Appendix A. Description of method for Hist-Delta and Simulated Stages at Ungauged River Transect Locations

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It is a basic premise of the wetland impact analysis that wetlands occur at specific elevations in the floodplain of the St. Johns River in response to hydrological conditions, particularly pool depth and frequency of inundation. If these conditions change, wetlands will respond. The responses may include shifts in species abundance, changes in species composition, shifts to other wetlands community types, and shifts to upland community types. Some of these changes would result in shifts of vegetation communities up or down an elevation gradient.

Because of patterns in historical land use and other spatially varying hydrologic inputs that were not duplicated by model inputs, the WSIS baseline model run (Base1995NN) results for water elevation do not match the USGS measured daily stages that have given rise to existing vegetation communities (Figure A-1). Many of the ecological impact analyses for the WSIS were accomplished by comparing the model baseline run with selected impact scenarios to determine the relative changes in flow or stage and their effects on ecological communities. However, for wetland community impacts from stage changes, the historical elevation gradient and inundation patterns at each location need to be captured in the analysis.

The WSIS model runs were therefore used to calculate a daily difference, or delta, between the model baseline (Base1995NN) and each of three withdrawal scenarios (Full1995PN, Half1995PN, and Full2030PN) for stations in segments 7 and 8. The daily difference attributable to the scenario was then subtracted from the historical daily stage. We refer to this approach as the "historic minus delta" or Hist-Delta method. The Hist-Delta daily time series could then be analyzed to determine changes in inundation frequency and pool depth and the resulting potential shifts in wetland vegetation communities . Hist-Delta time series were used as input for the Hydroperiod Tool as well as to prepare summary statistics for withdrawal scenario water levels.

The Hist-Delta approach is relatively straightforward for locations in which wetlands are in close proximity to long-term hydrological monitoring stations. For vegetation transects located immediately adjacent to a long-term surface water monitoring station, daily stage data from that monitoring station could be used to create a Hist-Delta time series to evaluate the effect of river stage on adjacent wetlands. However, most vegetation transects are not located near long-term monitoring stations. At river locations with WSIS model output near vegetation transects in river segments 7 and 8, there was a need for a simulated record of historical river stage (Table A-1).

Several methods were explored to determine the best way to estimate daily stage at vegetation transects that were not near long-term surface water monitoring stations. A simple adjustment of water elevations using linear interpolation based on known land surface elevations within wetlands did not agree well with measured stage at transect stations that have been established since 2008.

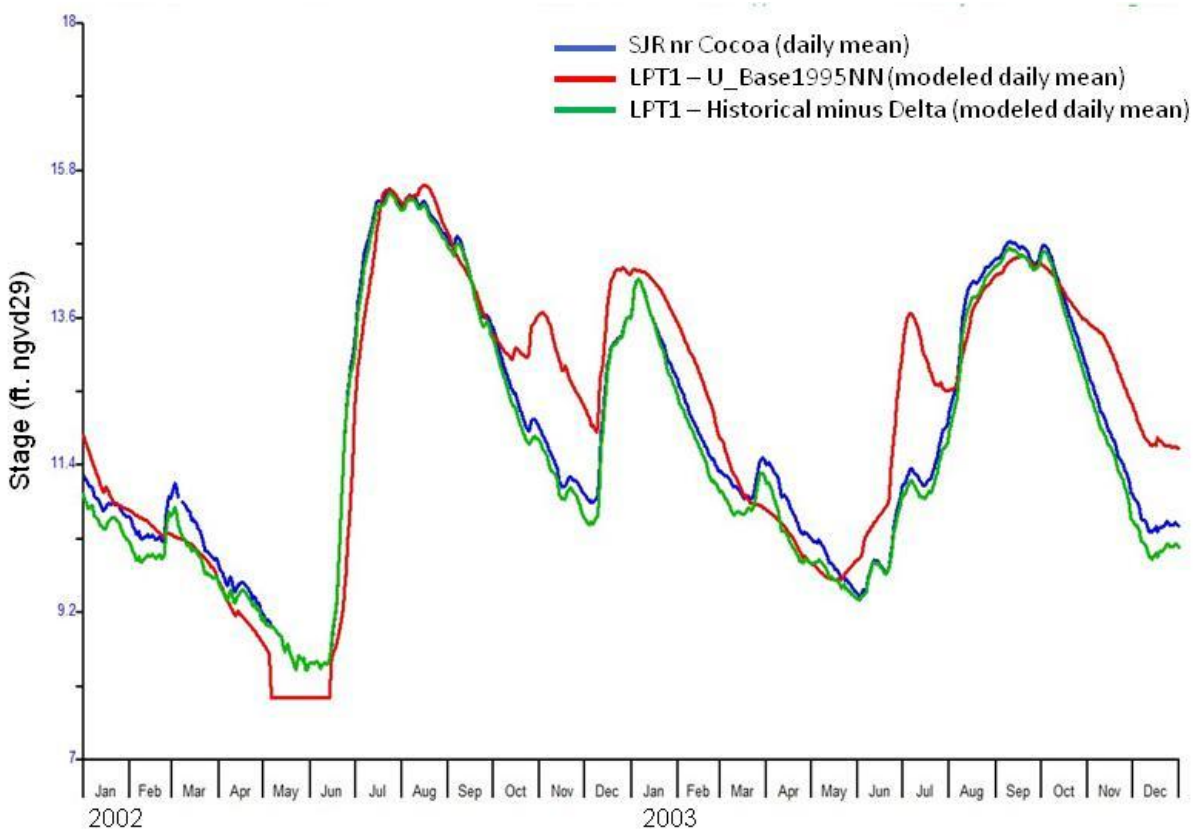

Figure A-1. Mean daily stage in 2003 – 2004, ft NGVD1929, for Lake Poinsett vegetation transect as measured at USGS station SJR at Cocoa (blue), compared with daily modeled baseline (U_Base1995NN) and Hist-Delta for modeled full withdrawal (U_Full1995NN).

Fortunately, the WSIS model output provides insight into river dynamics that could be used along with historical data to determine a valid adjustment based on a transect's physical location. Since EFDC baseline model output was available for model cells adjacent to vegetation transects as well as for nearby USGS monitoring stations, the modeled stage difference between the two locations could be determined for each day. This difference between daily modeled stages only reflects location differences, since all other variables are held constant by the model.

A comparison of Base1995NN model data sets from the Christmas gage and each of five transect locations suggested that a realistic stage adjustment to simulate stage at a nearby location would vary seasonally. The approach used therefore was to determine an adjustment for each calendar day of the year that could be applied to monitored stations to estimate stage at nearby vegetation transects. A hydrologic data management program (Hydstra, Kisters Pty. Ltd.) was used to store and manipulate model output for neighboring locations. For the vegetation transects that were not near monitored surface water stations, the Base1995NN scenario was used to determine daily average stage at each location for each calendar day of the year for the . model period of record (1975 – 2006). The resulting set of average daily stages for each day of the year was then used to calculate an average daily stage difference between a river transect location and a

neighboring monitored station. The difference was then applied to the historical USGS station water level for each day of the historical record to estimate water levels at the vegetation transect location. This simulated stage record was then used to determine Hist-Delta stages for river transect locations.

Table A-1. Station Locations and USGS Neighbors Used to Simulate Historical Water Levels.

Station description	**River Kilometer**	**SJRWMD Station ID**	**Nearest USGS station**
H1 Transect.	331.7	ES406221	02232500 – SJR nr Christmas
Cone Lake Transect.	338.2	ES406222	02232500 – SJR nr Christmas
Toso North Transect	347.9	ES406224	02232500 – SJR nr Christmas
Great Outdoors	354.3	ES406220	02232500 – SJR nr Christmas
Toso 528 Transect.	361.7	ES406223	02232500 – SJR nr Christmas
Toso Shelter Transect	368.4	ES407505	02232400 – SJR nr Cocoa
Puzzle Lake Transect	319.97	ES407504	02232500 – SJR nr Christmas
Pine Island Transect	245.71	ESMFL008	02236000 – SJR at DeLand
SJR at DeLand	232.1	14567018 (USGS 02236000)	NA
SJR nr Christmas	343.52	70207020 (USGS 02232500)	NA
SJR nr Cocoa	378.08	11807019 (USGS 02232400)	NA
LPT1 (Model Output)	378.09	ES237493	NA
SJR US Winder	400.10	01600751	NA
St Johns Weir (Lk Washington outlet)	414.23	01581076	NA

NA = reference or model stations