6 PROGRAM OF IMPLEMENTATION

As mentioned in Section 3.2, previous studies of Clear Lake indicate that the nuisance blue-green algae problem is a result of excess phosphorus inputs to the lake. These studies recommend that phosphorus loading from the surrounding watershed be controlled to improve water quality in the lake (Horne, 1972, Richerson et. al., 1994, Goldstein and Tolsdorf, 1994, Tetra Tech, 2004).

Most phosphorus is delivered to the lake attached to sediments that have eroded from the watershed. Therefore activities that cause an increase in erosion will most likely increase phosphorus loading to the lake. Excess phosphorus may enter the lake through erosion from roads, agricultural lands, stream channels, construction, gravel mining, wildfires and control burns, timber harvesting, livestock grazing, off highway vehicle use, dredging and filling, and stormwater runoff. Other activities such as fertilizer use or sewer and septic overflows may also increase the phosphorus loading to the lake. This section describes existing efforts and evaluates four implementation options for the control of phosphorus into Clear Lake.

As mentioned in Section 3.2, Existing Conditions, nitrogen concentrations are often high in the lake, especially during the summer and fall. It has been argued that the implementation program should also consider nitrogen controls as well as phosphorus controls. However, nitrogen fixation by certain species of blue-green algae may make nitrogen controls less effective.

This implementation program focuses on reducing phosphorus because the best available scientific studies indicate that phosphorous load reductions will positively affect nuisance blue-green algae levels. However, Central Valley Water Board staff recognizes that further study is needed to determine whether other factors other than phosphorus inputs have an impact on algae growth in the lake. For this reason, the Basin Plan Amendment calls for additional studies to be conducted to investigate the role of other factors such as nitrogen, iron and sulfur and to evaluate the chlorophyll-a target and load allocations.

6.1 Related Efforts

Currently there are many activities being undertaken pursuant to other programs or permits that contribute to reducing phosphorus loading in the Clear Lake watershed. Since 1991 the clarity of the lake has improved, possibly due to the results of these activities. These activities are summarized below.

6.1.1 Middle Creek Flood Damage Reduction and Ecosystem Restoration Project

The Lake County Department of Public Works (LCDPW) is working with the US Army Corps of Engineers (USACE) and other agencies to restore 1,400 acres of wetlands near Rodman Slough, which is located at the confluence of Middle and

Scotts Creeks. These two creeks drain into the Upper Arm and represent 57% of the inflow into Clear Lake. The USACE estimated that the restoration project would reduce annual phosphorus loading from Scott's and Middle creeks to Clear Lake by 40%.

6.1.2 Full Circle Effluent Pipeline

Full Circle is a wastewater reuse system whereby wastewater from communities surrounding Clear Lake is diverted for injection into the Geysers geothermal resource area for geothermal power generation. The first phase of the project was constructed in the 1990s and consists of a pipeline serving the communities in the northern and eastern portion of the lake. The second phase will divert wastewater from existing treatment plants in Lakeport and Kelseyville for injection into Geysers geothermal resource area. The schedule for the second phase includes planning and environmental review during 2004-2005, final design and funding acquisition during 2005-2006, and construction during 2006-2008.

6.1.3 East and West Lake Resource Conservation Districts

The East and West Lake Resource Conservation Districts (RCDs) provide technical and financial assistance to promote conservation of soil, water and related resources. The RCDs work with watershed groups and local landowners to implement erosion control projects in the Clear Lake watershed. These projects reduce the overall sediment load into the lake. East and West Lake RCDs are currently working with state regulatory agencies to develop a streamlined permitting process for erosion control projects in their areas. This will facilitate implementation of projects that have an overall positive impact on the environment.

6.1.4 Stormwater Permits (Phase II, Construction, Caltrans)

There are three statewide stormwater permits operating in the Clear Lake watershed. The Phase II stormwater permit addresses discharges from urbanized areas. The construction permit applies to construction activities that disturb one acre or more. The Caltrans stormwater permit addresses stormwater runoff from all state roads. The Lake County Clean Water Program Advisory Council, which is made up of the stormwater permittees (County of Lake, City of Clearlake, City of Lakeport), administers the Phase II and construction permits in Lake County. They have developed a Stormwater Management Plan (http://www.waterboards.ca.gov/stormwtr/docs/lake_co_swmp.pdf) that lists the best management practices (BMPs) that are being implemented to address stormwater runoff. These BMPs include public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management and pollution prevention/good housekeeping for municipal operations. As part of the stormwater program, Lake County Community Development Department is updating the grading ordinance for the County. The

Caltrans stormwater permit requires that agency to implement BMPs to reduce the impact of stormwater runoff from state roads.

6.1.5 Timber Waiver Program

Timber harvest activities that may cause a discharge of waste to waters of the state are regulated under the Timber Waiver Program of the Central Valley Water Board. In January 2003 the Central Valley Water Board adopted a Waiver of Waste Discharge Requirements for Discharges Related to Timber Harvest Activities. Timber harvesting operations must meet certain requirements in order to apply for coverage under this waiver. These requirements include implementing practices designed to eliminate erosion, as well as pre, during and post-harvest monitoring to evaluate if the practices have been implemented effectively. These measures are implemented in addition to the practices required under the State Forest Practices Rules. Timber harvesting activities occur in the Clear Lake watershed on both private and U.S. Forest Service lands (Mendocino National Forest). These operations are required to apply for coverage under the Timber Waiver. Central Valley Water Board staff review applications for coverage under the waiver and conduct inspections on a select number of operations.

6.1.6 Irrigated Lands Program

Discharges from agricultural lands in the Central Valley Region are regulated under the Irrigated Lands Program. Dischargers of irrigation return flows and stormwater from irrigated lands can apply for coverage under the Agricultural Waiver if they meet certain conditions. Most dischargers choose to participate in one of the nine large “coalition groups” that have been organized to meet the requirements of the program. The coalition groups are responsible for monitoring the effects of agricultural discharge in their areas and reporting the results to the Central Valley Water Board. The Sacramento Valley Water Quality Coalition has conducted monitoring throughout the Sacramento River watershed to assess the impact of agricultural runoff on water quality. In Lake County the Farm Bureau has organized a local group, called the Lake County Farm Bureau Education Corporation (LCFBEC), which works with the Sacramento Valley Water Quality Coalition. LFCBEC is working to find funding for monitoring and implementation of best management practices on agricultural lands in Lake County.

6.1.7 Water Quality Certification Program

Under Section 404 of the Clean Water Act (CWA) any dredge and fill activity that would cause a discharge to waters of the United States must receive a federal permit. The U.S. Army Corps of Engineers administers the Section 404 permits. Section 401 of the CWA states that a 404 permit also requires certification from the respective state. The Central Valley Water Board’s Water Quality Certification Program (WQC) works to fulfill this requirement. Typical projects for which WQC is requested include new subdivisions, bridges, roads, pipeline construction; levee reconstruction; wetland habitat improvement; pier installation; boat harbor dredging; gravel mining; flood control excavation; and minor stream

crossings. There are about 8 WQC applications each year in Lake County. Typical projects include highway maintenance, lagoon dredging, mine reclamation and construction activities near watercourses.

6.2 Implementation Alternatives Considered

The following four options were considered for implementation of the Clear Lake nutrient control program:

6.2.1 Alternative 1 – No Action

Under this alternative the activities described in Section 6.1 above would continue as is, with no additional requirements. No monitoring or reporting would be required of the responsible parties and the Central Valley Water Board would not review progress towards achieving the loading reduction required under this nutrient control program.

6.2.2 Alternative 2 – Individual Reporting

This alternative would add additional requirements to the existing activities that are now occurring in the Clear Lake watershed. These requirements would be continued studies, reports or management plans, monitoring, and possibly implementation of Best Management Practices (BMPs) to control phosphorus loading to the lake.

Continued Studies: As discussed in Section 3.2, Clear Lake is a complex system and several questions remain regarding nutrient cycling and algal blooms in the lake. Under Alternatives 2 these questions would be evaluated through continued studies. These studies would include investigating the cause of the recently improved clarity in the lake and the role of nitrogen or iron in controlling algae blooms. Under this alternative, additional studies may also be conducted to evaluate the chlorophyll-a target and loading allocations.

Reports or Management Plans: By five years after approval of the Basin Plan Amendment by OAL the responsible parties would be required to submit a report or management plans to the Central Valley Water Board that evaluates their progress towards meeting the load allocations and waste load allocations described in the Basin Plan Amendment. Responsible parties would be required to estimate their phosphorus loads, describe actions implemented and actions planned to reduce phosphorus loading, and gauge the effectiveness of their phosphorus control actions. By ten years after approval by OAL responsible parties would be required to submit a progress report updating the Central Valley Water Board on these items.

Monitoring: Monitoring would be conducted to evaluate conditions within the lake, estimate phosphorus loading into the lake (tributary monitoring) and evaluate the effectiveness of implementation actions. Monitoring conducted as part of the

Irrigated Lands waiver program would also be incorporated into the overall analysis. The results of the monitoring would be used to guide further implementation activities, as necessary.

BMP Implementation: Central Valley Water Board staff would review the reports submitted by the responsible parties to evaluate whether the actions they are implementing are improving conditions in Clear Lake with respect to nuisance algae blooms. If the Central Valley Water Board determines that conditions are not improving, responsible parties might be required to implement BMPs to control phosphorus loading to the lake.

Each responsible party would be responsible for producing a report or management plan that contains the required information. However, the responsible parties would be encouraged to work together to conduct studies, estimate phosphorus loading and monitor conditions in the lake.

6.2.3 Alternative 3 – Adaptive Implementation

Under Alternative 3 the responsible parties would be required to work together to develop and implement a plan to collect the information necessary to determine what factors are important in controlling nuisance blooms and to recommend what control strategy should be implemented.

The plan would address the following topics:

- Studies needed to evaluate the factors affecting algae growth in the lake. Recent data indicate that clarity has improved in the lake yet phosphorus levels have not dropped appreciably. Other factors such as nitrogen, iron or sulfur may have an impact on algae growth in the lake.
- Appropriate monitoring for evaluating conditions in the lake. It should be determined whether chlorophyll-a or secchi depth, or another method is the most appropriate measure of nuisance algae growth in the lake.
- Effective collection of phosphorus loading information from the lake. Phosphorus loading can be determined through either computer modeling or monitoring or a combination of the two methods.
- Practices implemented or planned to control phosphorus loading to the lake. An accounting of these activities is necessary to determine progress towards achieving compliance with the loading allocations.
- Information necessary to determine if Clear Lake is no longer impaired. Central Valley Water Board staff and the responsible parties should agree upon the conditions within the lake that when achieved would mean that beneficial uses are being attained.

The plan would be due to the Central Valley Water Board one year after the Basin Plan Amendment is adopted by the Office of Administrative Law. Once the plan is submitted, Central Valley Water Board staff would work with the responsible parties to find funding to implement the different elements of the

plan. To implement the plan the responsible parties would have to conduct studies, monitor conditions in the lake, estimate phosphorus loads, describe management practices and determine the impairment status of the lake. This information will be submitted to the Central Valley Water Board.

Five years after adoption of the Basin Plan Amendment Central Valley Water Board staff would review the information submitted by the responsible parties to determine whether the phosphorus load and waste load allocations should continue to be required or if some other control strategy or approach is more appropriate. If staff determines that conditions are not improving, responsible parties might be required to implement additional Best Management Practices (BMPs) to control phosphorus loading to the lake.

If at any time, based on the information provided by the responsible parties, the Central Valley Water Board determines that Clear Lake is attaining its beneficial uses and that phosphorus loads do not cause or contribute to nuisance algae problems, the load allocations and waste load allocations will no longer apply.

6.2.4 Alternative 4 –Immediate BMP Implementation

Under this alternative each Responsible Party would be required to reduce all controllable sources of phosphorus to Clear Lake. Under this alternative, for example, the USFS, BLM and Caltrans would be required to fully implement erosion control activities even if actions located in other parts of their watersheds (such as the Middle Creek Marsh Restoration Project) are sufficient to reduce phosphorus loading to acceptable levels.

6.3 Evaluation of Alternatives

6.3.1 Attainment of Water Quality Objectives

Alternative 1 may or may not result in the attainment of water quality objectives in Clear Lake. Water quality has improved in the lake since the early 1990's most likely as a result of existing activities. However, it is unknown whether these actions are adequate for long term improvement in the lake. Alternatives 2 and 3 require the responsible parties to estimate phosphorus loading from their lands and to report to the Central Valley Water Board on whether or not the load reduction has been achieved and beneficial uses restored. Alternative 3 also requires that a consensus opinion be developed on what constitutes fully attained. The Central Valley Water Board would review the information provided by the responsible parties and determine if additional measures are needed to achieve compliance. In this way, it is expected that Alternatives 2 and 3 would result in the achievement of water quality objectives. Alternative 4 would require all responsible parties to reduce their phosphorus loads to the level achievable regardless of the impact of other actions. This would most likely result in a greater than 40% reduction in phosphorus loading. Alternative 4 would also result in the attainment of water quality objectives in the lake.

6.3.2 Cost

Under Alternative 1, no additional activities would be required and the cost of this alternative would be zero. Alternatives 2, 3 and 4 would require additional actions. The elements of Alternative 2 are reports, studies, monitoring, load estimates, and possibly BMP implementation. The elements of Alternative 3 are planning, studies, monitoring, load estimates and possibly BMP implementation. Alternative 4 would require BMP implementation on all controllable sources of phosphorus to Clear Lake. The estimated costs of these elements are described below.

Reports: Under Alternative 2, two reports are required (five and ten years after approval of the Basin Plan Amendment by OAL). The estimated cost of each report is $5,000. Two reports in a minimum reporting cost of $10,000. If each responsible party submitted a separate report the cost would be $60,000

Planning: Under Alternative 3 the responsible parties would develop a plan that describes how they will address the elements required under the proposed Basin Plan Amendment. It is estimated that development of a plan would cost $5,000.

Studies: Under Alternatives 2 and 3 further studies would be conducted to evaluate the dynamics of the Clear Lake ecosystem. The cost of these studies is variable. Richerson, et. al., (1994) conducted an in-depth study of algae in Clear Lake that cost $160,000. The County of Lake estimates that, with inflation, the cost of updating the report would cost $400,000.

Loading Estimates: Under Alternatives 2 and 3 phosphorus loading estimates from each responsible party would be required. Loading estimates can be determined either through computer modeling or by monitoring, or a combination of the two methods. The estimated minimum cost of a loading estimate using computer modeling is $5,000 per loading estimate. Monthly water quality monitoring at 20 sites at an estimated cost of $100 per sample would amount to $24,000 per year. In order to obtain loading estimates the stream gages on Scott's, Middle and Kelsey creeks would have to be maintained. The estimated cost of maintaining the stream gages is $50,000/year.

Monitoring conditions in the lake: Alternatives 2 and 3 would require the responsible parties to determine the appropriate monitoring strategy for evaluating conditions in the lake. Water clarity (secchi depth) or chlorophyll-a can be used to monitor conditions in the lake. The Department of Water Resources is currently conducting water quality monitoring within the lake about 10 times a year that includes measuring nutrient levels and water clarity. This monitoring is expected to continue. Chlorophyll-a monitoring costs approximately $70/sample. Chlorophyll-a would be monitored during the growing season (April through October). The cost of monitoring for chlorophyll-a ($70/sample at three sites at three depths for 6 months) is estimated at $3,780 per year.

BMP Implementation: Under Alternatives 2 and 3, the Central Valley Water Board would review the information about phosphorus loading and conditions in the lake submitted by the responsible parties. Depending on the results of this evaluation, additional BMP implementation may be required. Alternative 4 would require immediate BMP implementation in areas where phosphorus is being discharged.

The Clear Lake watershed has an estimated total stream length of 2,872,831 feet. For the purposes of this cost estimate it is assumed that BMPs would have the most direct impact on water quality if they were implemented within the 50-foot buffer zone around each stream. There are a total of 8,495 acres of land within the 50-foot buffer zone.

Under Alternatives 2 and 3 it is estimated that additional BMPs would have to be implemented on 5% of stream length and 5% of the 50 ft. buffer zone to bring the lake into compliance with water quality objectives. This estimate takes into account existing erosion control projects (such as the Middle Creek Ecosystem Restoration Project) that are being or will be implemented. It is estimated that Alternative 4 would necessitate implementation of BMPs on at least 30% of the stream lengths and 30% of the 50 ft. buffer zone.

Table 6.1 is a list of selected BMPs that can be implemented in the Clear Lake watershed to control erosion. Some of the BMPs are implemented on an area basis and their unit costs are shown by acre. Other BMPs are implemented on a linear basis and their associated costs are shown by foot.

Table 6.1: Cost of Selected BMPs[1]

Practice Name	Unit Type	Unit Cost
Filter Strip	AC	$100
Critical Area Planting	AC	$500
Restoration and Management of Declining Habitats	AC	$1,000
Lined Waterway or Outlet	FT	$30
Clearing and Snagging	FT	$50
Streambank and Shoreline Protection	FT	$125

Table 6.2 lists the estimated costs for Alternatives 1, 2, 3 and 4. Alternative 1, No Action, would result in no additional actions and therefore the estimated cost is $0. Alternative 2, Individual Reporting would require studies, monitoring, loading estimates, reports and possibly BMP implementation. Alternative 3, Adaptive Implementation, would require planning, studies, monitoring, loading estimates and possibly BMP implementation. Alternative 4, Immediate BMP Implementation, would require implementation of BMPs on and estimated 30% of

[1] Cost estimates from the Natural Resource Conservation Service: www.nrcs.usda.gov/technical/efotg

the stream length and 30% of the 50-foot buffer zone area. The estimated costs of these four alternatives are described below.

Table 6.2: Estimated Costs for Alternatives 1, 2 & 3

Action	Cost
Alternative 1	
No action – current activities continue as is	$0
Alternatives 2 & 3	
Reports (Alternative 2 only)	$10,000 - $60,000
Planning (Alternative 3 only)	$5,000
Continuing studies	Variable (est. $400,000)
Loading estimates using computer modeling	$5,000 each
Loading estimates using monitoring	$24,000/yr (modeling) $50,000/yr (stream gages)
Chlorophyll-a monitoring	$3,780/yr
Erosion control BMPs as identified (assume 5% of stream length and 5% of buffer zone)	$4,330,483 - $18,379,912
Alternative 4	
Erosion control BMPs on 30% of stream length and 30% of 50ft. buffer zone)	$26,011,317 - $56,413,940

6.3.3 Feasibility

This section discusses the technical feasibility of implementing each of the three Alternatives. Alternative 1 is technically feasible because it is a no action alternative that includes activities that are currently underway. Alternative 2 would require report writing, studies, monitoring, phosphorus load estimating and possibly BMP implementation. Alternative 3 involves planning, studies, monitoring, phosphorus load estimating, and possibly BMP implementation. Planning and report writing are common actions that resource management agencies conduct to guide their activities. Persons with the appropriate scientific background could conduct the continued studies. Researchers from the University of California at Davis conducted the first Clean Lakes Study (Richerson, et. al., 1994). These people, or people with similar scientific backgrounds would be available to perform the continued studies. Monitoring in the lake would require technically trained personnel. Currently the monitoring is being conducted by DWR who are technically capable of performing these actions. Any additional sample collection could be collected and processed by appropriately trained personnel. Loading estimation can be done via computer modeling or monitoring. Both of these activities are technically feasible methods for estimating loading that have been employed for TMDLs and other efforts

where pollutant loading is a concern. Alternatives 2 and 3 might include BMP implementation and Alternative 4 would require BMP implementation. The BMPs used in the cost analysis are technically feasible methods that are promoted by the National Resource Conservation Service (NRCS). Other technically feasible BMPs that address erosion exist and may be employed as a result of this nutrient control program.

6.4 Recommended Alternative

Central Valley Water Board staff recommends the adoption of Alternative 3, Adaptive Implementation. This approach represents a balance between the need to reduce phosphorus loading to the lake and the cost of implementation actions. The adaptive implementation approach will ensure that the appropriate actions are being taken to address the impairment in Clear Lake. Under Alternative 1 no loading estimates or other information about the lake would be submitted to the Central Valley Water Board. The Central Valley Water Board would find it difficult to determine if Clear Lake is meeting its beneficial uses. Alternative 2 would result in the information needed to assess conditions in Clear Lake but also may result in duplicative reporting and a waste of resources if each of the responsible parties submits an individual report. Alternative 2 might also result in requirements for excessive BMP implementation since each of the responsible parties will be evaluated separately; thus, not taking advantage of load reductions other responsible parties are able to achieve. Implementation of Alternative 4 would most likely bring Clear Lake into compliance with the water quality objectives, however full implementation of this alternative may result in unnecessary expenditures of resources. Alternative 3 is the preferred option because it combines resources, and includes a feedback mechanism, which allows the Central Valley Water Board and the responsible parties to work together to evaluate current activities and focus resources where there is the greatest need and greatest potential for improvement.