EFFECTS OF PINEY POINT PHOSPHATE FACILITY CLOSURE ON WATER QUALITY IN BISHOP HARBOR

Ray Pribble, Tony Janicki: Janicki Environmental
Rob Brown: Manatee County
Presentation Outline

• Background
• Objectives
• Approach
• Monitoring Results
Background - Piney Point

- Feb. ’01 Piney Point Phosphates abandoned facility
- Wastewater had elevated TP, TN, with very low pH
- 16.5” rainfall in Dec. ’02, water level increased
- FDEP had to decide how to preclude storage failure
- Emergency Orders issued for discharge
- Discharged treated wastewater to Bishop Harbor
- Double lime treatment and spray aeration + RO
Objective

FDEP asked for assistance in determining allowable discharge to Bishop Harbor while being protective of the system.
**Approach**

Needed to link loading to chlorophyll

**Data Availability**

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<tbody>
<tr>
<td>Ammonia Load</td>
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<td>Ammonia Concentration</td>
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<td>Chlorophyll Concentration</td>
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<td>Process Water Discharge</td>
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Approach

Needed to establish chlorophyll endpoint

Terra Ceia Bay as reference system

Relatively unimpacted, healthy seagrasses

Average 1989-1998 chlorophyll - 7.8 µg/L
Approach

Employed two methods:

- Empirical Relationships
- Mechanistic Modeling
Empirical

Relationship between ammonia concentration at head of harbor and load

Ammonia Concentration (mg/L) vs. Ammonia Load (kg/day)
Empirical Relationship between ammonia and chlorophyll concentrations in upper harbor

![Graph showing the empirical relationship between ammonia and chlorophyll concentrations.](diagram.png)
Empirical

Chlorophyll endpoint: 7.8 µg/L

Ammonia concentration: 0.37 mg/L

Ammonia load: 140 kg ammonia-N/day
Validity of Empirical Approach questioned
DEP requested more complex approach to provide weight of evidence

- Utilized CE-QUAL-W2, two-dimensional laterally-averaged hydrodynamic and water quality model
- Resolves upper harbor
- Examine worst-case conditions for upper harbor
2-D Water Quality Model

Diagram showing a 2-D water quality model with segments labeled: "Downstream Segment" and "Upstream Segment." The diagram also indicates a discharge point.
### 2-D Water Quality Model

<table>
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<tr>
<th>Downstream</th>
<th>Upstream</th>
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<td>1.1 km</td>
<td>1.2 km</td>
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-0.73 m MLLW  

-0.56 m MLLW
2-D Water Quality Model

- Calibrated March-April 2003

- 1 yr model run with 140 kg ammonia-N/day
  Predicted annual chlorophyll 6.6 µg/L, less than the 7.8 µg/L target

Supported Loading Limit of 140 kg/day
Mechanistic Three-Dimensional Hydrodynamic and Water Quality Model

Still results questioned

Developed 3-D model

- Hydrodynamic Model (USF) - Based on ECOM-3D
- Water Quality Model - Based on CE-QUAL-ICM
Bishop Harbor
Hydrodynamic / Water Quality Model Grid
Mechanistic Three-Dimensional Hydrodynamic and Water Quality Model

FDEP developed closure plan based on recommended loading, developed discharge plan using this and expected rainfall, included offshore discharge. Ran 3-D model with planned discharges, concentrations. Model predicted only small changes in chlorophyll, no changes in DO in harbor.
Improved treatment => reduced loads
Double-lime and reaeration + RO
Bishop Harbor WQ Monitoring

Piney Point Facility

Piney Point Discharge
Monitoring Results - Chlorophyll

Chlorophyll Concentration (µg/L)

- BH1: 12.3
- BH1A: 9.7
- BH2: 8.3
- BH2A: 7.9
- BH3: 7.2

2004
Monitoring Results - Chlorophyll

Chlorophyll Concentration (µg/L)

2005

BH1: 8.0
BH1A: 5.3
BH2: 6.4
BH2A: 4.1
BH3: 3.3
Summary

• Developed loading targets based on 3 modeling efforts
• Provided DEP with necessary information to develop discharge management plan
• Loads were even lower than originally expected
• Resulted in no significant increase in Chlorophyll
• As of 2007, not discharging to Bishop Harbor
Acknowledgements

- Florida Dept. of Environmental Protection
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- ECT, Inc.
- USGS
- NOAA
- Tampa Bay Estuary Program