Miami-Dade Water and Sewer Department

COASTAL WETLANDS REHYDRATION DEMONSTRATION PROJECT (CWRDP)

May 18, 2007

Subconsultants:

MSA Milian, Swain & Associates, Inc.

CH2MHILL

AGENDA

9:00AM – 11:30 AM

9:00	Introduction & Program Objectives (MD-WASD)
9:05	Program Overview (CDM)
9:10	Wetlands Rehydration Demonstration Plant (CDM)
9:20	Constructed Wetlands (CH2M Hill)
9:30	Monitoring Plan (MSA)
9:40	Other Testing (microcosm/mesocosm) (FIU)
9:50	Break (10 minutes)
10:00	Develop Overall Objectives (Moderator)
11:00	Schedule (MD-WASD)
11:15	Other Items (MD-WASD)
	Action Items (MSA)
	Wrap up (MSA)

Project Overview

Current Program Status (5/18/07)

- WRDP
- Constructed Wetlands
- Monitoring Program
- Mesocosm/Microcosm Studies

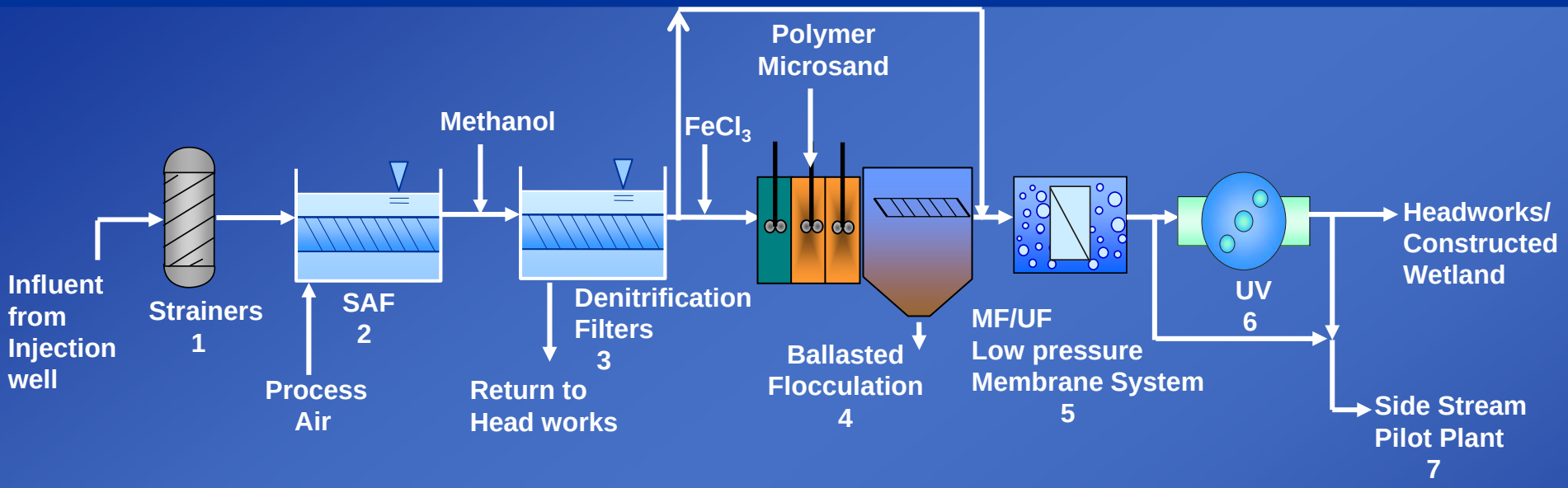
Comparison of Water Quality Objectives

Parameter	SDWWTP* Effluent Limits UIC System Monthly Average	SDWWTP SE (Average 2001-2006)	Receiving Wetlands Application Ch 62-611	Class III / OFW (Water Quality Goals - USCOE 2004)**
TSS, mg/L	30	10	5	3.5
$CBOD_5$, mg/L	30	5	5	N/A
Turbidity, NTU	N/A	3-10	N/A	0.5
Total Nitrogen, mg/l as N	N/A	21	3	0.27
Total Phosphorus, mg/L as P	N/A	1.52	1	0.005
Microconstituents (EPOCS)	N/A	USGS 2004	NR	Lowest possible level
Total Ammonia-N, mg/L	N/A	17	2	0.02 –005

* MDWASD South District WWTF PA File No. FLA042137-011-DWR

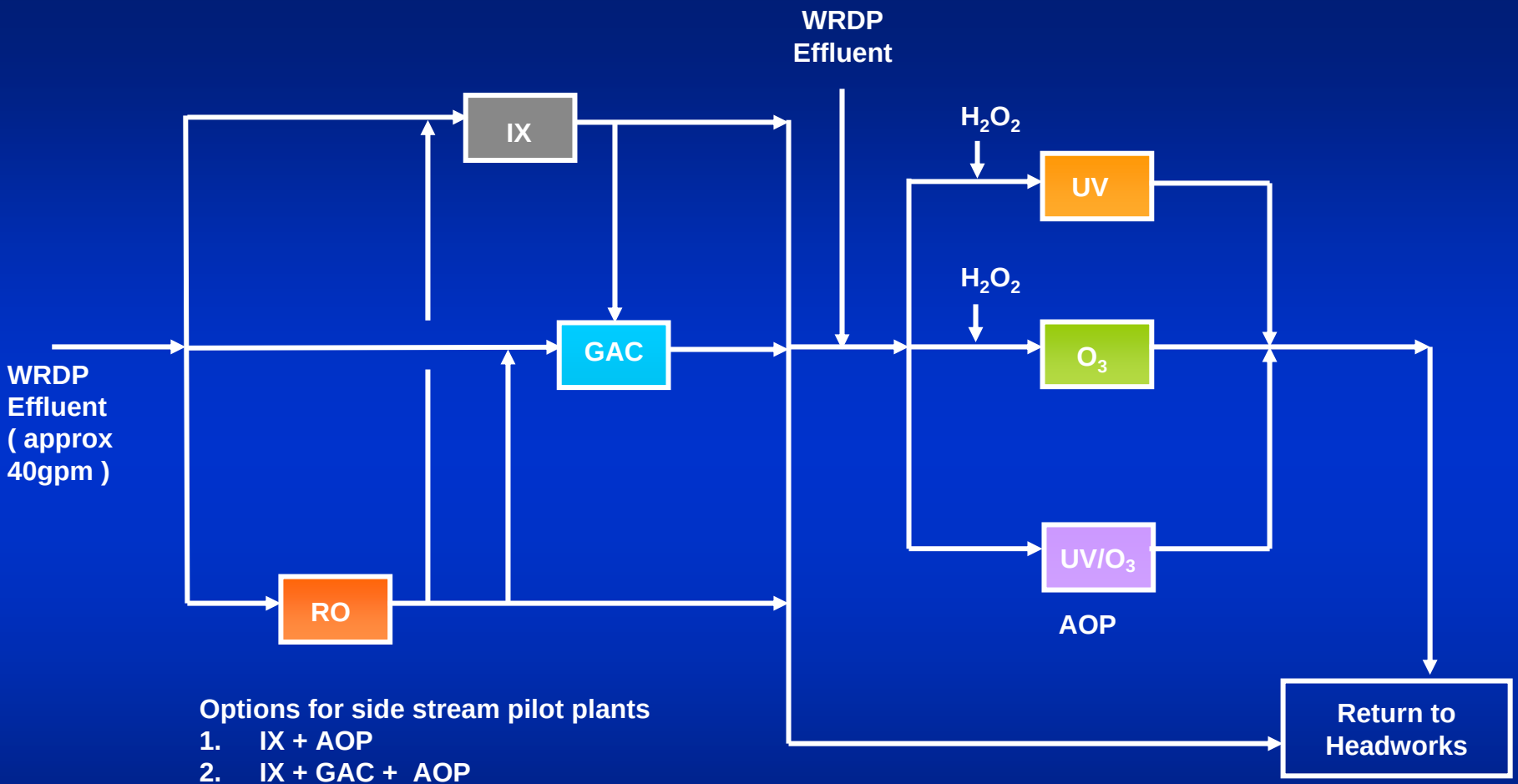
** CERP Team established anti-degradation targets as water quality goals (end of the pipe)

WRDP Process Schematic



Item	Treatment Objectives
1	Solids removal of fine particles (> 3mm)
2	Biological nitrification process to convert ammonia to nitrate
3	Biological denitrification process to convert nitrates to nitrogen gas
4	Chemical and physical processes to remove phosphorus
5	Solids separation process to remove suspend solids including particulate TP and TN
6	UV radiation for inactivation of microbial contaminants
7	SPPs include a combination of GAC, RO, IX, and AOP to test for removal of very low nutrient concentrations (TP < 0.1 mg/L and TN < 3.0 mg/L) and microconstituents

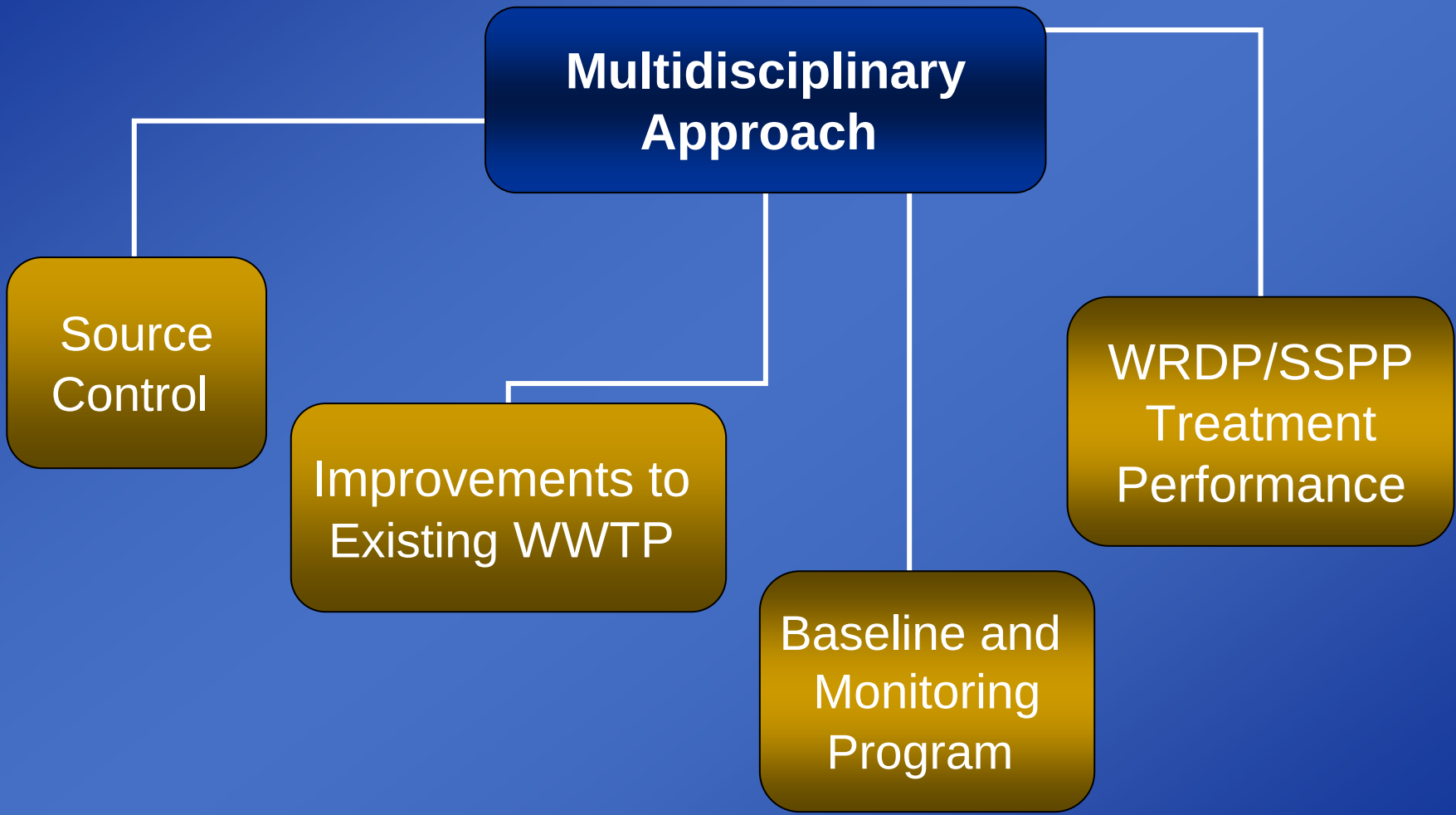
Side Stream Pilot Plant



Options for side stream pilot plants

1. IX + AOP
2. IX + GAC + AOP
3. GAC + AOP
4. RO + AOP
5. RO + GAC + AOP
6. RO + IX + AOP

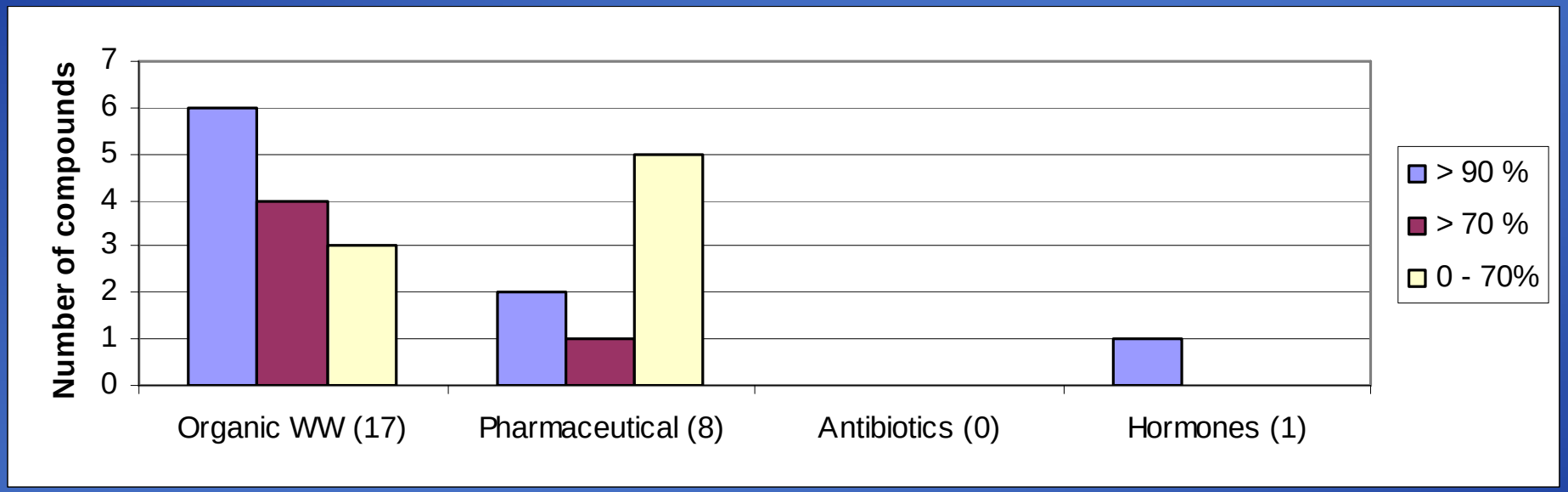
Microconstituents



Microconstituents – Desktop Evaluation

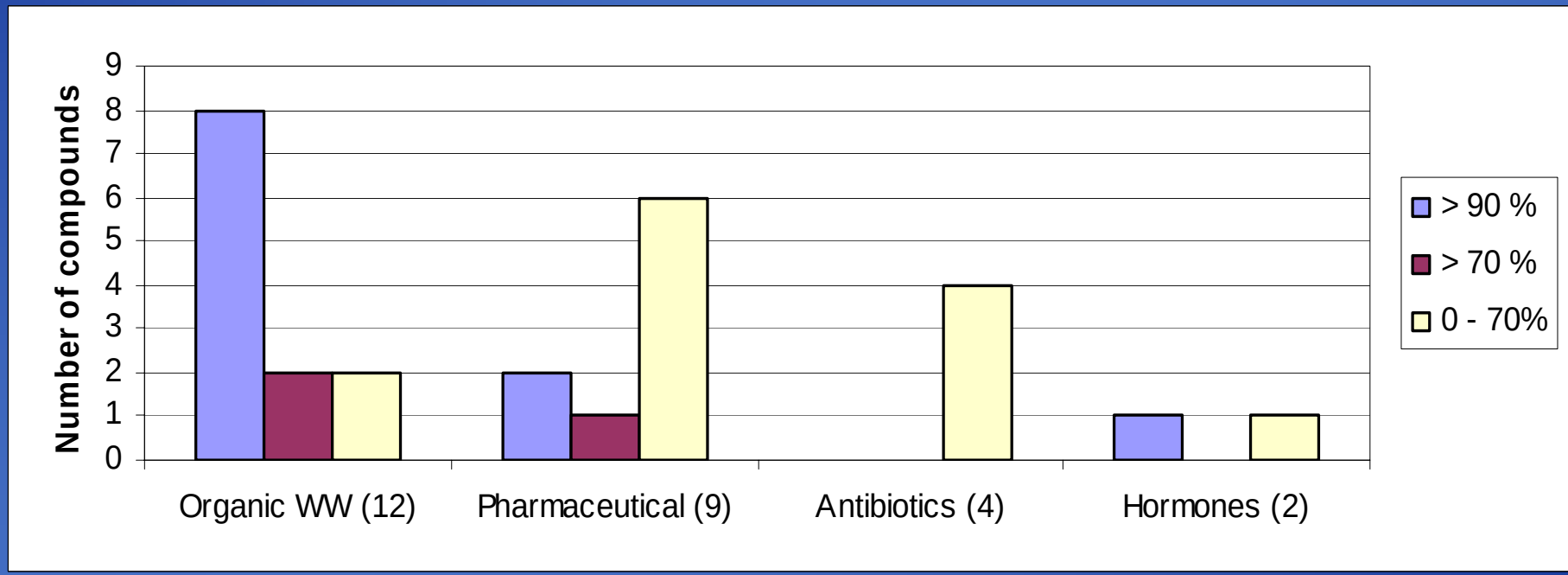
- USGS 2004 Report
- Existing SDWWTP Performance
- Investigate Source Control Initiatives
- Investigate Technology Performance

Reduction of Compounds at the SDWWTP (USGS 2004)



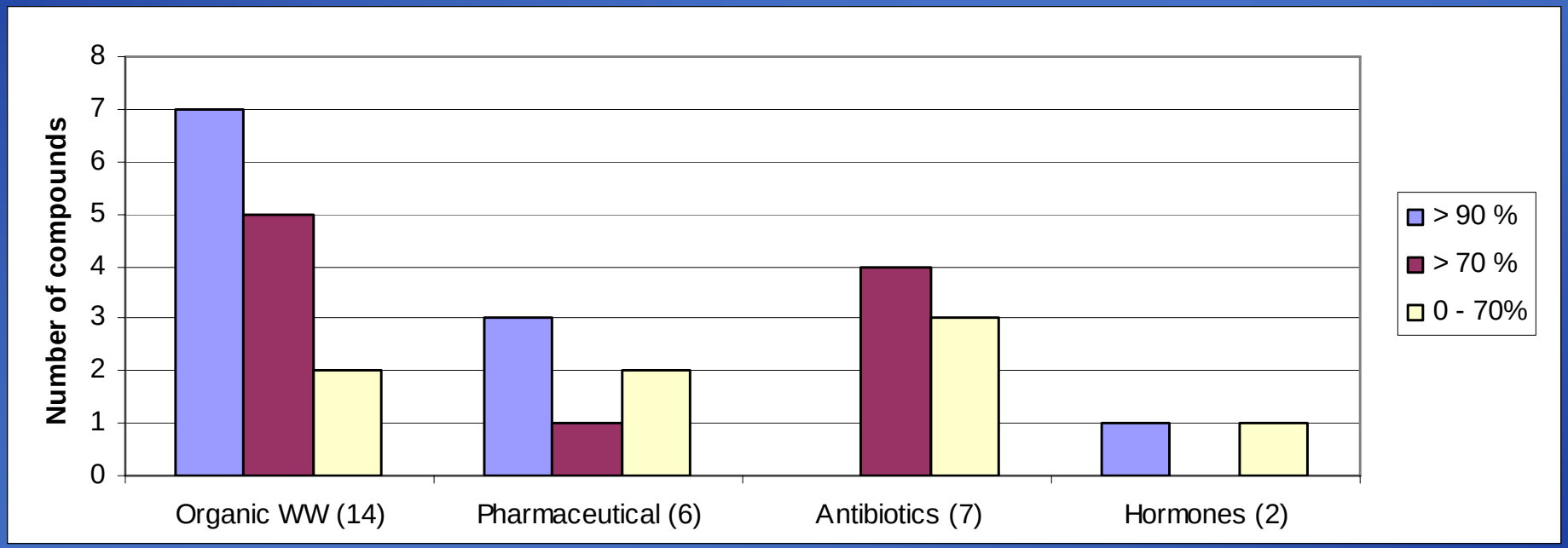
March 2-3, 2004 – Dry-Season

Reduction of Compounds at the SDWWTP (USGS 2004)



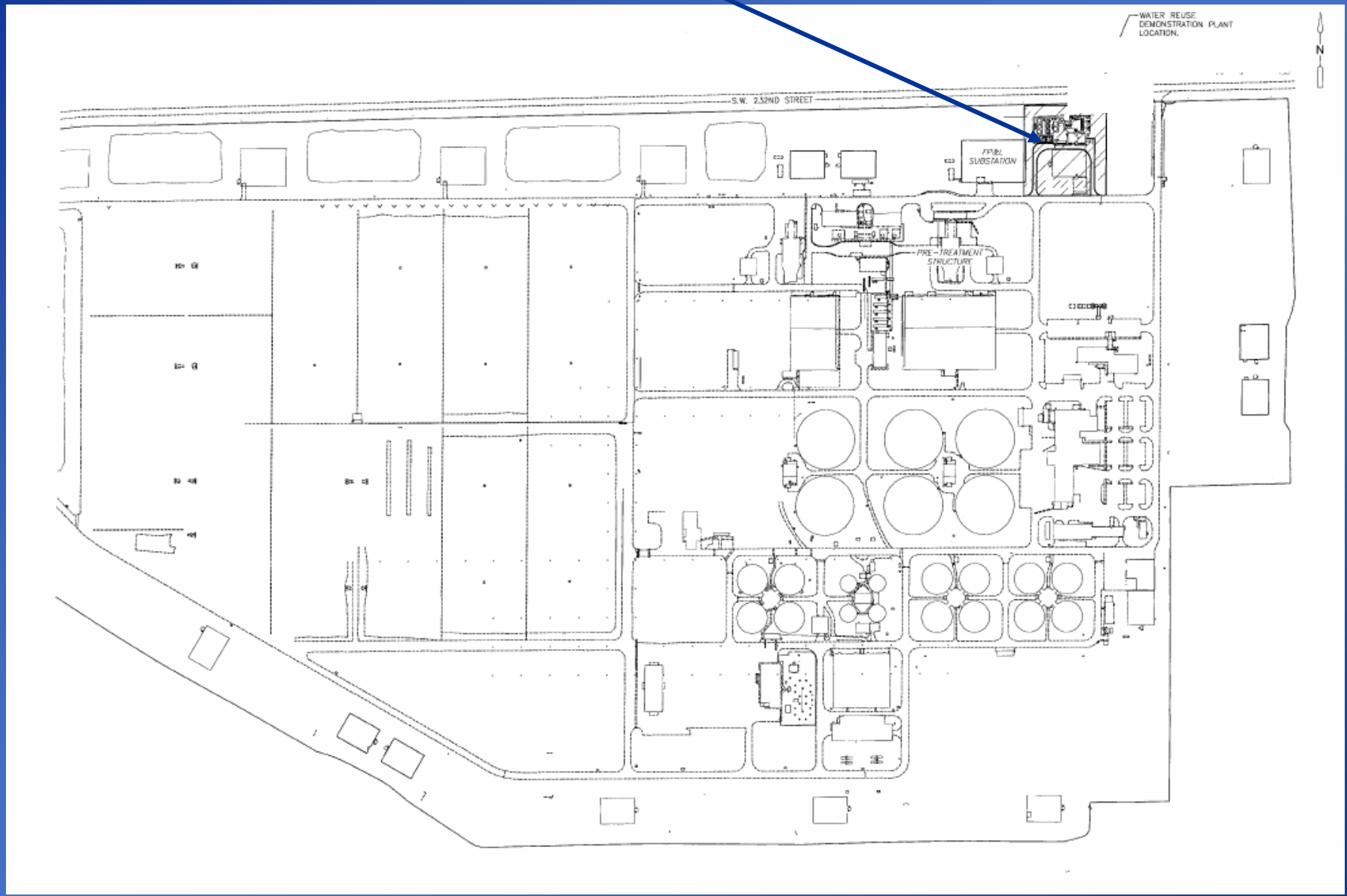
July 20-21, 2004 – Wet-Season

Reduction of Compounds at the SDWWTP (USGS 2004)



October 5, 2004

WRDP Location Plan



Coastal Wetland Rehydration Reuse Demonstration Project

Phase 1

Objectives & Goals

CH2MHILL

Goals

1. Ecosystem development capable of testing the Reuse Water Impacts to the System – Plants and Organisms
2. Support the Implementation of the CERP Coastal Wetlands Rehydration Project

Objectives

1. Grow-in of the freshwater and coastal wetland cells with Biscayne Aquifer Water
2. Evaluation of Impacts to the surrounding surface water and groundwater systems
3. Flexibility in the Operations of the Constructed Wetland through Design – Flexibility Parameters
    a) Inundation levels (depth of water in the cells)
    b) Water Balance
    c) Hydraulic Residence Time
    d) Wetland Hydraulics (includes Hydraulic Loading Rate)

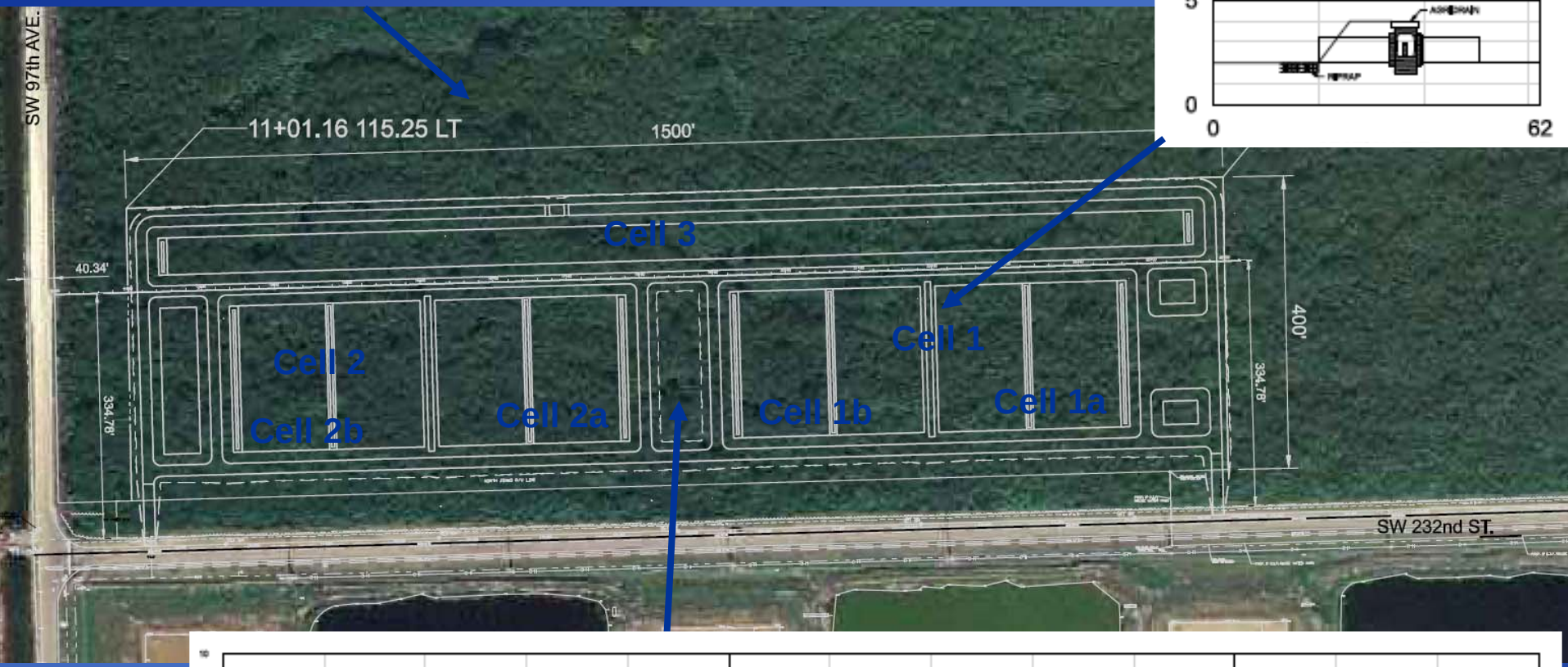
Constructed Wetland

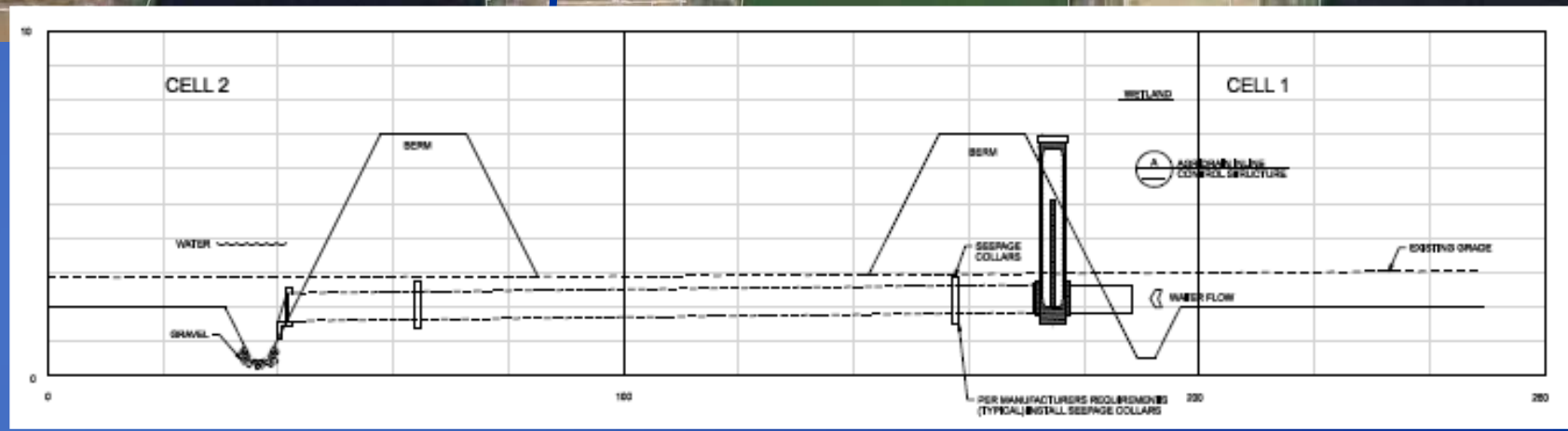
Demonstration Plant

Location Map

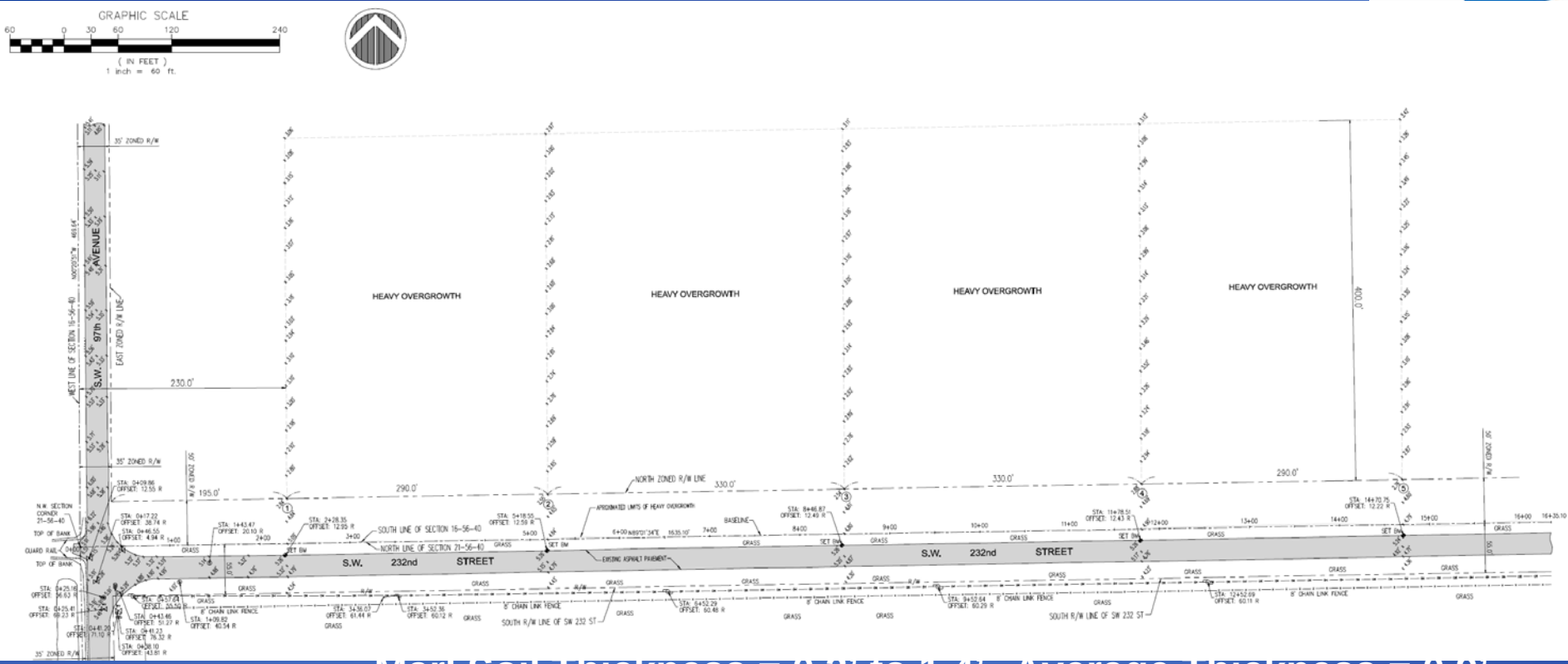
14 acre site
SFWMD – Owner
MD WASD - Leasee

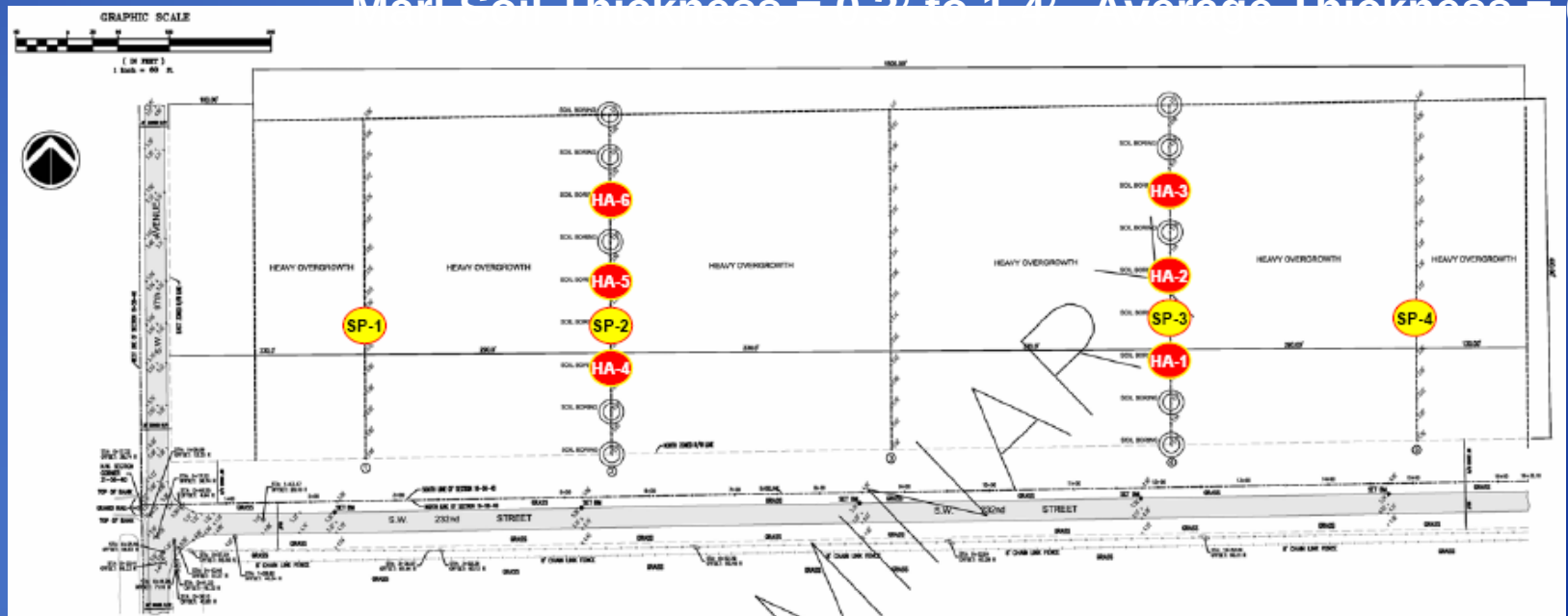
2 – 2.5 ac cells (Cell 1 & 2)
each Cell divided into 2 cells
1 – 1.9 ac cell (Cell 3)

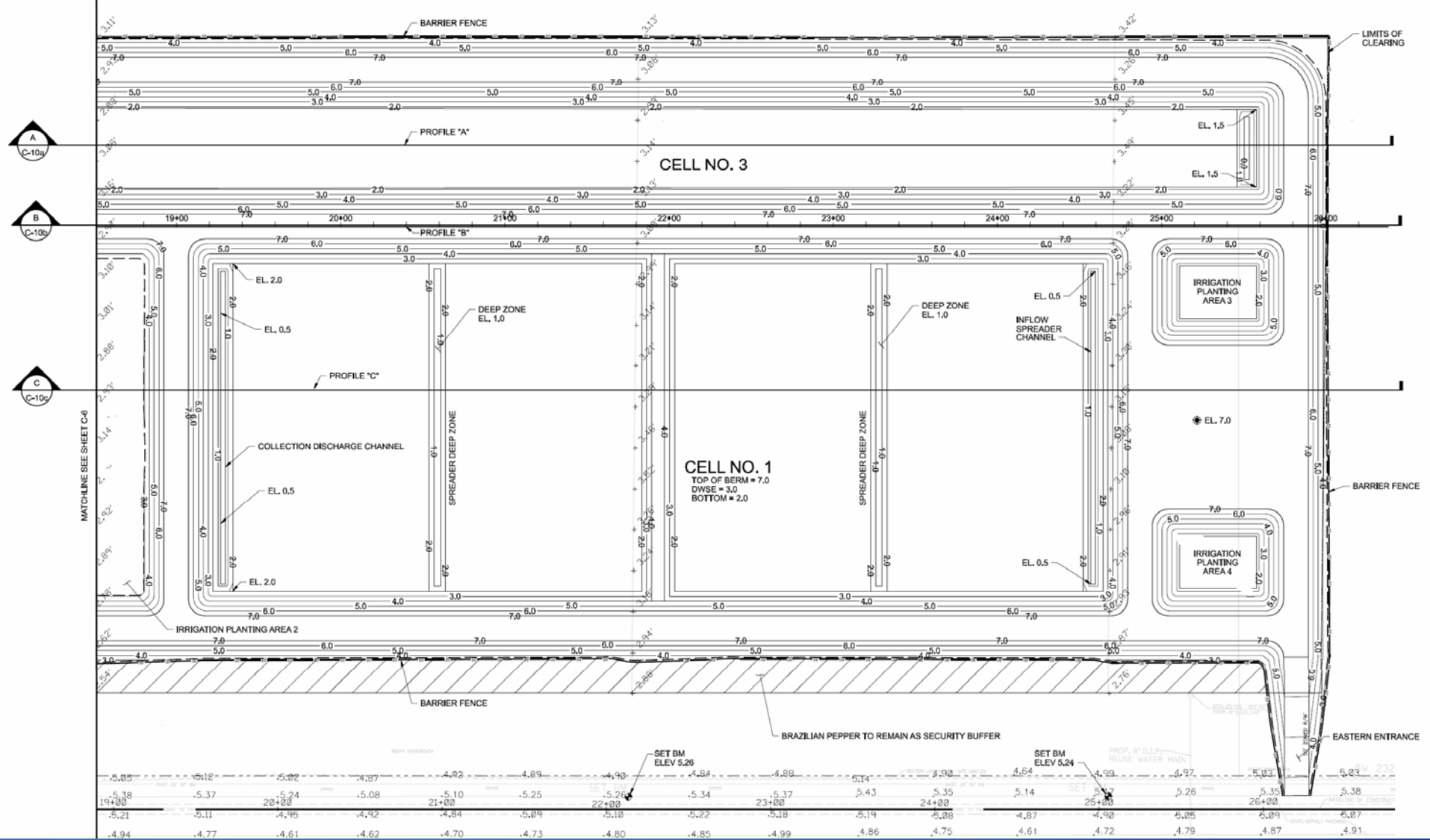




Mitigation Wetland – holding water in the Dry Season

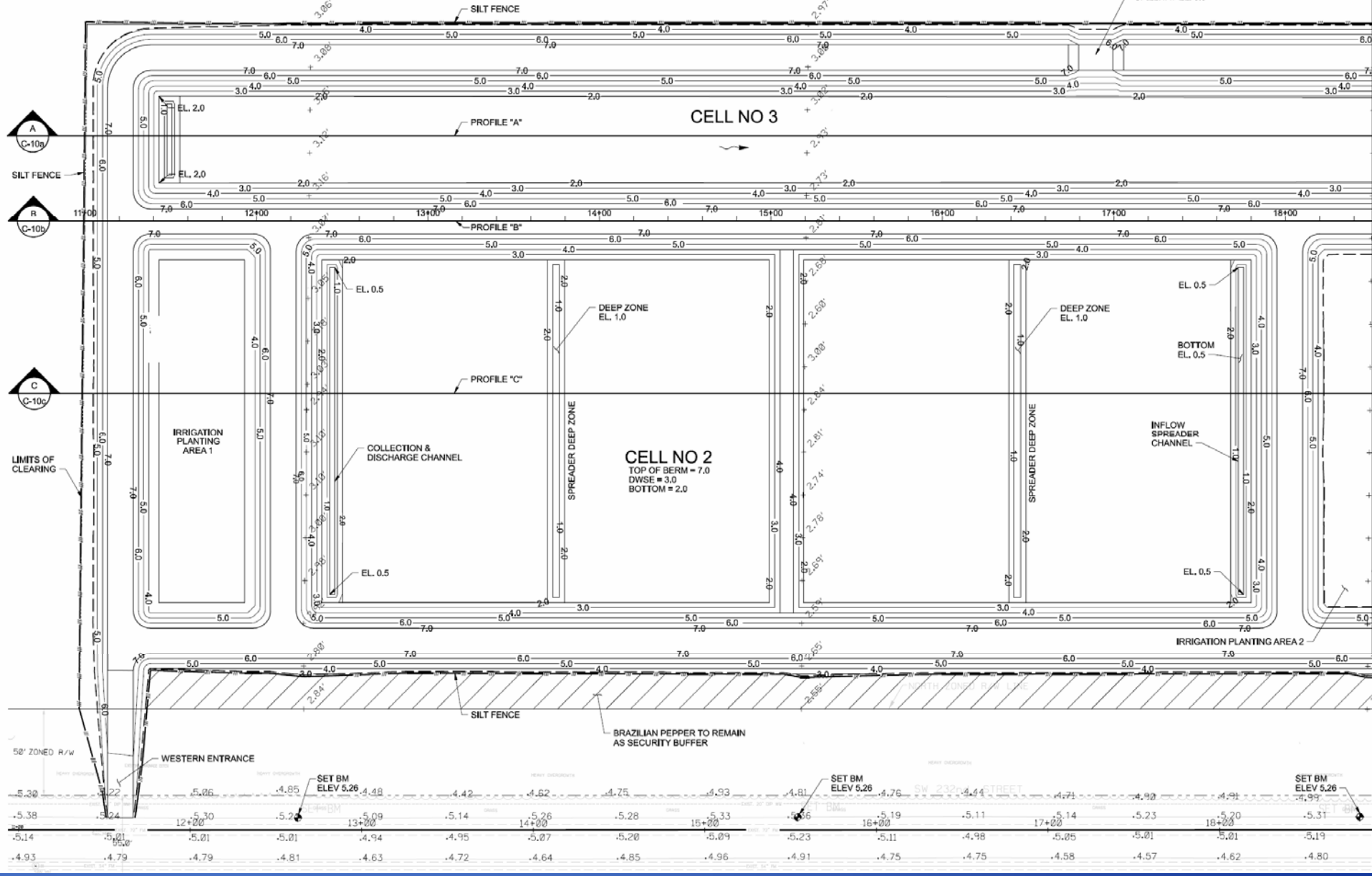

GRAPHIC SCALE
60 0 30 60 120 240
(IN FEET)
1 inch = 60 ft.
97th AVENUE S.W.
35' ZONED R/W
EAST ZONED R/W LINE
WEST LINE OF SECTION 16-56-40
HEAVY OVERGROWTH
HEAVY OVERGROWTH
HEAVY OVERGROWTH
HEAVY OVERGROWTH
230.0'
195.0'
290.0'
330.0'
330.0'
290.0'
400.0'
NORTH ZONED R/W LINE
SOUTH LINE OF SECTION 16-56-40
NORTH LINE OF SECTION 21-56-40
APPROXIMATE LIMITS OF HEAVY OVERGROWTH
BASELINE
EXISTING ASPHALT PAVEMENT
S.W. 232nd STREET
S.W. 232nd STREET
8' CHAIN LINK FENCE
SOUTH R/W LINE OF SW 232 ST
SOUTH R/W LINE OF SW 232 ST
GRASS
TOP OF BANK
GUARD RAIL


GRAPHIC SCALE
HA-6
HA-5
HA-4
HA-3
HA-2
HA-1
SP-1
SP-2
SP-3
SP-4
HEAVY OVERGROWTH
HEAVY OVERGROWTH
HEAVY OVERGROWTH
HEAVY OVERGROWTH
HEAVY OVERGROWTH
S.W. 232nd STREET
S.W. 232nd STREET



Design Topography of the Constructed Wetland – Cell 1 & 3

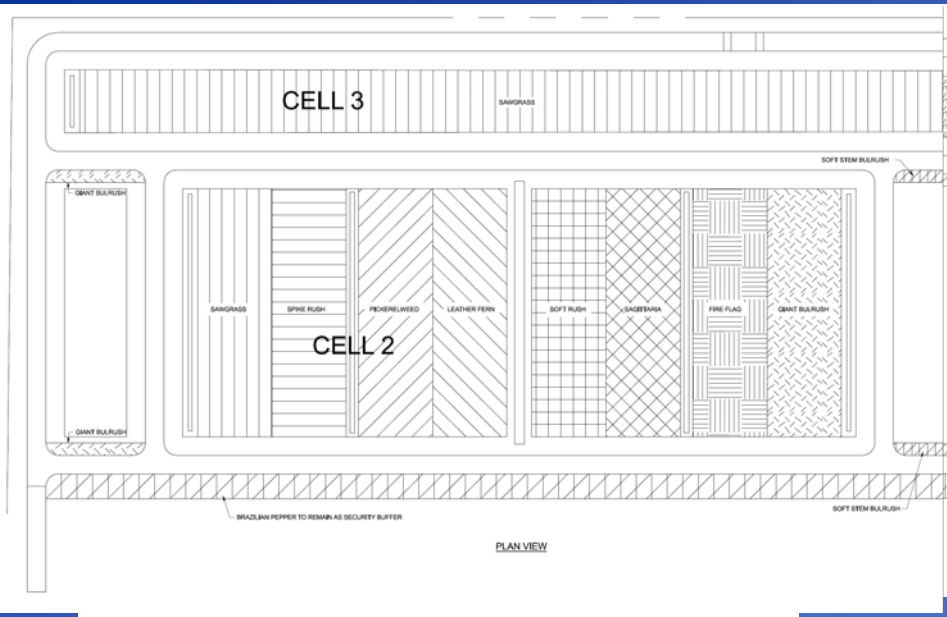
Note: Open Zones are to depth shown or top of rock

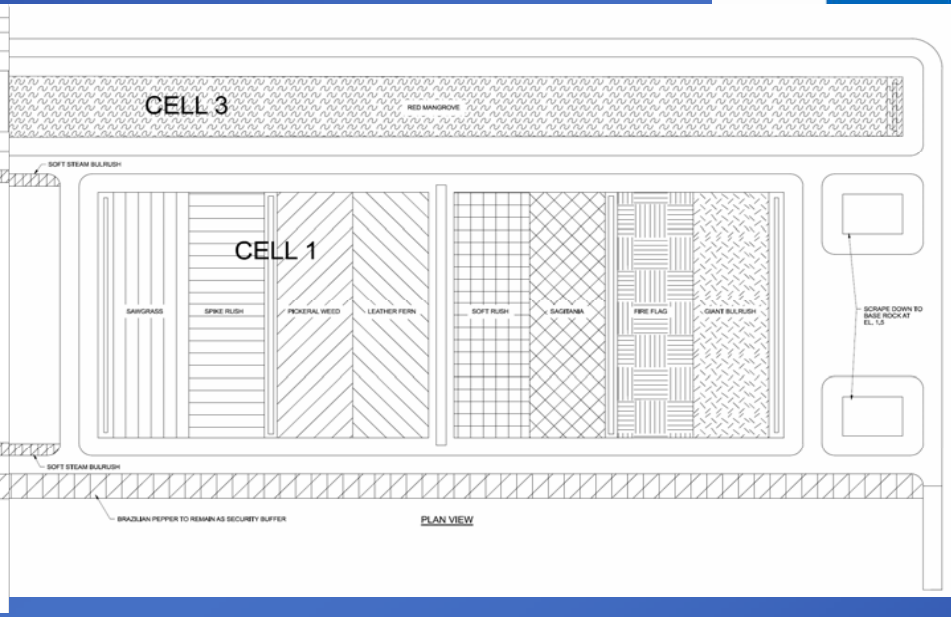


Design Topography of the Constructed Wetland – Cell 2 & 3

Note: Open Zones are to depth shown or top of rock

Wetland Vegetation





PLANT LIST

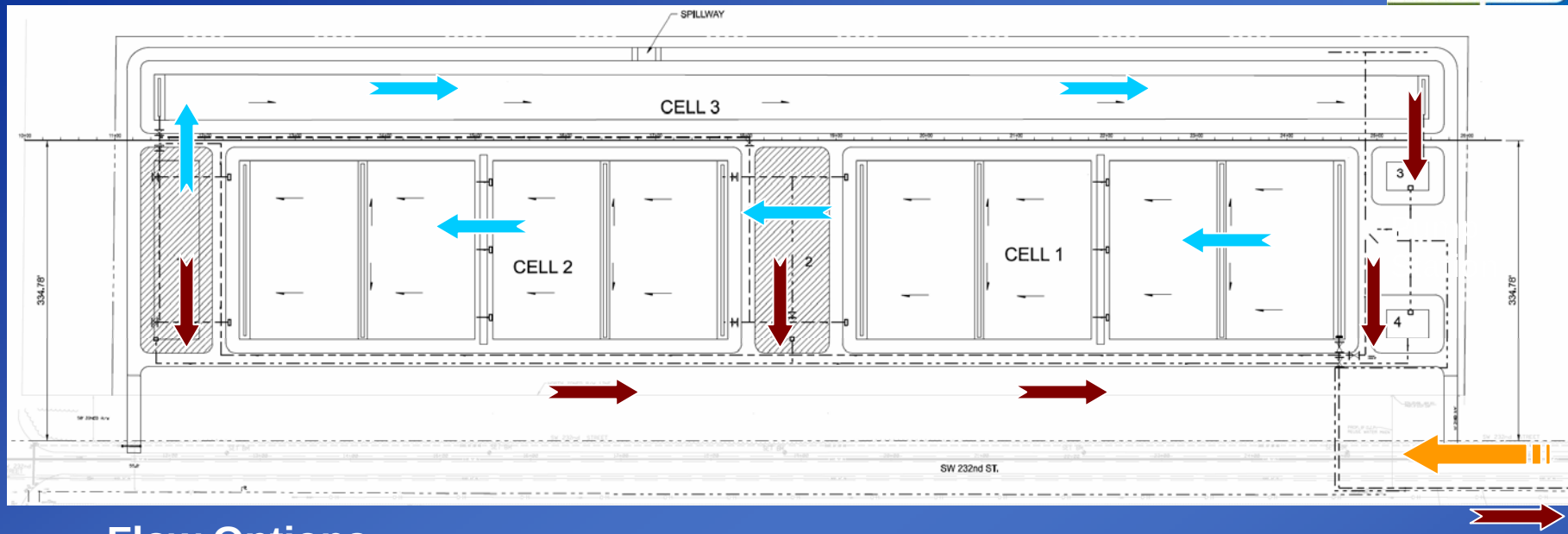
SHRUB AND GROUNDCOVER SPECIFICATIONS

SYMBOL	ABBR.	QTY.	BOTANICAL NAME	COMMON NAME	SPACING	SIZE	AREA (FT^2)
	CLJ	15,375	CLADIUM JAMAICENSE	SAWGRASS	2' O.C	LN	61,500
		6,000	ELEOCHARIS CELLULOSA	SPIKERUSH	2' O.C	BR	24,000
	POC	6,000	PONTEDARIA CORDATA	PICKEREL WEED	2' O.C	BR	24,000
	ACD	2,664	ACROSTICHUM DANAEFOLIUM	GIANT LEATHER FERN	3' O.C	1G	24,000
		6,000	JUNCUS EFFUSUS LATIFIA	SOFT RUSH	2' O.C.	BR	24,000
		6,000	SAGITTARIA	ARROWHEAD	2' O.C.	BR	24,000
		6,000	THALIA GENICULATA	FIREFLAG	2' O.C	BR	24,000
		6,325	SCIRPUS CALIFORNICUS	GIANT BULRUSH	2' O.C.	BR	25,300
		1,500	RHIZOPHOR MANGLE	RED MANGROVE	5' O.C.	1G	37,500
		325	SCIRPUS VALIDUS	SOFT STEM BULRUSH	2' O.C.	BR	1,300

LEGEND

LN = LINER

Flexibility of the Constructed Wetland Design



Flow Options

1. Series - Plant > Cell 1 > Cell 2 > Cell 3 > pump > return to WWTP
2. Series - Plant > Cell 1 > Cell 3 > pump > return to WWTP
3. Series - Plant > Cell 1 > Cell 2 > pump > return to WWTP
4. Series - Plant > Cell 2 > Cell 3 > pump > return to WWTP
5. Parallel - Plant > Cell 1 > pump > return to WWTP
   > Cell 2 > pump > return to WWTP
   > Cell 3 > pump > return to WWTP

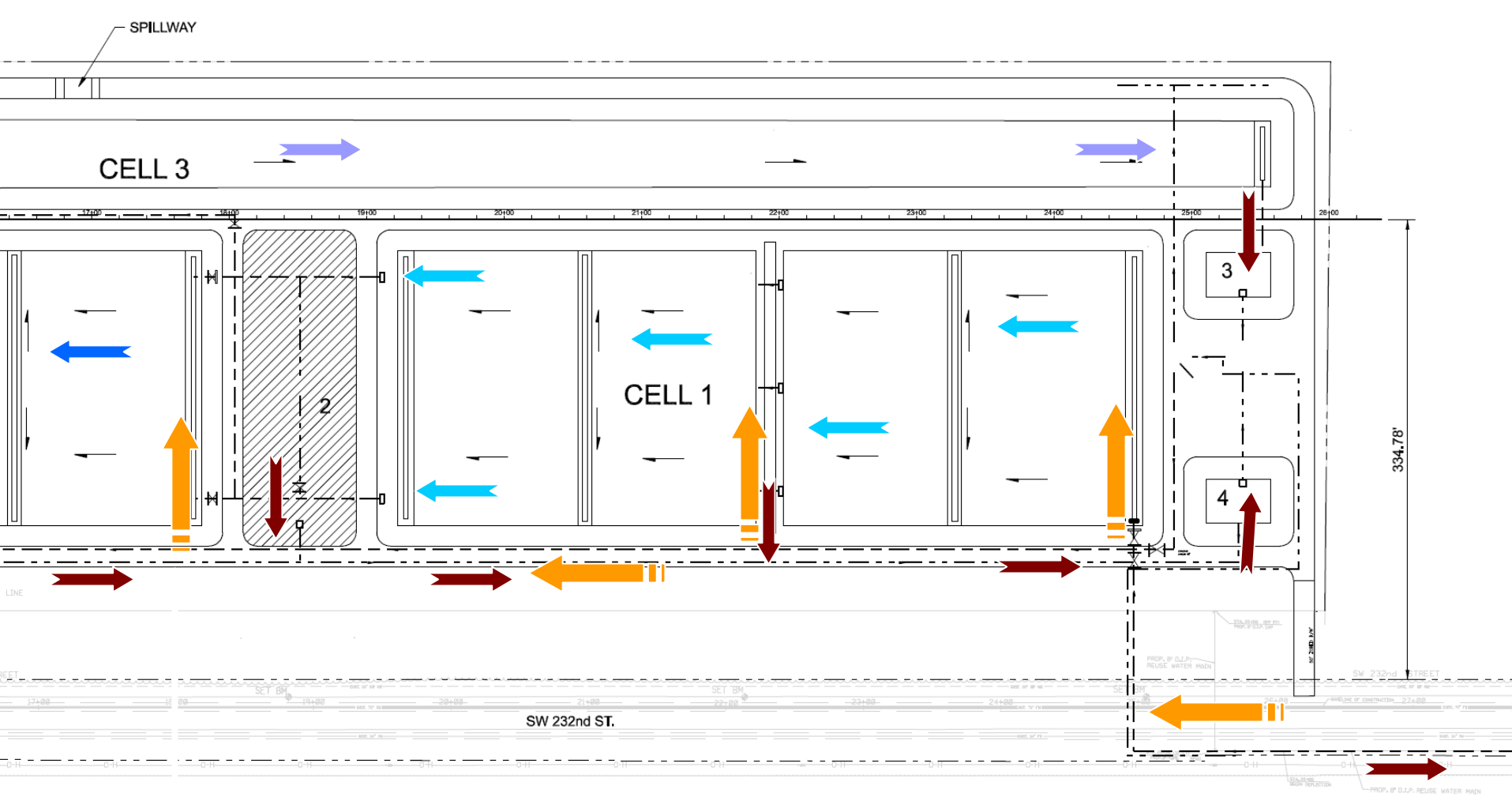
Inflow from the Demonstration Plant

Flow within the Cell

Return flow to the pump – and to the SD WWTP

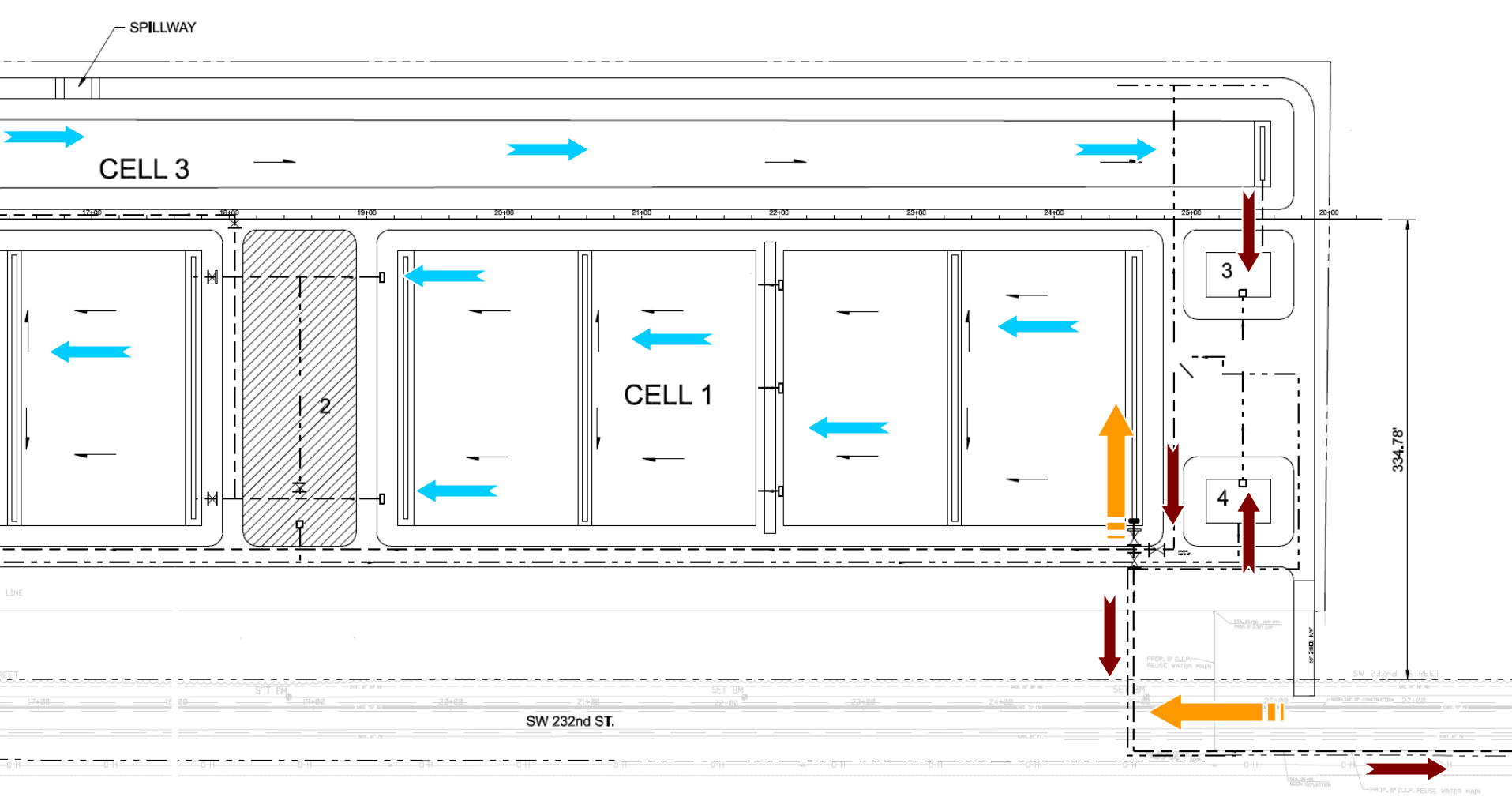
Combinations of Cell Configurations for flexibility in testing

	Cell 1a	Cell 1b	Cell 2a	Cell 2b	Cell3
Parallel	X	X	X	X	X
Series a	X	X			
Series b		X	X		
Series c			X	X	
Series d			X	X	X
Series e				X	X
Series f	X	X	X	X	X



Inflow to Cell 2 with the Cells operating in parallel

- Inflow from the Demonstration Plant
- Flow within the Cell
- Return flow to the pump – and to the SD WWTP



Inflow to Cell 2 with the Cells operating in series

Inflow from the Demonstration Plant

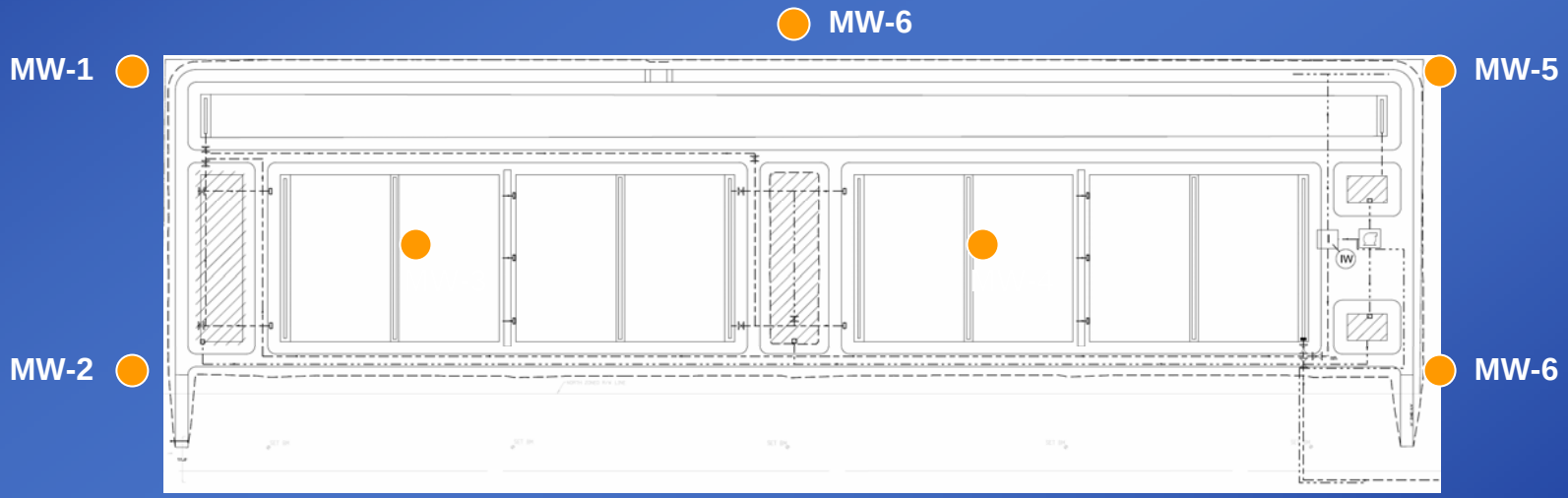
Flow within the Cell

Return flow to the pump – and to the SD WWTP

Water Quality of the Grow-in & Start-up Water from the Biscayne Aquifer

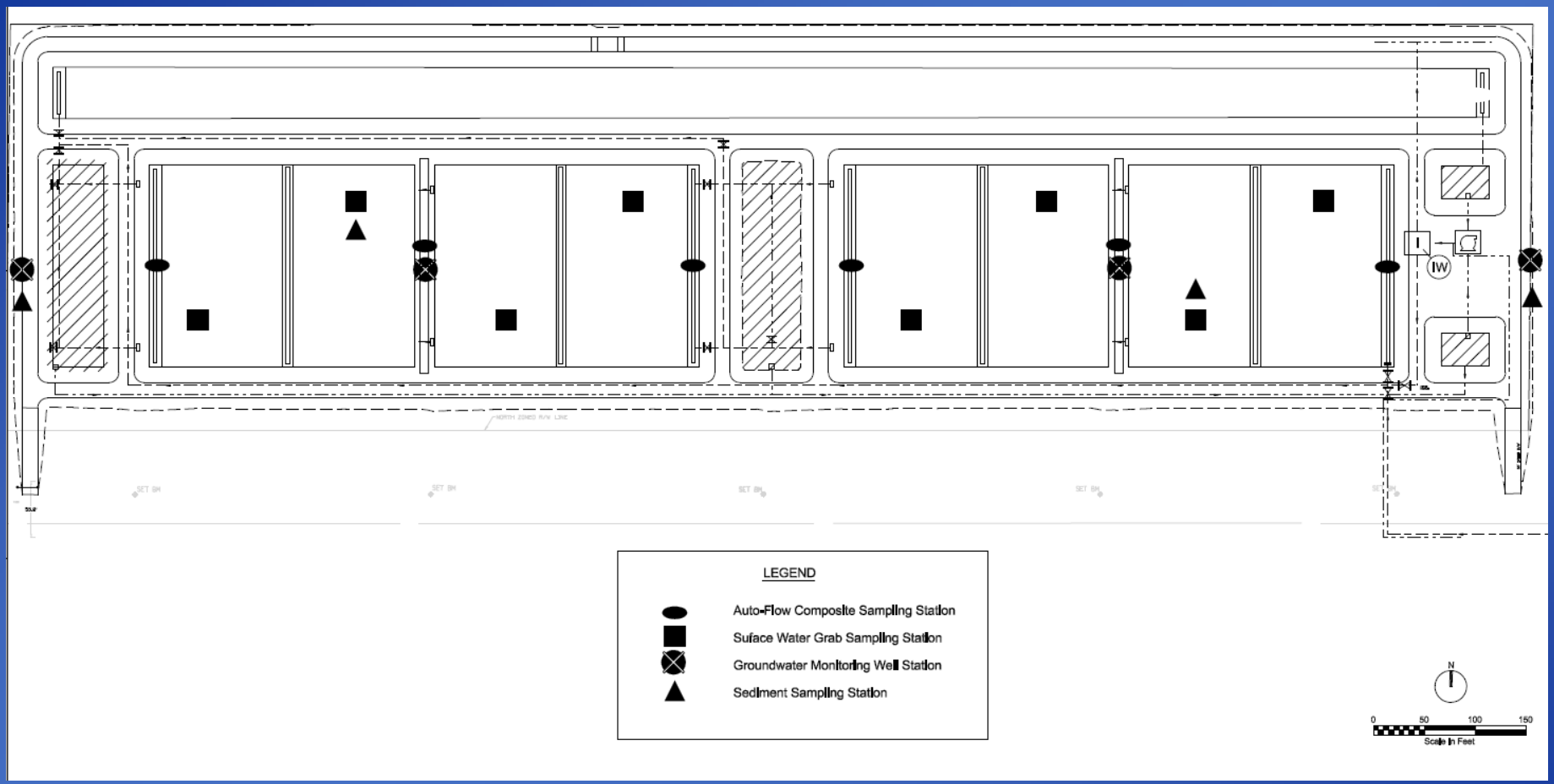
1. **Local source of water**
2. **Standardized water supply during Grow-in & Start up**
3. **Backup water supply if Demonstration Plant has interrupted supply**
4. **Baseline of data collection for a conservative design**

Groundwater Monitoring Well Configuration



Groundwater Monitoring Well Location

Sampling Locations



Removal of Brazilian Pepper
&
Retain Marl Soils

Critical Success Factors

1. Restoration of Freshwater Wetland on native soils by removal of the Brazilian Peppers
2. Establish Wetland with Biscayne Aquifer Water
3. Quantify wetland water balance and groundwater & surface water interaction
4. Quantify changes to inflow water quality
5. Development of a benthic ecosystem that supports the demonstration project
6. Maintain wetlands with Reuse Water
7. Stakeholders' Acceptance of Results
8. Provides useful information to CERP for full scale project

CWRRDP Monitoring Objectives

1. Enhance the current monitoring programs in areas surrounding the SDWWTP
   - C-1 and L31E Canals
   - BBCW east of SDWWTP
   - Coastal Wetland Fringe
   - Biscayne Bay

   Surrounding Area Baseline Monitoring Category A

2. Demonstrate the WRDP's ability to consistently attain water quality targets
   - Nutrients
   - Physical
   - Metals
   - Microconstituents
   - Cryptosporidium & Giardia

   WRDP Water Quality Monitoring Category B

3. Evaluate the ecological responses to the highly treated WRDP effluent
   - Surface Water Quality
   - Ground Water Quality
   - Sediments
   - Vegetation
   - Biota

   Constructed Wetland Monitoring Category C

4. Test the added treatment capabilities of the Sidestream Treatment Processes.

   Sidestream Process Testing Category D

Surrounding Area Baseline Monitoring Category A

Data Gaps Exist in the Following Areas:

- C-1 and L31E Canals
- BBCW east of SDWWTP
- Coastal Wetland Fringe
- Biscayne Bay

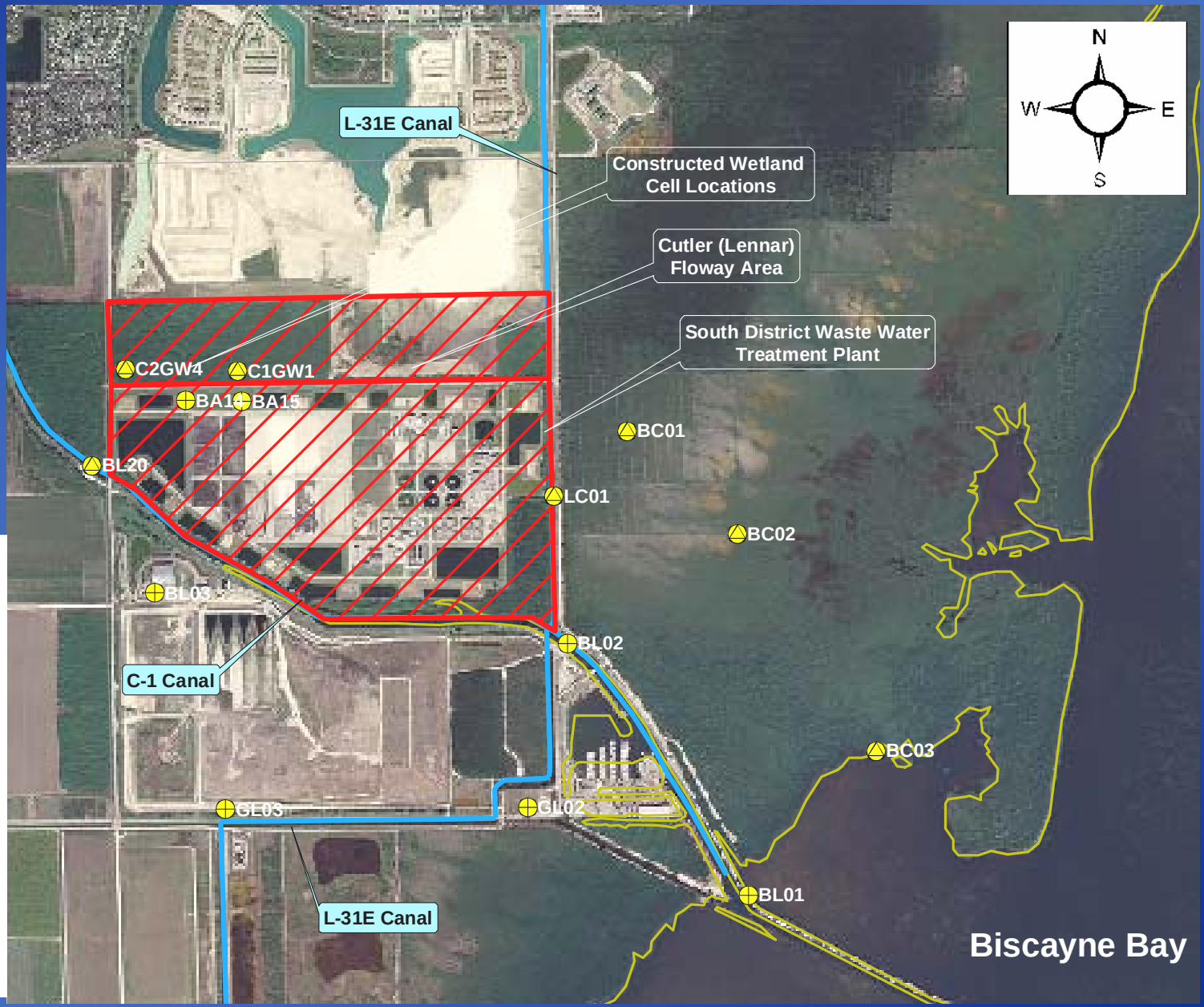
Added Stations will include the following matrices:

- Water Quality (Surface and groundwater)
- Sediment quality
- Vegetation

Parameters consistent with project Targets

Monitoring of the surrounding baseline will begin upon commencement of the project and continue through the life of the project.

Existing and Proposed Monitoring Stations



Legend

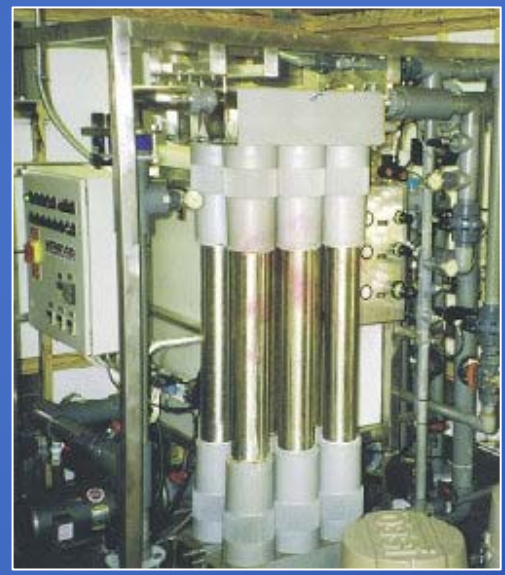
Monitoring Stations

Parameters

- Existing
- Proposed
- Project Area
- SFWMD Canals
- Major Roads
- Shoreline

WRDP Water Quality Monitoring Category B

- Collection and analysis of influent and effluent water quality samples from the WDRP
- Frequencies of the WRDP monitoring program will be finalized when the operational plan for the project is completed.
- This monitoring will be conducted throughout the life of the project.



Constructed Wetland Monitoring Category C

Start-up Phase (Two Years)

- Stabilization of soils, surface and groundwater quality, and biota within the constructed wetland cells prior to receiving WDRP-treated effluent

Demonstration Phase (5 Years)

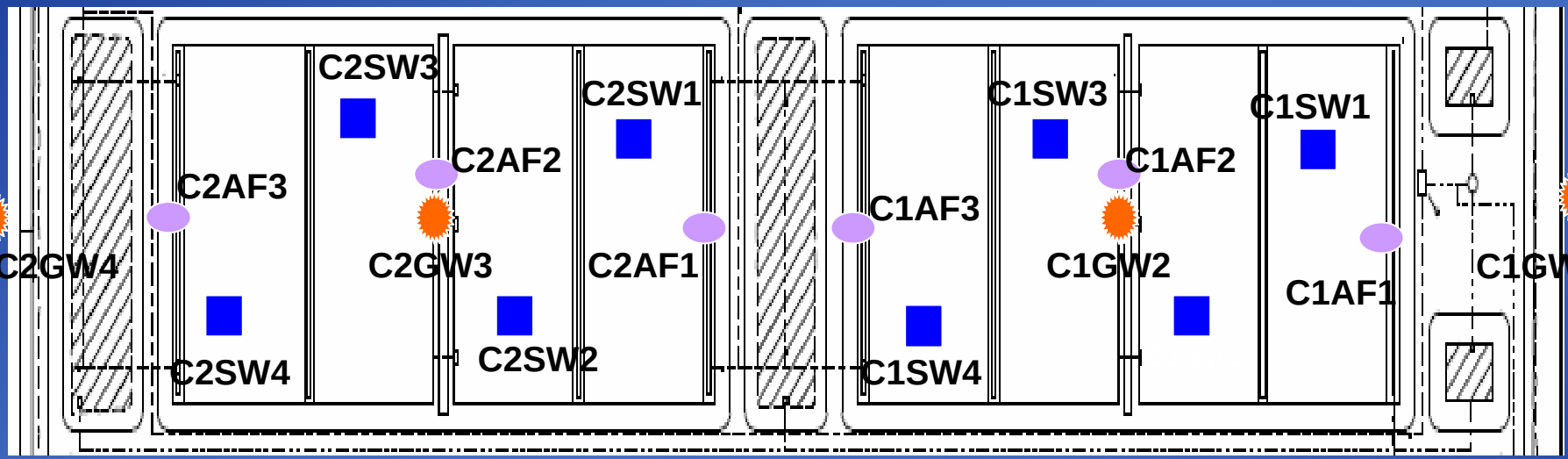
- Evaluate the water quality, soil, vegetation and biological responses within the constructed wetlands to the highly treated WRDP effluent.

- Monitoring through both phases will be identical
- A traditional paired watershed approach will be employed

Sample matrices include:

- Wetland Surface Water
- Groundwater
- Sediments
- Vegetation
- Macroinvertebrates and Fish
- Periphyton

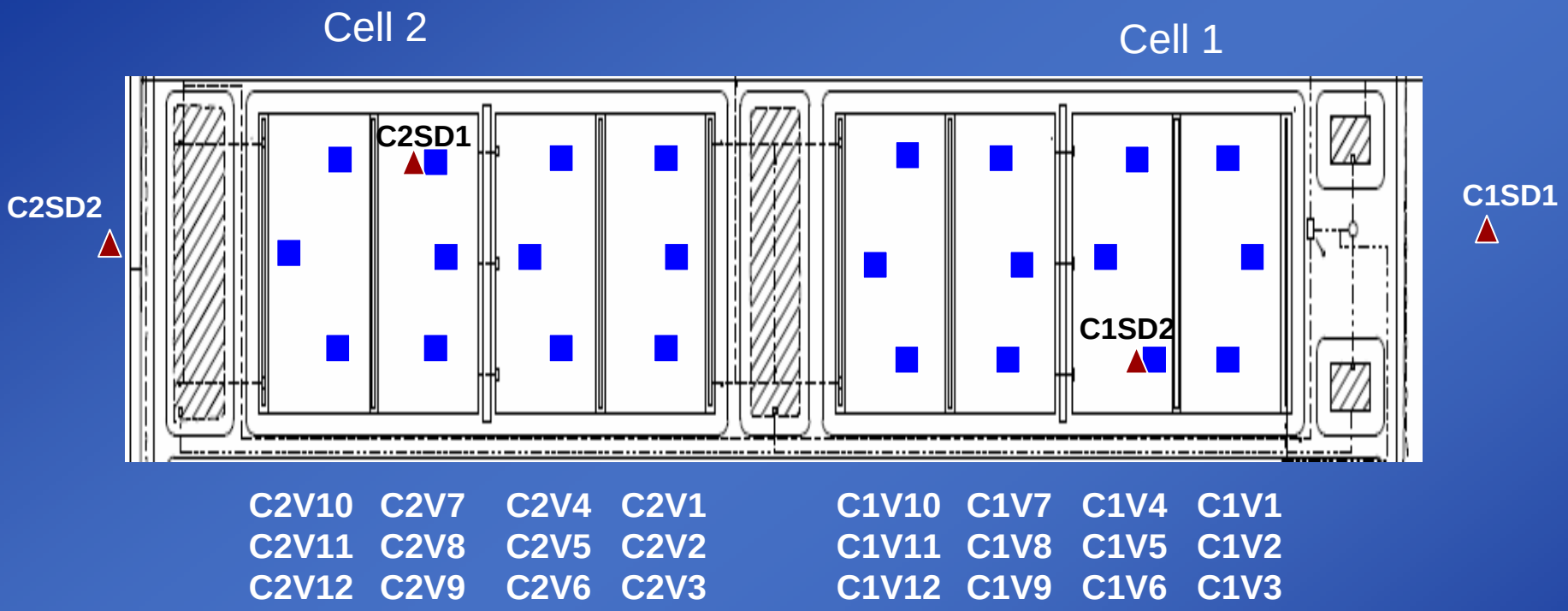
Water Quality Stations Within The Constructed Wetland Cells



Legend

- Surface Water Grab Sampling Station
- Auto-Flow Composite Sampling Station
- Groundwater Monitoring Well Station

Vegetation and Sediment Sampling Stations Within The Constructed Wetland Cells



Sidestream Testing
Category D

Four sidestream pilot technologies will be applied to WDRP effluent:

- Reverse osmosis,
- Ion exchange
- Granulated activated carbon
- Advanced oxidation

To determine the pilot technologies' operational capabilities in removing additional nutrients and microconstituents from WDRP effluent.

Testing conditions, sampling schedules, volumes of WRDP effluent used and time durations for each test are expected to vary for each technology and as refinements are made to the testing procedures.

Repeated trials and alterations to testing procedures are expected to occur until conclusions can be drawn and verified.

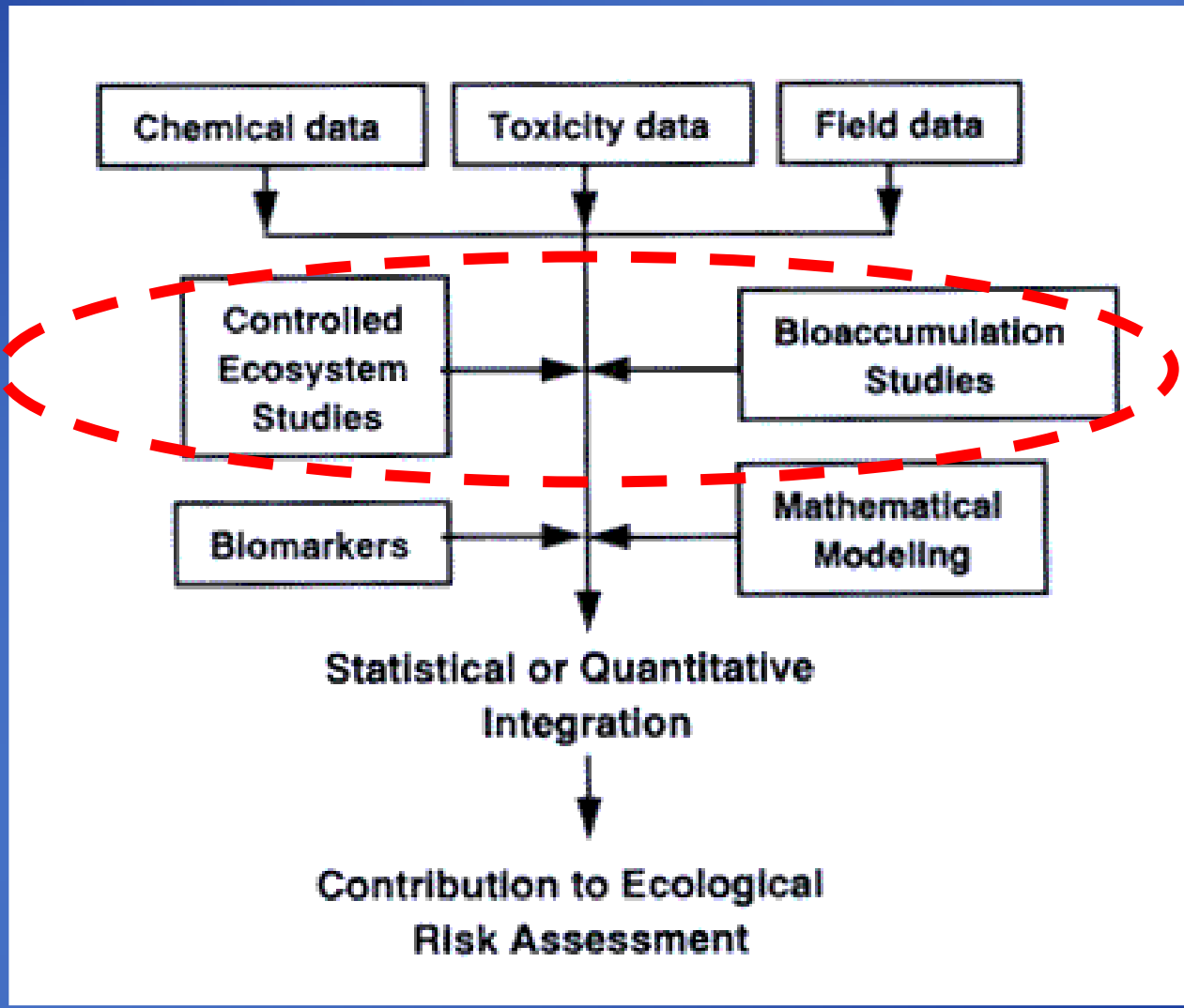
Microcosm Studies for Coastal Wetlands Rehydration Demonstration Project

Florida International University

Ecotoxicology Laboratory (*)
South East Environmental Research Center
Applied Research Center
Civil and Environmental Engineering Department

(*) FIU SERC Ecotoxicology Laboratory is NELAC accredited

Types of data used in ecological risk assessment



Microcosm and mesocosm studies

Microcosm & Mesocosm Studies

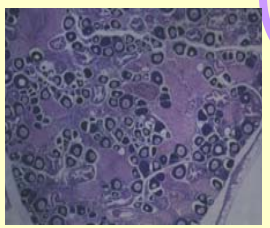
Differ from conventional toxicity tests:

- **inclusion of sediment, to allow the chemical to partition between water and sediment as it would do in nature;**
- **variation of chemical concentration over time, to simulate exposure patterns typically observed in the field when chemicals disappear due to degradation or water movement;**
- **periodic re-introduction of organisms, to simulate natural immigration and allow observation of population recovery (invertebrates or algae only, not fish).**

Objective

- To conduct controlled experiments in the laboratory and the field studies with selected animal and plant species to study the effects of wastewater effluent on the ecosystem.
- To demonstrate if the direct toxic effects of the wastewater effluent are mitigated by factors in nature.

Biological and ecological scales



Cell

Individual

Species

Population

Community

Ecosystem

Test environment

(microcosm)

Increasing temporal scale of response

Increasing spatial scale of response

Microcosm studies (indoors)

- Typical study
  - 3-5 exposure levels
  - plus controls, (in duplicates)
  - (12 to 18 microcosm units).
- Effects on phytoplankton, periphyton, zooplankton, or macroinvertebrates.

Mesocosm studies (outdoors)

- Inclusion of several special

Potential Impacts due to Wetlands Rehydration

- Toxicity of effluent
- Impacts on salinity
- Impacts on turbidity
- Impacts on vegetation
- Potential Habitat Fragmentation / Disturbance
- Potential impacts on dissolved oxygen levels

Questions that can be answered

- Identification of key surface and groundwater fate and transport uncertainties.
- Which naturally occurring species are performing better?
- Partitioning of selected compounds between water, sediments, and living systems.

Laboratory Facilities

Sediment system

Proportional diluter tanks

Laboratory Facilities

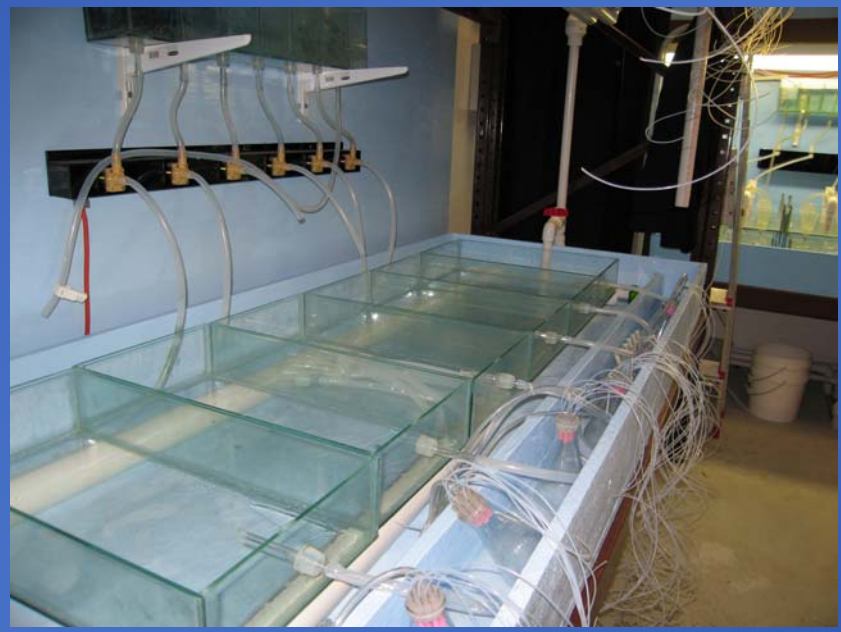
Laboratory Facilities

Laboratory Facilities

Ecotoxicology Laboratory, FIU

Laboratory Facilities

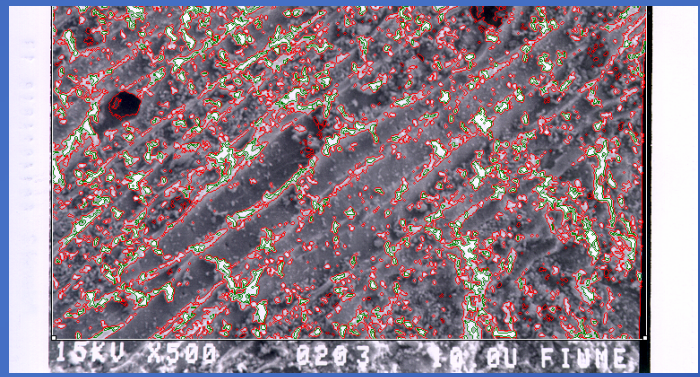
Laboratory Facilities

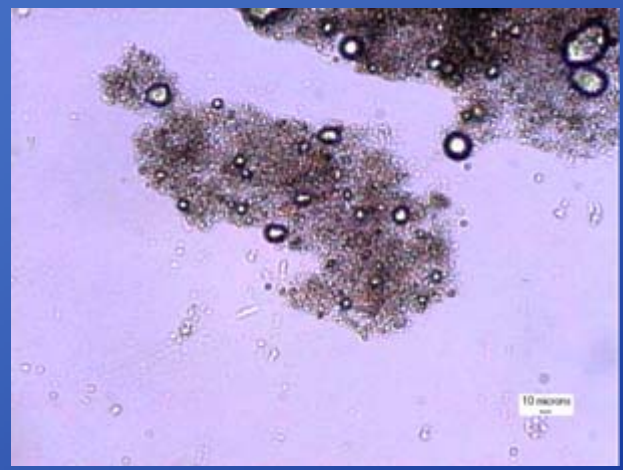


Plant studies

Study on mercury uptake by plants and the consequent effects in progress

Laboratory Facilities (analytical)





Proposed Tasks

Task I. Literature search

Task II. Microcosm tests (indoors)

Task II. Microcosm tests (outdoors)

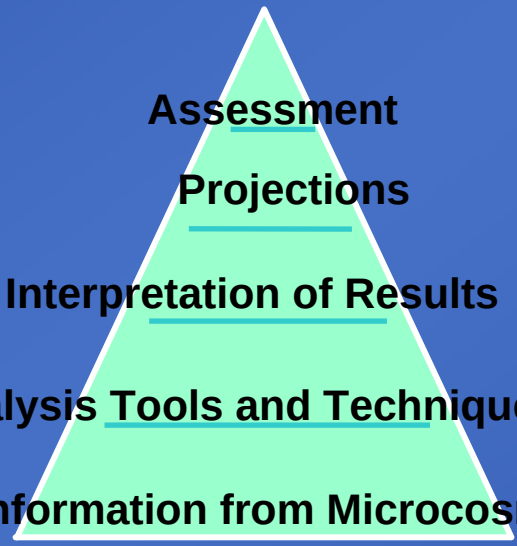
Task III a. Animal studies

Task III b. Plant growth studies

Task IV. Permeability and uptake studies

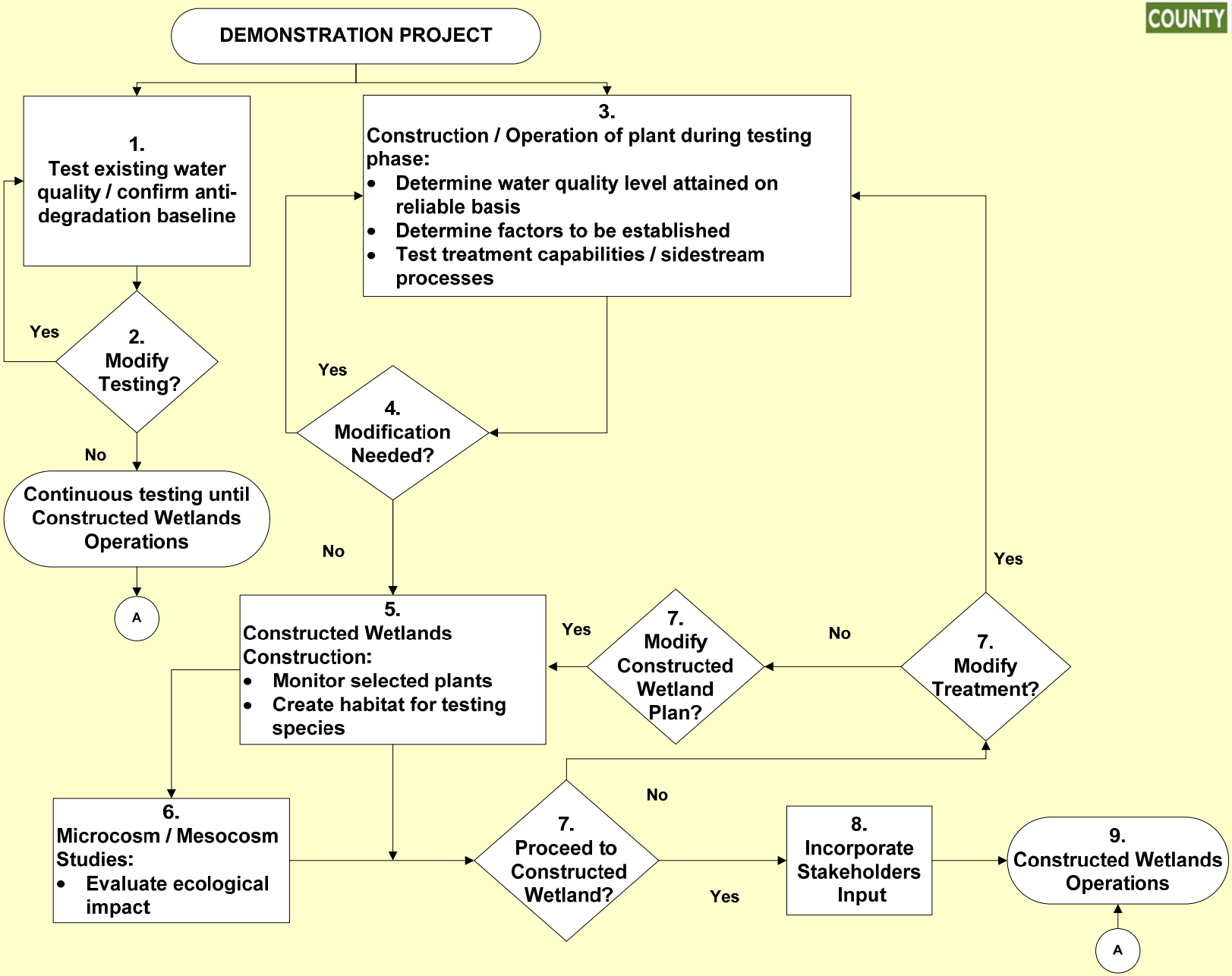
Task V. Projections and modeling

Task VI. Assessment of potential impacts



Test species

Test conditions	Plants	Animals
Microcosm (indoors) (individual settings)	**Freshwater marsh species** **(algae, waterfern, duckweed, sawgrass, cattails)**	**Invertebrates** **(oligochaete worms, snails, amphipods)** **Fish**
Mesocosm (outdoors)	**Freshwater marsh species** **(algae, waterfern, duckweed, sawgrass, cattails)**	**Invertebrates** **(oligochaete worms, snails, amphipods)** **Fish**


DEMONSTRATION PROJECT
1. Test existing water quality / confirm anti-degradation baseline
2. Modify Testing?
Yes
No
Continuous testing until Constructed Wetlands Operations
A
3. Construction / Operation of plant during testing phase:
• Determine water quality level attained on reliable basis
• Determine factors to be established
• Test treatment capabilities / sidestream processes
4. Modification Needed?
Yes
No
5. Constructed Wetlands Construction:
• Monitor selected plants
• Create habitat for testing species
7. Modify Constructed Wetland Plan?
Yes
No
7. Modify Treatment?
Yes
No
6. Microcosm / Mesocosm Studies:
• Evaluate ecological impact
7. Proceed to Constructed Wetland?
No
Yes
8. Incorporate Stakeholders Input
9. Constructed Wetlands Operations
A