Best Management Practices (BMPs) Regulatory Program

Ximena Pernett, P.E.
Bureau of Everglades Regulation
April 14, 2016
Agenda

- What are “best management practices” (BMPs)?
- Why is there a BMP regulatory program in the EAA?
- How are BMP Plans and Discharge Monitoring Plans verified?
- How well is the BMP regulatory program working?
373.4592 Florida Statutes:

A practice or combination of practices determined by the South Florida Water Management District, in cooperation with the Florida Department of Environmental Protection, based on research, field-testing, and expert review, to be the most effective and practicable, including economic and technological considerations, on-farm means of improving water quality in agricultural discharges to a level that balances water quality improvements and agricultural productivity.
The Everglades Ecosystem

- Natural drainage: Kissimmee River – Lake Okeechobee – Everglades – Florida Bay
- 1800’s – Drainage network for agriculture, flood control, and development
- 1988 – Conflicting priorities and lawsuits
- 1994 – Restoration plan is defined (Everglades Forever Act)
BMP Regulatory Program

- Permit for P discharges into SFWMD canals:
  - Comprehensive BMP Plan
  - Discharge Monitoring Plan
  - Training

- BMP research through EAAEPD

- EAA Basin Performance
  - District monitoring
  - Tracking trends
BMP Site Verifications

- **Prior**
  - Review permit, BMP annual report, previous visit reports, operation criteria, and farm data
  - Contact landowner or entity – Site verification checklist

- **During**
  - Review documentation
  - Field observations

- **After**
  - Follow up – Pending information or questions
  - Report (including recommendations, if applicable)
### Common BMP Plans

<table>
<thead>
<tr>
<th>BMP Plan A (53% of EAA)</th>
<th>BMP Plan B (44% of EAA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient Application Control</td>
<td>Nutrient Application Control</td>
</tr>
<tr>
<td>Nutrient Spill Prevention</td>
<td>Nutrient Spill Prevention</td>
</tr>
<tr>
<td>Soil Testing</td>
<td>Soil Testing</td>
</tr>
<tr>
<td>Particulate Matter &amp; Sediment Controls (4)</td>
<td>Particulate Matter &amp; Sediment Controls (6)</td>
</tr>
<tr>
<td>Water Management (1.0-inch)</td>
<td>Water Management (0.5-inch)</td>
</tr>
</tbody>
</table>
Nutrient Spill Prevention

- Formal practices and protocols for nutrient handling, transfer, and disposal. Protocols include guidelines on:
  - Proper handling of materials that contain P
  - Equipment operation to minimize misplacement & spillage
  - Location of transfer areas
  - Clean-up procedures and documentation
  - Training on spill prevention practices

- Permittee is responsible for BMP implementation. If application services are contracted, both contractor and permittee should be trained in spill prevention practices and ready to assist in the event of a spill.
Nutrient Spill Prevention
Nutrient Application Control

- Uniform and controlled boundary application of P
- Typical methods observed:
  - Banding at the root zone
  - Side-dressing
  - Pneumatic controlled-edge application (e.g., AIRMAX)
  - Controlled placement by fertilization under plastic near root zone
  - Other methods considered on a case-by-case basis
Nutrient Application Control

- Banding (sugarcane & vegetables)
- Side dressing (ratoon & corn)
- Vegetable Fertilization (mulched beds)
- Pneumatic applicator (corn & sod)
BMP Documentation

- Nutrient Spill Prevention
  - ✔ Formal Spill Prevention Protocol
  - ✔ Training attendance sheets
  - ✔ Record of spills reported

- Nutrient Application Control
  - ✔ If contracted, applicator invoices identifying fertilized areas, crop, and application method

- Observation of nutrient application and spill prevention practices by District staff typically occurs every three years or if there is a change to your applicator.
Goal: Avoid excess P application by determining soil P levels and using justified crop specific recommendations

Soil samples shall be collected and reviewed prior to application for the acreage in production

Soil P analysis results shall be used to improve the accuracy of the P application rates and reduce over-application of P

The permittee is responsible for obtaining and reviewing soil P data as a guideline for application

Where application rate or quantity differs from soil test recommendations, keep notes on the logic for the difference
Laboratories use different methods (extractants) to determine soil P levels.

The use of the appropriate soil test method reduces the potential for over-application. Ensure that the laboratory uses a method based on your soils and crops.

An appropriate method provides recommendations based on yield response curves developed by correlating laboratory-measured soil P levels with yield responses measured in the field.

The technical basis for the recommendations is requested on a case by case basis (e.g., yield response curves, site-specific pilot studies, applicable industry standards).
For a representative sample of crops grown, soil test results, P recommendations and P application records are reviewed

- Important: This information is necessary for all lessees, even if they are short-term

- Total P application rate of all P nutrients must not exceed P recommended rate

- Specific considerations for organic amendments. Requirements may vary based on the source, amounts applied, water quality, etc.
Soil Test – Verification Example

FARM 1

Total Acreage: 463
Crops: Sugarcane, vegetables

<table>
<thead>
<tr>
<th></th>
<th>F1A (32 ac)</th>
<th>F1B (31.6 ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F2A (34 ac)</td>
<td>F2B (33.7 ac)</td>
</tr>
<tr>
<td></td>
<td>F3A (35.3 ac)</td>
<td>F3B (35 ac)</td>
</tr>
<tr>
<td></td>
<td>F4A (35.5 ac)</td>
<td>F4B (35.8 ac)</td>
</tr>
<tr>
<td></td>
<td>F5A (33 ac)</td>
<td>F5B (33.4 ac)</td>
</tr>
<tr>
<td></td>
<td>F6A (34 ac)</td>
<td>F6B (34 ac)</td>
</tr>
<tr>
<td></td>
<td>F7A (27.3 ac)</td>
<td>F7B (28.4 ac)</td>
</tr>
</tbody>
</table>

* This is a fictional example
Soil Test Verification Example* - Sweet Corn

<table>
<thead>
<tr>
<th>Date</th>
<th>Laboratory</th>
<th>Field ID</th>
<th>Acreage</th>
<th>pH</th>
<th>Extractant Pw</th>
<th>IFAS Recommended P2O5 (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/10/14</td>
<td>IFAS</td>
<td>F5A</td>
<td>33</td>
<td>6.9</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F6A</td>
<td>34</td>
<td>6.6</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F7A</td>
<td>27.3</td>
<td>6.0</td>
<td>10</td>
<td>67</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Invoice No.</th>
<th>Mix</th>
<th>%P</th>
<th>Ton</th>
<th>P Applied (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/03/15</td>
<td>68229</td>
<td>8-5-30</td>
<td>5%</td>
<td>18.5</td>
<td>19.6</td>
</tr>
<tr>
<td>01/15/15</td>
<td>36521</td>
<td>11-37-0</td>
<td>10%</td>
<td>5.4</td>
<td>42.4</td>
</tr>
</tbody>
</table>

Total P applied = 62 lb/ac

* This is a fictional example
## Soil Test Verification Example* - Sugarcane

<table>
<thead>
<tr>
<th>Date</th>
<th>Laboratory</th>
<th>Field ID</th>
<th>Acreage</th>
<th>Term</th>
<th>pH</th>
<th>Extractant Pm1</th>
<th>In-house Recommended P2O5 (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/08/14</td>
<td>Waters</td>
<td>F5B</td>
<td>33.4</td>
<td>1st Ratoon</td>
<td>7.6</td>
<td>26</td>
<td>56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Laboratory</th>
<th>Field ID</th>
<th>Acreage</th>
<th>Term</th>
<th>pH</th>
<th>Extractant Pm3</th>
<th>In-house Recommended P2O5 (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/15/14</td>
<td>IFAS</td>
<td>F3B</td>
<td>35</td>
<td>Plant</td>
<td>5.7</td>
<td>28</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Invoice No.</th>
<th>Mix</th>
<th>%P</th>
<th>Ton</th>
<th>P Applied (lb/ac)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/17/14</td>
<td>44556</td>
<td>6-14-39</td>
<td>14%</td>
<td>22.37</td>
<td>56</td>
<td>Permittee indicated that from the total invoice amount, 6.7 tons were applied in Field F5B</td>
</tr>
</tbody>
</table>

| 09/01/14   | 22334       | 7-12-34 | 12%  | 15.14| 40                | Permittee indicated that from the total invoice amount, 5.9 tons were applied in Field F3B |

* This is a fictional example
Water Detention

- Permit indicates if discharges start after 0.5, 1 or 1.5 inches of rain based on rain gages onsite
- Detention is based on water table depth and crop needs
- When multiple permittees within a Basin ID, each permittee is responsible for BMP implementation
- Control and critical elevations may be required for example:
  - Start and stop discharge elevations
  - Elevations associated with critical activities (e.g., harvesting, planting, land preparation)
Water Detention Documentation

- Detention plots – Tool to depict daily rainfall and flow
- Pump logs – Review includes:
  - Did discharges occur after the rainfall detention level was met?
  - Were start elevations met?
  - Were stop elevations met?
  - Were deviations because of critical activities and were they in accordance with critical elevations?
  - Are appropriate comments included for deviations?
  - Are deviations recurring, suggesting that the water detention BMP cannot be consistently achieved?
There may be instances in which verification of staff gages being relative to each other is needed.
Before the site visit:

- Screening of detention graphs:
  - Six discharge events prior to detention criterion

- Pump logs to be requested:
  - April 2014
  - August – September 2014

* This is a fictional example
Water Detention - Verification Example*

- Discharge criterion (rainfall or start/stop elevations) to achieve permitted detention
- Review requested pump logs for:
  - Structure operation in accordance with discharge criterion
  - Completeness
    - Staff gage readings. Minimum twice/day when continuous pumping
    - Daily raingage reading
    - Date, time, and pump speed (rpm)
    - Notes explaining special pumping events, maintenance activities, etc.

* This is a fictional example
Water Detention – Verification Example*

Based on pump logs review:

- April 2014 – Request permittee to resubmit data
- August and September 2014 – Discharges met critical elevation criterion

* This is a fictional example
Particulate Matter & Sediment Controls

- Permits require between 4 and 6 practices:
  - Canal cleaning
  - Vegetation on ditch and canal banks
  - Ditch bank berms
  - Sediment sump in main canal and field ditches
  - Slow field ditch drainage
  - Leveling fields
  - Floating aquatic vegetation
  - Cover crops or flooded fields

- Practices are reported annually in BMP Annual Report
Particulate Matter & Sediment Controls

- Typically field verified, however, some practices require documentation (e.g., maps, work orders/invoices, photos)
- Practices are implemented consistently throughout the farm
- Important: Permittee is responsible for lessee’s implementation and documentation
Canal Cleaning and Floating Aquatic Vegetation (FAV) Control

- **Documentation**
  - Maps indicating dates and canal segments and ditches that were cleaned
  - If contracted, work orders/invoices
  - Criterion to determine cleaning needs and method
  - Important:
    - Canal cleaning and pumping off-site at the same time is NOT a BMP
    - Remove FAV mechanically, even if treated with herbicides
    - Herbicidal control of FAV limited to spot spraying of weedy areas

- **Observation**
  - To verify methods and sediment disposal
  - Weed barrier location, FAV coverage at time of visit
Vegetation on Ditch and Canal Banks & Ditch Bank Berms

Observation
✓ Vegetated berms along canal banks
✓ Herbicide overuse can kill canal vegetation causing soil erosion
Sediment Control Practices

- **Leveling fields** – Work orders/invoices, maps

- **Sediment sump upstream of discharge structure** – Field observation; maintenance records (maps)

- **Field ditch drainage sump** – Field observation; consistently implemented throughout the farm
Sediment Control Practices

- Slow field ditch drainage – Field observation of culvert with risers (i.e., boards on)

- Cover crops or flooded fields
  Maps, work orders/invoices (e.g., cover crop seeds).
  No P is applied to cover crops
  Runoff from flooded and rice fields is not pumped directly off-site
Water Quality Monitoring Plan - Verification

- P concentration, flow, and load are reported electronically
- Goal – Verify P loads are accurate:
  - Equipment (autosampler, rain gage, staff gages)
  - Flow verification
  - Water quality submittal (up to date)
  - Water quality audits (annually)
- Laboratory results may be requested to verify consistency with levels reported
- Site visits also include review of water quality data (e.g., trends, comparison among farms, etc.)
- In some cases, improvements can be made if a relationship between P levels and farm activities is observed
Water Quality Permittee Data

Rain-Adjusted Unit Area Load (RAUAL) Summary Graph

TP Concentration Summary Graph

Flow (Mgal) vs TP (ppm)

DAILY FLOW
CONCENTRATION
Nutrient spill prevention: Protocols are up to date

Controlled application: Periodic field observation verifies implementation

Soil Testing: Proper methods and technical documentation. Application recommendations for P buildup or maintenance do not meet the goal of this BMP

Water management: Pump logs include appropriate comments when deviations occur. Follow rainfall and elevation criteria

Particulate matter and sediment controls: Uniform implementation and timing

Overall: Permittee is responsible for appropriate implementation by staff, contractors, and lessees
EAA Basin P Load Performance

- TP data collected at EAA outflow points represent total TP load leaving the EAA
- A mathematical model is used to calculate EAA runoff representative of permittee discharges from EAA. The model excludes inflow loads passing through from Lake Okeechobee and other sources (298 diversion areas and C-139 Basin)
- EAA Basin compliance is based upon the entire EAA Basin runoff load for current water year vs. rainfall adjusted base period runoff load
- EAA Basin runoff load requirement is to reduce at least 25% from the base period load, adjusted for rainfall
EAA Map of Inflows and Outflows
**EAA Basin Historical Performance**

**Baseline Period (WY1980-1988)**
- Rainfall Adjusted Predicted Load: 185 mt
- Average Annual Concentration: 173 µg/L

**WY2015 Runoff**
- TP Load Reduction: 79%
- TP Load: 38.7 mt
- FWM TP Conc.: 47 µg/L

**TP Load Reduction from Base Period (%)**

- 25% TP Load Reduction Requirement (Target)
- WY1996 First Compliance Year
- Pre-BMP Implementation
- Partial BMP Implementation
- Full BMP Implementation

**Annual % TP Load Reduction**

**5-year TP Load Reduction**
Reducing Phosphorus into Stormwater Treatment Areas (STAs)

BMPs Prevented 3000 mtons of Phosphorus from Entering STAs

Without BMPs

With BMPs

![Graph showing TP Load (mtons) over Water Year from 1995 to 2015. The graph compares TP Load with and without BMPs, indicating a significant reduction with BMPs.]
Celebrating 20 years of the BMP Regulatory Program – 1995 - 2015

The BMP Regulatory Program continues to be extremely successful with a long-term reduction of phosphorus in runoff averaging 56%

The Program provides legally defensible verification of performance based on BMP implementation, field and records verification and water quality monitoring

Ongoing implementation is essential as the program is the keystone of one of the biggest restoration projects in the world.

*** ¡And your role is key to program success! Thank You! ***
Contacts

Ximena Pernett, P.E., Supervisor
Bureau of Everglades Regulation
E-mail: xpernett@sfwmd.gov
Phone: (561) 682-2928
Questions?