California Regional Water Quality Control Board
Santa Ana Region

RESOLUTION NO. R8-2008-0070

Resolution Approving the Big Bear Lake In-lake Nutrient Monitoring Plan Submitted by the Big Bear Lake TMDL Task Force Pursuant to the Big Bear Lake Nutrient Total Maximum Daily Load for Dry Hydrologic Conditions Specified in the Water Quality Control Plan for the Santa Ana River Basin

WHEREAS, the California Regional Water Quality Control Board, Santa Ana Region (hereinafter, Regional Board), finds that:

1. An updated Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) was adopted by the Regional Board on March 11, 1994, approved by the State Water Resources Control Board (SWRCB) on July 21, 1994, and approved by the Office of Administrative Law (OAL) on January 24, 1995.

2. An amendment to the Basin Plan to incorporate the Big Bear Lake Nutrient Total Maximum Daily Load (TMDL) for Dry Hydrologic Conditions was approved by the Regional Board on April 21, 2006, by the SWRCB on April 3, 2007, by the Office of Administrative Law on August 21, 2007, and by the US Environmental Protection Agency on September 25, 2007.

3. The Big Bear Lake Nutrient TMDL for Dry Hydrologic Conditions was developed in accordance with Clean Water Act Section 303(d) and the California Water Code, Division 7, Chapter 4, Article 3, Section 13240 *et seq*. The amendment is incorporated into Chapter 5 "Implementation," of the Basin Plan.

4. Responsible agencies and dischargers in the Big Bear Lake watershed have formed a Big Bear Lake TMDL Task Force (TMDL Task Force). The TMDL Task Force members are working jointly to implement requirements of the Big Bear Lake Nutrient TMDL. TMDL Task Force members include the following agencies/parties: County of San Bernardino, US Department of Agriculture – Forest Service, the City of Big Bear Lake, Bear Mountain Resorts, the California Department of Transportation and the Big Bear Municipal Water District.

5. The Big Bear Lake Nutrient TMDL, Tasks 4.1 and 4.2 – Nutrient Water Quality Monitoring Program – requires the submittal of a monitoring proposal that include an in-lake monitoring program and a watershed-wide monitoring program. The TMDL requires that these proposed monitoring programs include tasks to provide data necessary to do the following: allow determination of sources of the nutrient of concern, phosphorus; to allow development of TMDLs under other hydrologic conditions; evaluate compliance with numeric targets specified in the TMDL, and facilitate review and update of the Big Bear Lake Nutrient TMDL.

6. The Big Bear Lake Nutrient TMDL, Tasks 4.1 and 4.2 – Nutrient Water Quality Monitoring Program – requires that the monitoring proposal include tasks to determine compliance with the existing total inorganic nitrogen (TIN) water quality objective specified in the Basin Plan and to allow development of nitrogen TMDL, WLAs and LAs in the future.

7. The TMDL requires implementation of the monitoring program upon Regional Board approval.

8. In compliance with the Big Bear Lake Nutrient TMDL – Task 4.1, the TMDL Task Force submitted a proposed Big Bear Lake Watershed-wide Nutrient Monitoring Plan, dated November 30, 2007, for Regional Board approval. The TMDL Task Force revised the November 30, 2007 submittal, based on Board staff comments, and submitted a revised proposed Big Bear Lake Nutrient TMDL Watershed-wide Monitoring Plan on June 26, 2008. At the July 1, 2008 TMDL Task Force meeting, the Task Force identified additional monitoring strategies that should be incorporated in the watershed-wide monitoring plan. The final revised watershed-wide nutrient monitoring plan will be considered for Regional Board approval at the earliest opportunity.

9. In compliance with the Big Bear Lake Nutrient TMDL – Task 4.2, the TMDL Task Force submitted a proposed Big Bear Lake In-lake Nutrient Monitoring Plan dated November 30, 2007, for Regional Board review and approval.

10. Regional Board staff have reviewed the proposed Big Bear Lake In-lake Nutrient Monitoring Plan and finds that it complies with the applicable requirements of the Big Bear Lake Nutrient TMDL specified in the Basin Plan.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. The Regional Board approves the Big Bear Lake In-lake Nutrient Water Quality Monitoring Plan as shown in the attachment to the Resolution.

2. The Big Bear Lake In-lake Nutrient Monitoring Plan complies with the applicable requirements of the Big Bear Lake Nutrient TMDL specified in the Basin Plan.

3. The Members of the Big Bear Lake TMDL Task Force are in compliance with Task 4.2 of the Big Bear Lake Nutrient TMDL.

4. The Big Bear Lake Nutrient In-lake Monitoring Plan schedule shown in the attachment to this Resolution must be implemented upon Regional Board approval.

5. A Sampling and Analysis Plan that is consistent with Surface Water Ambient Monitoring Program (SWAMP) protocols must be submitted no later than September 18, 2008.

6. The Regional Board's Executive Officer is hereby delegated authority to approve subsequent revision to the plan and schedule set forth in the attachment to the Resolution.

I, Gerard J. Thibeault, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Santa Ana Region, on July 18, 2008.

G J Thibeault

Gerard J. Thibeault
Executive Officer

Attachment to Resolution

R8-2008-0070

BIG BEAR LAKE
NUTRIENT MONITORING PLAN

NOVEMBER 2007

1.0 INTRODUCTION

At present, Big Bear Lake is considered a moderately eutrophic waterbody (RWQCB, 2006). In 1994, the Santa Ana Regional Water Quality Control Board (RWQCB) released a Phase I Clean Lakes Study on Big Bear Lake and several of its tributaries. As a result of the Clean Lakes Study, as well as other data suggesting water quality deviations from several Basin Plan objectives, Big Bear Lake and four of its tributaries were placed on the 1994 Clean Water Act Section 303(d) List of Water Quality Limited Segments. Specifically, Big Bear Lake was listed as being impaired for nutrients, noxious aquatic plants, sedimentation, and metals (including copper and mercury).

In response to the 303(d) listing, the RWQCB initiated the development of Total Maximum Daily Loads (TMDL) for the Big Bear Lake watershed in 2000. Initial TMDL development efforts were focused on nutrients in Big Bear Lake, which led to the issuance of a Nutrient TMDL for Big Bear Lake under Dry Hydrological Conditions (RWQCB, 2006). The 2006 Basin Plan Amendment established numerical water quality targets for the lake for Total Phosphorus (TP), chlorophyll-a, overall macrophyte coverage, and 95% eradication of Eurasian Watermilfoil and any other invasive aquatic plants (RWQCB, 2006). The TMDL numeric water quality targets are as follows:

Numerical TMDL Targets

Parameter	TMDL Numerical Targets for Big Bear Lake
Total Phosphorus (TP)	35 μg/L (annual average)
Chlorophyll a (Chl a)	14 μg/L (growing season average)
Macrophyte Coverage	30 to 40% on a total lake area basis
Percentage of Nuisance Aquatic Vascular Plants Species	95% eradication on a total area basis of Eurasian Watermilfoil and any other invasive species

In addition to the TMDL targets, the RWQCB also indicated that narrative Basin Plan objectives for dissolved oxygen and total inorganic nitrogen (TIN) were not being consistently met in Big Bear Lake (RWQCB, 2006). The Basin Plan objectives of concern are:

Basin Plan Objectives of Concern

Parameter	Existing Basin Plan Objectives Santa Ana River Basin -1995
Total Inorganic Nitrogen (TIN)	150 μg/L
Dissolved Oxygen	COLD BU: > 6.0 mg/L WARM BU: > 5.0 mg/L

The main purpose of this Big Bear Lake Nutrient Monitoring Plan is to provide the nutrient and supporting water quality data needed to review and update the Big Bear Lake Nutrient TMDL. Specifically, the data collected will be used to:

1) Determine annual compliance with phosphorus and chlorophyll a numeric targets;
2) Determine annual compliance with the existing total inorganic nitrogen (TIN) Basin Plan objective; and,
3) Evaluate if a refinement of the in-lake model for the purposes of TMDL review and development are needed.

2.0 BACKGROUND

Big Bear Lake is a man-made reservoir located in the San Bernardino Mountains of Southern California (Figure 1). The lake was created by the construction of the Bear Valley Dam in 1883-1884, and the new and higher dam in 1911-1912. The Big Bear Lake watershed is small (only 37 square miles) and primarily consists of coniferous forested lands (62.7 percent) that surround the lake. Located near the center of the watershed, Big Bear Lake itself occupies 12 percent of the total watershed area. Relative to the dam spillway, the full pool elevation of Big Bear Lake is 6,743.2 feet above mean sea level. At full pool, the surface area of the lake is estimated at 2,971 acres with a water storage capacity of 73,320 acre-feet. The lake is oriented from west to east, and is relatively long (7.0 miles in length) and narrow (0.5 mile in average width) in shape. The Bear Valley Dam is located on the western end of the reservoir, essentially downstream of the entire reservoir. Water stored in the western end of Big Bear Lake is substantially deeper (12 to 15 meters or 36 to 45 ft) than water stored near the eastern end of the lake (3 to 6 meters or 12 to 18 ft).

The beneficial uses of Big Bear Lake, as specified by the Water Quality Control Plan for the Santa Ana Basin (Basin Plan) include: 1) cold freshwater habitat (COLD), 2) warm freshwater habitat (WARM), 3) water contact recreation (REC1), 4) non-contact water recreation (REC2), municipal and domestic water supply (MUN), agriculture supply (AGR), groundwater recharge (GWR), wildlife habitat (WILD), and rare, threatened or endangered species (RARE).

Although the relationship between water quality objectives and beneficial uses are often complex, it is understood that in order to protect the beneficial uses of a water body, certain water quality conditions must be maintained. For example, for the protection of cold freshwater habitat (COLD), Basin Plan objectives indicate that dissolved oxygen concentrations of water should not be depressed below 6.0 mg/L. Similarly, the protection of warm freshwater habitat (WARM) requires that dissolved oxygen concentrations not be lower than 5.0 mg/L.

In Big Bear Lake, REC1 and REC2 uses were known to be adversely affected by the excessive growth of aquatic vascular plants (macrophytes). Because accelerated aquatic plant growth (either algae or macrophytes) is a characteristic of lake eutrophication (or nutrient enrichment), it was necessary to investigate the trophic status of Big Bear Lake.

Since June of 2001, intensive in-lake water quality monitoring has been performed for Big Bear Lake. This intensive lake water quality monitoring, in conjunction with several other types of data collection efforts (e.g., lake sediment nutrient flux studies), afford a considerable weight-of-evidence regarding nutrient sources and cycles in the lake.

This existing weight-of-evidence and continued nutrient monitoring efforts should provide the Regional Board with ample data to evaluate the basis of the Big Bear Lake Nutrient TMDL for Dry Hydrological Conditions. The Regional Board has committed to reviewing all of the data generated by the TMDL requirements and has acknowledged that changes to the TMDL may be warranted in light of that data (RWQCB, 2006).

3.0 NUTRIENT MONITORING PLAN OBJECTIVES

In accordance with the Big Bear Lake Nutrient TMDL Resolution (R8-2006-0023), the primary objectives of this Big Bear Lake Nutrient Monitoring Plan are to collect and analyze the nutrient and supporting water quality data needed to review and update the Big Bear Lake Nutrient TMDL. Specifically, the data collected will be used to:

4) Determine annual compliance with phosphorus and chlorophyll-a numeric targets;
5) Determine annual compliance with the existing total inorganic nitrogen (TIN) Basin Plan objective; and,
6) Evaluate if a refinement of the in-lake model for the purposes of TMDL review and development are needed.

If warranted, the data may also be used to support the development of a Nutrient TMDL for Wet/Average Hydrological Conditions, or to assess the effectiveness of lake nutrient mitigation efforts (USEPA, 2000).

Finally, the continuation of lake monitoring activities affords the opportunity to continue to characterize the lake system and evaluate its response to changes in environmental conditions over time.

4.0 EXPERIMENTAL DESIGN

This Big Bear Lake Nutrient Monitoring Plan provides for continued in-lake nutrient and supporting water quality sampling and analysis at previously established open-water lake stations (i.e., TMDL Stations MWDL1, MWDL2, MWDL6 and MWDL9.) The experiment design elements of this Big Bear Lake Nutrient Monitoring Plan serve to:

- Identify in-lake nutrient sampling locations;
- Define sample type, sampling frequency, and parameters;
- Identify the analytical methods for each parameter sampled;
- Provide the standard operating procedures for sample collection; and,
- Establish appropriate QA/QC requirements to ensure that the collected data are compatible with the State of California, Surface Water Ambient Monitoring Plan (SWAMP).

The sampling design utilizes a fixed station sampling approach. A fixed station sampling approach provides for the collection of samples at regular sites on a continuous basis. It also enables the examination of water quality trends. The lake stations are located along a line that corresponds with lake orientation (see Figure 1). These open-water stations provide the best representation of the average water quality condition of the lake. Further, USEPA recommends a minimum of three monitoring sites for large reservoirs (USEPA, 2000). At the initiation of Nutrient TMDL development monitoring, a total of four, open-water lake monitoring stations were established and have been consistently monitored since that time. These same stations are identified in the Basin Plan Amendment as the required sampling locations for the lake (RWQCB, 2006).

4.1 Sampling Locations

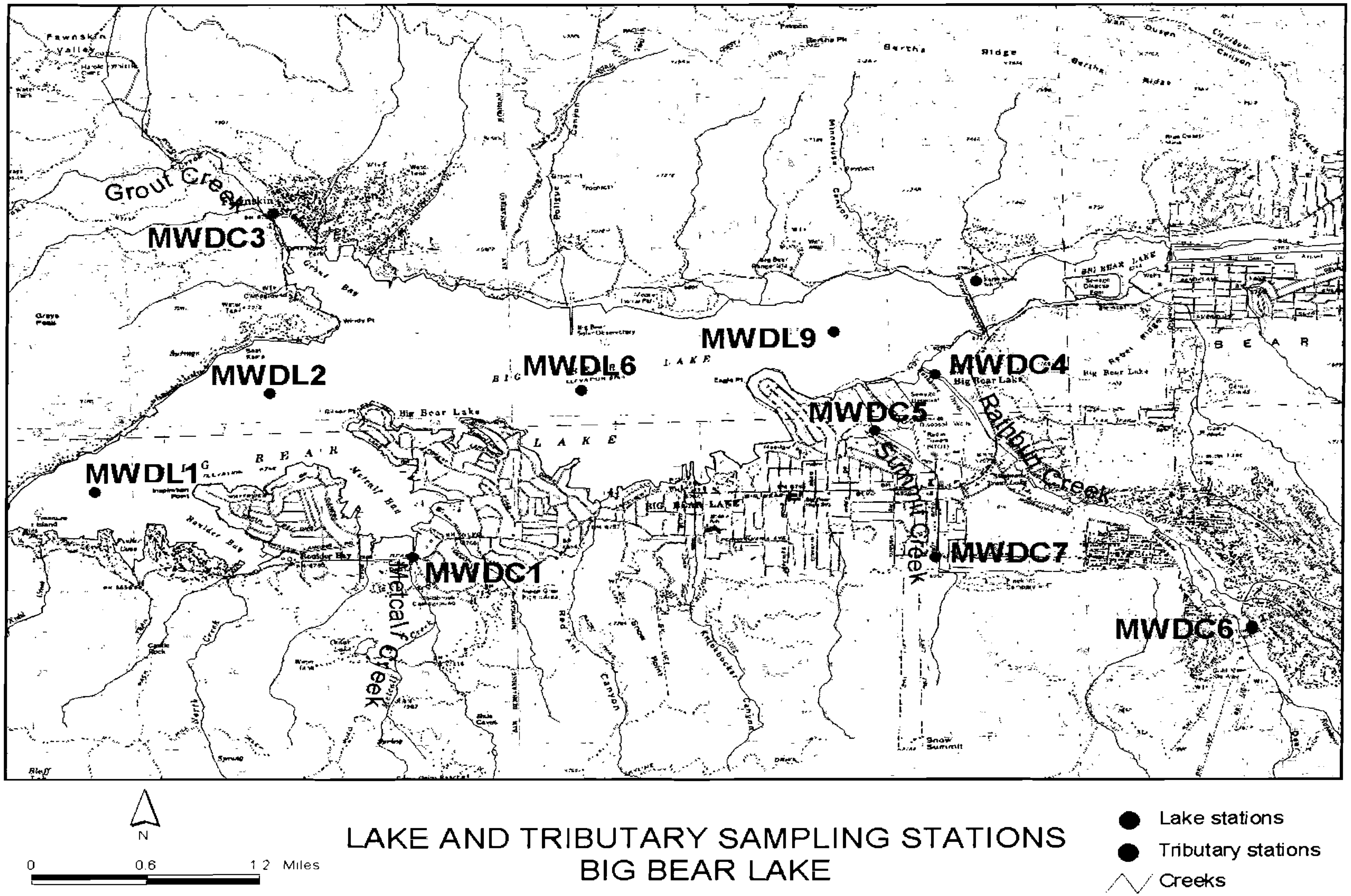
The established in-lake sampling locations in Big Bear Lake are depicted in Figure 2. The Big Bear Lake open water sampling locations, site identification numbers, and GPS coordinates are as follows:

Station Number	Station Description	GPS Coordinates (a)
MWDL1	Dam (Site No. 1)	N 34° 14' 14.9" W 116° 57' 59.9"
MWDL2	Gilner Point (Site No. 2)	N 34° 15' 11.4" W 116° 56' 56.5"
MWDL6	Mid Lake Middle (Site No. 6)	N 34° 15' 7.2" W 116° 55' 18.3"
MWDL9	Stanfield Middle (Site No. 9)	N 34° 15' 25.9" W 116° 53' 56.0"

Notes:
(a) Datum NAD 83

Since their initial establishment (i.e., June 2001), the above in-lake monitoring stations have been marked by water quality monitoring buoys that are secured in place by 500 pound concrete anchors. As in the past and for future sampling events, station location will be verified by recording station GPS coordinates at each station buoy. The recorded

FIGURE 2. MAP OF BIG BEAR LAKE NUTRIENT TMDL MONITORING STATIONS



GPS coordinates will be compared to the above values to verify that the station locations have not moved substantially.

4.2 Sampling Frequencies

Nutrient and supporting water quality samples will be collected in accordance with an established schedule at each station. Samples will be collected in Big Bear Lake from March to November of each year. During the winter months of December, January and February, the lake will not be monitored due to the potential ice formation on the lake surface which generally renders one or more of the open-water lake stations inaccessible.

The recommended nutrient and water quality sampling frequencies for Big Bear Lake are as follows:

Month	Number of Vertical Profile & Water Quality Sampling Events (a)	Scheduling Comments (b)
March	One Event	Schedule sampling near the middle of the month
April	One Event	Schedule sampling near the middle of the month
May	Two Events	Schedule sampling during the first and third week of month
June	Two Events	Schedule sampling during the first and third week of month
July	Two Events	Schedule sampling during the first and third week of month
August	Two Events	Schedule sampling during the first and third week of month
September	Two Events	Schedule sampling during the first and third week of month
October	Two Events	Schedule sampling during the first and third week of month
November	One Event	Schedule sampling near the middle of the month

Notes:

(a) For each sampling event, both physical data (via vertical profile) and chemical data (via water quality sampling) will be collected.

(b) The recommended sampling schedule provides sufficient temporal resolution.

The proposed sampling frequency will result in a total of 15 lake sampling events each year and will result in a total of 120 samples per year (15 events x 4 locations x 2 sample depths).

The selected sampling frequency is similar to the sampling frequency conducted in recent years (i.e., 2001 through 2006). Sampling frequency and types are sufficient to ensure that the primary objectives of the Big Bear Lake Nutrient Monitoring Plan are met. Further, the proposed sampling approach and resolution are sufficient to support statistical analyses and interpretation of lake water quality responses relative to the existing water quality database (Dr. William Edwards, Niagara University, personal communication).

4.3 Sampling Techniques & Parameters

Lake water quality samples will be collected using techniques essentially identical to those employed for previous baseline characterization and TMDL development monitoring efforts (i.e., for lake monitoring years of 2001 through 2006). Water quality sample types collected at each station will consist of a photic zone composite and a bottom discrete sample of lake water. Both sample types will be collected using the Weber sampling apparatus. The photic zone composite sample will be determined by the secchi disk depth, such that equal aliquots of sample will be collected from the surface (surface = 0.5 meters below water surface), the secchi disk depth on station, and 2 times the secchi disk depth on station. Bottom discrete samples will be collected above the lake bottom (bottom = 0.5 to 1.0 meter above the lake sediments).

Photic zone composite and bottom discrete samples will be analyzed for the following parameters:

	Sample Types	
Parameters	**Photic Zone Composite**	**Bottom Discrete**
Total Phosphorus (TP)	X	X
Total Dissolved Phosphorus (TDP)	X	X
Orthophosphate (OP)	X	X
Total Nitrogen (TN)	X	X
Total Dissolved Nitrogen (TDN)	X	X
Ammonia-Nitrogen (NH3-N)	X	X
Nitrate+Nitrite-Nitrogen	X	X
Total Suspended Solids (TSS)	X	X
Total Dissolved Solids (TDS)	X	X
Alkalinity	X	
Hardness	X	
Total Organic Carbon (TOC)	X	
Dissolved Organic Carbon (DOC)	X	
Chlorophyll a	X	

The majority of water quality samples for total nutrients, dissolved nutrients and other supporting water quality indicators will consist of a photic zone composite (conservatively defined as 2.0 times the secchi disk depth) and a discrete bottom sample (collected 0.5 m above the sediment-water interface) collected at each of the four main sampling stations. Chlorophyll-*a*, total organic carbon (TOC), dissolved organic carbon (DOC), biochemical oxygen demand (optional; BOD_5), hardness, and alkalinity will be collected as photic zone composite samples only.

In addition to the above chemical constituents, the following physical measurements will be taken at each lake station for each lake sampling event. The physical measurements include:

- Water temperature (ºC)
- Dissolved oxygen (mg/L)
- Specific Conductance (mS)
- pH (s.u.)
- Turbidity (NTU)
- Water Clarity (secchi disk)

The physical measurements will be taken using a YSI 6920 multi-parameter sonde and secchi disk. Water quality physical parameters (i.e., dissolved oxygen, pH, water temperature, specific conductance, and turbidity) will be recorded at the surface (i.e., 0.5 meter below the air-water interface) and at 1.0 meter depth intervals. Water clarity measurements (i.e., secchi disk depths) will be recorded in centimeters. The multi-parameter sonde will be calibrated each day prior to the commencement of lake sampling activities. Meter calibration will be recorded on the designated forms and/or in the project field logbook. Field measurements will be recorded on a designated form also.

District sampling personnel will use the YSI 6920 multi-parameter sonde to gather lake vertical profile data during lake water quality sampling activities. Field measurements and water quality samples will be collected using the Weber sampling apparatus, a YSI 6920 multi-parameter sonde and a secchi disk.

The primary sampling team will be Mr. Jim Weber of Big Bear Municipal Water District (BBMWD) and another staff member from the Big Bear Municipal Water District.

4.4 Analytical Laboratory, Methods and Data Quality Objectives

GEI Consulting (formerly Chadwick & Associates) has been the analytical laboratory utilized to analyze the majority of recent lake water quality samples collected from Big Bear Lake. The current Big Bear Lake water quality database (June 2001 to November 2006) is almost entirely comprised of nutrient and supporting water quality samples analyzed by the GEI Consulting laboratory. Initially, GEI Consulting was selected to conduct the water quality sample analysis due to their abilities to perform ultra-low level nutrient analyses. In the future, the analytical laboratories selected for nutrient and water quality analyses for Big Bear Lake will provide analytical QA/QC services that are determined to be compatible with the Surface Water Ambient Monitoring Plan (SWAMP) guidance.

The recommended analytical methods and the corresponding Data Quality Objectives are provided below. Data Quality Objectives (DQO), Measurement Quality Objectives (MQOs) and Data Quality Indicators (DQI) for the monitoring elements in this Plan are essentially based on the default DQIs and MQOs recommended in the SWAMP guidance document. The Plan MQOs/DQIs for Completeness, Sensitivity, Precision, and Accuracy for sampling events and analytical methods have been established in accordance with the SWAMP guidelines and are sufficient for the measurement of nutrients and the comparison of results to TMDL numerical targets.

Low Level Nutrient Analyses of Water Samples

Parameter	Method	Units	MDL/TRL	Accuracy	Precision	Recovery	Completeness
Total Nitrogen	Standard Methods 4500-N B	mg/L	0.004	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Total Dissolved Nitrogen	Standard Methods 4500-N B (with Durapore HV 0.45 µm filter)	mg/L	0.004	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Ammonia Nitrogen	QuickChem 10-107-06-3-D with 0.45 µm filter	mg/L	0.003	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Nitrate-Nitrite Nitrogen	QuickChem 10-107-04-1-B with 0.45 µm filter	mg/L	0.005	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Total Phosphorus	QuickChem 10-115-01-1-U	mg/L	0.002	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Total Dissolved Phosphorus	QuickChem 10-115-01-1-U (with Durapore HV 0.45 µm filter)	mg/L	0.002	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Ortho-Phosphate	QuickChem 10-115-01-1-T with 0.45 µm filter	mg/L	0.003	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%

Supporting Water Quality Analyses (Laboratory)

Parameter	Method/Range	Units	MDL/TRL	Accuracy	Precision	Recovery	Complete-ness
Chlorophyll a	SM 10200	µg/L	2.0/2.0	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Total Suspended Solids (TSS)	Standard Methods 2540 D	mg/L	1.0/1.0	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Total Dissolved Solids (TDS)		mg/L					
Total Organic Carbon (TOC)	SM 5310 B	mg/L	0.1/0.6	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Dissolved Organic Carbon (DOC)	SM 5310 B With pre-filtration	mg/L	0.1/0.6	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Alkalinity as $CaCO_3$	Standard Methods 2320 B	mg/L	0.2/1.0	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%
Hardness as $CaCO_3$	Man Ver 2 Buret Titration HACH 8266	mg/L	0.2/1.0	Standard Ref. within 95% CI	Laboratory duplicate 25% RPD	Matrix Spike 80 -120%	90%

Notes:
MDL = Method Detection Limit
TRL = Target Reporting Limit

Conventional Water Quality Parameters (Field Monitoring)

Parameter	Method	Units	MDL/TRL	Accuracy	Precision	Recovery	Complete-ness
Water Depth	Marked Tape	m	N/A	0.2 m	N/A	N/A	90%
Secchi Depth	Secchi Disk	cm	N/A	N/A	N/A	N/A	90%
Temperature	Thermometer (-5 to 50)	Celsius	-5 °C	+/- 0.5 °C	+/- 5%	N/A	90%
Dissolved Oxygen	Electronic Meter/sonde	mg/L	0.1	+/- 0.5 mg/L	+/-10%	N/A	90%
pH	pH meter (4.0 to 10.0)	s.u.	2.0	+/-0.5 s.u.	+/-5%	N/A	90%
Specific Conductance	Conductivity Meter	µS/cm	2.5	+/-5%	+/-5%	N/A	90%
Turbidity	Nephelometer	NTU's	0.1	+/-10%	+/-10%	N/A	90%

5.0 SAMPLING PROCEDURES AND PROTOCOLS

5.1 Sample Collection Procedures

In-lake nutrient and supporting water quality data will be collected in accordance with the following procedures at each station:

1. Travel to the first station marked with an identifying buoy and/or activate GPS system and travel to the selected sampling station. Generally, samples should be collected from west to east (i.e., in the order of MWDL1, MWDL2, MWDL6, and MWDL9). Anchor the boat at the station. After anchoring, record latitude and longitude coordinates on the field notes and compare GPS readings to target coordinates. Record lake observational data such as water color, the presence or absence of fish kills and/or algae blooms. Record wind direction, wind speed, and other weather conditions (e.g., precipitation, sky conditions).

2. Record the site identification, total water depth, and sample date and time at each station on the designated field forms.

3. Determine the total water depth at the station by lowering the marked roped weight until it hits the bottom. Record the total water depth from the rope. Take caution in lowering the weight as to not stir the bottom sediments, or to back splash water.

4. Take and record the secchi disk depth at the station. Read the secchi disk depth from the sunny side of the boat, and record the water depth that brackets the depth where the secchi disk disappears and reappears upon slight vertical movement. For highest accuracy, secchi disk depth readings should be taken between 10:00 am and 1:00 pm.

5. Collect the lake physical measurements via vertical profiling with a 6920 multi-parameter sonde. Record the measurements on the designated field form. Take physical measurements at the surface and continue at one meter intervals until reaching the last one-half meter above the lake bottom (sediment-water interface). For example, if the total water depth on station is 10 meters, the last physical measurements will be taken at 9.0 meters and 9.5 meters. The sampler must be careful not to allow the YSI 6920 sonde to come into contact with bottom sediments. The lake surface measurements will be collected at 0.5 meter below the surface of the water and will be labeled as "0" meters or surface. The next sample will be taken at 1.0 meter below the surface of the water, etc.

6. Prepare to collect the photic zone composite sample and discrete bottom water quality samples. Sample bottles will be labeled with the parameters for analysis. Field sampling personnel will verify sample bottle labels in the field to ensure the appropriate sample station identification. After each sample is

collected, field personnel will note the stations sampled in the field logbook and complete the chain of custody. The field logbook notes must include the sampling date, sampling times, and sampling team names.

7. Review the secchi disk depth recorded on the field notes. Determine the photic zone depth by multiplying the secchi disk depth by 2.

8. Prepare to collect photic zone composite sample by flushing the Weber sample pump apparatus with station lake water. Allow enough time to thoroughly flush all lines and pump.

9. Collect the photic zone composite sample by sampling equal aliquots of lake water at the surface, the secchi disk depth, and 2X the secchi dish depth using the rinsed Weber sample pump apparatus. Run the pump in mix mode to ensure a homogeneous sample. Remember to ensure that the chlorophyll *a* sample is collected in the amber 1.0 L Nalgene sample bottle.

10. Collect photic zone composite water quality samples in the pre-labeled and designated sample bottles. Samples bottles must be received clean and pre-rinsed from the analytical laboratory. Bottles will be rinsed with laboratory de-ionized water. Water samples collected from the lake will be placed in the cooler and stored on ice immediately after collection.

11. Prepare to collect the bottom discrete sample. Discard the remaining photic zone composite sample from the sample collection bucket. Lower the suctioning end of the Weber sampling apparatus to approximately 0.5 to 1.0 meter above the lake bottom (i.e., sediment-water interface) and ensure thorough rinsing of the device and hose. After device is well-rinsed, pump up the lake bottom sample and fill the designated sample collection bucket (5-gallon). The bottom sample will be a discrete water column sample. For example, if the total water depth is measured at 10 meters, then the bottom discrete sample will be collected at approximately 9.0 to 9.5 meters water depth. The bottom discrete sample bottles will then be filled from the bottom water collected in the sample bucket.

12. After collecting the bottom discrete sample, rinse the Weber sampling apparatus thoroughly with surface water to ensure it is free of bottom debris (especially if any material/sediments are visible).

13. Immediately after collection, place all samples on ice and in the ice chest. The ice chest should be lined with a heavy duty trash bag (to contain water from melted ice). Sample bottle caps should be sealed with black electrical tape to ensure that caps do not come off during transportation.

14. The samples will be stored on ice and returned to the lab. For every other sampling event, one laboratory duplicate sample (lab QA/QC sample), a field duplicate, and a field blank will be collected at one of the station location. In deemed necessary, a trip blank will also accompany each batch of samples collected for analyses.

15. Repeat the above procedure at each sampling point.

5.2 Sample Handling

This section briefly describes the sample handling procedures to be followed during field activities. A detailed discussion of the QA/QC measures to be followed during sample handling is presented in the QAPP associated with this Plan.

Labeling

Sample labeling is the task most susceptible to the introduction of error. To minimize this problem, sample bottles will be labeled as fully as possible prior to conduct of sampling activities. This will minimize the possibility of cross labeling samples between sites and will ensure that mis-labeling is not an issue. At a minimum, all sample labels will contain the following information:

- Station Name (Dam, Gilner Point, Mid Lake Middle, & Stanfield Middle);
- Site Identification (MWDL1, MWDL2, MWDL6 & MWDL9);
- Sample Date; and,
- Parameters Sampled

The sample time and the initials of the person collecting the sample will be recorded on the sample bottle in the field. This information should be recorded at the time sample labels are verified on station.

Chain-of-Custody

To maintain sample accountability and promote clear communication with the analytical laboratory, a chain of custody record will accompany all samples from the point of collection to the lab. The COC form will indicate to the analytical lab the desired water quality analyses.

Containers, Preservation, and Transport

All sample bottle containers will be provided by the selected analytical laboratory. Due to the use of low level nutrient analyses, none of the samples require the inclusion of sample preservatives. Samples must be shipped via overnight delivery to the analytical laboratory. If necessary, constituents will be preserved at the laboratory to ensure holding time compliance. Arrangements for sample shipping will be made with UPS.

5.3 Sampling Equipment

Sampling equipment, supplies, and instrumentation required for each sampling event includes the following:

- Weber Sampling Apparatus (with sample bucket & hose)

- Van Dorn Sampler (as back-up sampling device)
- YSI 6920 multi-parameter sonde
- GPS Unit
- Secchi disk
- Roped weight
- Gloves
- Ice and ice chest
- Chain of custody forms
- Field notes forms
- Pen and sharpie marker
- Sample Bottles with Labels
- Radio
- Life vest

6.0 DATA MANAGEMENT

Data will be compiled and maintained at the Big Bear Municipal Water District office. As needed, the information will be shared with the Santa Ana Regional Water Quality Control Board, State Water Quality Control Board, TMDL Stakeholders, and upon request, to other state, federal, and local agencies and organizations. Water quality data from Big Bear Lake will be provided to the Regional Board in a spreadsheet format that is compatible for importing into the SWAMP database. The analytical laboratory will be asked to supply all data in an electronic format using a template that is SWAMP compatible.

7.0 REPORTING

For each year of in-lake nutrient and supporting water quality monitoring under this Plan, the results will be summarized in an annual report and submitted to the RWQCB. The annual report will evaluate the data collected and provide a comparison of compliance with the TMDL numeric targets (i.e., total phosphorus and chlorophyll a) and applicable Basin Plan objectives of concern (dissolved oxygen and total inorganic nitrogen). The annual report is due to the Regional Board by February 15th of each year.