Scientific Inadequacies of Evaluating Direct, Indirect and Cumulative Impacts from Phosphate Mining in the Peace River Watershed

by
Nora Egan Demers, Ph. D.
Florida Gulf Coast University

Public Comments on Mining Impacts

Consideration of direct, indirect and cumulative impacts from mining permitted by federal agencies is required during creation of an Environmental Impact Statement (EIS).

Public evaluations and input from independent scientists regarding mining impacts are restricted to the public comment period of the EIS.

Modifications, variances and non-compliance of permit conditions after the EIS is completed prevents public comment on those impacts and circumvents the public review and NEPA processes.

Modifications, Variances and Non-compliance

Modifications to mining permits are granted routinely by DEP, the Water Management Districts and federal agencies after the public comment period has ended.

The state (DEP) mining rule (62C-16.0045 FAC) allows **variances** to mining permit conditions and variances to mining permit conditions are granted routinely.

De facto modifications and variances of permit conditions after the EIS is completed also result from **non-compliance** with permit conditions, further circumventing the public review and NEPA processes.

Environmental Impacts from Modifications, Variances and Non-compliance

More than 100 examples of modifications, variances and non-compliance related to phosphate mining permits issued in the Peace River Watershed were identified.

This analysis identifies those and other scientific inadequacies of evaluating direct, indirect and cumulative impacts on the natural and human environment from mining in the Peace River Watershed.

What are Cumulative Impacts?

The National Environmental Policy Act (NEPA) requires federal agencies to consider the cumulative effects (impacts) of agency actions.

Cumulative impacts were defined in 1969 by 40 CFR § 1508.7 as follows:

"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

What are Cumulative Impacts?

An extensive description of cumulative impacts is provided in the 1997 report, “Considering Cumulative Effects Under the National Environmental Policy Act” published by the US Council on Environmental Quality, Executive Office of the President.

Types of Cumulative Impacts

The report describes 8 types of cumulative impacts:

Type 1 (frequent/repetitive effects on an environmental system) such as extensive destruction of forested wetlands - particularly pond-cypress wetlands - with no "regrowth" or replacement.

Type 2 (delayed effects)
such as collapse of the aquifer structure - sinkholes - from groundwater mining, and exposure of coastal organisms and human communities to slow-acting contaminants (e.g., fluoride contaminants) from discharges to surface waters and aquifer-injected effluent and other wastes.

Types of Cumulative Impacts

Type 3 (high spatial density of effects on an environmental system)
such as pollution discharges into the aquifer from aquifer injections.

Type 4 (effects occur away from the source)
such as discharge of fluoridated water and breached groundwater "divides" causing diversions from one watershed as a result of groundwater pumping in another watershed (e.g., pirating water from the Everglades watershed).

Type 5 (change in landscape pattern)
such as fragmentation of critical wildlife migration corridors.

Types of Cumulative Impacts

Type 6 (effects arising from multiple sources or pathways)
such as synergism among fluoride contaminants in municipal water discharges mixing with fertilizer runoff from agricultural lands in streams and the Gulf of Mexico.

Type 7 (secondary effects)
such as any and all type of development following highway construction.

Type 8 (fundamental changes in system behavior of structure)
such as large-scale flow reversals and other alterations in the Floridan aquifer system (e.g., former discharge of ground water to springs, streams, wetlands, and coastal areas halted or flowing in.

Dewatered Kissengen Springs near phosphate mines in Polk County, FL 3/9/09

The nearly vertical shaft tapered to a diameter of about 106 feet at a depth of 60 feet and extended more than 400 feet below the top of the stack.

An estimated 4 million cubic feet of phosphogypsum and an undetermined amount of contaminated water disappeared through the shaft.

Ground-water samples collected from the Upper Floridan aquifer confirmed that the aquifer had been locally contaminated with stack wastes. Officials began pumping nearby wells to capture the contaminated ground water and prevent its movement off-site.

(Hayward Baker, Inc., 1997)

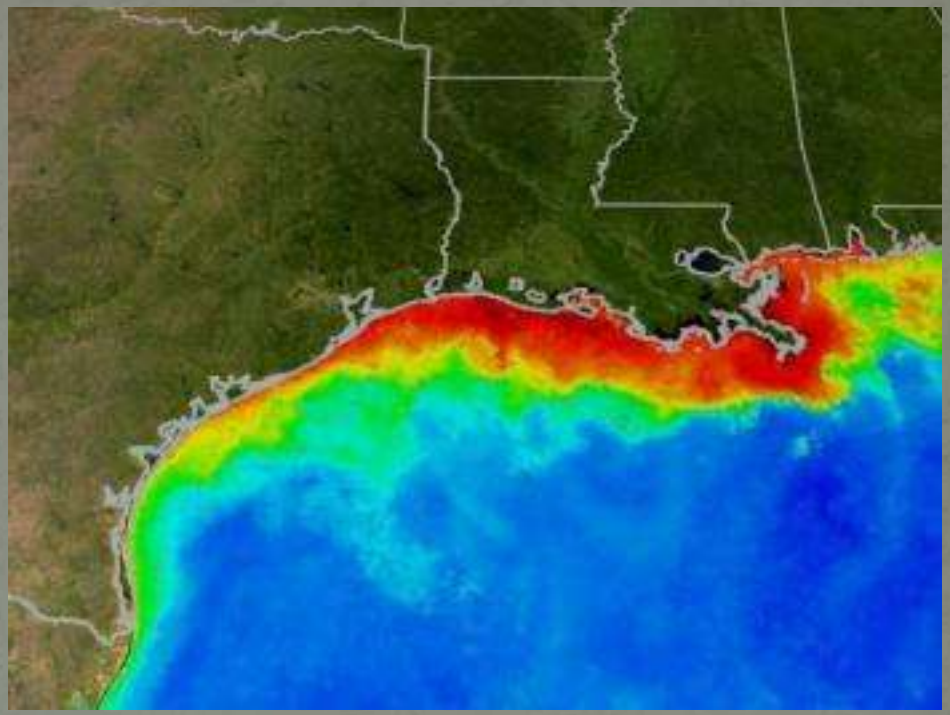
Cumulative Impacts of Phosphate Mining Beyond the Peace River Watershed

Examples of cumulative impacts throughout the US from phosphate mining in the Peace River Watershed include:

1. the anoxic “dead zone” in the Gulf of Mexico due to fertilizer runoff from agricultural lands;

2. impacts to the environment and humans (e.g., dental/skeletal fluorosis, brain impairment) from disposing of hazardous mining waste such as hydrofluosilicic acid in municipal waters.

Plume from Mississippi River Agricultural Discharges Beyond the Boundaries of the Area-Wide EIS



Summertime satellite observations of ocean color from MODIS/Aqua. Reds and oranges represent high concentrations of phytoplankton and river sediment. Image taken by NASA and provided courtesy of the NASA Mississippi Dead Zone web site.

MSDS FOR FLUORIDATION CHEMICALS

Mosaic

SECTION I	PRODUCT AND COMPANY IDENTIFICATION
TRADE NAME:	Hydrofluosilicic Acid
CHEMICAL NAME:	Hydrofluosilicic Acid
CAS NUMBER:	16961 - 83 – 4
CHEMICAL FAMILY:	Inorganic Fluorides
SYNONYMS:	Fluorosilicic Acid Hexafluosilicic Acid HFS FSA
PRIMARY USE:	Industrial Chemical
COMPANY INFORMATION:	MOSAIC 8813 U.S. Highway 41 South Riverview, Florida 33569 www.mosaicco.com 306-345-8400, 8 AM to 5 PM Central Time US
EMERGENCY TELEPHONE:	CHEMTREC 1-800-424-9300

SECTION II	HAZARD IDENTIFICATION	
EMERGENCY OVERVIEW:	Health Hazards:	Hydrofluosilicic acid is corrosive to the skin, eyes, and mucous membranes through direct contact, inhalation and ingestion. Large doses can cause nausea, vomiting, diarrhea, abdominal burning, and cramp-like pains. Circulatory, respiratory, nervous complaints, and skin rashes may occur. Liquid or vapor also causes severe irritation and burns, which may not be immediately apparent. It also causes severe irritation to the lungs, nose and throat. If swallowed, it can cause severe damage to throat and stomach. Handle with extreme caution.
	Physical Hazards:	Not applicable
	Physical Form:	Liquid
	Appearance:	Water white to straw yellow liquid
	Odor:	Pungent

NFPA HAZARD CLASS	
Health:	3
Flammability:	0
Instability:	1
Special Hazard:	Corrosive

HMIS HAZARD CLASS	
Health:	3
Flammability:	0
Physical Hazard:	2
PPE	Section 8

POTENTIAL HEALTH EFFECTS:		
	Eye:	Corrosive. Contact may cause severe irritation, eye burns, and permanent eye damage.
	Skin:	Corrosive. Contact may cause severe irritation, skin burns, and permanent skin damage.

Mosaic

Incompatible Materials:	Avoid contact with metals, stoneware, strong acids and alkalies, explosives, toxicants, readily oxidizable materials, alkali metals, combustible solids, and organic peroxides.
Hazardous Decomposition Products:	Extreme temperatures such as a fire cause formation of highly toxic and corrosive fumes of fluorides such as SiF_4 and HF. Hydrogen gas may be formed at temperatures above 227°F.
Corrosiveness:	Attacks silica bearing materials, metals, and stoneware
Hazardous Polymerization:	Will not occur.

SECTION XI	TOXICOLOGICAL INFORMATION
Acute Oral Toxicity	LD50 = 200 mg/Kg (guinea pig)
Acute Inhalation Toxicity	LC50 850 – 1070 ppm / 1 hour (Rat)
Acute Dermal Toxicity	140 mg/kg LDLo (Frog)
Mutagenesis	No data available
Target Organ	No data available
Developmental Toxicity	No data available
Carcinogenicity	No data available

SECTION XII	ECOLOGICAL INFORMATION
ECOTOXICOLOGY:	No data available

SECTION XIII	DISPOSAL CONSIDERATIONS
	Keep in covered DOT-approved poly drums pending disposal. Handle and dispose in full compliance with all applicable International, Federal, State and Local regulations.

SECTION XIV	TRANSPORT INFO
Regulatory Status	None established
Proper Shipping Name	Hydrofluosilicic Acid
Hazard Class	Class 8 (corrosive)
Packing Group	II
Identification Number	UN1778
Guide Number	154

SECTION XV	REGULATORY INFORMATION
CERCLA:	Not Regulated

Status: Revised
Section(s) Revised: Section III, IV, VIII, and XI
Issue Date: December 8,, 2009
MSDS #: MOS 20011.09

SE Florida Discharges and Injects Fluoridated Water into the Aquifer Beyond the Boundaries of the Area-Wide EIS

2008 WATER TESTING RESULTS

During the past year, we have taken thousands of water samples in order to determine the presence of any radioactive, biological, inorganic, volatile organic, or synthetic organic contaminants. The table below shows only those contaminants that were detected in the water. Although all of the substances listed here are under the Maximum Contaminant Level (MCL), we feel it is important that you know exactly what was detected and how much of the substance was present in the water. The state requires us to monitor for certain substances less than once per year because the concentrations of these substances do not change frequently. In these cases, the most recent sample data are included along with the year in which the sample was taken.

MICROBIOLOGICAL CONTAMINANTS

Contaminant and Unit of Measurement	Dates of sampling (mo./yr.)	MCL Violation Y/N	Highest Monthly Percentage/Number	MCLG	MCL	Likely Source of Contamination
Total Coliform Bacteria (% positive samples)	2008 (Monthly)	No	1.3 %	0	For systems collecting at least 40 samples per month: presence of coliform bacteria in 5% of monthly samples	Naturally present in the environment

Total coliform bacteria: Highest Monthly Percentage/Number is the highest monthly percentage of positive samples for systems collecting at least 40 samples per month.

Contaminant and Unit of Measurement	Dates of sampling (mo./yr.)	MCL Violation Y/N	Total Number of Positive Samples for the Year	MCLG	MCL	Likely Source of Contamination
Fecal coliform and E. coli	2008 (Monthly)	No	1**	0	0*	Human and animal fecal waste

* MCL for fecal coliforms is 0 for acute violations only where a fecal or E. Coli positive is followed by a repeat sample positive for fecal E. Coli or total coliform.
** The repeat sample was absent of any Fecal Coliform or E. Coli therefore there was no violation.
- A fecal or E. Coli positive followed by proper repeat sampling absent of any contamination does not generate a violation as long as the total coliform rule has not been violated. For a system taking over 40 samples per month, this result is then totaled with any total coliform positive compliance results for the month to determine percentage compliance with the total coliform rule.
- A system that collects more than 40 samples per month and has one positive sample followed by two positive repeat samples, with at least one of those being fecal positive, would have an MCL violation, even if the total number of positive samples is less than 5% of the total for the month.

Contaminant and Unit of Measurement	Dates of sampling (mo./yr)	MCL Violation Y/N	Highest Single Measurement	Lowest Monthly Percentage of Samples Meeting Regulatory Limits	MCLG	MCL	Likely Source of Contamination
Turbidity (NTU)	2008 (Daily)	No	29	100	N/A	TT	Soil runoff

Note: The result in the lowest monthly percentage column is the lowest monthly percentage of samples reported in the Monthly Operating Report meeting the required turbidity limits.
Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of the effectiveness of our filtration system. High turbidity can hinder the effectiveness of disinfectants.

RADIOLOGICAL CONTAMINANTS

Results in the Level Detected column for radiological contaminants, inorganic contaminants, synthetic organic contaminants including pesticides and herbicides, and volatile organic contaminants are the highest average at any of the sampling points or the highest detected level at any sampling point, depending on the sampling frequency.

Contaminant and Unit of Measurement	Dates of sampling (mo./yr.)	MCL Violation Y/N	Level Detected	Range of Results	MCLG	MCL	Likely Source of Contamination
Alpha emitters (pCi/L)	2008 Monthly (February, June-December)	No	3.36	ND-3.36	0	15	Erosion of natural deposits
Radium 226 + 228 [Combined Radium] (pCi/L)	2008 Monthly (February, June-December)	No	2.1	ND-2.1	0	5	Erosion of natural deposits

INORGANIC CONTAMINANTS

Contaminant and Unit of Measurement	Dates of sampling (mo./yr.)	MCL Violation Y/N	Level Detected	Range of Results	MCLG	MCL	Likely Source of Contamination
Arsenic (ppb)	2008 Monthly (February, June-December)	No	0.934	ND -2.34	N/A	10	Erosion of natural deposits; runoff from orchards; runoff from glass and electronics production wastes
Barium (ppm)	02/25/08	No	0.0064	N/A	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Cyanide (ppb)	02/26/08	No	3.0	N/A	200	200	Discharge from steel/metal factories; discharge from plastic and fertilizer factories
Fluoride (ppm)	03/07/08	No	0.73	N/A	4	4.0	Erosion of natural deposits; discharge from fertilizer and aluminum factories. Water additive which promotes strong teeth when at optimum levels between 0.7 and 1.3 ppm
Nitrite (as Nitrogen) (ppm)	02/21/08	No	0.025	N/A	1	1	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrate (as Nitrogen) (ppm)	03/01/08	No	0.15	N/A	10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Sodium (ppm)	02/25/08	No	64	N/A	N/A	160	Salt water intrusion, leaching from soil
SYNTHETIC ORGANIC CONTAMINANTS INCLUDING PESTICIDES AND HERBICIDES							
2,4,5-TP (Silvex) (ppb)	02/29/08	No	0.061	N/A	50	50	Residue of banned herbicide
Pentachlorophenol (ppb)	05/31/08	No	0.0090	N/A	0	1	Discharge from wood preserving factories
VOLATILE ORGANIC CONTAMINANTS							
Toluene (ppm)	02/29/08	No	0.00036	N/A	1	1	Discharge from petroleum factories

STAGE 1 DISINFECTANT AND DISINFECTION BY-PRODUCTS

Cumulative Impacts Beyond Boundaries of Area-Wide EIS

Significant expansion of phosphate mining proposed in the Peace River Watershed initiated an Area-wide Environmental Impact Statement.

How will the US Army Corps of Engineers (Corps) evaluate the cumulative impacts to the natural and human environment resulting from phosphate mining in the Peace River Watershed but occurring beyond the boundaries of the Area-Wide EIS?

Scientific Methodology for Evaluating Cumulative Impacts

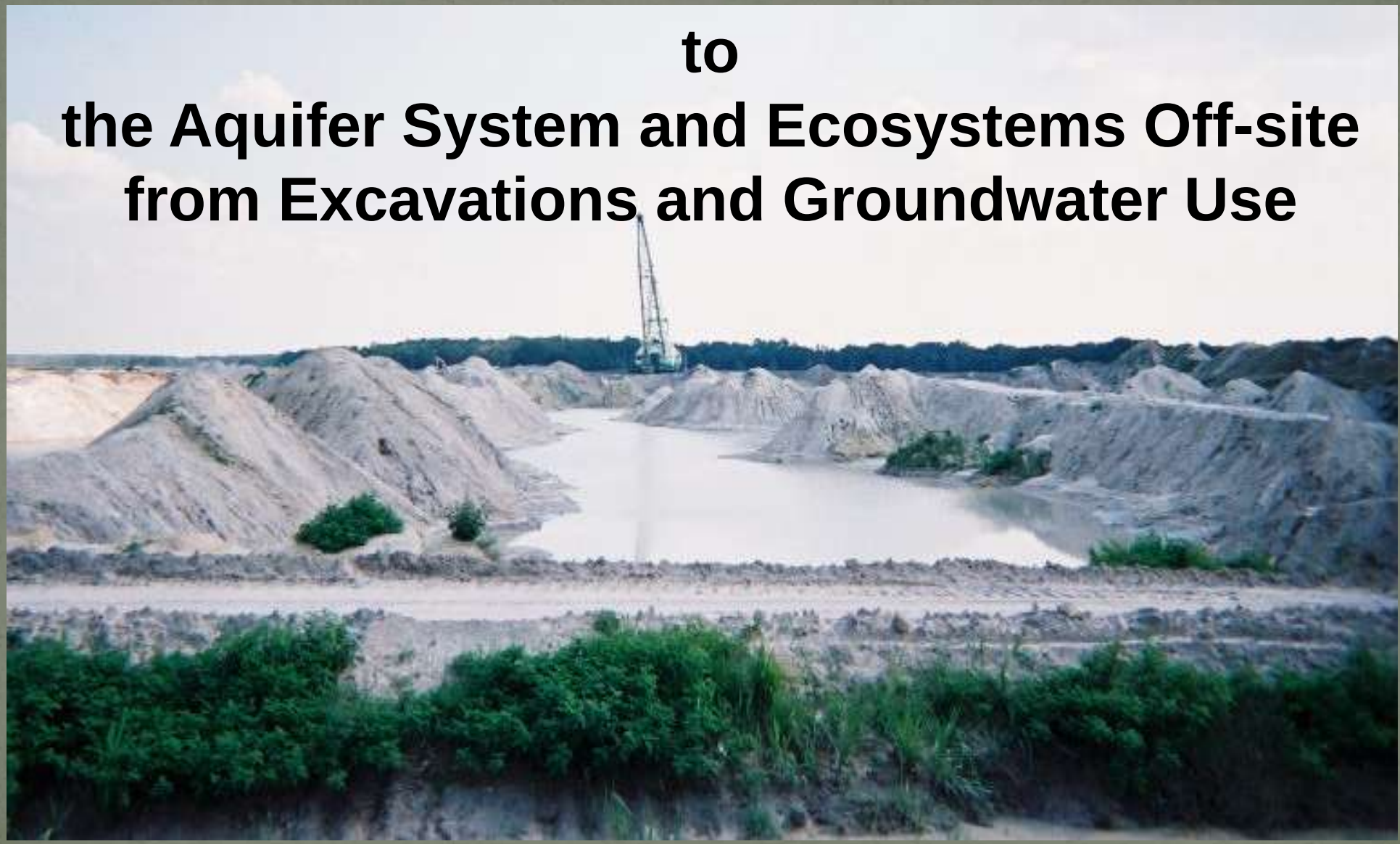
The Corps has not evaluated the cumulative impacts to the natural and human environment of mining in Florida, including impacts to the regional aquifer system that is the life blood of Florida's ecosystems.

What scientific methodology will the Corps use to analyze the cumulative impacts to the natural and human environment of mining in Florida?

How will that scientific methodology evaluate cumulative impacts from modifications, variances and non-compliance of permit conditions?

Mining Causes Cumulative Impacts

to
the Aquifer System and Ecosystems Off-site from Excavations and Groundwater Use



Cumulative Impacts

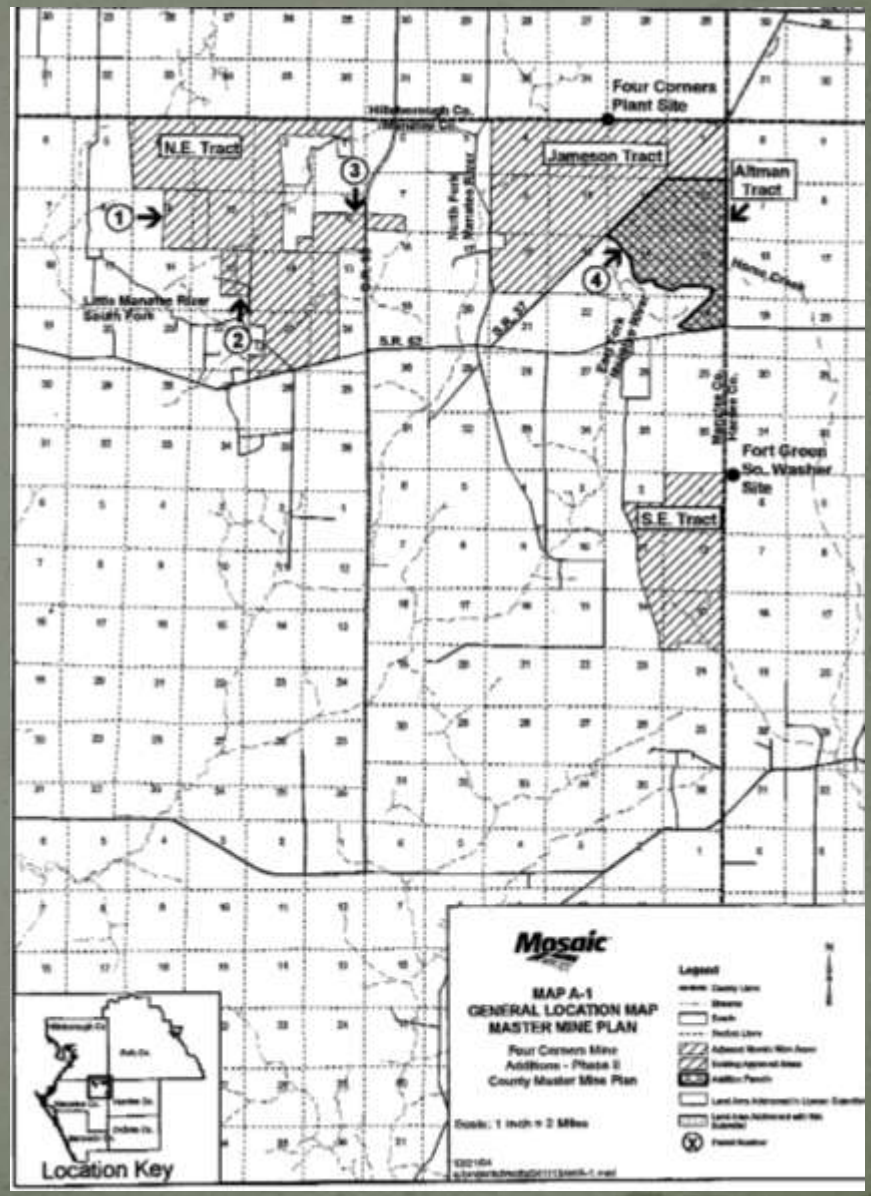
Cumulative impacts to off-site ecosystems and habitat critical for the survival and recovery of threatened and endangered species can result:

1.from a single mine;

2.from multiple mines;

3.in wetlands ranked as “low quality” or “degraded”

using the Uniform Mitigation Assessment Method (UMAM)

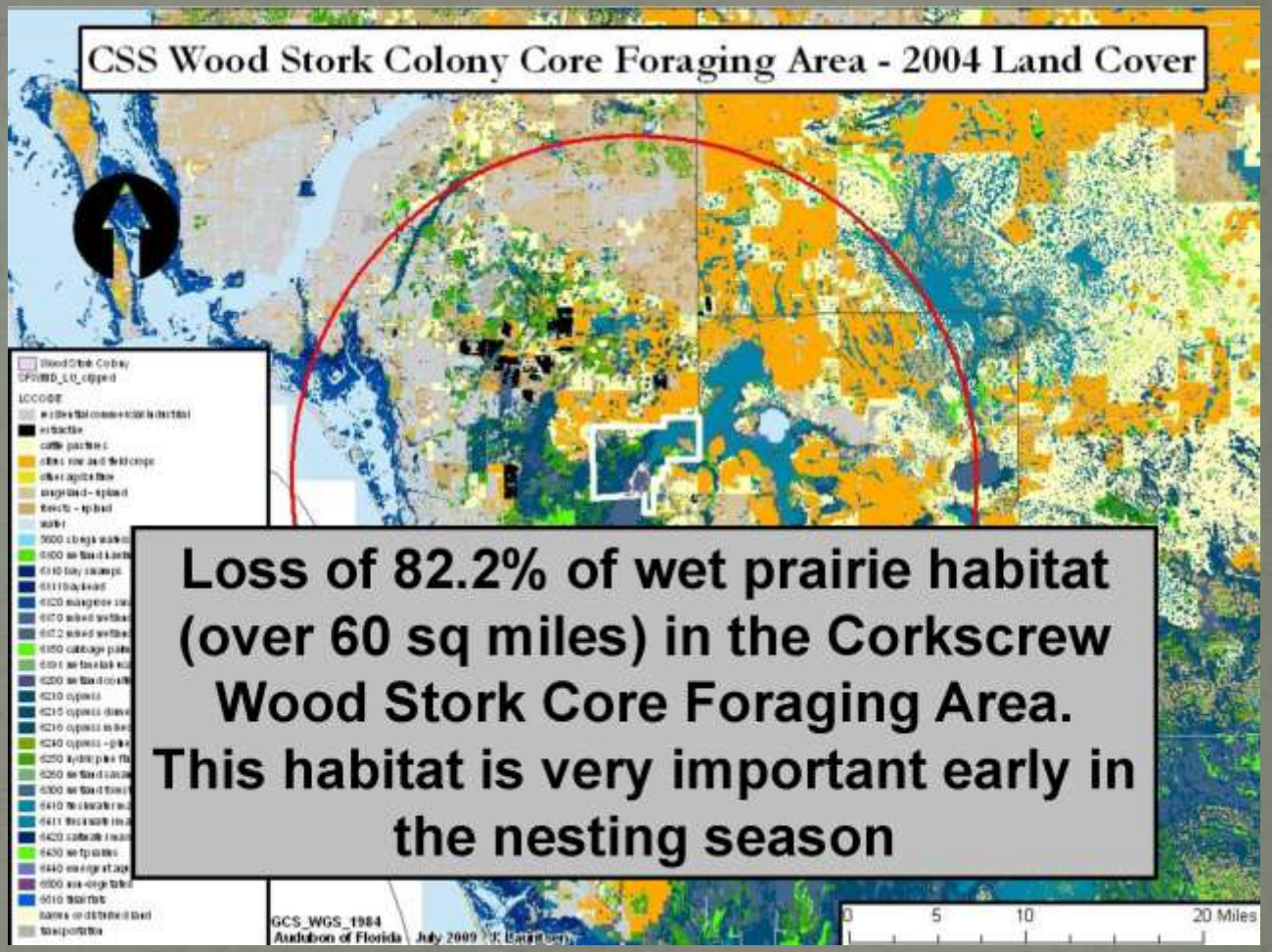


Cumulative Impacts On-Site and Off-Site

What scientific methodology will the Corps use to determine whether wetlands identified as “low quality” or “degraded” using UMAM or other ranking systems are exhibiting indirect or cumulative adverse impacts from mining?

Cumulative Impacts On-Site and Off-Site

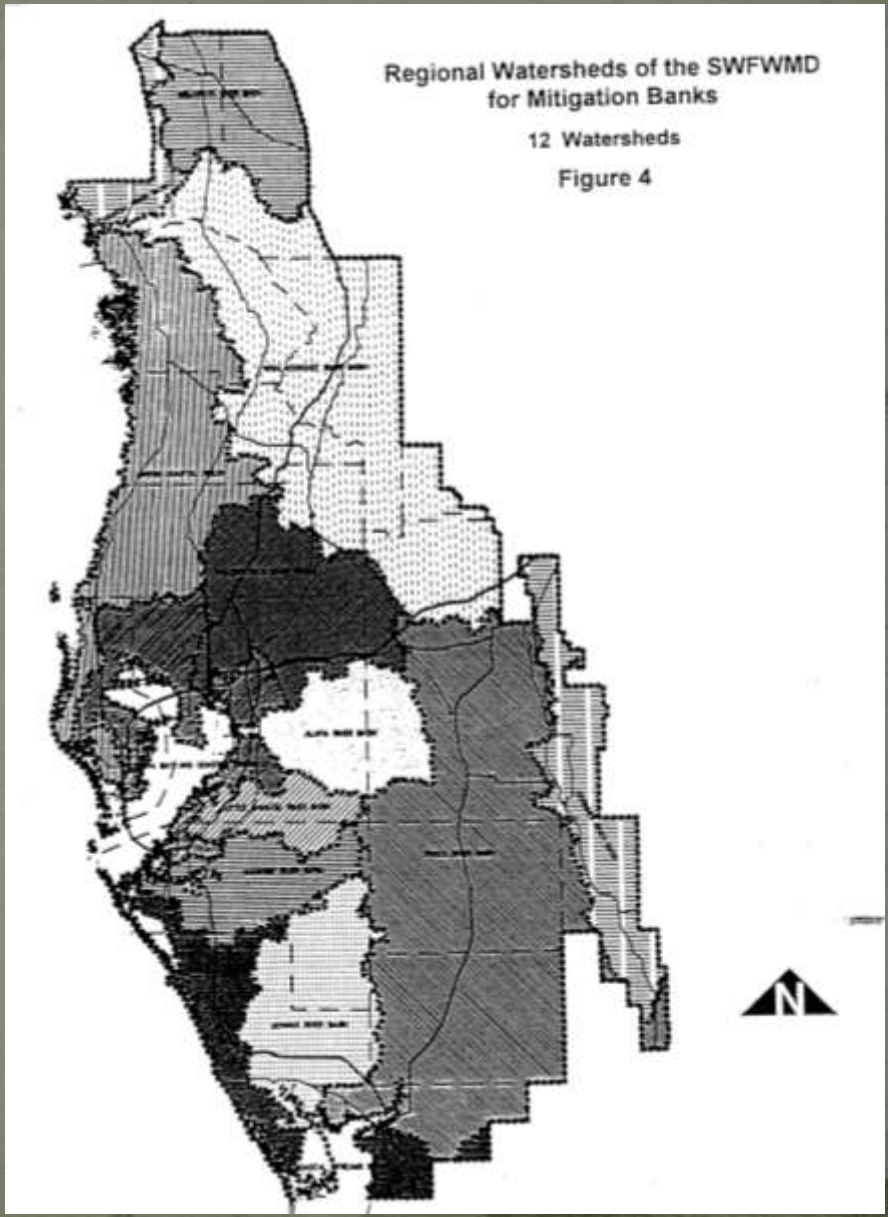
What scientific methodology will the Corps use to determine the cumulative impacts from the loss of wet prairie habitat for wood storks from phosphate mining in the Peace River Watershed?



Cumulative Impacts to Mitigation Banks?

What scientific methodology will the Corps use to determine whether off-site Mitigation Banks are exhibiting indirect or cumulative adverse impacts from mining?

(map from SWFWMD 62-342, fig. 4)



Cumulative Impacts to Off-site Ecosystems and Critical Habitat

Permit conditions do not require monitoring of impacts to off-site ecosystems and habitat critical for the survival and recovery of threatened and endangered species.

Groundwater models cannot evaluate impacts to ecosystems and habitat critical for the survival and recovery of threatened and endangered species.

Cumulative Impacts to Off-site Ecosystems and Critical Habitat

Instead of developing methodology to analyze off-site and cumulative impacts to ecosystems and habitat for threatened and endangerd species the Corps relies on the "Applicant's Data" to meet permit conditions requiring:

1. preserving stream buffers
2. maintaining "Perpetual Conservation" Areas
3. preventing "take" of endangered or threatened species
4. determining the permit is not "contrary to the public interest"

(see example conditions 17, 24, 27 & Further Information 4 for Mosiac's S. Ft. Meade Mine permit SAJ-1997-4099-IP-MGH)

Examples of Modifications, Variances and Non-Compliance of Mining Permit Conditions

(synopsis/permit source)

Delay reclamation for lack of affordable materials to restore elevation (Mosaic-Ft. Meade Mine)

Not reclaim 2,600 acres and use clay settling areas past permit (Mosaic-Four Corners Mine)

Lack of materials and expense (CFI-Ft. Meade, Hopewell and S. Pasture Mines)

Changes in waste disposal, hydrology, and reclamation boundaries (Mosaic-Hardee S. Pasture, Four Corners, Kingsford and Payne Creek Mines)

Dissolved oxygen permanent variance as materials not available and will leave 15 deep pits (CFI-South Pasture Mine)

Additional Examples

Wetlands shift from one mining unit to another (Mosaic/Agrifos- Hopewell, Four Corners, Agrifos and Wingate Mines)
Clay pond changes (Mosaic-Four Corners Mine)
Reduce wetlands (Mosaic-Hooker's Prairie Mine)
Failed to file with 7 days of CRP Modification (Mosaic-Hooker's Prairie Mine)
Timing change of reclamation (Mosaic-Hopewell Mine, Payne Creek Mine)
No known way to reclaim deep pits (Mosaic-Ft. Meade Mine)
Reclamation of deep pits not practicable (Mosaic-Ft. Meade and Four Corners Mines)

Additional Examples

Updates to changes in mitigation plans and schedules (CFI/Mosaic-S. Pasture and Four Corners Mines)
Shifting wetlands reclamation to another mining unit (Agrifos-Agrifos Mine)
Increase mine pits from 6 to 8 (Mosaic-Hopewell Mine)
Gypstack rezone to industrial, no way to reclaim (Mosaic-New Wales exempts gypstack from reclamation)
Change preservation land, wetland, and boundaries (CFI/Mosaic-S. Pasture Mines, Old Colony Addition)

No Readily Accessible Record of Modifications, Variances and Non-Compliance of Mining Permit Conditions,

Although permit conditions require that all documents related to the permit conditions be submitted to the Corps, EPA and the US Fish and Wildlife Service, those agencies have no readily accessible record of all of the modifications, variances and non-compliance for each individual mining permit issued by the Corps.
(see example condition 5 for Mosiac's S. Ft. Meade Mine permit SAJ-1997-4099-IP-MGH)

This inadequacy increases the difficulty for the Corps and independent scientists to assess the cumulative impacts of mining.

Data Needs for Draft EIS

To overcome this inadequacy, the Corps' draft EIS should include a table
summarizing data compiled from each of the modifications, variances and non-compliance of conditions for phosphate mining permits in at least the following categories :

1. Company/mine requesting modification, variance or non-compliance
2. date requested/granted
3. agency/permit #
4. synopsis/type
5. area affected directly, indirectly and cumulatively
6. scientific methodology for determining area affected

Summary

1. Public input is circumvented when modifications, variances and non-compliance of mining permit conditions occur after EIS.

2. More than 100 examples of modifications, variances and non-compliance of conditions for phosphate mining permits issued in the Peace River Watershed were identified.

3. Data table needed to summarize all modifications, variances and non-compliance of permit conditions and scientific methodology that will be use to evaluate those resulting direct, indirect and cumulative impacts.

4. Monitoring of impacts to off-site ecosystems and habitat for threatened and endangered species isn't required.

What scientific methodology will be used to determine whether wetlands identified as "low quality" or "degraded" using UMAM or other ranking systems are exhibiting indirect or cumulative adverse impacts from mining?

Summary

5. What scientific methodology will be used to analyze cumulative impacts
to the natural and human environment of mining in Florida, including to mitigation banks?

6. How will cumulative impacts from phosphate mining in the Peace River Watershed be evaluated when they occur beyond the Area-Wide EIS boundaries, such as:

a. the anoxic “dead zone” in the Gulf of Mexico due to fertilizer runoff from agricultural lands;

b. impacts to the environment and humans (e.g., dental/skeletal fluorosis, brain impairment) from disposing of hazardous mining waste such as hydrofluosilicic acid in municipal waters.