AquaTechnex

Water Clarity Improvement Plan 2010

AquaTechnex, LLC

Presented to SVLA for Consideration by ►►►

PO Box 4193
Palm Desert, CA 92261
760-272-5842
www.aquatechnex.com

Introduction

On Thursday February 18th, Aquatechnex biologists and Spring Valley Lake Association Directors and Staff held a planning session to identify and plan missions to manage lake water quality issues. The team used a planning process called the Flawless Execution Model, a program developed by Afterburner, Inc. of Atlanta, Georgia. This system is adapted from procedures and protocols developed by the United States Air Force and are extremely useful in formulating programs that will be effective if executed properly.

2010 Mission Planning

Once the Future Picture is developed, planning teams need to develop the missions that will be necessary to implement to accomplish that goal. The Flawless Execution Engine is used to develop these plans/missions. This system uses a cyclical process that consists of planning, briefing the plan to those responsible for execution, executing the plan, debriefing at the end of the mission and using that process over again to move to the next mission. The planning phase of this system was used to develop the information presented in this document for consideration by the Board for implementation.

This planning process has six steps that the team must work through. That work was accomplished at the Thursday workshop.

Step One, Determine the mission objective

The first critical step is to develop a clear understanding of what the mission objective will be for the period of time in question. This mission objective has to be clear, measureable, achievable and support the Future Picture.

History

The information in this part of the Lake Plan was put together using several sources. The information does not include outcomes of decisions made as to the maintenance of the lake. This information will only include proposed and tried maintenances and may name people involved in those decisions. Although there could be many other ideas how these decisions came about, this report is not meant to be an interview with persons who were involved in solving the problems with the lake.

Construction:

The master planned recreation oriented community was created by Boise Cascasde Properties, Inc. and named, Spring Valley Lake. The excavating of the lake began in June 1969. The lake was completed and filled by February 8, 1970.The master plan was to accommodate the popular sixteen foot water skiing boats. This size boat would minimize the wave erosion effect to the shore line.

Excavation of the lake was done at 15 feet under the ground level with seven million cubic yards of dirt moved out. Ten (10) dewatering wells were needed to lower the under ground water level while the lake was being constructed.

The lake would be filled with 1,080,000,000 gallons of water being pumped into the basin at a rate of 20,000 gallons per minute, around the clock, by the ten wells already in place. The plan for the lake would be 800 feet from side to side at the narrowest point. The lake design was for 200 surface acres and nearly 7 miles of shoreline with a maximum length of 6,000 feet. The depth would range from nine feet to 22 feet. In the center of the lake a swale was designed where trout would be able to survive in the coldest part of the lake during the hot months of the year. Constant water to the lake would flow from the fish hatchery at a rate of 8,500 gal. per minute.

An on surface outfall tunnel, approximately 12 feet square, poured with steel and concrete was constructed to provide an outflow from the lake to the Mojave River; thus regulating the water flow from the lake back to the Mojave River. A 36 inch gate valve was added to be used only if the lake would need to be completely drained or to lower the lake to do shore line repairs.

Pipes measuring 18 inches in diameter were installed in the fingers to prevent stagnation by creating water flow between the fingers.

To hold the water in the man made lake, a lake liner would need to be applied. The liner consisted of clay, bentonite, chemicals and silt. This mixture was rolled on to the bottom of the lake, then compacted to a density of 98%. A gradual slope was constructed and sprayed with a curing compound in hopes of preventing wave erosion to the coving.

Lake water problems:

It was noted early on that the nutrients from the hatchery water would create an algae growth problem in the lake. For this reason, and at some point, the hatchery added settling ponds to help SVL receive a better quality of water.

In 1973, Boise engaged Dr. Goldman, a botanist from the University of California and Mr. Damavandi, a lake consultant, to conduct a study of the lake. Recommendations included the application of chemicals, Diquate and Casoran.

Another recommendation was to install twelve (12) new pumps in the quiet ends of each finger of the lake. This would be to maintain proper lake levels, to agitate and aerate the water (creating a build-up of oxygen during the critical summer months) and to increase circulation of water to the fingers.

Weed growth was determined to also be a potential problem with the man made lake. A harvester would need to be purchased to control the weed growth. It was determined that if the harvester was used on a scheduled basis, the results would be positive.

Over the next 30 years, several Water Quality Management studies have been done, and just as many solutions were given to the sitting Boards and General Managers. These solutions included chemical installations of various kinds, depending on the biochemical results done for each study. Suggestions also included lake dredging, and lake draining. Soil testing was also a part of an equation because soil, in which water runs through, provides the first contaminants in the lake. Other experts noted the lack of healthy weed growth in our lake. Those studies recommended a concentration of weed growth and let nature take it from there. Other studies determined that the lake water was not "clear" enough to allow the natural light penetration from the sun to help with the healthy weed growth, and that chemicals would be needed to help this process along. While still more experts felt that if the water was aerated efficiently, the sun would get to the level where plants were and thus the plants would flourish. This suggestion prompted the purchase and lease/purchase of a solar system for aeration. Another study made it clear that the Association needed to stop using the amounts of water (currently) from the hatchery. Of course, as you read on into the lake plan, you will read about the court decision for the water flow in the determined Verde Group.

Filtering systems have been suggested and proposed plans for those systems are explained in detail in this Lake Plan.

Fish types in the lake:

In 1970, Boise Cascade decided to have fish stocked and began a species study. Since then, Spring Valley Lake has been professionally stocked with trout, blue gill, crappie, catfish, and bass. As the lake plans progressed, several fishing areas were implemented. SVL members who do not reside in a lake front home, or do not own a boat, could fish from these fishing points.

Fishing was so successful that in 1984, the SVL Fishing Club was started and is still active as of this writing.

An exact date is not known when carp were first found in the lake. This fish is not a welcomed species and plans to eradicate them began to take shape. A method of shocking the fish was determined to be the better solution. A shocker boat was purchased. As fish (all species) are shocked in the lake and rise to the top, only the carp are netted and removed. The other fish are not harmed by this method. The shocker boat plan would need constant scheduling and record keeping for successful results.

In 2009, shad was successfully introduced into the lake. This schooling specie would add to the food chain for larger fish.

Alerts and dangers related to the lake:

Several studies over the years have mentioned a too large number of aquatic birds will increase the nutrient input into lakes. Geese, coots, ducks, and seagulls would need to be discouraged from seeking a comfortable life on our lake. Permits from the California Department of Fish and Game would provide information on this type of control.

Blue/green algae can cause some swimmers to have an itchy rash. For this reason, if readings are high, alerts are made to the community. Not everyone will have an adverse reaction to these algae, and so the lake does not require it to be closed.

From late 2008 to present, an alert was announced about Quagga/Zebra Mussels. This is a type of mussel that attaches itself to filtering and pump devises. These mussels could enter the lake from water craft that have been exposed to an infected mussel lake. Postings were made and erected at the docking area and a plan for water craft inspections was put into place.

Boat, watercraft and swimming safety have always been in the forefront of Rules and

Regulations for Spring Valley Lake. Suggestions have been implemented from the Public Safety Committee for increased officers for the busiest months on the lake. During the peak months of swimming, Memorial Day weekend through Labor Day weekend, lifeguards are at the swimming area.

The Public Safety dept. holds boating safety classes and issues a vessel operators permit to property owners who attend the class and take the test.

Mojave Water Agency (MWA)

Since 1993, Mojave Water Agency (MWA) has regulated and enforced the water usage for Spring Valley Lake Association. This section provides a brief history of MWA and its effect on Spring Valley Lake's water usage and cost.

History

In May 1990, the city of Barstow filed a lawsuit demanding delivery of water from the Mojave River. After 12 years of litigation, the Supreme Court finally established a ruling that ensured water to the city of Barstow. In 1993 MWA was appointed Water Master to administer the judgment. The Water Master's purpose is to verify production, collect assessments, monitor sub-area obligations and buy imported water from MWA on behalf of the parties to the judgment. The decision established an equitable distribution of natural water supply throughout the Mojave basin area.

Verde Ranch Group

The Verde Ranch Group was formed by the court to give a group of users the option of sharing their allocated water, provided that there is no increase in overall consumption use. The group consists of:

- DFG- Fish Hatchery
- SVL Country Club
- Spring Valley Lake Association
- Mojave Narrows Park
- Kemper-Campbell Ranch

Make-up water obligation

The final judgment awarded the city of Barstow 23,000 acre feet of water per year. All parties that are influenced by the judgment would have to share the burden of this obligation. The make up water obligation was negotiated and all producers would have to contribute to the reduction of use and share the cost of purchasing make-up water. The judgment by the courts established an annual production of water pumped for each user (i.e. Spring Valley Lake Association) from 1986 and 1990. Spring Valley Lake Association's annual production rate was determined to be ***3,056 acre feet.***

Spring Valley Lake's Obligation

Spring Valley Lake Association's obligation is determined by the sum of the association's ground water production plus inflow from the SVL Country Club minus outflow to the park.

Groundwater (wells) + SVLCC inflow –outflow to Narrows ***= SVLA production (3,056 AF)***

This calculation also includes:
- Lake evaporation
- Seepage
- Discharge to the Mojave Narrows

Water Master Assessments

The court's decision required all producers (SVLA) to pay the following assessments:

- Administrative ($3.40 per acre foot)
- Biological ($0.72 per acre foot)
- Replacement assessment ($432.00 per acre foot)[1]
- Make-up ($453.00 per acre foot)[2]

[1]The the amount of water pumped in excess of the producer's allocated amount (i.e. SVLA 3056 AF). Rate can vary.
[2]The make-up water cost is the producer share of the downstream sub-area obligation.

Water Ramp Down

The court's final decision required all parties to "ramp down" water production in order to:

- Raise funds for the purchase of imported water
- Curb over-production of water to provide a sustainable water supply
- Reduce the amount of water that can be pumped free of replacement water obligation

In 2003, the court additionally ordered a ramp down of water production at 5% per year until a level of 60% of total production was achieved. The ramp down has ensured that there is a balanced supply and demand of water to the affected parties named in the court decision of 2002.

The ramp down has affected Spring Valley Lake Association is two ways:

- Reduction of ***free water*** allocated to Spring Valley Lake Association has resulted in a cost for any water used over the 60% threshold, which has resulted in additional cost to homeowners.
- Reduction in the ability to use ***well water*** to flush our lake with nutrient-rich clean water has resulted in a challenge to regulate lake biological parameters, and has

contributed to the obvious lake problems that our community has incurred in the last several years.

Spring Valley Lake Association's production ramp down results in a reduction from the original allocation of 3,056 AF to 1,833 AF.

3,056 AF x 60% = 1,833 AF

If our production rate continues at the original allocation we will have to pay for 1,222 AF of water.

Example: 1,222 AF x $432.00* = $527,904.00 ($126.00 per lot/per year)[3]

[3]Water production and per acre feet cost could vary.
*Acre foot cost determined by 2011 MWA rates

The above calculation illustrates that the cost of supplying water to Spring Valley Lake Association for the use of our lake has increased due to the court decision made in 2002. This decision will ultimately ensure that the communities in the high desert will have a sustainable supply of water for the future.

Future Picture

The first step in using this system is to insure that the planning team understands the future picture Where do we want to be in the future? The consensus of the team was that the lake is the heart of the community. The lake has had water quality issues in the recent past. The future picture would be to get the lake back to where it was in the late 1990's. The key metrics identified to accomplish that would be to:

- Improve water clarity
- Restore appropriate aquatic plant life
- Insure a healthy fishery
- Insure recreational uses including boating, waterskiing and fishing

To accomplish this, the team then used the planning process to develop missions/program to accomplish this objective over time.

The four key metrics listed above all rely on improved water clarity. First, water clarity is a listed goal. Second, establishing appropriate aquatic plant life in the lake is not possible until water clarity improves. Aquatic plants need light to photosynthesize. The water clarity conditions currently are such that this is a limiting factor. The health of the fishery also has a water clarity component. Lastly, the boating community can limit their use of the lake if water clarity and algae conditions are such that those forms of recreation are impacted. Many species of bluegreen algae also pose a health threat to lake users.

As such, the team determined that the first mission must be to improve water clarity. This objective meets all of the tests, it supports the future picture, it is a clear objective, it is achievable provided the appropriate resources can be devoted to the mission and it is measureable.

The mission to be implemented during the 2010 season will be to improve water clarity in Spring Valley Lake to a 3-4 foot transparency level.

Step Two, Identify threats to accomplishing this mission objective

This process was used to list all of the potential threats or obstacles to accomplishing the mission outlined in Step One. During this process, the team listed internal threats and external threats. The team also discussed and classified these as controllable or uncontrollable.

Internal Threats to water clarity identified by the Team:

- Algae blooms in the lake degrading water clarity. These conditions are a severe problem during the spring, summer and fall. There are a number of potential solutions to these blooms, this was classified as controllable.
- Suspended Sediment in the lake degrading water clarity. Samples sent in recent days to BioSafe Laboratories identified suspended clay and sediments as a primary component of the lake water turbidity at this time of year. This component may also be present in the summer months but obscured by the extensive algae populations present in the lake. There are solutions to this problem and it was classified as controllable.
- Carp are a threat to water clarity because of their feeding methods. They cause turbidity problems. There are solutions to this problem and it was classified as controllable.
- Some members of the community may have issues with some of the tools necessary to control algae and suspended sediments; Alum was one example cited. There is extensive data from the US EPA and others to support the safe use of these materials that can be presented and this was classified as controllable.
- The Budget. Many of the strategies needed to improve water clarity required a significant financial commitment. Through proper planning and using the resources available over time effectively, we felt this could be classified as controllable.
- Boat traffic may be contributing to suspended sediments, particularly "bladder boats" designed to provide a large wake. If suspended clays remain an issue,

(sampling is proposed to determine and document this) education and focusing these activities in deeper water can mitigate that threat. So, this was classified as controllable.

External Threats to water clarity identified by the Team:

- The water quality of the source water coming into the lake is a major threat. These waters are extremely high in the nutrients required by algae to thrive. As algae are single celled organisms, they need to obtain the nutrients they need to thrive from the water column. Limiting those nutrient levels is a key step in limiting algae growth. This was classified as controllable.
- The regulatory environment. There are rules and regulations from various agencies that can present a challenge to the mission of improving water clarity. For example limitations on the use of certain algaecides. This was classified as uncontrollable in the short term and something that needed to be taken into account in the planning process.
- Storm drainage. Storm water normally carries considerable loads of sediments and other materials detrimental to the health of the lake. These often contribute directly to lake water clarity after storm events. The winter rains can be a major contributor. Summer flash thunderstorms can also have an impact. While the weather events are uncontrollable, improvements in stormwater management both within the community and within the watershed outside the community is mandated by environmental laws. Over time, this can be controllable.
- Waterfowl contribute nutrients that drive algae blooms. The lake is used by a number of migratory and local waterfowl. It is not known how significant their contribution is to the nutrients present in the lake compared to other sources. There are methods to mitigate this issue so this was classified as controllable.
- Evaporation requires water inflows to maintain the lake level. Evaporation also concentrates nutrients and minerals. This was classified as uncontrollable.

Developing and listing these was a key step in moving to the next phase of the mission planning process.

Step Three, Identify your available resources

The process here reviews all of the resources available to use to accomplish this mission. It includes looking at training, leadership, people, fiscal resources, systems and technologies. During the process of identifying resources, thought is also given to how they can be used to mitigate the threats identified in Step Two.

Algae were classified as a threat to the objective of improving water clarity. There are a number of tools available to the team to target this problem. Over time, the key objective of any algae management program is to reduce or remove the nutrients in the lake water that allow these species to thrive. Algae are single celled plants. They have to obtain the phosphorus they need to thrive from the water. Removing or reducing the levels of this limiting nutrient reduces the carrying capacity of the lake to produce algae blooms.

There are a number of tools identified by the team to accomplish this objective. They are:

- Obtaining better water. The current water coming from the Fish Hatchery as delivered is extremely high in phosphorus and other nutrients. The levels present in this water would be classified as hyper-eutrophic if sampled from a lake. One tool available is well water to replace some or all of this input.
- Obtaining better water from the Hatchery. Technology exists to treat this waste water stream prior to it arriving in Spring Valley Lake. There may also be grant funds available to help meet this objective. There are water quality standards they are required to comply with.
- Using in-lake phosphorus management technologies. Aluminum Sulfate treatments were developed by the US EPA Clean Lakes Program and have been used extensively throughout the nation. Phoslock is a newer technology developed by the Australian Government to accomplish this objective as well.
- Aeration can be used as needed to limit phosphorus release from the lake sediments. There are deeper areas of the lake that may benefit from the use of this technology.
- Algaecides are available to target this problem. If bloom conditions are such that they require treatment to meet this objective, there are a number of products available for this purpose. They require professional application and there are regulatory requirements to comply with. Peroxygen based algaecides, endothol based algaecides and copper based algaecides are tools that can be used.
- Application teams. There are capabilities both with our consultant (AquaTechnex) and our lake management staff to make the necessary applications for in-lake remediation.
- Budget. On approval by the SVLA Board, there will be a budget to implement that final plan.

Sediment is the other parameter that is limiting water clarity. There are a number of tools available to the team to mitigate those threats. They are:

- In-lake phosphorus removal technologies, listed in the algae management section above, have an added benefit of precipitating suspended materials from the water column. This tool, if selected, would provide this additional benefit.
- There are monitoring technologies that can identify the makeup of water turbidity. These technologies can be used to determine sediment sources. Education can be used to focus boat traffic in areas that mitigate suspension of these materials. Storm water management can also be used to mitigate inflows.
- Carp can contribute to water clarity problems. The SVLA has tools to manage carp populations in the lake. These include the in house shocking boat to remove carp. There are also contractors that do this work. Communities like Big Bear Lake that have Carp problems conduct Derbies that attract professional bow teams from around the Western United States. This is a tool that might have applications, especially if held in the same time frame as other tournaments in the area.

One of the issues related to the use of tools such as Alum was identified as members of the community needing to understand the safety of this approach with respect to the environment and human health. A number of tools are available:

- US EPA Clean Lakes Program documents that have studied the process
- State documents such as the Minnesota Department of Natural Resources program that have documented the safety of these methods.
- We have staff and consultants (AquaTechnex) that can provide education that should mitigate these concerns.

Monitoring will be a critical component of this program. We have a number of tools available to our team for this mission:

- SVLA has a water quality laboratory and staff qualified to collect and analyze this data.
- SVLA has the majority of the instrumentation necessary to track water clarity.
- We have identified external laboratory support that have the capabilities to provide data we are not set up to collect internally.
- We have outside consultants (AquaTechnex) that can support this task as necessary to complete the mission.

There will be a budget for this effort. The SVLA will develop and approve a budget based on the costs necessary to accomplish this mission and the fiscal commitment to carry it to fruition.

Regulations to support protection of our water quality: There are a number of regulations that apply throughout the Spring Valley Lake Watershed that are designed to protect water quality. There are water quality standards that must be met by dischargers such as the state Hatchery. There are storm water regulations that must be met by developers that clear land in the watershed. There are state and local agencies charged with the mission of protecting water quality throughout the watershed. Our team will use these as appropriate to help achieve this objective and goal.

Outside funding to support protection of our water quality. There are grants and funding sources available to manage and protect water quality at the federal, state and local level. Some of these may be available directly to SVLA. Some of these may be available to groups such as the Hatchery to help them comply with discharge standards, or the local government to help manage storm water quality. Our team will use these as appropriate and available to help achieve this objective and goal.

Step Four, evaluate lessons learned

This step of the planning process seeks to review previous attempts to mitigate problems in the lake and highlight the lessons learned. Tasks that have been tried in the past that didn't work need to be reviewed and considered. Tasks that did contribute toward the mission objective need to be noted and considered for use in the future as well. The team discussed and listed these lessons:

- Aquatic weed treatments in the late 1990's are considered to be the cause of the current problem. Water clarity in that time frame was much better. Suppressing this vegetation completely shifted the dynamics in the lake to an algae dominated system and has resulted in poor water clarity. In the future there may be a need to do additional aquatic weed control. If so, the focus should be on using selective technologies when herbicides are used to target problem plants and protect beneficial plants. Other methods of control should be considered prior to lake wide treatments.
- SLVA has learned that the primary source of make up water added to the lake from the State Hatchery is extremely high in the nutrients that drive algae growth. This probably is an important contributing factor to algae growth and resulting poor water clarity.
- Solar Bees were used in the lake for two seasons. It was determined that these provided no benefit in terms of meeting the objective of improving water clarity. In the future, the use of aeration should focus on technologies that improve dissolved oxygen levels in the deeper portions of the lake and should be based on an identified need as shown by ongoing monitoring.
- Peroxygen based algaecides have been used successfully in the lake. In the summer of 2009, two applications were made at different rates. The higher rate used provided good control for a number of weeks. The lower rate used provided very short term control. This information should be used to support future use of this material. While there are a number of manufacturers of this algaecide, BioSafe provides laboratory support. A cost should be developed based on the volume that will be used. Application rates should be sufficient to target and suppress target algae.
- SLVA has implemented a program to manage Carp. Originally a contractor was hired for this mission. While that was successful, the Community learned that purchasing and deploying their own shocking boat was more cost effective. This program has removed significant numbers of Carp, thereby limiting their contribution to suspended sediments. Carp levels at this point are such that the fishing effort and cost is not producing significant catch. This means that there have been successes in this area. This tool should remain in place. Monitoring should track any increase in carp populations and increased effort should be used if populations start to bounce back and increase.

Step Five, Develop a Course of Action

The end result of this mission planning is this step. Based on the work performed to this point, a course of action is presented to SLVA Board for consideration and approval. This plan is presented with costs associated with completing this work. It also focuses on who does what, when and to what metric or measurement. It is presented in spreadsheet fashion. SVLA may need to add labor and other in house costs to this document. It will be provided in electronic form as well for "what if" analysis.

A brief description of the Course of Action is also presented here in discussion form.

Task One, water clarity monitoring. This is a critical component of this mission because it measures the success in meeting the objectives of this mission. Secchi disk monitoring should be performed weekly at a number of stations throughout the lake. It's important to track water make up to determine if algae or suspended sediments are a primary cause of poor water clarity. It is important to understand the makeup of the algae community. We would want to review this data and develop a short report as part of our consulting services.

Task Two, Compliance. It's critical to see if there are violations of water quality standards by the upstream discharger, the fish hatchery. If so, there are regulations and potentially grants to help mitigate this problem. This task would research that information and compare their discharge to those standards. A short report would summarize these and this would be the basis for discussion. We have some consulting fees proposed for this task.

Task Three, feasibility of other water source. Our discussion indicated that the wells could augment or replace the lake water high in nutrients. There are, however, costs associated with this action that SVLA needs to evaluate. This process should be performed internally.

Task Four Algae Management. This task assumes a major expenditure for in lake phosphorus removal using Alum. There are other options such as Phoslock, but they are probably cost prohibitive. We have proposed costs for our support of each task. We have also provided what should be a high estimate for the materials necessary. The jar testing will play a key roll in narrowing that cost. There may be savings available based on that. There are also tasks for algae management. The dose rates are based on the 90 pounds per acre rate that we learned was effective. The whole lake costs assume that rate over the entire lake surface. The cost for fingers and shoreline assume treatment of approximately 1/4 of those acres. We have proposed costs for SVLA to purchase equipment. We have also proposed costs for our team to make an application. SVLA can choose which option best meets the budget and needs. The Alum treatment, if performed. will also mitigate suspended sediments.

Task Five Carp Management. This task should be maintained in house at SVLA. The team is equipped and trained to perform this mission. Focus should be on targeting points where these fish congregate such as spawning areas. SVLA may also consider tournament events.

Task Six, Mission Debriefing. The Flawless Execution model had debriefing as a key component. This process is critical to completing this mission. The Debriefing Process includes these steps:

- Setting the time.

- Tone, Nameless and rankless, key to effective collaboration.
- Execution vs. Objectives, was the mission objective met in accordance with the Course of Action?
- Analyze Execution, what were the causes and the root causes of failure and successes? (use the Root Cause Analysis Matrix)
- Lessons Learned, develop actionable lessons learned.
- Transfer Lessons Learned, assign a specific point of contact and a timeline for the lesson to be properly implemented.
- High Note, positive summation of the mission.

This task will be used to determine the next missions and steps to keep moving toward the Future Vision.

Step Six, Plan for Contingencies

The primary threat to successful completion of this mission in 2010 will probably be having the financial resources to implement all of the necessary steps.

The primary cost proposed will focus on the Alum treatment. When performed, this will mitigate the algae and suspended sediments present at that point. It should be sufficient to protect water clarity through the majority of the summer season and perhaps beyond. The factors that will impact that are recovery of phosphorus levels if hatchery water remains the primary water source, or if boats do in fact have a significant impact on suspending lake sediments.

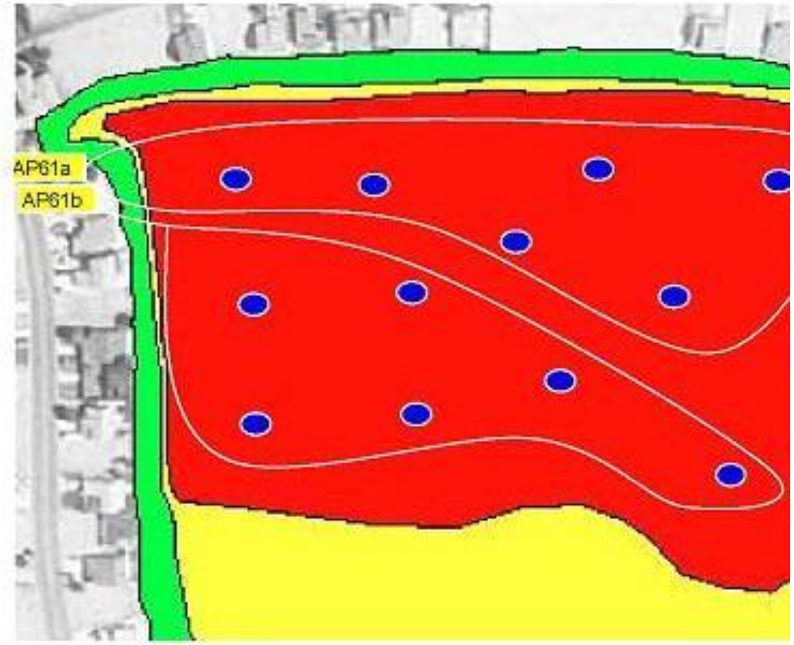
SLVA should consider costs using well water after the Alum treatment to mitigate the re-introduction of phosphorus. Hatchery water could be used up until the treatment is performed.

The need for algae treatment should be minimal for some period after the alum treatment. It is possible it will not be necessary at all. There are costs proposed in case treatments become necessary later in the season.

If the alum treatment is beyond the budget available for 2010, algae treatments should be planned as needed.

There is some potential that a dramatic increase in water clarity will result in aquatic plant growth or bottom growing filamentous algae growth. Monitoring should be in place to detect and monitor any development of problem levels.

Client Name:	Aquatechnex
Contact:	Terry Mc Nabb
Site Name:	
Date:	March 1, 2010
Design Technician:	Ron Given



North end of SVL

TER FEATURES

Surface Acres:	15
Average Center Depth (feet):	15
Diffuser Placement Depth (feet):	15
Perimeter (feet):	
Shelf Width (feet):	
Average Shelf Depth (feet):	
GPM @ Depth for Diffuser:	3808
Average Waterway Depth (feet):	15.0
Total Waterway Volume (Gallons):	73,327,500
Complete Site Turnover / Day:	**1.0**
Diffuser Pads Recommended:	12.0

Diffuser Hose Length (ft)			
AP61a	AP61b		
250	400		
500	**650**		
900	800		
1150	1200		
750	650		
1000	750		
Hose Req'd.	9000		

Definitions:

Average Center Depth: The average depth in the deepest areas. Diffuser Pads Recommended: The number of diffuser pads for correct aeration, based on area and shape.

Perimeter: The distance in feet along the entire shoreline around the water way. Complete Site Turnover / Day: The number of times per day the full volume of the water way is moved from the bottom to the surface. Surface Acres: The total surface acres of the entire water way.

Total Waterway Volume: The volume of the entire water way in U.S. Gallons.

Cost

Task	Cost/SVL	Cost/Out	Cost/Aqua	Timeline	Responsible Party/Notes
Task One, Monitoring					
a. Water Clarity/Secchi Disc				Weekly	SVLA, should be done weekly all year
b. Water Make Up		$300		Quarterly	outside lab, algae vs. suspended sediments
c. Algae Counts/Species ID		$1,500		Quarterly	outside lab
d. Consultant Support			$3,000	Quarterly	Aqua report ($750/quarter)
Task Two, Compliance					
a. Research WQ Standards			$1,000	Feb/March	Aqua Reseach and report
b. Determine if Hatchery has Compliance Issue				March	Aqua/SVLA
c. Mitigate			$1,000	March	Meeting with Hatchery Management
d. Funding to improve water quality inputs				TBD	If available obtain and put into action
Task Three, Feasbility of Other Water Source					
a. Develop water budget				March	SLVA
b. Cost this option				March	SLVA
c. Determine Feasibility				March	SLVA
d. Implement as Feasible				April	SLVA
Task Four Algae Management					
a. In lake Phosphorus Removal/Alum					
1. Develop P levels in lake sampling		$500	$500	April	Outside lab/Aqua evaluate
2. Perform Jar Tests to determine Alum Dose			$1,500	Late April	Aqua or SVLA
3. Calculate exact material costs			$500	late April	Aqua based on jar Test
4. Estimated Material costs		$40,000		Late April	This is an estimate for mid range
5. Assemble application equipment	$4,000		$1,000	May	Aqua/SVLA
6. Order material				May	SVLA
7. Training application team			$1,500	May	Aqua days prior to application
8. Receive and stage Alum				May	SVLA
9. Perform application			$4,000	May	SVLA/Aqua
10. Monitor pH and other paramters			$500	May	SVLA/Aqua during treatment
Aeration Systems - 2 Systems - North End	$1,000	$18,500	$1,000	April	
b. Algae control					
1. Set treatment threshold				March	SVLA/Aqua
2. monitor conditions summer				Twice weekly	SVLA/Aqua
3. Obtain necessary license/training			$1,500	May	Aqua
4. Obtain necessary equipment or contract	$3,500			May	Aqua/SVLA
5. Stage materials				May	SVLA/Aqua
6. Cost Whole Lake		$30,780	$4,500	As necessary	Estimate per application

7. Cost Fingers/Shoreline		$7,290	$2,500	As necessary	Estimate per application
Task Five, Carp Management					
a. Monitor fish populations				Monthly	SVLA, assign staff
b. Focus efforts during spawning				May	SVLA, plan efforts during this time
c. Use as nessesary				TBD	SVLA
Task Six, Mission Debriefing					
a. Assemble data				Oct	SVLA
b. Meeting of team			$750	Nov	Aqua leads
c. Use Debriefing Protocol				Nov	Aqua leads
d. Develop 2011 Missions/Flawless Engine			$1,500	Nov	Aqua leads
Current Sub Totals	$8,500	$98,870	$26,250		
Current Project Total				$133,620	

Summary

AquaTechnex is ready to support SVLA as needed. Additional fees for Travel and Daily Meeting/Operations that may be requested in addition to those tasks presented here will be quoted on your request.

AquaTechnex, LLC. | **I**