FINAL REPORT OF SEAGRASS TECHNICAL ADVISORY COMMITTEE

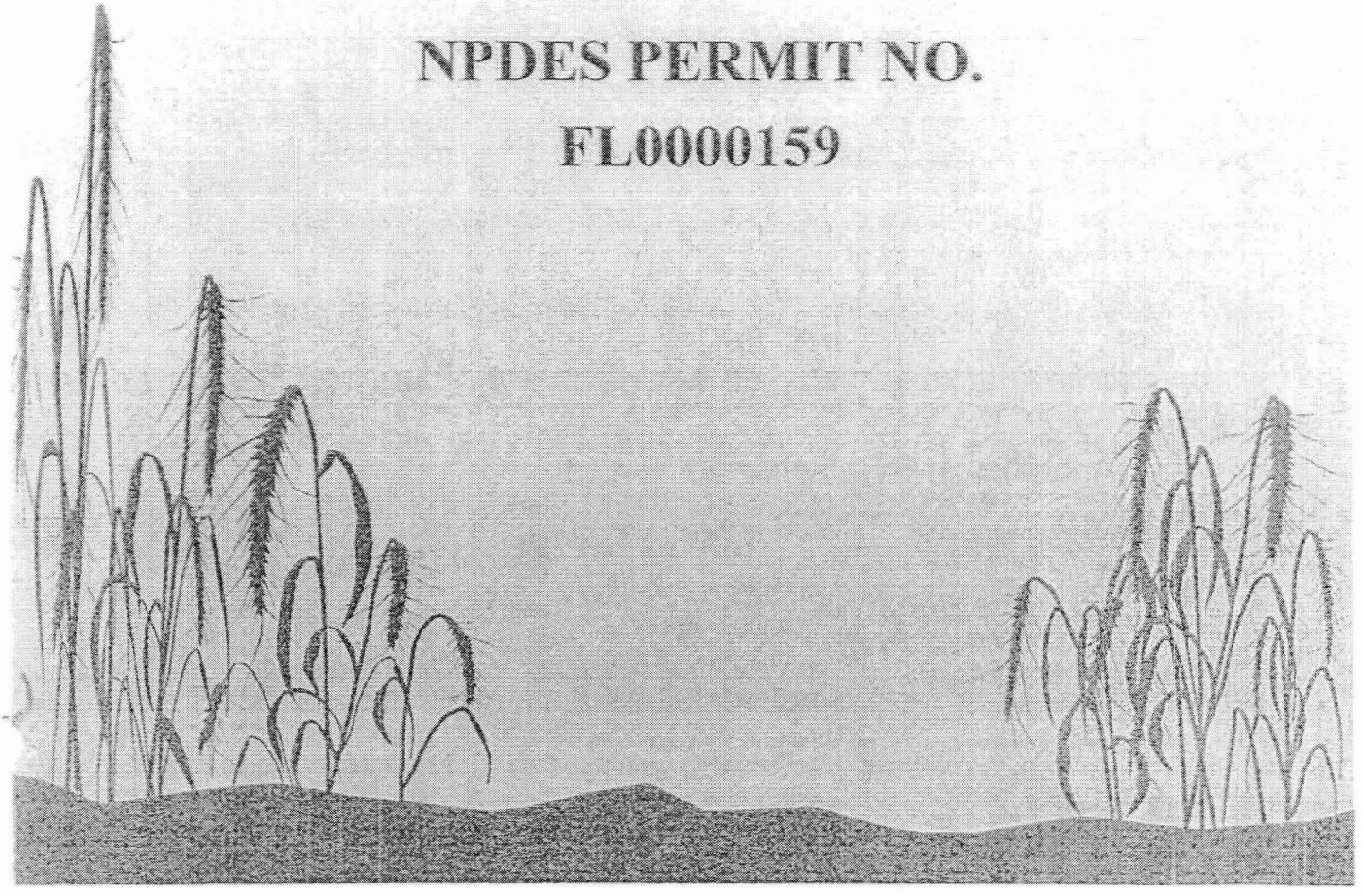
Submitted By

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNITS 1, 2, 3

NPDES PERMIT NO.

FL0000159



CRYSTAL RIVER ENERGY COMPLEX

The Florida Power Corporation's (FPC) Crystal River Energy Complex is located on the west coast, approximately 1.5 miles from the shore of the Gulf of Mexico. Approximately 2.5 miles north of the site are the mouths of the Withlacoochee River and the Cross Florida Barge Canal.

NPDES Permit No. FL0000159 currently authorizes the discharge of industrial wastewater from Units 1, 2 and 3. Unit 1 began commercial operation in October 1966, Unit 2 in November 1969. On December 31, 1974, EPA issued an NPDES permit for the operation of Units 1, 2 and 3 which required offstream cooling subject to consideration of a variance and alternative thermal limits under Section 316 of the Clean Water Act. Subsequently, Unit 3 began commercial operation in March 1977.

The thermal component of the discharge from the facility was subject to the water quality standards specified in Section 17-3.050 FAC. The rule required that thermal discharges "shall not increase the temperature of the receiving body of water (RBW) so as to cause substantial damage or harm to the aquatic life or vegetation therein or interfere with the beneficial uses assigned to the RBW". During renewal of the NPDES (and state Industrial Wastewater) permit in 1979, and in accordance with Section 316 and Section 17-3, EPA and the FDEP required post-operational biological and thermal studies in order to make a determination of the need for offstream cooling, reduced thermal discharge and/or reduced intake flow. Following the completion of the 316 (a) and (b) studies in 1984, the EPA and the FDEP issued a public notice of determination that "substantial damage" had occurred in approximately 1100 acres of Crystal Bay, primarily due to the thermal discharge from the facility. Subsequently, in accordance with Section 17-3.05(1)(a)(3), FAC, the agencies imposed permit limitations on the thermal component of the discharge consistent with off-stream cooling. The EPA and FDEP agreed that offstream cooling would subsequently satisfy the requirements of the Florida Water Quality Standards and Sections 316 (a) and (b) of the Act. FPC disagreed with the conclusions made from the study. Specifically, FPC questioned if seagrass was ever actually present in the area, the extent of the area identified as affected and if the thermal discharge from the site resulted in substantial damage in the area to plants and animals. In February 1987, FPC initially proposed to extend the discharge canal into deeper water as an alternative to off-stream cooling towers. Following rejection of the initial proposal, FPC offered a second proposal in 1988 which included the construction of helper cooling towers.

In 1989, following several years of testimony, engineering studies and negotiations, the EPA issued an NPDES (and state Industrial Wastewater) permit with the following requirements: installation of flow reduction equipment to reduce flow through the plant by 15 percent during the months of November through April; construction and operation of a multi-species mariculture center to mitigate for intake impacts to aquatic fisheries; and construction and operation of helper cooling towers to mitigate for thermal impacts to water quality, macrophytes and seagrasses. The multi-species mariculture center was operational October 1991 and flow reduction was implemented May 1992. The helper cooling towers were designed and constructed to ensure that a maximum discharge temperature from the Crystal River site point of discharge (POD) of 97.0°F. Following implementation of cooling tower operation in 1993, the permit required that seagrass monitoring be conducted to quantify seagrass presence and recovery within the zone of discharge of the facility and the establishment of a Seagrass Technical Advisory Committee (TAC) to review the report and make recommendations regarding future activities at the site.

The results of the seagrass monitoring project and recommendations of members of the Seagrass TAC are included in this report.

SEAGRASS MONITORING PROJECT SUMMARY

Following commencement of helper cooling tower operation, NPDES Permit FL0000159 required the following:

Seagrass Monitoring

Evaluation of seagrass colonization in the zone of discharge after a period of two years to determine recruitment rates and zones. A baseline distribution survey using aerial photography and field surveys, including one survey no later than two years following the initial survey. If natural colonization is determined to be proceeding at an acceptable rate, no further activity will be required.

Seagrass Technical Advisory Committee

The establishment of a Technical Advisory Committee to review the seagrass monitoring reports and offer suggestions regarding future activities at the site.

Sprig Planting

If natural colonization is unsatisfactory, sprig planting will be conducted during the third year of tower operation and will consist of replicated, multi-species plots in a cross section of discharge habitats.

Seagrass planting

If it is determined that seagrass planting is feasible and necessary, seagrass will be planted in the area within the zone of discharge during years 5 through 9 following tower operation, at a rate of ten (10) acres per year.

SEAGRASS MONITORING RESULTS

Biological studies were conducted by Mote Marine Laboratory for three years following implementation of the helper cooling towers at the Crystal River Energy Complex. The study was conducted to quantify seagrass presence and recovery within a two mile radius of the site point of discharge (POD) into the Gulf of Mexico.

Spatial as well as temporal patterns in the distribution of seagrasses and rhizophytic algae occurred at transacts and seagrass monitoring bed locations. Patterns depicted a system of bed recruitment and expansion in submerged aquatic vegetation (SAV) cover and condition over the three year monitoring period. Six new beds appeared in barren areas, and of those, three persisted into 1995. More than half of the intensely monitored beds had net increases in perimeter and 8 of 15 beds also increased with respect to cover from 1993 to 1994. Biomass was lower and productivity was higher in 1995, than in 1994, possibly a result of the heavy storms and rains which occurred in 1995. Overall, changes along the transact and bed locations within the 2 mile zone of discharge were mirrored by changes at more distant sites.

TECHNICAL ADVISORY COMMITTEE

A Seagrass Technical Advisory Committee (TAC) which consisted of representatives from state and federal environmental agencies and experts in the field of seagrass dynamics convened to review the Crystal River seagrass monitoring reports and make recommendations regarding future activities at the site.

Participants are as follows:

Mr. Gary Serviss, Senior Scientist, CCI Environmental Services, Inc.

Dr. Clinton Dawes, University Distinguished Research Professor, Department of Biology, University of South Florida.

Dr. Michael Durako, Senior Research Scientist, Florida Marine Research Institute, Florida Department of Environmental Protection.

Mr. Phillip Murphy, Acting Chief, Ecological Support Branch, U. S. Environmental Protection Agency.

Mr. David Bruzek, Manager, Crystal River Mariculture Center, Florida Power Corporation.

Ms. Manitia Moultrie, Chair, Seagrass TAC, Environmental Specialist, Florida Power Corporation.

SEAGRASS TAC MEETINGS

The initial meeting of the Seagrass TAC was held on February 21, 1996 at the Florida Power Corporation, General Office Complex.

Seagrass TAC members discussed the history of the Crystal River site and the results of the Seagrass Monitoring Project conducted in 1994 and 1995. The following issues were discussed:

- Expansion of Seagrass Beds
- Percent Cover
- Total Seagrass Biomass
- Shoot Density
- Productivity

Overall, several seagrass beds had net increases in perimeter and cover from 1993 to 1994, with some decrease in cover in 1995. Biomass was lower and productivity was higher in 1995 than in 1994. TAC members agreed that there may be an infinite array of causes for the increase in productivity and decrease in biomass within the seagrass communities. While the inclination of the TAC was to question if the helper cooling towers have had an impact on seagrass recovery, the focus of the committee was to evaluate seagrass recovery rates within a two mile radius of the site POD and determine if "acceptable" recolonization has occurred. The lack of barren controls which are representative of the study area, the lack of historical data and the regional affects on productivity and biomass were discussed.

The second meeting of the Seagrass TAC was held on March 29, 1996 at the Crystal River Mariculture Center. A helicopter tour of Crystal River Units 1, 2 and 3 and the study area was conducted prior to the meeting.

A summary of the 316 studies which was conducted from June 1983 to August 1984 was provided to the TAC. The monitoring program was conducted to evaluate the effects of plant operations on the area within the zone of discharge from the Crystal River site.

The impact of light intensity, turbidity, salinity variation and suspended load on seagrass colonization was evaluated. The TAC suggested that these factors are a significant influence on seagrass colonization and could be more critical than the temperature factor.

TAC members indicated that they could not determine if adequate seagrass colonization has occurred within the zone of discharge in comparison to regional seagrass colonization rates. There are insufficient areas within the region which are actually representative of the zone of discharge due to the location of the spoil dikes and influences offsite from the Withlacoochee River, Cross Florida Barge Canal and Homosassa Springs.

TAC members indicated that based on available data, there are too many factors to consider which may have a dramatic impact on seagrass colonization. The historical data and geography of the area suggest that while temperature cannot be ruled out as an impact to seagrass colonization, the primary factor affecting seagrass recolonization may not be temperature since seagrass recolonization has not been dramatic since implementation of the helper cooling towers. Impacts which need to be considered which were not a part of this study include turbidity, light intensity and salinity variations. TAC members agreed that the isolation of these factors may not be appropriate for FPC to evaluate since FPC performed the necessary mitigation and should not be required to continue to evaluate the area to isolate which factor is responsible for past impacts to the seagrass community.

The TAC also discussed the cost and benefits of sprig planting and subsequent monitoring to evaluate physical data, seagrass survival rates and regrowth. As a result of this discussion, the TAC agreed that sprig planting may be futile if factors such as turbidity and light intensity are as limiting as they appear to be.

Following the final meeting, each TAC member was asked to provide an official comment letter to address the following issues:

- Interpretation of the historical ecological data regarding impact to seagrass communities within the zone of discharge of the Crystal River POD.
- Expected seagrass recolonization rates based on current research, existing data and regional impacts.
- The requirement to conduct sprig planting, if natural colonization is unsatisfactory and conduct subsequent monitoring to evaluate seagrass survival rates.

Comments from the TAC members are provided in the following section.

COMMENTS

SEAGRASS TAC MEMBERS

Dr. Clinton Dawes, USF
Mr. Gary Serviss, CCI
Dr. Michael Durako, FDEP
Mr. Phillip Murphy, U.S. EPA

From the historical data available, it appears that seagrass beds were present in the POD region but were lost due to the discharge/construction activities. By 1983-84 there were only minimal grass patches and this apparently has remained at the same level based on the 1993-95 study. The patchy nature of seagrass communities surrounding the Crystal River Plant indicates that there are wide fluctuations in seagrass development. Thus one cannot anticipate development of extensive beds at any time in the near future but might expect some contraction.

The colonization rate of the beds appears to be static based on the limited data from the 1993-95 study. However, without control sites outside the impacted region, it is difficult to know just how different expansion or contraction rates are. Thus, a small study comparing colonization rates within and outside the POD/impacted sites might be an alternative to planting. The Syringodium beds to the south of the channels might serve as controls. If this is done, continuous recordings of temperature and salinity are needed.

My experience suggests that the impacted area (POD, region of channels) will not change much in the next 10 to 15 years and that the seagrass communities are in a steady state at this time. The one problem, as pointed out, is the high rates of blade growth determined in 1996, without expansion. This suggests a reaction to high temperatures, low light and a future contraction of the beds.

A general seagrass planting should not be attempted unless there is evidence that the sprigs would survive in the POD and impacted region. If sprig planting is decided on, a number of small pilot, or test plantings should first be tried (2 year study) over the zones (A through D) listed in the 1983-84 study (Fig. 6.1-7). Such a study should include continuous monitoring of temperature and salinity data.

Clinton J. Dawes
Distinguished Research Professor
University of South Florida

Historical data relative to the composition, density and distribution of seagrasses within the zone of discharge of the Crystal River POD is limited. A single map from the 1975 Florida Power Corporation (FPC) report documents the distribution and standing crop of submerged aquatic vegetation (SAV). The methods used to prepare the map, the intensity of the survey effort and the antecedent weather conditions are not known. It is also not known if this map accurately reflects the historic distribution and density of SAV in the zone of discharge.

Consideration must be given to the limited historic distribution data. The historic SAV map essentially represents a snapshot in time and actual historic SAV coverage may vary substantially from that shown on the map.

Based on the above-mentioned limitation, the actual impact to seagrass communities in the zone of discharge is difficult to quantify. Although SAV cover is substantially less than in the 1975 map, it appears that a large percent of the zone of discharge area was barren or sparsely vegetated in 1975.

Review of the water quality section of the 316 Study provides insight into the dynamics of the zone of discharge. The water quality data indicates that this area is probably marginal at supporting seagrasses. The photometry data indicate that a significant percentage of incident light is absorbed before reaching the substrate over much of the zone of discharge. Unconsolidated sediments were documented to resuspend under windy conditions and result in increased turbidity. The area was also documented to be a highly depositional environment.

The 316 Study documented the spatial temperature variation from the POD. Isotherms were provided for the zone of discharge for various tidal and seasonal combinations. These figures provide information relative to the potential impact area of SAV which could be attributed to elevated temperature levels.

The two mile zone of discharge radius for seagrass community impacts due to elevated temperatures appears conservative (i.e., larger than the temperature data would indicate). Although the impact of high water temperature on seagrass communities has been well documented, the temperature changes documented in the 316 Study would not be expected, in and of themselves, to result in the loss of seagrasses within the entire area. It appears that other factors may also have contributed to the reduced coverage of SAV in the zone of discharge. Again, it is important to note these results are based upon a limited historical data base relative to SAV coverage.

Seagrass colonization rates at this location are difficult to estimate. As previously discussed, there is limited historical data on actual seagrass coverage. This combined with the depositional nature of the area, wind suspension of unconsolidated material and the low transparency of the water provide variables to consider in predicting colonization rates.

Based upon the temperature modeling before and after helper cooling tower usage, recolonization of seagrasses would be expected within a portion of the zone of discharge. This predicted recolonization, however, assumes that the higher temperatures were the sole or primary cause of seagrass loss in some areas and that the reduction of temperature in and of itself would allow the area to recolonize. This does not appear to be a reasonable assumption based upon the nature of the area.

Drawing conclusions from the Seagrass Monitoring Report data is exacerbated by several factors. Relative to the study design, it generally appears appropriate for answering the questions discussed. The study could, however, have benefited from water quality data at varying distances from the POD. This is especially true because of the climatic events which occurred in 1995. The impact of these climatical events upon seagrass recolonization is difficult to assess in the absence of some abiotic water quality parameters.

Short of phenomenal natural recolonization, it was probably optimistic to expect two years of monitoring to provide sufficient data on recolonization trends. Typically, monitoring would be necessary over several years to allow for natural fluctuations in recolonization rates and still reveal the appropriate trends. This is especially true when the marginal water quality of the area is considered.

The results of the monitoring in 1994 were encouraging since a few new beds were observed to colonize the area near the POD. Unfortunately, the monitoring in 1995 confused the trends, with seagrasses disappearing from 1994 locations and beds appearing in new locations. The climatic events of 1995 may well have contributed to the variable recolonization of seagrasses. The 316 Study documented the effect of storms on turbidity levels and several storms occurred in 1995.

The results of the study do not allow for a finding that recolonization is proceeding at acceptable rates nor are the results such that one would conclude that recolonization is occurring at unacceptable rates. The limited time frame of data collection combined with the regional climatic events in 1995 does not provide a clear picture of recolonization trends.

The following recommendations are provided:

- Continue monitoring the recolonization of seagrasses, as done in 1994 and 1995, until the trend data stabilizes. Once stabilized, the data can be reviewed for acceptable rates of recolonization. Monitoring could be done every other year to provide information on long-term trends.

- Add the collection of key abiotic parameters (e.g., salinity, transparency, temperature, turbidity) to the monitoring program. Data collection points should extend outward from the POD for approximately three miles. The frequency of water quality monitoring should be sufficient to characterize the various basins.

- Sprig planting is not recommended at this time. Before expending funds to study the planting of seagrasses, the issue of natural recolonization rates should be resolved. The water quality data may also be helpful in determining which basins are likely to be compatible with seagrass re-establishment. Failure of areas to naturally recolonize likely indicates that conditions are not suitable for seagrass establishment and sprig planting would be unsuccessful.

Gary M. Serviss
Senior Scientist
CCI Environmental Services, Inc.

Dr. Michael Durako, FDEP

A primary limitation to the interpretation of the historical data, is the lack of a reliable, pre-operational seagrass distribution map. Based on the findings of the 316(a) studies which were undertaken after Unit 3 was operational, approximately 3,000 acres adjacent to the POD were biologically adversely affected by POD discharge and 1,100 acres were barren of seagrasses. The 316(a) studies concluded this impact was primarily due to thermal effects. Installation of helper cooling towers, which became operational on June 15, 1993, was intended to return the discharge area to the approximate thermal levels in existence prior to the operation of Unit 3. A three-year monitoring report on the seagrass communities adjacent to and in the area contiguous to the POD suggests that the Crystal River site is dynamic, with increases and decreases in seagrass biomass and coverage being observed throughout the study area over the three-year study period. This study did not demonstrate any persistent seagrass recovery within the zone nearest to the POD. The absence of temperature, salinity or light-availability data precludes any assessment as to the reasons why seagrasses have not recolonized the interior 1,100 acre zone. Individual patches of seagrasses were observed to colonize the area, but most disappeared within a year. The lack of suitable control sites also limits the interpretation of the monitoring data with respect to natural, regional seagrass recolonization rate.

The lack of spatial water temperature data in the study area before and after the installation of the helper cooling towers is most surprising (and disturbing). Water temperature reduction was the reason for the helper cooling tower installation. Merely measuring temperatures at the POD does not provide sufficient information regarding the effective spatial scope of the reduced temperatures.

Statements made in both the seagrass monitoring report and in the presentation of the report's findings by Mote Marine Lab scientists, coupled with my observations during the aerial overflight of the sight suggest that factors (e.g., turbidity, salinity, stochastic meteorological events) other than temperature may also be affecting potential recolonization of the site by seagrasses. Without reliable data on light availability, salinity variation, and disturbance regimes, it is impossible to ascertain what factors are restricting recolonization in the study.

Based on the information provided and discussions with the other TAC members, I would not recommend attempting any significant transplanting efforts until more information regarding the physical attributes of the near-POD area have been gathered, specifically turbidity and light availability data.

Michael J. Durako, Ph.D.
Senior Research Scientist
Florida Marine Research Institute

Phillip Murphy, U. S. EPA

This letter is in response to our conversations over the past three months as they relate to the request for my participation on the Seagrass Technical Advisory Committee for the Crystal River Plant. I regret that our participation was severely hampered by the budgetary crisis and associated travel restraints which our office incurred precisely during the period that the TAC was convened. This likewise, coincided with the retirement of Mr. Delbert Hicks who had served for years as the EPA representative for biological matters regarding the Crystal River Power Plant. With his departure, the institutional knowledge of our staff relative to the Crystal River Plant also went out the door. Consequently, I have been playing catch-up without too much success. Thanks to you for supplying me with the TAC meeting minutes and other associated literature. They are my only connection to the questions and TAC discussion relative to the Seagrass Study. Accordingly, with these qualifiers, I offer the following limited comments.

As we discussed several weeks ago via telephone, the seagrass study by Mote Marine Lab is, at best, inconclusive regarding regeneration of seagrasses within the thermal plume area. I think it would be stretching any facts to suggest that recolonization is occurring. It appears from the information that I have at hand, that there are many compounding variables, within the zone potential impact formerly attributed to the heated discharge, which singularly, or collectively, could affect seagrass growth and/or recolonization. While elevated ambient temperatures are the focus of your company's concerns because of Section 316 requirements, it goes without argument the role of turbidity and associated light attenuation play relative to seagrass communities. Like the members of the TAC who were able to participate in the site visit, I, too, am unable to evaluate the interaction of elevated water temperature, turbidity, and light extinction, in the impact area versus control areas. From the information packages you have provided me, my only evidence of the turbidity fronts which have been discussed, is a single aerial photograph which, indeed, appears to indicate a zone of turbidity in excess of ambient, associated with the thermal plume area. I note within the meeting minutes the attribution of this turbidity to the affects of discharges from the Cross Florida Barge Canal. While I cannot refute or confirm this possibility, it does appear to me that the turbidity is most elevated within the thermal plume area. If this perception is correct, I think an appropriate consideration is whether any physical phenomena associated with the increased water temperature is conducive to enhancing, and sustaining, resuspension of sediments within the thermal plume area beyond what is measurable in adjacent coastal areas beyond the thermal plume. We cannot dismiss too quickly the affects of temperature interaction with other factors.

In closing, it is important for me to emphasize that the above comments are offered solely in a technical advisory capacity and does not reflect EPA's position on regulatory matters. Any such position must come from the NPDES program office in EPA's, Region IV, Water Division. Thanks for your patience with us during the past four difficult months.

Phillip Murphy, Acting Chief
Ecological Support Branch
U. S. Environmental Protection Agency

FLORIDA POWER CORPORATION

SUMMARY

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RECOMMENDATION

As a result of the 316 (a) and (b) studies which were conducted in June 1983 - August 1984, the EPA and FDEP determined that substantial damage had occurred within the zone of discharge to the Gulf of Mexico from the Crystal River site. The demonstration and subsequent determination was controversial due to the complex dynamics of the shallow receiving water body (zone of discharge), the lack of historical baseline data to document conditions within the region prior to the operation of Units 1, 2 and 3 and the lack of environmental justification to require FPC to mitigate for thermal impacts to Crystal Bay.

FPC continues to question if seagrass was ever present in all of the areas identified as being impacted from the thermal discharge from FPC following the 316 studies. A historical vegetation map for the study area provided by the University of Florida provides the only historical baseline map for comparison. The validity of the map is questionable since it does not provide a description of methods, date, an author or narrative.

Ecosystem stress to the biota within the zone of discharge is affected by factors unrelated to the operation of Units 1, 2 and 3 . These factors include salinity, turbidity, siltation and the geography of the area (i.e., fluctuation from the Cross Florida Barge Canal, the input of fresh water and suspended sediment from the Withlacoochee River and Homossassa Springs).

FPC strenuously objected to the requirement to construct helper cooling towers, due to the enormous cost and the lack of environmental justification. While the installation of cooling towers has reduced the temperature in the near shore area and subsequently limited heated water discharges, this change in temperature has not necessarily resulted in any significant measurable benefit to the Crystal Bay area. To date, FPC has completed construction of the helper cooling towers to mitigate for thermal impacts and completed the seagrass monitoring project as specified in the permit, at a cost of over $90 million. Seagrass monitoring results are inconclusive and thus support FPC's initial contention that temperature is not the only factor which affects seagrass colonization in the area.

FPC has always doubted that a cost effective monitoring program could be developed to evaluate biological recovery within the zone of discharge as a function of thermal reductions. It would be difficult for biologists to isolate the individual components which contribute to ecosystem stress and determine their incremental influence on the aquatic community. Additionally, FPC should not be required to conduct long term monitoring to determine the limiting factor to seagrass recovery and/or attempt to identify the impact of light intensity, salinity, regional impacts and/or temperature impacts on seagrass recovery within the zone of discharge from the Crystal River site.

Given the fact that FPC initially questioned the environmental benefit of the construction of cooling towers and contended that temperature was not the limiting factor to seagrass colonization and that a monitoring program would not adequately evaluate biological recovery, FPC request that no further action be required with regard to the seagrass monitoring project.

In conclusion, FPC and members of the TAC currently agree that temperature is not the limiting factor to seagrass recovery. While the TAC suggest that additional data may be warranted to clearly identify the limiting factor to seagrass recovery, they concur that FPC has mitigated for past thermal impacts as required by the FDEP and EPA. FPC should not be required to conduct long term monitoring to determine the limiting factor to seagrass recovery since this is beyond the intent of the seagrass monitoring project. Additionally, an attempt to identify the impact of light intensity, salinity, regional impacts and/or temperature impacts on seagrass recovery within the zone of discharge from Crystal River is overly burdensome and may not result in any significant environmental benefit. Since temperature is not the limiting factor, sprig planting would obviously be futile if factors such as turbidity and light intensity are as limiting as they appear to be. The requirement to conduct sprig planting and subsequent seagrass planting and monitoring should be deleted from the NPDES permit.