OVERALL LAKE WATER MAINTENANCE GUIDELINES

GENERAL

The PMCDD has 103 lake of which 68 are in Pelican marsh and 35 in Tiburon. Of this number in 2011 approximately 19 were identified as priority lakes in Pelican Marsh and 8 in Tiburon.

Resident Fences and plants on PMCDD property around the lake

Residents are not allowed to install fences or plants beyond their property onto PMCDD property around the lakes. The PMCDD property is required to be clear to allow personnel and vehicles to service the lake.

The PMCDD intends to migrate from a reactionary plan to chemically treat algae to a preventative plan to prohibit algae from growing by planting more littoral plants.

The main causal factors of algae and weeds are accepted as a water temperature 72 degrees and higher and high level of nutrients coming primarily from fertilizers washed into the water ways. However there are cooler weather algae that will grow in water with temperatures in the low 60 degree range.

While Algae and weeds grow from excess nutrients in the water, during their decaying process, they also give back nutrients to the water, thus completing a cycle of potentially high nutrients in the water.

Chemical treatment shall be separated by season with the winter months of December through March with cooler waters having one day per week treatment or alternate weeks with two day service. Tiburon, with their December golf tournament shall get priority in December. The warmer months of April through October with warmer waters have two day per week treatment.

The names of the materials used to treat algae and weeds must be specified

The focus shall be on the priority lakes and lakes without aerators.

Fish kills can occur both in the winter and summer, when the water temperature is either too high or too low for the fish to survive. Fish kills are primarily Tilapia, although other species may be affected on occasion from excessive high or low temperatures. Fish kills also occurs from low levels of oxygen. These low levels of oxygen can occur from decaying plant life, which absorbs Oxygen for the decaying process or high water temperatures, which hold less oxygen.

The Operations manager shall keep a log of all issues raised by the residents including recording the date, resident, lake and issue. These resident issues shall be used to further identify problem lakes.

REPORTS

The contractor reporting format shall be that which was initiated on 3/1/11 or one mutually agreed upon by the contractor and PMCDD. The report shall be issued for each day on site with a separate report issued for Pelican Marsh and Tiburon lakes. The focus shall be on the size of the algae; the type of algae, and the chemical treatment. The same report format shall be used for evasive weeds, both submerged and shoreline. Modifying the report shall be considered to identify the separate types of weeds.
Oxygen testing shall continue during the weekly service. There is still controversy in the industry as to the most advantageous location to take the water samples to obtain the Oxygen reading. Whether the reading should be in the shallows along the lake, in the deeper lake waters, or at the bottom of the deepest part of the lake is still being reviewed.
The contractor maintenance report shall also identify any general information that may be useful for monitoring lake water quality.

The contractor lake maintenance reports for 2010 were used as a guideline for identifying priority lakes. A report summary shall be developed separately for Pelican Marsh and Tiburon lakes. Community association, along with each golf course, shall be notified of any problem lakes in the community or the golf courses with any appropriate information available. The intent is to have the communities and the golf courses review their fertilizing operations and what impact they may have on the increased nutrients in the waters.

ALGAE PREVENTION ACTIONS

Fertilizer shall be applied per county regulations.
Grass clippings and fertilizer on hard surfaces shall be blown back onto grassy areas.
Quantities of aquatic plants shall be maximized to absorb nutrients in the water.
Hand raking along the shorelines shall be maximized in lieu of chemical spray, when feasible.

LITTORAL PLANTS

Littoral plants are plants along the shore line. Littoral plants shall be installed in “blocks”. A “block” shall consist of plants spaced one foot apart and three rows deep, unless directed by the Operations manager. Appropriate plants shall be selected for the various rows based upon their tolerance to water. The length of the “blocks” shall be based upon the need for the area. The “blocks” should provide for better plant survival and sustainability. The plant blocks would

reduce erosion, where no geo tubes are used. Greater nutrient absorption from the water is expected, which would reduce algae occurrences.

Location of littoral plants shall avoid the residential embankments unless approved by the community association.

Each year the Operations manager shall prepare a matrix of lakes where littoral plants to be installed. The information shall include the lake number, number of plants per lake and the name of the plants per lake. The lakes with known algae issues shall take priority over other lakes including request from residents. Special attention shall be given to lakes without aerators. This lake matrix shall be distributed to the board supervisors to be inserted into their Operation manuals to tract progress on lake quality

AERATORS

There are two primary purposes of the aerators:
--- air pumps provide more oxygen to the lakes

- Plants use water oxygen at night to process their nutrition requirement
- Bottom sediment decays and uses up oxygen
- Aquatic animals require oxygen
- Decaying algae blooms use up algae
- Low oxygen on the bottom will release phosphorous in the sediment, which encourages algae

--- air moves the cooler water from the lake bottom to the top.
Oxygen levels are directly related to the water temperature with cooler water holding more oxygen. Algae grows primarily in water temperatures over 72 degrees

The Operations manager shall maintain a matrix of pump electric meters with the lakes that they service. The pump horse power varies between ½ and 1 ½ depending upon the sizing for the lake water volume
As aerators age, their repair and replacement will accelerate. The approximate lifespan of the pump is approximately 5-6 years

Through 2010 Pelican Marsh had aerators on 57 of 68 lakes. It is not known why the 11 lakes were excluded from having aerators. Complete data for Tiburon aerator is expected by the summer of 2011.Tiburon has a shallow lake #5 with no aerator .Lake 28 also has no aerator since it is an irrigation retention pond for the golf course.

The Operations manager shall develop a maintenance program for the aerator diffusers to keep the diffuser ports open for maximum water column movement. Emphasis shall be on the priority lakes and the frequency established through experience.

LAKE CARP

Carp were introduced to the Pelican Marsh lakes about 2000. Tiburon has no carp in their lakes. The carp are sterile and therefore do not reproduce. They have an expected life of ten years. The original intent of the carp was to have then feed on the algae at the bottom of the lakes. Experience has shown that the carp favor the littoral plants .While some plants are preferred over others, they will feed on all the plants before the lake bottom algae. It is suspected that the carp have lost their value and eradicating them could be of greater value, since they appear to be living beyond their expected 10 year life.

LAKE SEDIMENT/GEOTUBES

Lake sediment contains decaying vegetation along with nutrients either from the decayed vegetation matter or excess fertilizer. This sediment continues to decay and in the process absorbs Oxygen from the lake bottom and contributes to the depletion of Oxygen in the lake. The stored nutrients in the sediment can also be released to the water increasing algae potential formation. When Geotubes are installed for lake erosion, a side benefit is that this lake sediment is utilized to fill the Geotube and assist in removing this sediment from the lake bottom.

LAKE MAINTENANCE CONTRACT

The base contract shall be for treating algae and lake weeds along with installing an agreed amount of aquatic plants to absorb nutrients to minimize algae.
Cost shall be separated by treatment during cooler weather (December through March) and warmer weather (April through November) schedules. Actual monthly payments to the contractor can be equalized.
The cooler weather months shall include one day per week or alternate two days every two weeks and focus on the priority lakes. (List attached).
The warmer months shall include two days per week with focus on the priority lakes, but a review of all lakes.

The contractor's report format requires PMCDD approval and shall include the following:
Algae- size of bloom; type of algae; chemicals utilized to treat the algae
Weeds- size of weeds,; chemicals used to treat the weeds (separating submerged from shoreline is under consideration)
Oxygen level - readings on lakes treated with specific agreed testing procedures

Contract cost identified for:

--Treatment for algae
--Treatment of lakeshore weeds
--Treatment of submerged weeds
– Materials used to treat algae and weeds must be identified in the report
--Submerged and lakeshore weeds may be hand removed at the discretion of the Operations manager.
--Oxygen reading per agreed procedure
- Blocks of 7500 littoral plants shall be quoted for material and labor
– Contract would be for one year with a two year or longer option extension with possible annual modifications for work content and appropriate cost changes
-- Summer treatment May through November shall be two days per week
-- Winter treatment shall be one day per week or two days on alternate weeks whichever is cost effective and functional
-- Treatment report format shall be mutually agreed

FERTILIZER

Nitrogen and Phosphorus flowing into the lakes has been determined to be a major cause of algae.
Fertilizer practices are a major factor in lake water quality.
At the end of 2011 the fertilizing application rates in the District were reduced to meet the new 2011 Collier County fertilizer ordinance.