

## EXECUTIVE SUMMARY – CITY OF VACAVILLE PROPOSED LAGOON VALLEY LAKE MANAGEMENT PLAN

### **BACKGROUND AND PURPOSE OF THE PLAN**

The City of Vacaville *Comprehensive Parks, Recreation and Open Space Master Plan* identified the potential for the Lagoon Valley Regional Park to provide improved opportunities for a variety of passive and active recreational opportunities, many of which are directly related to Lagoon Valley Lake. The City has prepared a master plan for the Lagoon Valley Regional Park to implement the recommended recreational improvements. However, successful implementation of the recreational improvements is dependent on development of a long-term lake management plan that will address a wide range of lake management concerns. Therefore, in December, 1998, the City selected LSA Associates, Inc., following a bid selection process, to prepare a Lagoon Valley lake management plan.

The draft lake management plan was completed by LSA Associates in June, 1999. The draft plan is intended to complement the City's regional park master plan by providing 47 possible short and long-term options for enhancing and managing Lagoon Valley Lake. The overall goal of the plan is to ensure that the lake will remain a natural, scenic and recreational amenity for the people of Vacaville and the surrounding region.

### **MANAGEMENT PLAN REVIEW AND REVISION PROCESS**

City staff and various local, regional and state agencies reviewed the draft plan and provided comments in June-August, 1999. Additionally, a public workshop and subsequent Community Services Board public meeting were held in July, 1999, at which public comments were received. Based on the various city, agency and public comments, the draft plan's 47 possible management options were pared down and synthesized into 9 proposed capital improvement actions, which are described in this Executive Summary. Management options not included in the selected set of capital improvements were treated as follows:

- Some management options were rejected as being too costly and/or impractical based on City budgetary and labor constraints, or were rejected in favor of options more consistent with the park master plan (e.g., mechanical harvesting of lake weeds, establishment of a wading beach).
- Other management options were placed in a "contingency" category of management actions that may be desirable to implement based on further study and budgetary considerations, or as part of the future operations and maintenance budget (e.g., off-stream water quality treatment ponds, dam crest trail enhancement).
- Several management options were directly incorporated into the design of the proposed regional park master plan (e.g., fishing piers, shade tree planting).

The remaining (selected) lake management options are proposed as capital improvements under a 4-phase implementation process that will allow adequate time for developing and enhancing funding sources, conducting detailed engineering design studies and obtaining federal and state regulatory approval.

### ***BACKGROUND ON LAGOON VALLEY LAKE SITE***

Lagoon Valley Lake is located within a 670-acre area of contiguous open space and regional parkland owned by the City of Vacaville. The site is situated at the southern (lower) end of Lagoon Valley, between the Vaca Mountains to the west and the Laguna Hills ridgeline to the east. The urbanized areas of the City of Vacaville lie to the east of the Laguna Hills. Adjacent land uses consist of a mix of open space grazing lands, a commercial nursery and other small scale commercial uses. Immediately to the north and east are the park's existing passive recreational areas. The Pena Adobe Community Park lies to the northeast of the lake.

The Lower Lagoon Valley drains to Laguna Creek which is a tributary of Alamo Creek, which is, in turn, a major tributary of the Ulatis Creek watershed in the northwestern portion of Solano County. Lagoon Valley Lake was historically a natural seasonal lake and wetland. The present lake was created in the late 1970s as part of the Lagoon Valley Regional Park construction. An earthen dam (bermed embankment) forms almost the entire western and southern boundaries of the lake. West of the dam is a bypass channel that diverts runoff from the southeast and west sides of the valley. The lake is 106 surface acres, with an average depth of 6 to 7 feet, and a maximum depth of 9 feet near the dam's spillway. The lake receives inflow from a perennial to near-perennial tributary that enters the lake at its southeast corner near the intersection of Lagoon Valley Road and the park road. Several minor intermittent tributaries also flow to the lake.

### ***SUMMARY OF LAKE MANAGEMENT PROBLEMS***

Existing conditions in the surrounding watershed are contributing to a range of lake management problems. These conditions can be categorized by whether they occur in the upper or lower watershed areas. The proposed management plan takes a "start at the source" approach in solving these problems. Wherever feasible, problems are addressed first in the upper watershed, then in the lower watershed and finally in lake itself.

The upper watershed appears to be a major source of sedimentation to the lake. These sedimentation problems may be attributed to the following causes:

- erosion of upper watershed drainages possible due to over-grazing by cattle grazing;
- a lack of riparian vegetation that would help stabilize drainages, and
- possible erosion of recreational trails and fire roads.

The lower watershed contributes to a range of problems in the lake as follows:

- sedimentation problems from intermittent tributary erosion in the lower watershed, and
- high levels of nutrients that flow into the lake primarily from the perennial tributary, causing excessive summertime growths of aquatic weeds, depletion of dissolved oxygen in the lake, and unsuitable conditions for fishing.

Problems intrinsic to the lake itself include the following:

- heavy infestations of Sacramento blackfish, which are conflicting with the ability to maintain a viable sportfishery; blackfish enter the lake when the lower lagoon drain backs-up, allowing backflows to enter the lake over the dam spillway;
- minor shoreline erosion caused by exposure to wind and wave action;
- shallow lake depths that allow light penetration all the way to the bottom, thereby promoting the growth of aquatic weeds that interfere with sailboarding and fishing opportunities;
- high bacterial levels in the lake probably due to runoff from resting and foraging areas that are heavily used by waterfowl, and
- Need for improved maintenance of the dam embankment and bypass channel to ensure that their water control functions are maintained in an optimal condition.

#### ***LAKE BENEFICIAL USES AND MANAGEMENT GOALS***

Lagoon Valley Lake potentially offers a wide range of recreational and non-recreational benefits. City of Vacaville staff suggested that the following beneficial uses and specific management plan goals for Lagoon Valley Lake be investigated under this management plan. Project studies and investigations were directed toward evaluating and achieving these specific management plan goals. Beneficial uses and management goals are summarized on the next page.

<b>1. Beneficial Use: Recreational Fishing</b>
<p>Goals:</p> <ul style="list-style-type: none"> <li>A. Manage and control Sacramento blackfish populations</li> <li>B. Expand largemouth bass and redear sunfish populations</li> <li>C. Maintain Sacramento perch nursery benefits</li> <li>D. Improve recreational fishing accessibility</li> <li>E. Reduce sedimentation</li> <li>F. Reduce summer aquatic weed infestations</li> </ul>

<b>2. Beneficial Use: Small Motorless Craft Use of Lake</b>
<p>Goal:</p> <ul style="list-style-type: none"> <li>A. Facilitate windsurfing usage of lake</li> </ul>

<b>3. Beneficial Use: Scenic Amenity that Encourages Passive Recreational Use</b>
<p>Goals:</p> <ul style="list-style-type: none"> <li>A. Maintain 1-80 corridor view of lake and valley</li> <li>B. Enhance the visual quality of shoreline usage areas</li> </ul>

<b>4. Beneficial Use: Wildlife Habitat</b>
<p>Goals:</p> <ul style="list-style-type: none"> <li>A. Establish shoreline wetland zones</li> <li>B. Establish woody riparian vegetation zones along the lake shoreline</li> <li>C. Enhance stabilized drainage corridors</li> </ul>

<b>5. Beneficial Use: Storm Water Management</b>
<p>Goals:</p> <ul style="list-style-type: none"> <li>A. Maintain lake storage capacity</li> <li>B. Property maintain spillway and dam</li> </ul>

<b>6. Beneficial Use: Swimming &amp; Shoreline Recreation</b>
<p>Goals:</p> <ul style="list-style-type: none"> <li>A. Establish a controlled wading beach</li> <li>B. Enhance interpretive values</li> <li>C. Enhance shoreline passive recreational opportunities in conjunction with the park master plan</li> </ul>

## **SUMMARY OF STUDY RESULTS**

The project team conducted a wide range of geotechnical, hydrological, water quality, fisheries, ornithological, and recreation/interpretive investigations and technical studies in support of the project management goals. Appendix B of the draft management plan provides a summary of the relationship of the project team's investigations and technical studies to the management plan goals. A brief summary of key study results is provided below:

- **Lake Water Supply** - Lagoon Valley Lake is currently receiving an adequate supply of water, and under current conditions has the potential to supply approximately 977 acre-feet of water per year for other uses. No supplemental water inflow is currently needed. For the purposes of increasing lake depth and water surface area, the lake would have more than adequate water to accommodate increasing the height of the spillway by at least one foot.
- **Storm Water Detention and Retention** - Based on the elevations of its earthen berm and spillway, the lake is currently capable of adequately detaining water from a 100-year storm under conditions of both low and high pre-storm lake levels. However, in the absence of watershed erosion mitigation measures, a relatively high rate of sedimentation will likely continue in future years, causing the lake's storage capacity to decline.
- **Lake Water Quality Problems** - Excessive nutrient loading, in combination with much of the lake being less than 6 feet in depth, creates massive growths of aquatic plants and algae that cover most of the lake during the summer. These growths interfere with beneficial uses such as swimming, boating, fishing, and general aesthetics, and may lead to dissolved oxygen depletion and fish kills. Based on sampling results, the primary source of these nutrients is the perennial tributary that receives direct runoff from the Hines Nursery during the rainy season. Domestic waterfowl wastes also play a role in nutrient enrichment of the lake. The limited data available suggests that cattle grazing in the lake's watershed is not a significant contributor of nutrients to the lake. A second water quality problem is periodically high levels of fecal coliform bacteria. Domestic waterfowl are the most probable cause of this problem.
- **Sedimentation Problems** - Elevation-Storage relationships indicate that Lagoon Valley Lake has lost approximately 130 acre-feet (AF) of storage at elevation 208, 223 AF at elevation 210, and 349 AF at elevation 215 (storage capacity) in the past 17 years. This amounts to an average annual sedimentation rate of 20.5 AF/year. The main sources for this sediment is soil erosion associated with the contributing watersheds and channel bank erosion from channels, and headcuts that feed directly into the lake.
- **Shoreline Erosion** - In general, shoreline erosion to the lake itself does not appear to be a significant cause of lake sedimentation problems at this time. However, some segments of the lake's shoreline are experiencing some degree of bank failure or slumping of material into the lake. Most lake shoreline erosion problems

can be attributed to wind and wave action against the water's edge. Failure to take shoreline stabilization actions will likely cause these problems to get worse.

- **Lake Fisheries** - All attempts to establish a productive sport fishery in Lagoon Valley Lake have been adversely impacted by the presence of large numbers of Sacramento blackfish. Due to an apparent lack of predators, populations of desirable sport fish, such as Sacramento perch, appear to be too heavily skewed toward juveniles to provide much fishing opportunity. A key to creating a productive sport fishery in Lagoon Valley Lake is to eliminate or greatly reduce the numbers of Sacramento blackfish in the lake. Another impediment to recreational angling in the lake is the extensive growths of sago pondweed and filamentous algae that fills much of the lake each summer. There is very little open water that can be fished from shore, as only the deepest portions of the lake are free of pondweed.
- **Waterfowl** - Lagoon Valley Lake and the adjacent uplands provide significant resting and foraging seasonal habitat for migratory waterfowl, particularly geese, ducks and American coots. Foraging activities by both migratory, domesticated birds and gulls tends to be concentrated on the east shore picnic area. The concentration of birds in these areas corresponds to the limited coliform bacterial data that show high levels in the waters below the eastern shore.

#### **SUMMARY OF RECOMMENDED CAPITAL IMPROVEMENT PROGRAM:**

A four-phase program for capital improvements is proposed for the next decade. The actual timing for commencement of each phase will depend on completion of necessary engineering and geotechnical design studies, procurement of adequate funding and completion of the federal and state environmental review process.

#### **PHASE 1: REDUCE THE SOURCES OF SEDIMENTATION INTO THE LAKE; IMPROVE LAKE SPILLWAY DRAIN**

**1-1: UPPER WATERSHED EROSION MANAGEMENT** - In order to control the sources of upper watershed sedimentation to the lake, an integrated set of upper watershed management actions will be implemented. These will include a grazing management plan, stabilization and revegetation of upper watershed drainages, and a program for trail/fire road assessment and maintenance. An annual sediment and nutrient monitoring program in the watershed and lake will also be conducted.

Total Estimated Cost \$300,000
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**1-2: HINES NURSERY DITCH STABILIZATION** - The runoff collection ditch that borders the Hines Nursery has bank erosion problems will be alleviated by stabilizing the entire channel bank with vegetation and/or geotextiles. Check dams and small sedimentation basins will be integrated into the ditch system. This would need to be done with the permission and cooperation of Hines Nursery.

Total Estimated Cost \$102,200
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**1-3: LAGOON DRAIN REHABILITATION** - In order to facilitate lake outflow and to improve drainage below the lake, a shallow obstruction zone in the lagoon drain, near the Pena Adobe footbridge, will be removed. Constricting emergent vegetation in the drain will also be removed.

Total Estimated Cost \$72,000
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**PHASE 2: REDUCE LOWER WATERSHED SEDIMENTS INTO THE LAKE**

**2-1: SEDIMENT BASINS; ENGINEERING DESIGN & ANALYSIS** - Two 4-acre sediment basins will be installed upstream of the lake to intercept and retain sediments from the surrounding watershed.

Total Estimated Cost \$685,000
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**2-2: INTERMITTENT DRAINAGE CHANNEL STABILIZATION** - Three intermittent drainages that enter Lagoon Valley Lake will be stabilized within the park area. This will entail the construction of cutoff walls and plunge pools, and rock riprap stabilization of heavily eroded areas.

Total Estimated Cost \$60,620
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**PHASE 3: IMPROVE LAKE WATER QUALITY THROUGH DEEPENING, SHORELINE STABILIZATION AND POSSIBLE SPILLWAY MODIFICATIONS**

**3-1: DEEPEN THE LAKE; CREATE NEW WETLAND AREA** - This improvement will entail deepening of sufficient area of the lake (estimated 50-70 percent) to a depth of 8-10 feet in order to reduce the potential for aquatic weed growth. The lake will be initially drained to allow earthmoving equipment to excavate selected portions of the lake. Drainage and excavation is a significantly cheaper method of deepening than dredging. Based on rough cost estimates, lake excavation will cost approximately \$740,000 per each foot of increased depth, assuming a total excavation area of 80 acres, or approximately \$460,000 for each foot of increased depth for a 50 acre lake excavation area.

Total Estimated Cost \$1,078,000
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Lake draining will have the added advantage of eliminating blackfish from the lake. The excavated materials will be deposited in the south end of the lake to create a new emergent marsh. The created marsh will greatly enhance the biological quality of the lake by providing a significant littoral area with habitat for fish, aquatic fauna, and waterbirds. It should also reduce nutrient loading by routing inflow through a meandering tributary channel in the created emergent marsh that would help strip nutrients.

**3-2: LAKE SHORELINE – STABILIZATION AND PLANTING** - In order to mitigate the effects of erosion along the shoreline, at the mouths of intermittent tributaries, and on the island, shoreline stabilization will be conducted, as follows:

Total Estimated Cost \$296,000
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- **Regrading** - Where steep vertical cuts have developed, regrading to a more stable configuration is achievable. In most instances such regrading will entail minor re-sloping (7:1 grade or gentler) and compacting of banks.

- **Rock Riprap** - Rock riprap will provide a permanent structural solution for areas that are experiencing severe erosion problems.
- **Tri-Lock Articulated Erosion Control System** - *Tri-Lock* is a flexible, permeable erosion control system that has the capacity to allow revegetation. This solution will be utilized in zones of moderate erosion.
- **Shoreline Planting** - Planting of shorelines with woody riparian species and seeding will be conducted in conjunction with or, in some cases, as an alternative to other shoreline erosion control treatments. Trees will also serve as a windbreak to reduce shoreline erosion.

**3-3: ADD RISER TO DAM SPILLWAY** - Based on the results of the Phase 2 engineering study, the dam spillway elevation may be increased by about 1 foot to allow the lake to store more water and increase lake depth. This could also potentially prevent blackfish re-introductions during period of downstream flooding problems.

Total Estimated Cost \$13,000
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#### **PHASE 4: LAKE FISHERY IMPROVEMENTS**

**4-1: Fish Stocking Program** – Following the Phase 1-3 improvements, the lake should provide suitable habitat for sustaining and promoting Sacramento perch, while also allowing stocking with redear sunfish and largemouth bass.

Total Estimated Cost \$50,000
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#### **REGULATORY REQUIREMENTS**

Section 7.0 of the draft management plan discusses local, state and federal regulatory requirements that may be applicable to the management actions contained in this plan. These are summarized as follows:

Phase 1 and Phase 2 improvements would likely require approval under a Corps of Engineers (Corps) Nationwide Permit. Regional Water Quality Control Board (RWQCB) Section 401 Water Quality Waiver and a California Department of Fish and Game Streambed Alteration Agreement would also be needed. Because the Phase 1 improvements fall within the categories of watershed enhancement and channel maintenance, approval from these agencies is likely, provided that adequate documentation is provided as to routine pollution and erosion prevention measures during work (e.g., water diversion, seasonal restrictions). A Storm Water Pollution Prevention Plan (SWPPP), to be implemented during construction work, may also be required from the RWQCB. The proposed sedimentation basins under Phase 2 would also likely require RWQCB review and approval under waste discharge requirements. The spillway improvement under Phase 1 would need to be reviewed and approved by the State Division of Dam Safety.

Any improvement requiring Corps of Engineers Section 404 approval will likely require that a formal Section 404 wetland delineation be submitted to the Corps of Engineers. This will entail extensive field data collection, mapping of wetland boundaries and preparation of an accompanying technical report and formal review and approval by the Corps.

The proposed lake deepening under Phase 3 would require extensive regulatory approval. A Corps of Engineers Individual Permit would be needed. Under the permit application, the City would likely need to demonstrate that lake deepening is the least impacting means of accomplishing the project purpose. This may require preparation of a section 404(b)(1) Alternatives Analysis. A Mitigation and Monitoring plan would also need to be prepared. The Environmental Protection Agency will review the Corps Section 404 permit application to ensure that the lake deepening is consistent with the goals of no net-loss of wetlands or wetland functions and values.

The lower Lagoon Valley may provide habitat for at least one federally-listed threatened/endangered species (*i.e.* California red-legged frog). Under Section 7 of the federal Endangered Species Act, the Corps will consult with USFWS on any listed species potentially affected by the project. As part of this consultation process, the USFWS could require formal surveys for the species if there is a reasonable possibility of the action adversely impacting the species or its habitat. Based on the results of the surveys and an accompanying Biological Assessment, the USFWS will prepare a Biological Opinion on whether or not the proposed action will jeopardize the species and will adequately compensate for any adverse affects to the species. A Corps permit will not be issued with a negative Biological Opinion. Additionally, the USFWS will provide specific comments and recommendations upon the effects of a proposed Corps permit on wildlife and wetland functions and values. RWQCB Section 401 water Quality Certification (or waiver thereof) and a CDFG approval would also be required for Phase 3 work.

The proposed fish stocking under Phase 4 would require authorization from the CDFG. This authorization is likely based on comments received from the CDFG during the management plan review process.

### **CONTINGENCY CAPITAL IMPROVEMENTS**

The following management options from the draft management plan are considered "contingency" improvements that may be considered as some point in the future depending on funding availability, the results of the water quality monitoring and the success of the four-phase capital improvement program:

***Lower Watershed Nutrient Management*** - A cooperative nutrient reduction program with Hines Nursery may be needed. Under this program, the City and Hines Nursery would work together to design changes to the nursery's storm water management system to greatly reduce nutrient inflows to the lake, while ensuring that the nursery maintains its existing level of flood protection. This would likely include an increase in the storage capacity of the nursery's irrigation recycling reservoir so that the need for bypass flows from the reservoir to the perennial tributary could be greatly reduced or entirely eliminated. The cooperative program could also include the construction of one

or more water quality treatment ponds downstream of the nursery bypass discharge. The water quality pond(s) would be designed to treat the "first-flush" of storm water runoff which contains most pollutants.

***Bio-Inoculants for Nutrient Control*** - The City has been approached by a firm that uses microbial inoculants to successfully control algae in aquacultural, wastewater and water feature settings. This new technology may be suitable for use in Lagoon Valley Lake provided a number of potential ecological concerns could first be adequately addressed (see Attachment A).

***Crest Trail Enhancement*** - The lake dam can currently be over-topped during storm events in excess of the 100-year storm. The ability to withstand such events could be enhanced by construction of an impervious all-weather (asphalt) bike/hiking trail along the dam's crest. This would also serve to enhance the recreational utility of the dam.

**ATTACHMENT A**

***Proposal by EM Technologies and  
Review of Proposal by LSA Associates, Inc.***

6/26/99

PROPOSAL TO TREAT AND CLEAN  
THE EXISTING SMALL POND  
ON THE SOUTHEASTERN CORNER  
OF THE LAGOON VALLEY LAKE

EM TECHNOLOGIES, INC.  
WESTERN REGION, U.S.A.

## **INTRODUCTION**

EM TECHNOLOGIES, INC. takes pleasure in conducting this experiment to show the City of Vacaville how effectively EM can remediate this pond. EM will gradually eliminate the invasive species of water weed(s) and algae over the course of several weeks; however, it will not interfere with the ecological balance of the aquatic life. (Please see RESULTS.) The existing duck population will continue to populate the small pond and possible increase in population can occur. (This is from our previous experience in pond remediation.) The time frame for this clean up is maximum of four months.

For this experiment, there is no cost to the City of Vacaville. However, we would like the City to monitor the aquatic life in and around the pond. If this succeeds to your satisfaction and the City wishes to proceed with the remediation of the entire lake, EM technologies, Inc. will donate EM and technical assistance to the City. There are so many ways to apply EM into the lake. We can discuss about these concerns at that time. However, the projected time frame for clean up is minimum of two years and maximum of three years. The company will do follow-up maintenance for three years after the completion of the remediation without the cost to the City.

## **MATERIALS:**

1. EM Waste Treatment – extended for economy
2. Three canisters – HDPE
3. Red-lava rocks – from Home Depot for garden usage

## **EM APPLICATION**

Extended EM is used for the treatment of the small pond. This procedure will extend stock solution EM to 1:10. This will be produced at FRANK'S Septic Service, Inc.

There are few menus of options available for this treatment\*:

1. Small boat with sprayer rig will apply Extended EM on to the surface of the pond.
2. Apply Extended EM from the banks with sprayer rig; however, due to constant wind condition, it might not be feasible.
3. Pour Extended EM from strategic sites around the pond. This application is simple and safe.

\*All applications are done early in the morning.

The application is done once every week for four weeks (for the first month), then application will drop to once every two weeks (for the second month). On the third month, Extended EM is applied once only. The amount of Extended EM per application is 200 gallons. The amount for the first month is 800 gallons. Then, the amount for the second month is 400 gallons. Finally, the amount for the third month is 200 gallons. **The sum total is 1,400 gallons of Extended EM.**

Immediately, after the last application of Extended EM (in the third month), the company will make the canisters for maintenance and drop into the pond in a timely manner for effective maintenance.

For maintenance, three canisters (five-gallon size) are placed into the pond. They are extracted once every four to five months for fresh inoculation. These canisters will contain **EM inoculated red-lava rocks** weighing approximately fifteen to twenty pounds each.

## RESULTS

EM will immediately tie-up all nutrients in the sludge causing water weed(s) population to decrease as well as the sludge. Any bottom dwelling algae will surface, sometimes within 48 hours. As soon as they begin to surface, second application of Extended EM is made. Algae will begin to sink and disappear. At earliest time frame (in a month), the bottom will begin to clear.

The continual introduction of duck dungs will not increase the nitrogen level in the pond. It will become a feed for the EM.

If you have any inquiries, please address them to Western Regional Office at (562) 421-9194. (This is telephone and facsimile number.)

Respectfully Yours,



Glenn S. Kozawa  
Field Operations Manager

EM Technologies, Inc.

"Making a World of Difference"

MATERIAL SAFETY DATA SHEET

Kyusei Effective Microorganisms

PREPARED: 12/15/97  
PRODUCT NAME: Kyusei EM  
PRODUCED BY: EM Technologies, Inc.  
1802 West Grant Road  
Tucson, AZ 85745  
(520) 629-9301

SECTION I - PRODUCT IDENTIFICATION

GENERAL OR GENERIC NAME: Liquid Microbial Inoculant  
HAZARD RATING: HEALTH: 0 Normal Material  
FIRE: 0 Will not burn  
REACTIVITY: 0 Stable

SECTION II - HAZARDOUS INGREDIENTS

If present, carcinogens and chemicals subject to reporting are identified in this section:

<u>INGREDIENTS</u>	<u>%(By Volume)</u>	<u>Note</u>
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No hazardous ingredients present; not hazardous to humans, animals or plants.

SECTION III - PHYSICAL DATA

BOILING POINT:	>100 °C	SPECIFIC GRAVITY:	N/D
VAPOR PRESSURE:	N/D	SOLUBILITY IN WATER:	Complete
VAPOR DENSITY:	Air = 1	MELTING POINT:	N/A
% VOLATILE BY VOLUME:	0	EVAPORATION RATE:	Equal to water
APPEARANCE AND ODOR:	Brown liquid; mild	pH OF SOLUTION:	3.5

SECTION IV - FIRE AND EXPLOSION INFORMATION

FLASH POINT:	N/A	HAZARDOUS DECOMPOSITION BYPRODUCTS:	None
EXPLOSION LIMIT:	0	FIRE FIGHTING PROCEDURES:	N/A
EXTINGUISHING:	N/A	SPECIAL FIRE & EXPLOSION HAZARDS:	None

## SECTION V - HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LEVEL: None; see Section II  
HEALTH HAZARDS: None  
CARCINOGENICITY: Non-carcinogenic  
EFFECTS OF CHRONIC OVEREXPOSURE: None

PRIMARY ROUTES OF ENTRY: Skin contact, Eye contact, Ingestion, Inhalation

### SIGNS AND SYMPTOMS OF EXPOSURE:

SKIN: None  
EYES: May cause eye irritation  
INHALATION: None  
INGESTION: May cause gas

### FIRST AID:

IF ON SKIN: None  
IF ON EYES: Flush with fresh water  
IF INHALED: None  
IF INGESTED: Drink fresh water

## SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION: Will not occur  
STABILITY: Stable, no toxic fumes.  
INCOMPATIBILITY: None  
HAZARDOUS DECOMPOSITION  
OR BYPRODUCTS: None; biodegradable

## SECTION VII - SPILL OR LEAK PROCEDURES

IN CASE OF LEAK OR SPILL: Mop up with fresh water, sewer disposal  
WASTE DISPOSAL METHOD: Sewer disposal  
HANDLING AND STORING PRECAUTIONS: Store at room temperature  
OTHER PRECAUTIONS: Not recommended for human consumption

## SECTION VIII - PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: None  
VENTILATION: None  
PROTECTIVE GLOVES: Optional  
EYE PROTECTION: Safety glasses recommended  
PROTECTIVE CLOTHING: None  
WORK PRACTICES: Clean up spills immediately; floor will be slick



LSA Associates, Inc.

Environmental Analysis  
Transportation Engineering  
Biology and Wetlands  
Habitat Restoration  
Resource Management  
Community and Land Planning  
Landscape Architecture  
Archaeology and Paleontology

June 26, 1999

*Principals*

Rob Balen  
Sheila Brady  
Les Card  
David Clore  
Ross Dobberteen  
Steve Granholm  
Richard Harlacher  
Roger Harris  
Art Homrighausen  
Larry Kennings  
Laura Laster  
Carolynn Lobell  
Bill Mayer  
Rob McCann  
Anthony Petros  
Rob Schonholtz  
Malcolm J. Sprout  
Lloyd B. Zola

To: Bob Farrington  
City of Vacaville

From: George Molnar *GM*  
Wetland Ecologist

Subject: Proposed Use of Microorganisms for Water Quality - Lagoon Valley Lake

I have reviewed the materials sent by EM Technologies regarding the use of microbial inoculants into Lagoon Valley Lake. My overall recommendation is for the City to use extreme caution before attempting to apply such materials because of several concerns that should be properly investigated first. These concerns are discussed below:

*Associates*

James Baum  
Connie Calica  
Tony Chung  
Steven W. Conkling  
Gary Dow  
Jack Easton  
Richard Erickson  
Kevin Fincher  
Frank Haselton  
Climt Kellner  
Benson Lee  
Judith H. Malamut  
Sabrina Nicholls  
M. W. "Bill" O'Connell  
Deborah Pracilio  
Amy Skewes-Cox  
Lynette Stanchina  
Jill Wilson O'Connor

**Suitability to Lagoon Valley Lake**

The EM product line appears to be heavily oriented toward agricultural, aquaculture, and wastewater treatment applications - not large scale aquatic management work such as required at Lagoon Valley Lake. EM lists only two applications involving situations even remotely similar to Lagoon Valley Lake. The first application was a 1.5-acre golf course pond that receives tertiary treated wastewater. The product was apparently successful in controlling filamentous algae in the small pond. Second, a 0.75-acre pond in Tucson, Arizona was treated, although the EM literature does not discuss results.

Both examples provided by EM involve very small confined aquatic systems in which intensive algal growth could be reasonably expected to be treated by any number of methods. Lagoon Valley Lake, on the other hand, is over 100 acres in size and contains a volume that is many order of magnitude larger than these very small ponds.

I suggest that EM provide an example of a successfully treated lake or reservoir within a similar size and volume range as Lagoon Valley Lake, and with a similar mix of water quality management problems.

06/26/99(P:\COV831\INOCULAN.MMO)

157 Park Place  
Pt. Richmond, California 94801

Telephone 510 236-6810  
Facsimile 510 236-3480  
E-mail lsa2@ix.netcom.com

Other offices located in Berkeley  
Irvine, Riverside and Sacramento

### **Effect on a Non-confined Ecosystem**

Unlike the confined ponds cited by EM, Lagoon Valley Lake is not a confined system. It is connected to the Laguna Creek system and ultimately Alamo Creek downstream, as well as associated wetlands and riparian areas. I have no idea what the effects would be from the introduction of the microbial inoculants upon these downstream ecosystems.

### **Effectiveness against Vascular Aquatic Plants**

The photosynthetic bacteria contained in the EM inoculant apparently works by outcompeting filamentous algae. Basically, the bacteria are able to utilize nutrients in the water column more effectively and quicker than filamentous algae, thereby depriving the algae of the nutrients they need for growth. Whether this would work in such a large volume of water as Lagoon Valley Lake is unknown. However, Lagoon Valley Lake not only has an algae growth problem but also a tremendous problem from the growth of sago pondweed, a rooted vascular plant that derives its nutrients, at least in part, from bottom sediments. EM offers no evidence that their product would be effective against aquatic plants or would uptake nutrients from bottom sediments. Again, I would suggest that they provide verifiable evidence of a lake or reservoir where their product has been effective against rooted vascular plants.

### **Effects on the Aquatic Food Web**

Lagoon Valley Lake is an important natural feature that supports large populations of aquatic and terrestrial fauna. I have no idea how the introduction of the bacterial inoculant would affect the lake's food web. For example, would the bacteria decrease populations of planktonic organisms to the extent that filter feeders and other aquatic invertebrate would be adversely affected? If this happened, what would be the effect upon fish populations as well as waterfowl? These questions are particularly important given the City's goals of improving the lake's sportfishery and biological values.

I also have no idea if the mix of bacterial species contained in the inoculant are indeed native and/or suitable for Lagoon Valley Lake, or whether they would have adverse effects on other desirable bacteria that currently occur in the water column.

### **Safety and Legal Approval**

Based on the Material Safety Data Sheet (MSDS), the product would appear to be relatively safe for human exposure, provided there would be no direct contact during application. However, the City needs to investigate whether or not the product is federally and state approved for use in aquatic systems such as Lagoon Valley Lake. For example, I do not know if the product requires an Environmental Protection Agency (EPA) label number similar to herbicide or

pesticide. I also do not know if the product is approved by the California or U.S. Departments of Agriculture for such application. In general, approval by these agencies is required before introducing any new form of biological control agent.

### Summary

The EM microbial inoculant product may, in fact, be a highly effective and safe solution to Lagoon Valley Lake's weed problems. However, until the above concerns can be reliably answered, I strongly suggest that the City not proceed with application of the product into the lake. I recommend instead that the City first retain an expert on the use of such microbial products to help provide answers to the above-stated concerns. I suggest that the City contact the UC-Davis Agricultural Extension Service (Dr. Lars Anderson) for further expertise or for direction on who would have the expertise to assist the City.



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