Integrated Modeling for Environmental Evaluation using ICPR v4

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Background

St. Johns Marsh Conservation Area

- Near headwaters of Upper St. Johns River
- Approximately 35 square miles
- Land is owned and managed by SJRWMD
- Provides important water quality and ecological functions
- Managed flood flows from south and east
St. Johns River Water Management District

Background

SJMCA Concerns

• Historic overdrainage, causing oxidation of heavily organic soils
• Release of nutrients downstream
• Historic canal plugs resulted in adverse hydraulic conditions
St. Johns River Water Management District

2000 transects
35 transects
1,420 points
~500m between transects
~50 meters between points

2009 transects

2009/2010
Repeat 5 transects
175 points
~same location

Distance along transect (m)
Background

Changes to Historic Conditions

- Canal plugs installed in the 1990s
- All but one were removed by early 2000s
- Former inflows diverted eastward into Three Forks MCA before returning to SJMCA
ICPR version 4 selected

Criteria:
- Represent 2D overland flows
- Continuous simulation
- Hydraulic structures
- Simulate surface/groundwater interaction
- Ease of use
- Reasonable cost

Jones Edmunds Associates contracted to develop base model

Streamline Technologies, Inc. (software developer) contracted to perform peer review
Model Development

SJMCA 1D Features

- Inlet structures
- S-96C
- S-252A-E
- S-257 Weir
- C-40 and western farm canals
- E-7 cut-around channel
- 3 cross-marsh airboat trails
- Western creek and flow-way channels
- Pond control volume – borrow pit
Model Development

- Combination of 1D and 2D overland flow, plus 2D groundwater mesh
- Intended for design of structural improvements

- Possible future additional uses include:
  - Evaluation of flowage easements on western boundary
  - Improved stage/discharge relationships for large-scale watershed models.
Model Development

2D Surface Region

- Breakpoints
- Breaklines
- 2D weirs
- Control volumes
- 8,500 surface nodes
- Lidar-based DEM
Model Development

Groundwater Region

- 3,400 groundwater nodes
- Peat layer above sand aquifer
- Downstream boundary condition established using gauge data
- No leakance to UFA
Alternatives Analysis

SJMCA 2D Model

- Combinations of restored and new canal plugs and other features
- Alternatives were developed in three phases
- Environmental criteria applied for:
  - Percent inundation
  - Dry-down periods
  - Predicted vegetation community
West Side Alternatives

Alt 1: none
Alt 2a: W-1, 2
Alt 2: W-1, 2, 3
Alt 2b: W-1, 2, 3, 4
Alt 2c: W-3, 4
Alt 2d: W-3, 4, 5
Alt 2e: W-3, 4 + E-7 x 2
Alt E: All 36”; Apr-Jun
Alt F: All 60”; Apr-Jun
Alt G: All 60”; Jan-Dec
Model Outcome

Preferred scenario (Alternative E):

- ~1,700 additional acres (12%) protected from oxidation
- ~1,800 additional acres (13%) predicted to maintain most desirable vegetation categories

Restoration partially complete; the remainder pending further flood control analysis and other concerns.
Project Team

• Jones Edmunds Associates
  – Model development, calibration, initial alternatives

• Streamline Technologies: Pete Singhofen
  – Support, review, code modifications

• SJRWMD
  – Hector Herrera – USJRB Restoration Project overall management
  – Tom Jobes – work order management, modeling
  – Rayner Fernandez – modeling support, postprocessing scripts
  – Steven J. Miller, Kimberli Ponzio, Dianne Hall – environmental analysis
  – Sandra Fox – DEM analysis and corrections

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Questions?