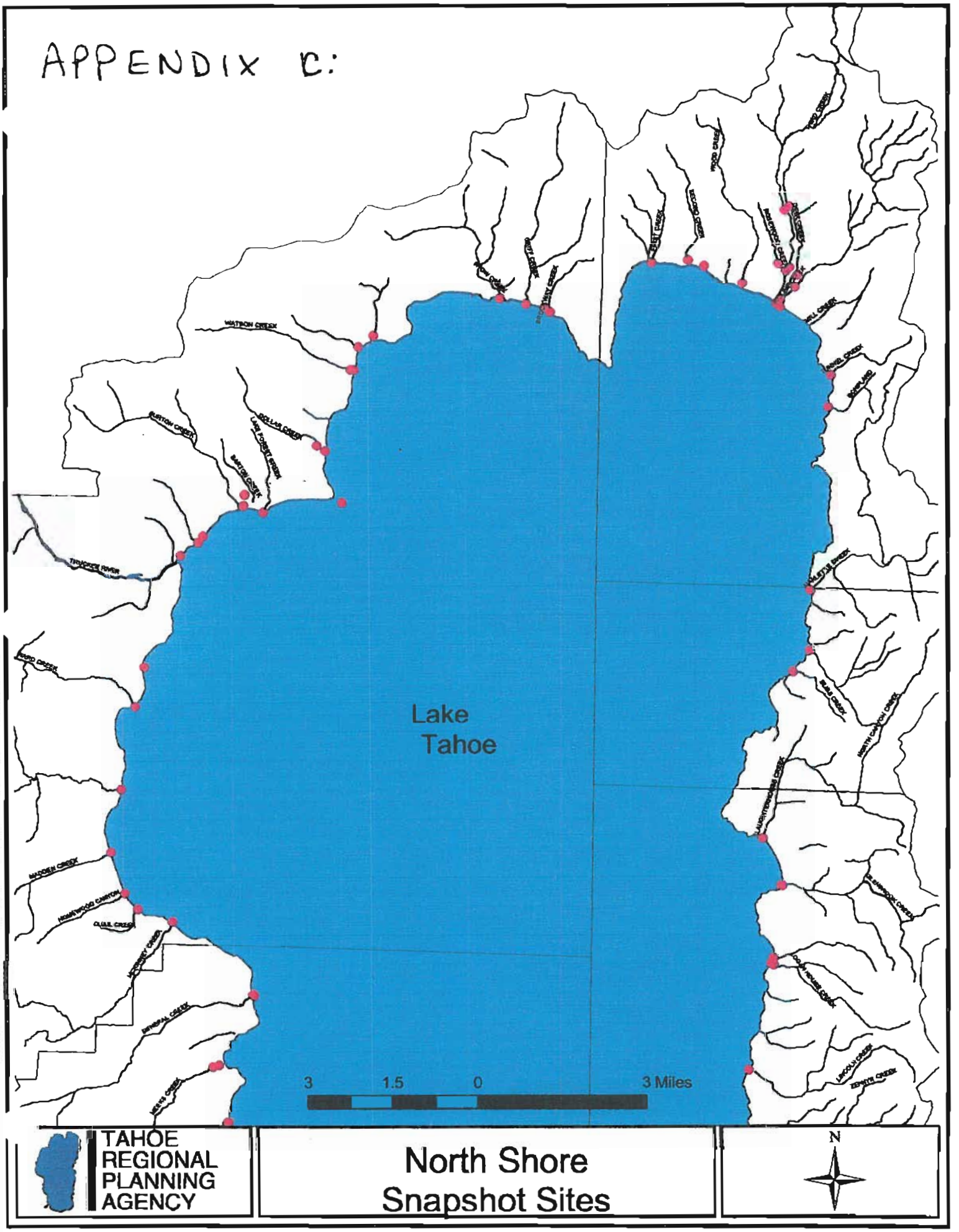
2 1 0 2 4 6 8 Miles

TAHOE REGIONAL PLANNING AGENCY

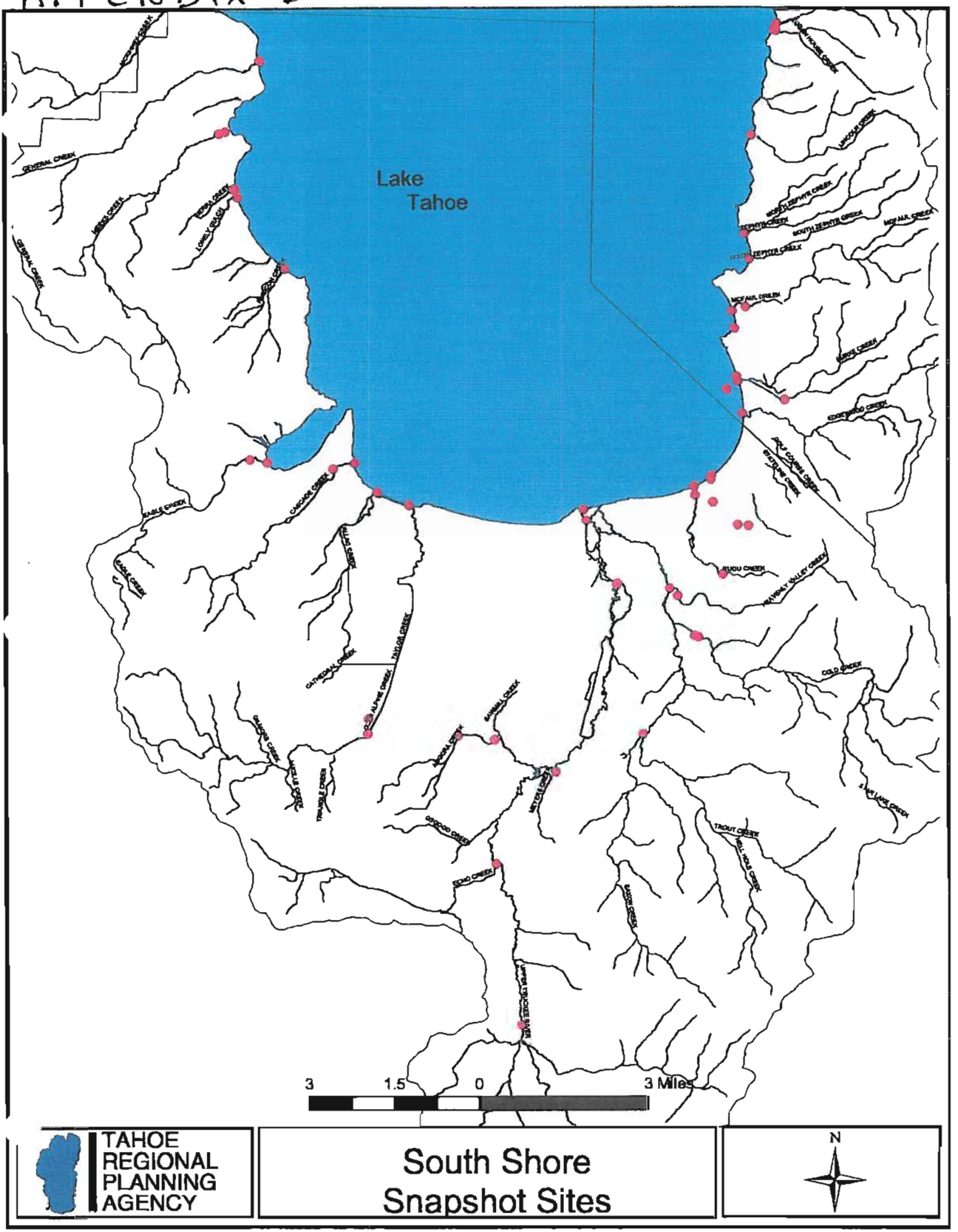
Priority Watersheds

N W E S

APPENDIX C:


Lake
Tahoe
3
1.5
0
3 Miles
TAHOE
REGIONAL
PLANNING
AGENCY
North Shore
Snapshot Sites
N

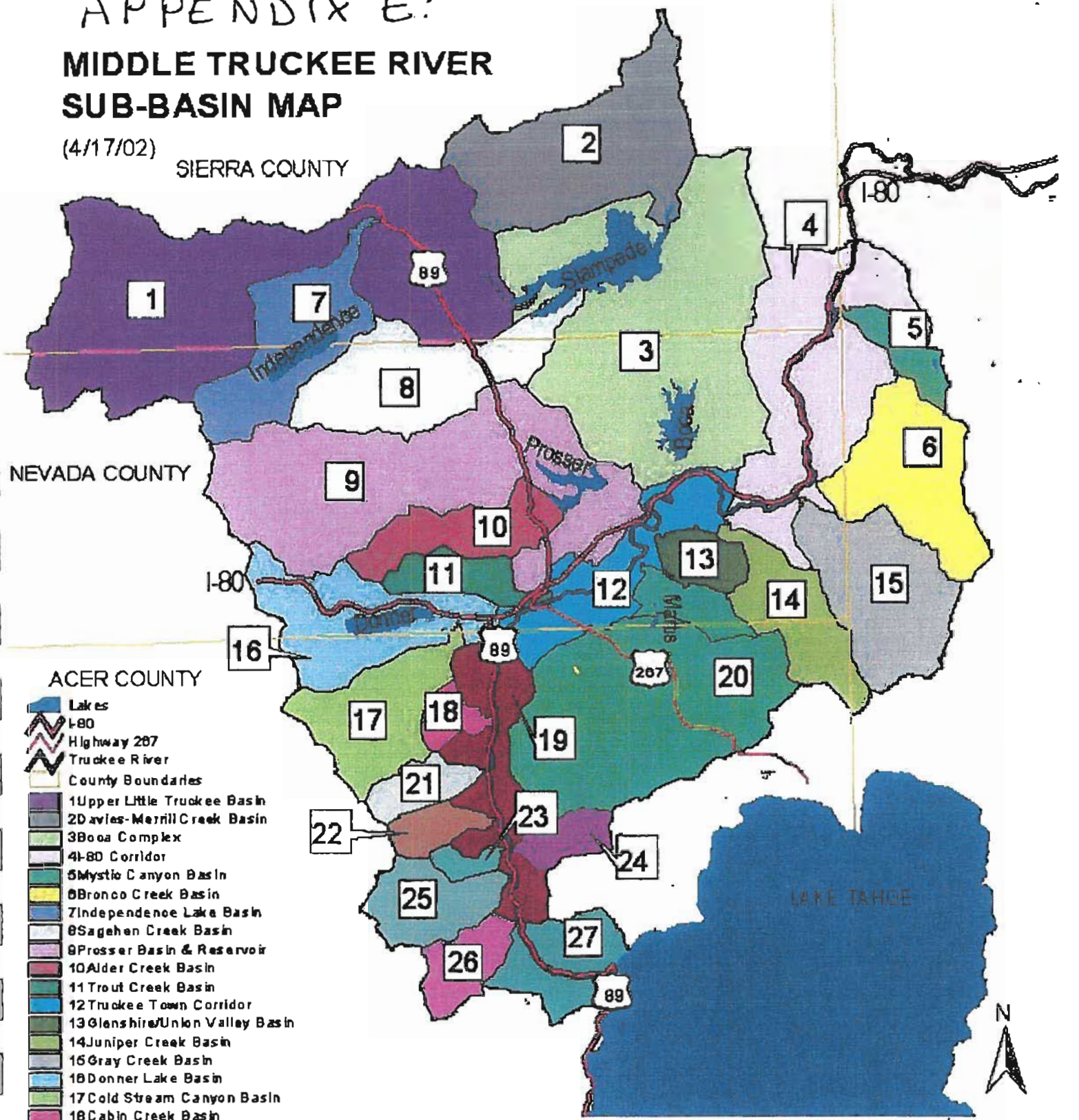
APPENDIX D:


Lake
Tahoe
GENERAL CREEK
MEEKS CREEK
LONELY GULCH
EAGLE CREEK
CHOCOLATE CREEK
CATHEDRAL CREEK
TAYLOR CREEK
ALPINE CREEK
TRIMBLE CREEK
OSGOOD CREEK
ECHO CREEK
UPPER TRUCKEE RIVER
MEYERS CREEK
BAYVIEW CREEK
TROUT CREEK
COLD CREEK
STUDU CREEK
EDGEWOOD CREEK
MCKINNEY CREEK
SOUTH UPPER TRUCKEE RIVER
3
1.5
0
3 Miles
TAHOE REGIONAL PLANNING AGENCY
South Shore
Snapshot Sites
N

APPENDIX E:

MIDDLE TRUCKEE RIVER SUB-BASIN MAP

(4/17/02)



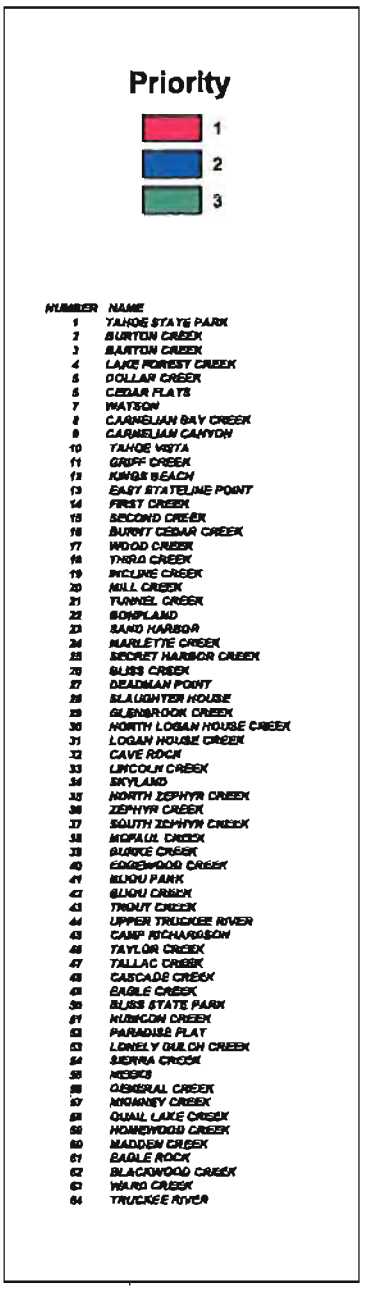
TRUCKEE RIVER WATERSHED COUNCIL
PO Box 8568 * Truckee, CA 96161
530-550-8760 * www.truckeeriverwc.org

Special thanks to the Lahontan Regional Water Quality Control Board and the Desert Research Institute for their assistance.

Developed with funding from the State of California Resources Agency through the UC Davis Public Service Research Program

Prepared by Kerri L. Timmer, Sierra Connections
530-273-7320 * kvtimmer@oro.net

APPENDIX B:



NUMBER	NAME
1	TAHOE STATE PARK
2	BURTON CREEK
3	BARTON CREEK
4	LAKE FOREST CREEK
5	DOLLAR CREEK
6	CEDAR FLATS
7	WATSON
8	CARNELIAN BAY CREEK
9	CARNELIAN CANYON
10	TAHOE VISTA
11	GRIFF CREEK
12	KINGS BEACH
13	EAST STATELINE POINT
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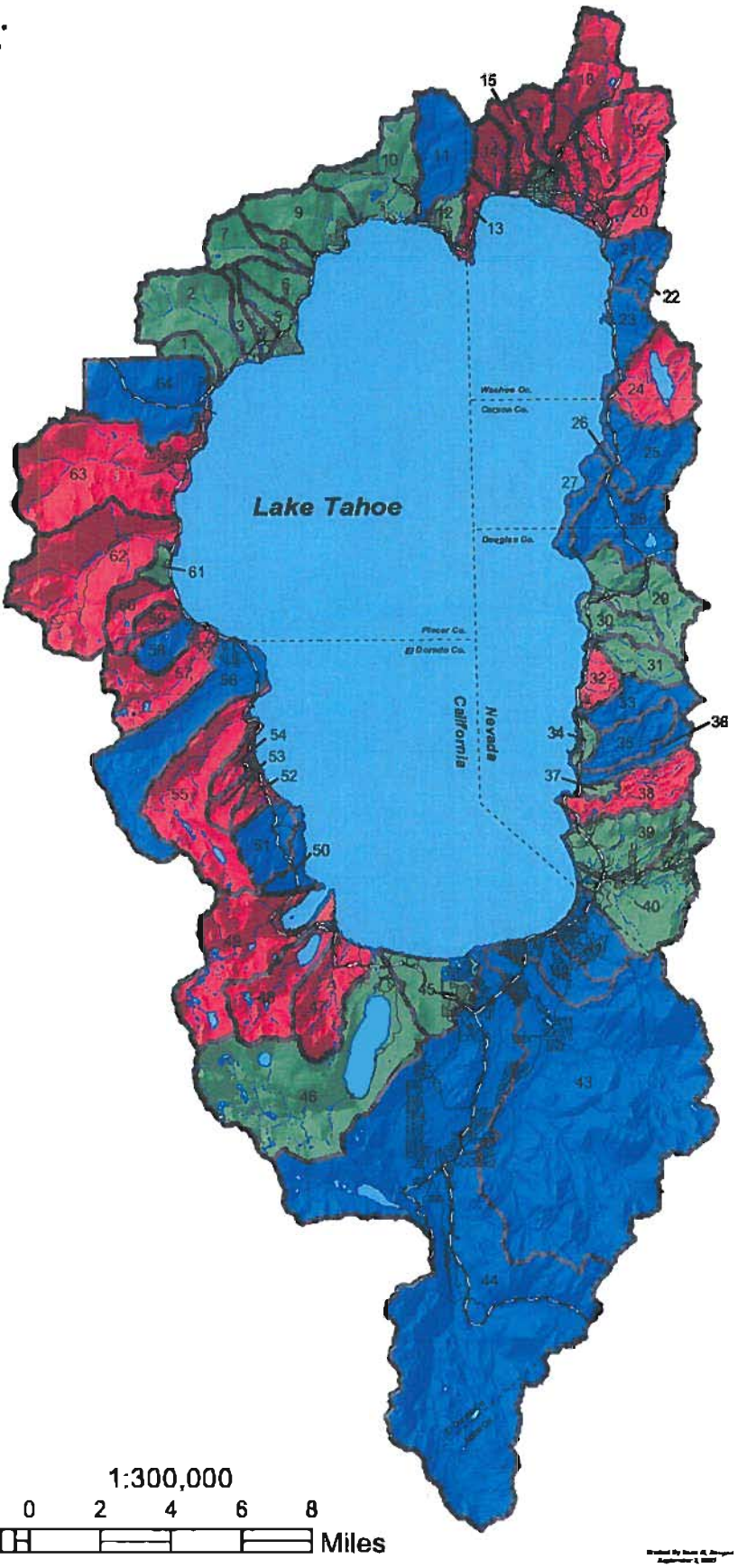
30	NORTH LOGAN HOUSE CREEK
31	LOGAN HOUSE CREEK
32	CAVE ROCK
33	LINCOLN CREEK
34	SKYLAND
35	NORTH ZEPHYR CREEK
36	ZEPHYR CREEK
37	SOUTH ZEPHYR CREEK
38	MOFFAT CREEK
39	BURKE CREEK
40	EDGEWOOD CREEK
41	UPPER TRUCKEE RIVER
42	CAMP RICHARDSON
43	TROUT CREEK
44	UPPER TRUCKEE RIVER
45	CAMP RICHARDSON
46	TAYLOR CREEK
47	TALLAC CREEK
48	CASCADE CREEK
49	EAGLE CREEK
50	BLISS STATE PARK
51	RUBICON CREEK
52	PARADISE FLAT
53	LONELY GULCH CREEK
54	SIERRA CREEK
55	MEEKS
56	GENERAL CREEK
57	MCKINNEY CREEK
58	QUAIL LAKE CREEK
59	HOMEWOOD CREEK
60	MADDEN CREEK
61	EAGLE ROCK
62	BLACKWOOD CREEK
63	WARD CREEK
64	TRUCKEE RIVER

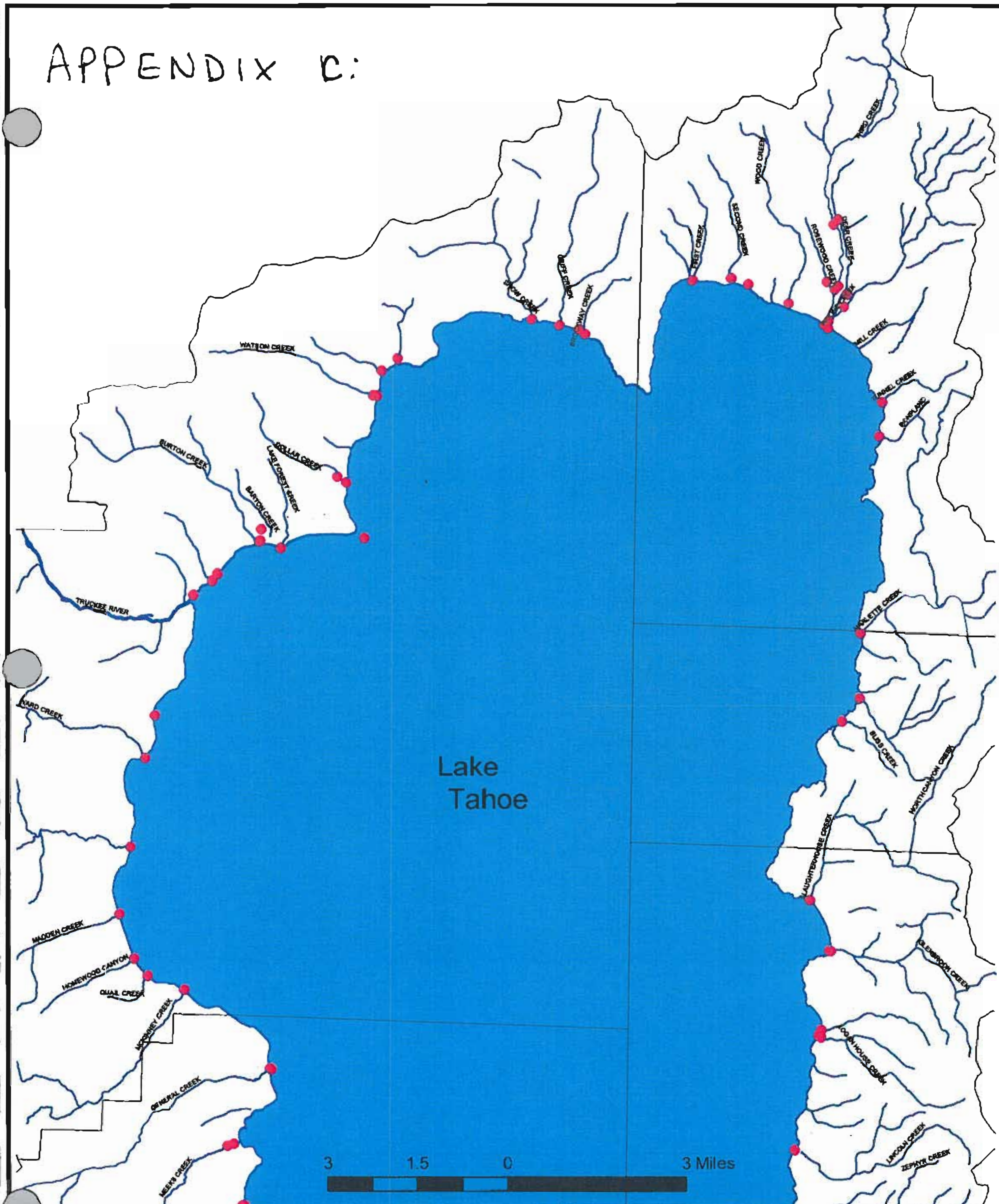


TAHOE REGIONAL PLANNING AGENCY

Priority Watersheds

N
W E
S

APPENDIX C:

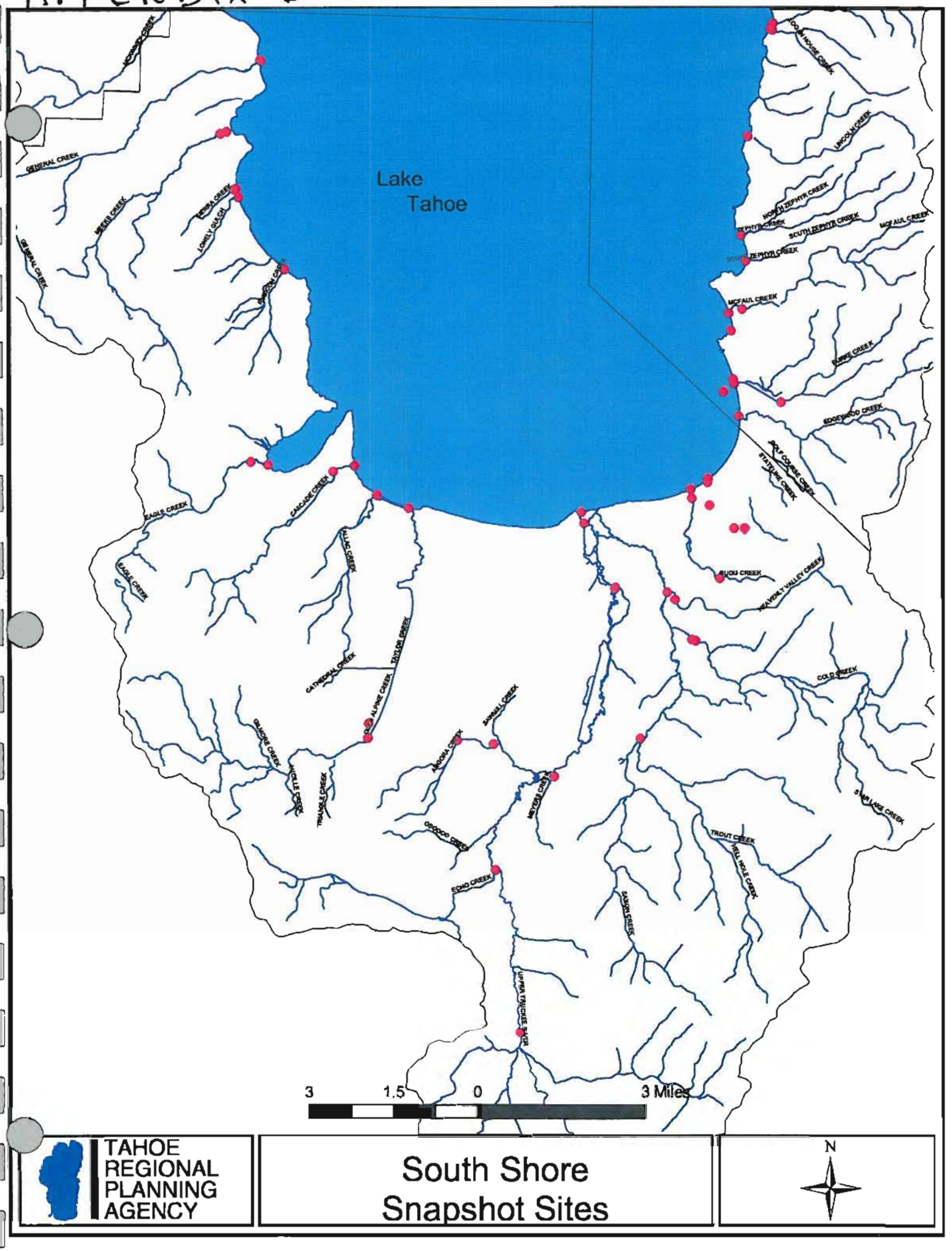


TAHOE REGIONAL PLANNING AGENCY

North Shore Snapshot Sites

N

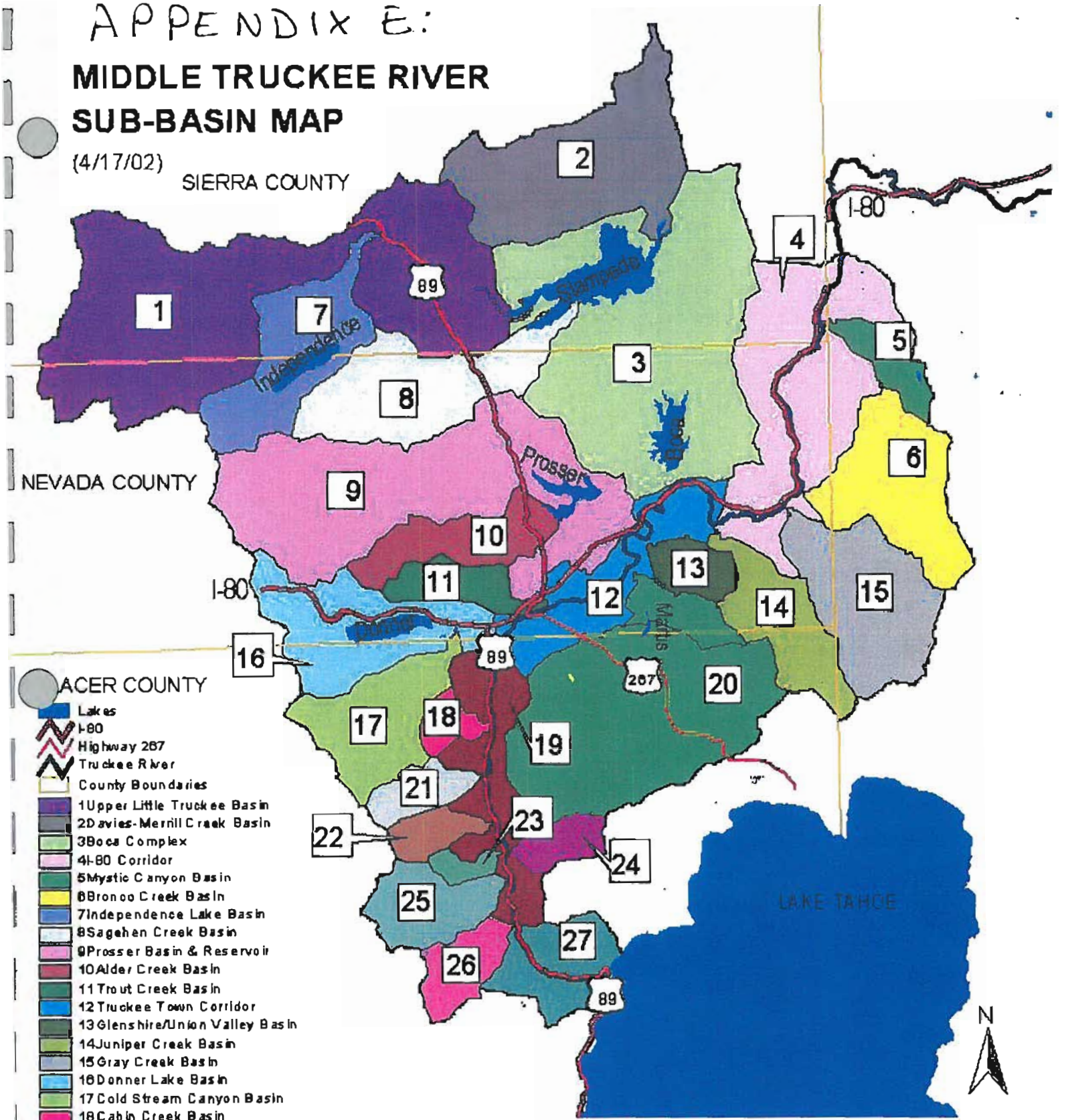
APPENDIX D.


Lake
Tahoe
GENERAL CREEK
MEEKS CREEK
LONELY GULCH
EMERALD BAY
EAGLE CREEK
CASCADE CREEK
TALLAC CREEK
TAYLOR CREEK
CATHEDRAL CREEK
ALPINE CREEK
GRASS LAKE CREEK
TRIANGLE CREEK
ANGORA CREEK
JAMMELL CREEK
MEYERS CREEK
GOOSE CREEK
ECHO CREEK
UPPER TRUCKEE RIVER
RUBICON CREEK
LOOKOUT HOUSE CREEK
LINCOLN CREEK
NORTH ZEPHYR CREEK
ZEPHYR CREEK
SOUTH ZEPHYR CREEK
MCFAUL CREEK
EDDYWOOD CREEK
BIJOU CREEK
HALVEMY VALLEY CREEK
COLD CREEK
TROUT CREEK
BIG MEADOW CREEK
DAVIS CREEK
3 0 1.5 3 Miles
TAHOE REGIONAL PLANNING AGENCY
South Shore
Snapshot Sites
N

APPENDIX E:

MIDDLE TRUCKEE RIVER SUB-BASIN MAP

(4/17/02)



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