Appendix 1 - SICS Application Scenarios

The Southern Inland and Coastal Systems (SICS) application utilizes version 2.1 of the FTLOADDS code. The field-calibrated SICS application was developed as described by Swain and others (2004) and Langevin and others (2004). The boundaries of the model were modified (Wolfert and others, 2004) to link with the South Florida Water Management Model (SFWMM). This formulation then was applied to selected scenario simulations.

Initial Conditions and Boundary Conditions

The field-calibrated FTLOADDS application is the most comprehensive numerical representation available of the hydrology in the SICS domain, based on measured quantification of static parameters and forcing functions (Swain and others, 2004). The model input parameters are as follows:

- Topography is represented by land-surface altitudes (Swain and others, 2004).
- Vegetation is represented by vegetation features and frictional resistance (Swain and others, 2004).
- The freshwater-saltwater interface for initial conditions is represented by apparent resistivity (Swain and others, 2004).
- Biscayne aquifer depth is represented by the altitude of the base of the aquifer (Wolfert and others, 2004).
- Leakage parameters are represented by peat thickness (Harvey and others, 2000) and Florida Bay bottom types (Prager and Halley, 1997).
- Other parameters are represented by the stream friction term and Manning's *n* (Swain and others, 2004), and aquifer hydraulic conductivity, peat hydraulic conductivity, storativity, specific yield, and porosity (Langevin and others, 2005).

Discharge at lateral boundaries are the only inputs to the SICS surface-water application that are altered when generating restoration scenarios from SFWMM output. Boundary locations for the SICS application are shown in figure A1 and described fully in Wolfert and others (2004). The groundwater application contains a general-head boundary (Wolfert and others, 2004) that extends along the edges of the wetland part of the SICS domain and is modified by acquiring stage values from SFWMM cells that correspond in location to the SICS cells. The SFWMM cells that correspond to the SICS boundaries (fig. A2) supply water-level values for the boundaries in the restoration scenarios.

Linkage to the South Florida Water Management Model (SFWMM)

The SICS application was run with boundary conditions defined by the SFWMM model (Wolfert and others, 2004). This linked simulation used the input data previously described, with the exception that the northern model boundaries utilized water levels from the SFWMM verification run as boundary conditions. The SFWMM uses hydraulic structure operating rules that were actually implemented for the period from 1996 to 2000. Locations of SFWMM cells used to derive water-level boundary conditions for the SICS application are shown in figure A2.

Flow and salinity from the linked model are compared with the calibrated SICS model at McCormick Creek, Mud Creek, Taylor River, Trout Creek, and West Highway Creek (figs. A3-A5). This comparison demonstrates the difference in using boundary conditions generated from the SFWMM and those created from measured data. Surface-water stage from the calibrated and linked model runs is compared at wetland stations CHP, EPSW/GW, EVER7, P37, and R-127 in Everglades National Park (figs. A6-A7). A comparison of the results from the calibrated and verification linked model runs indicates the ability of the SICS/SFWMM linkage to represent existing conditions for the 1996-2000 period.

This section describes the different scenario runs that were conducted for the FTLOADDS application to the SICS domain using boundary conditions generated from the SFWMM model runs. The results of scenarios 1 and 2 are presented in this section.

Scenario 1: 2000B2_SICS

The 2000B2_SICS simulation modifies the SICS application to use boundary conditions generated from the SFWMM 2000B2 model run (Wolfert and others, 2004). The simulation period is from 1996 to 2000, and land use, canal, and structure operation criteria from the year 2000 are used for the entire simulation. The same rainfall series developed for the calibrated SICS application is used. The boundary conditions are derived from SFWMM cells (fig. A2). The 2000B2_SICS application results for discharge and salinity at McCormick Creek, Mud Creek, Taylor River, Trout Creek, and West Highway Creek are shown in figures A8 and A9. Model results are presented in figure A10 for surface-water stage at wetland stations EVER7, CP, EPSW/GW, P37, and R-127.

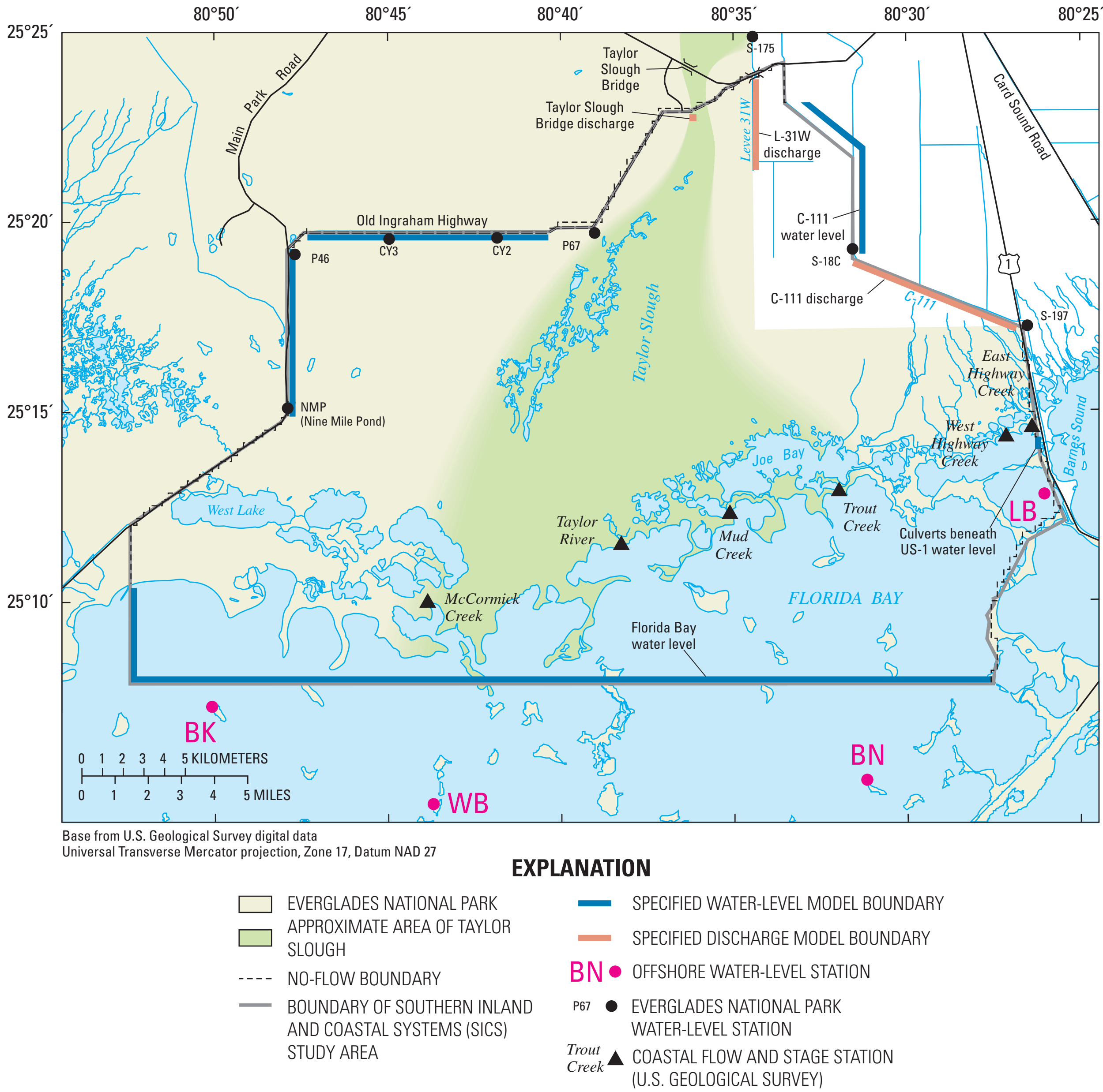


Figure A1. Boundary conditions for the SICS domain (from Swain and others, 2004). SICS is Southern Inland and Coastal Systems.

Scenario 2: SLR_SICS (Sea Level Rise)

The SLR_SICS simulation modifies the SICS application to use inland boundary conditions generated from the SFWMM 2000B2 model run. The offshore boundaries use the same time series, raised uniformly by 8 cm. Although estimates vary (Intergovernmental Panel on Climate Change, 2001), this rise in sea level corresponds to reasonable values expected for the year 2050. Otherwise, the simulation uses the same 1996-2000 data as the calibrated SICS application. Thus, the same environmental time-series data are used, with the only difference being higher sea level. The SLR_SICS model results are presented for discharge and salinity at McCormick Creek, Mud Creek, Taylor River, Trout Creek, and West Highway Creek (figs. A11 and A12). Discharge differences are not dramatically different, but minimum salinity values are substantially greater in the western creeks and maximum salinity values are substantially greater in the eastern creeks. The net effect is to increase the salinity range in the eastern creeks and reduce the salinity range in the western creeks.

Model results are presented for surface-water stage at wetland stations EVER7, CHP, EPSW/GW, P37, and R-127 (fig. A13). As might be expected, higher wetland stages are induced by the sea-level rise; particularly at the southern end of the model.

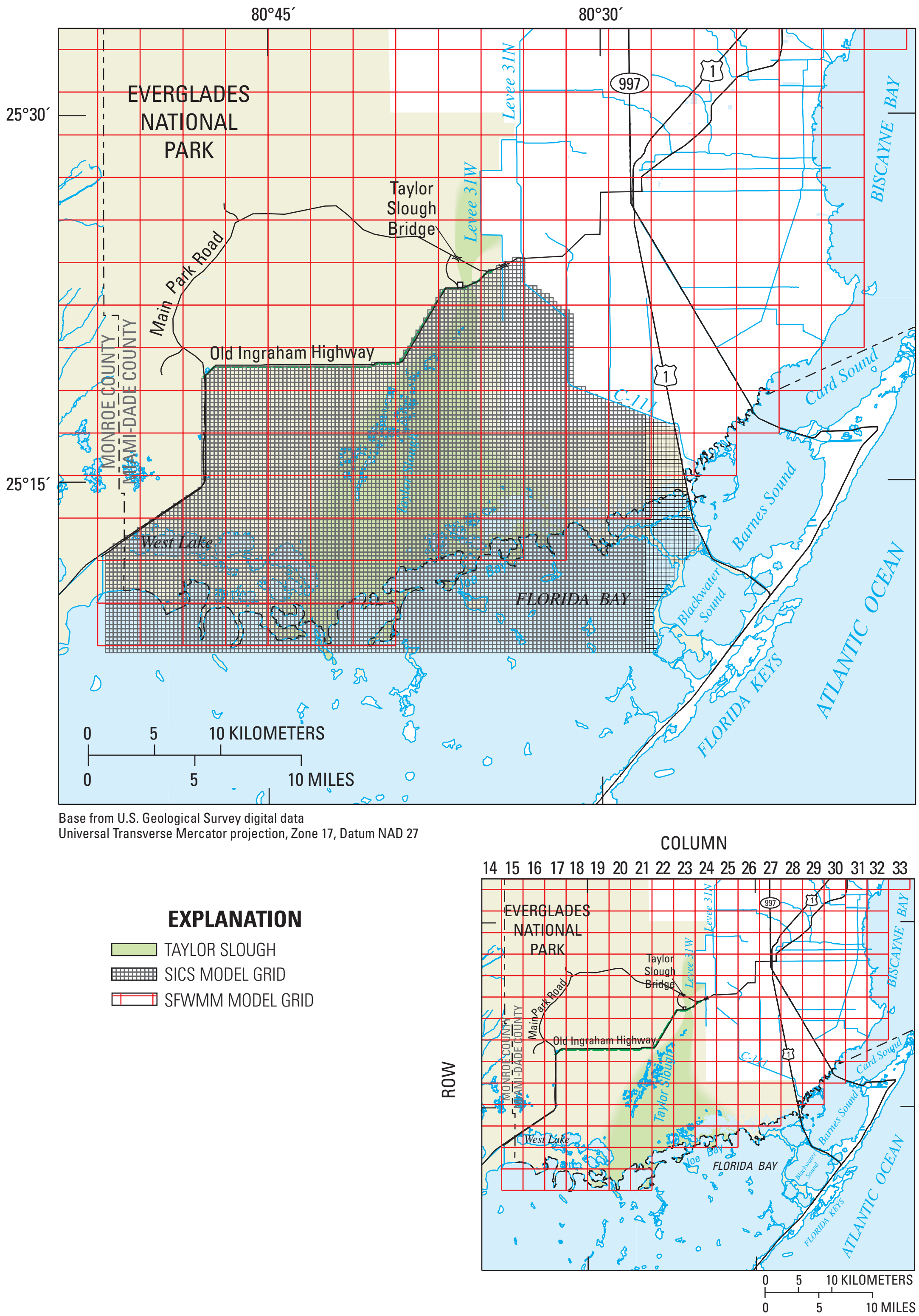


Figure A2. Overlay of the SFWMM grid on the SICS model grid (from Wolfert and others, 2004).

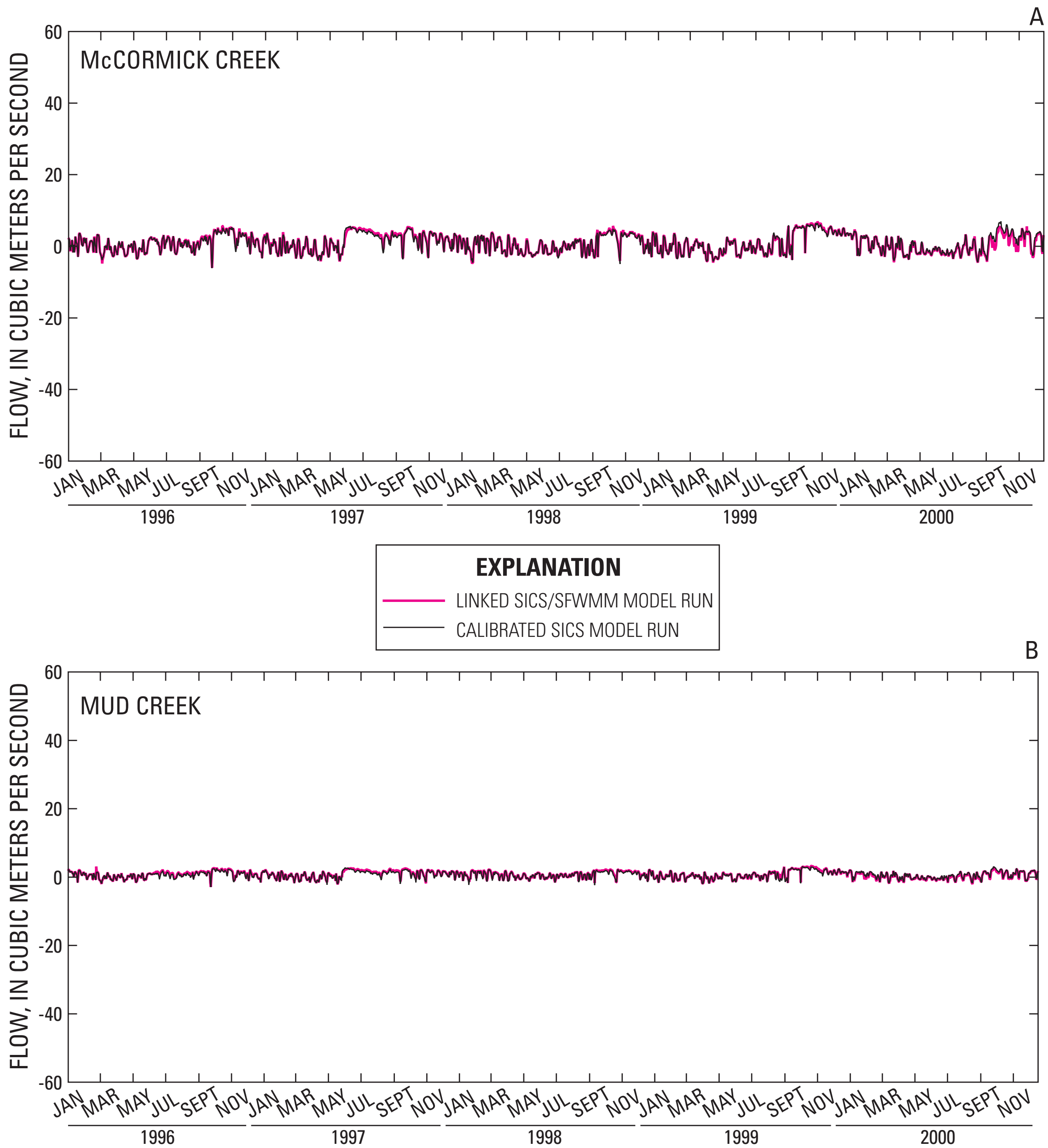


Figure A3. Flow from the calibrated and verification linked model runs at selected coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. Site locations are shown in figure 8.

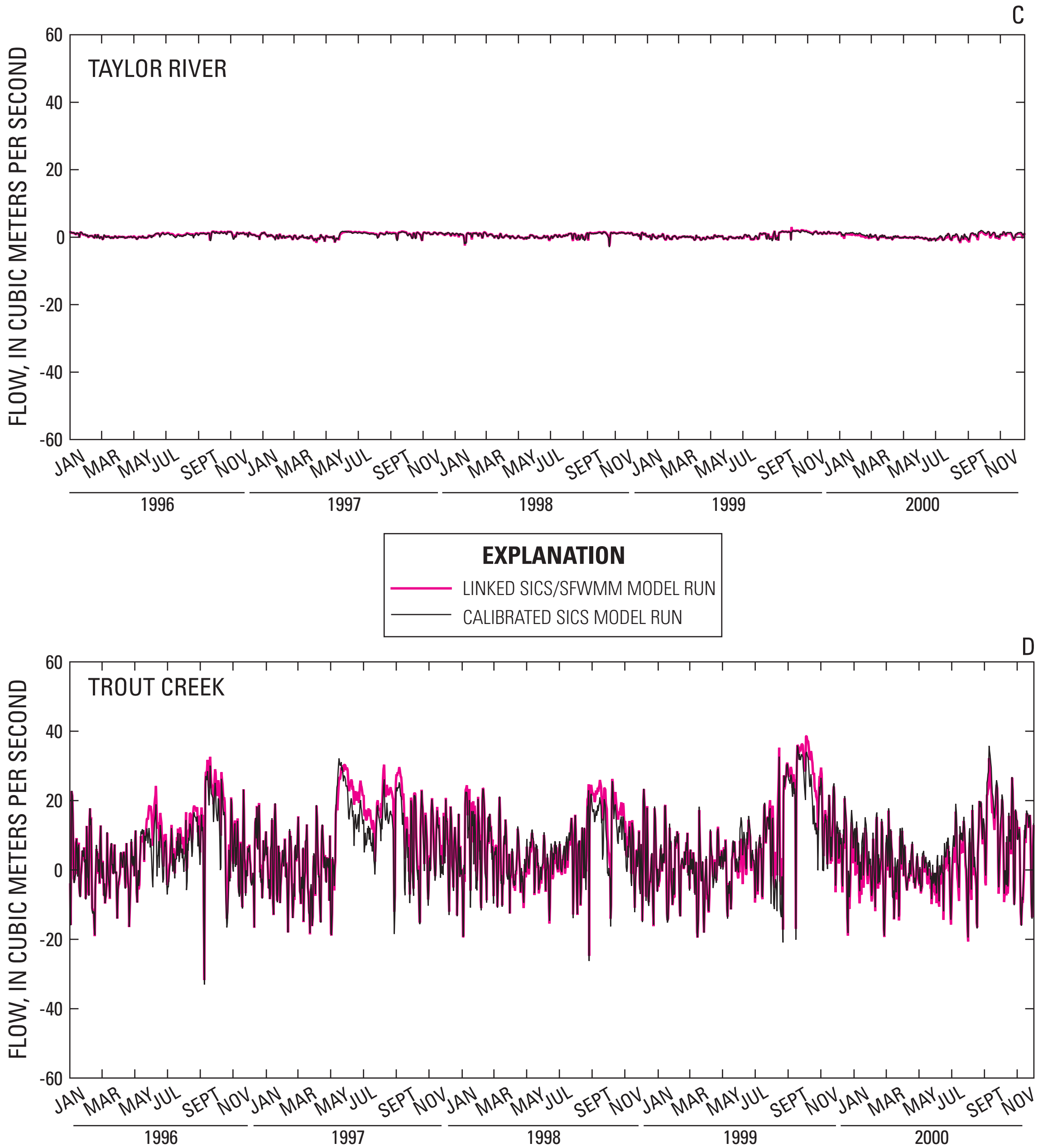


Figure A3. Flow from the calibrated and verification linked model runs at selected coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. Site locations are shown in figure 8.—Continued

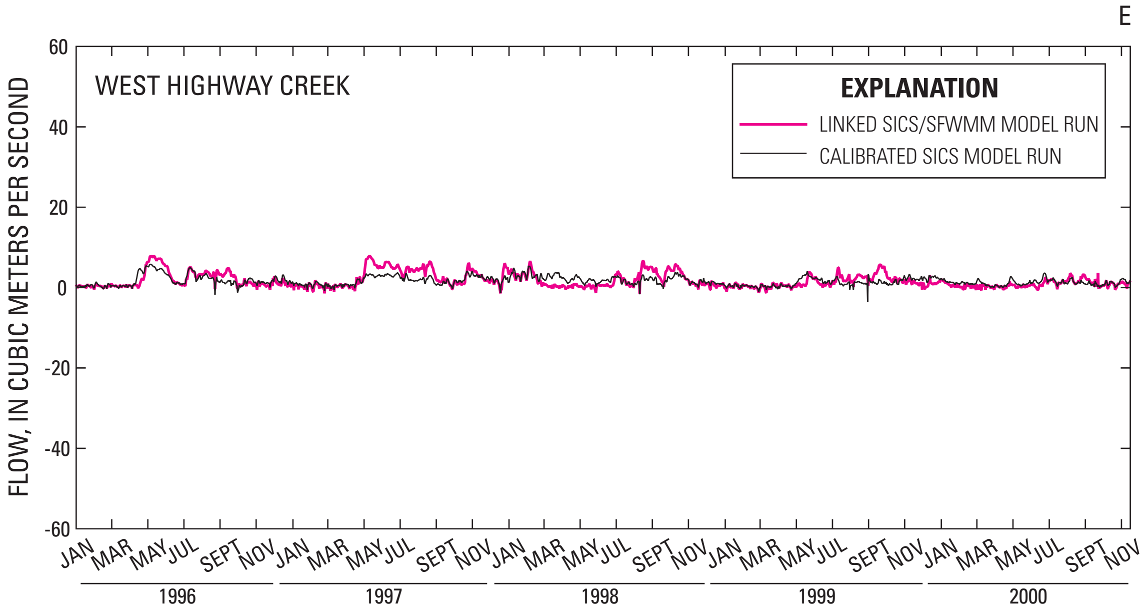


Figure A3. Flow from the calibrated and verification linked model runs at selected coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. Site locations are shown in figure 8.—Continued

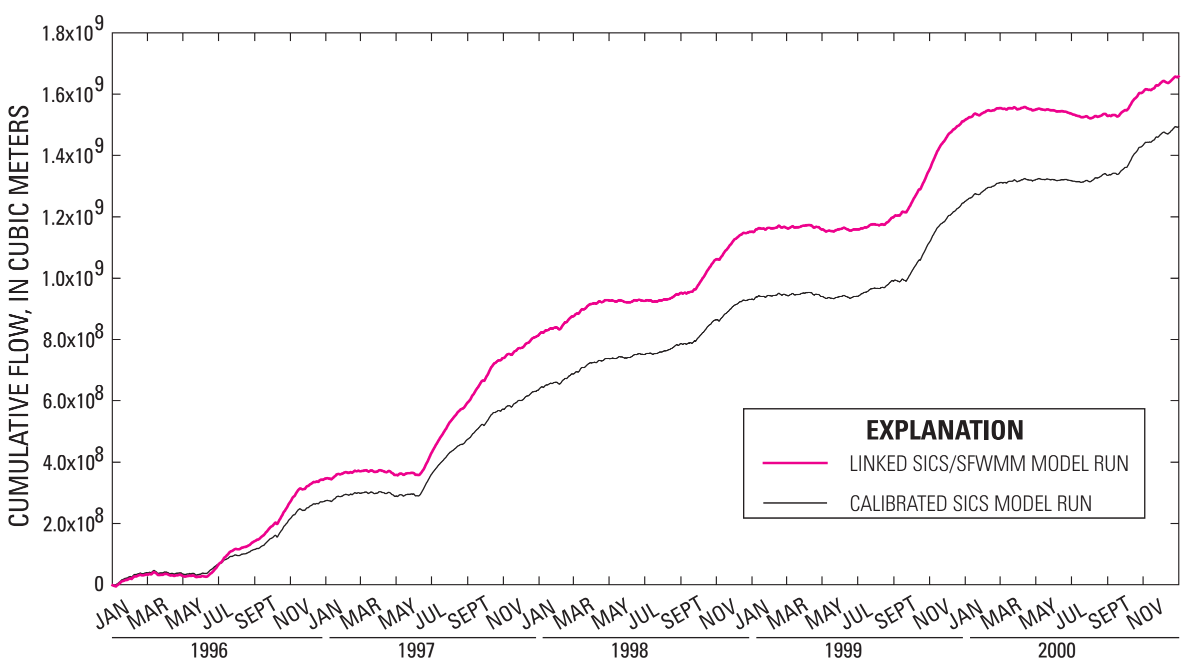


Figure A4. Cumulative flow from the calibrated and verification linked model runs at five coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. The locations of McCormick Creek, Mud Creek, Taylor River, Trout Creek, and West Highway Creek are shown in figure 8.

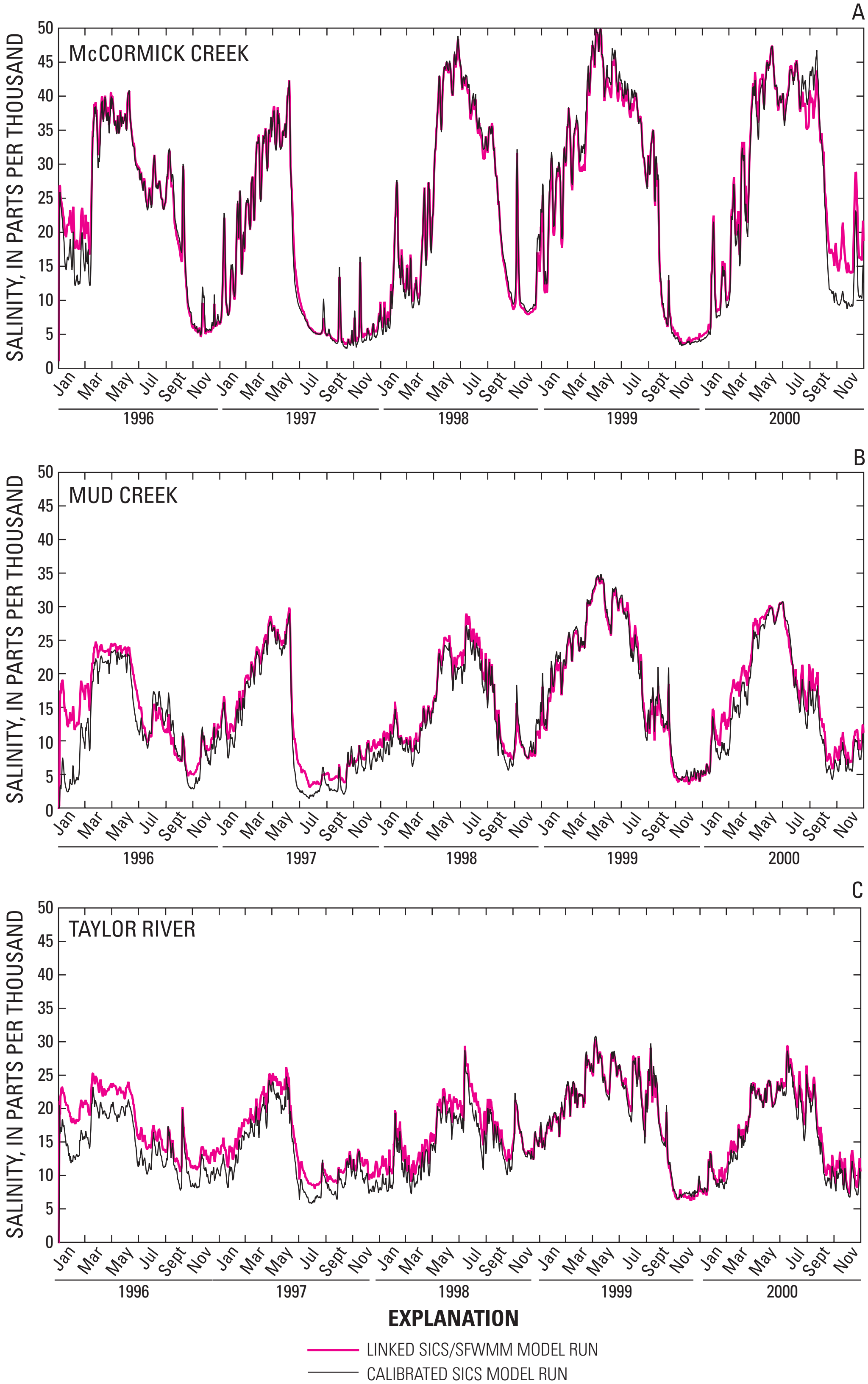


Figure A5. Salinity from the calibrated and verification linked model runs at selected coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. Site locations are shown in figure 9.

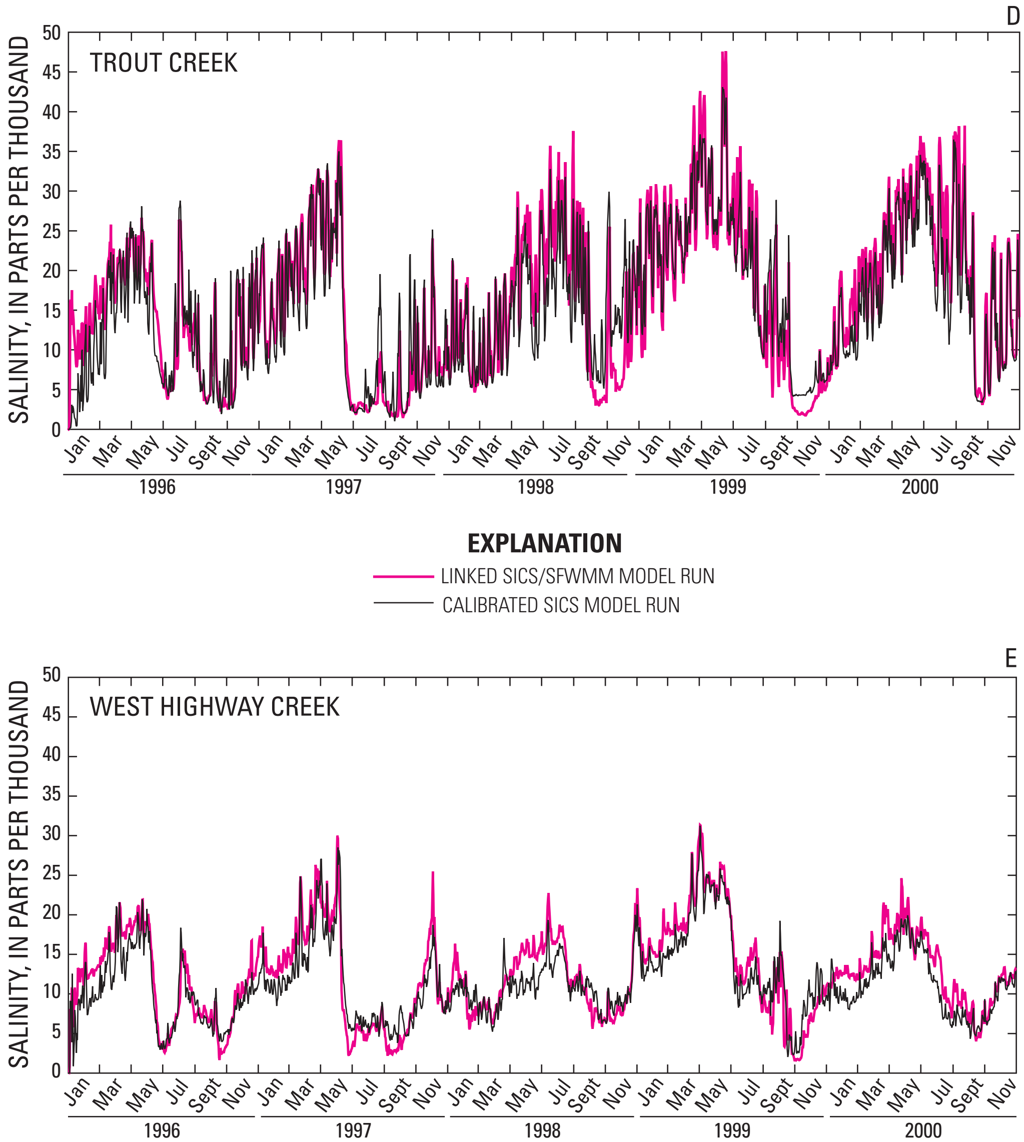


Figure A5. Salinity from the calibrated and verification linked model runs at selected coastal creeks along northeastern Florida Bay, 1996-2000, using FTLOADDS. Site locations are shown in figure 9.—Continued

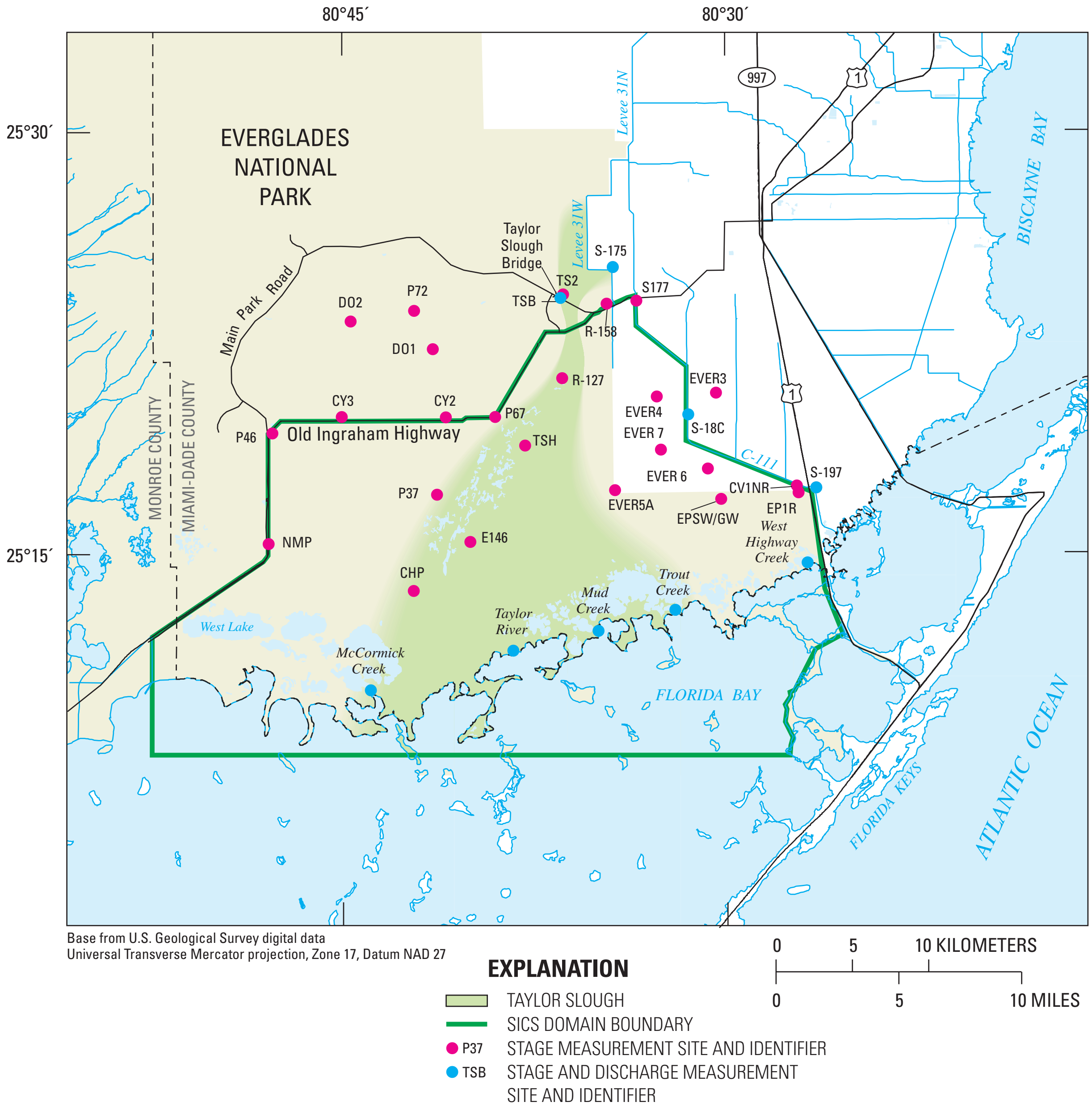


Figure A6. Location of surface-water stations used for determination of water-level and discharge data in the SICS domain (from Wolfert and others, 2004).

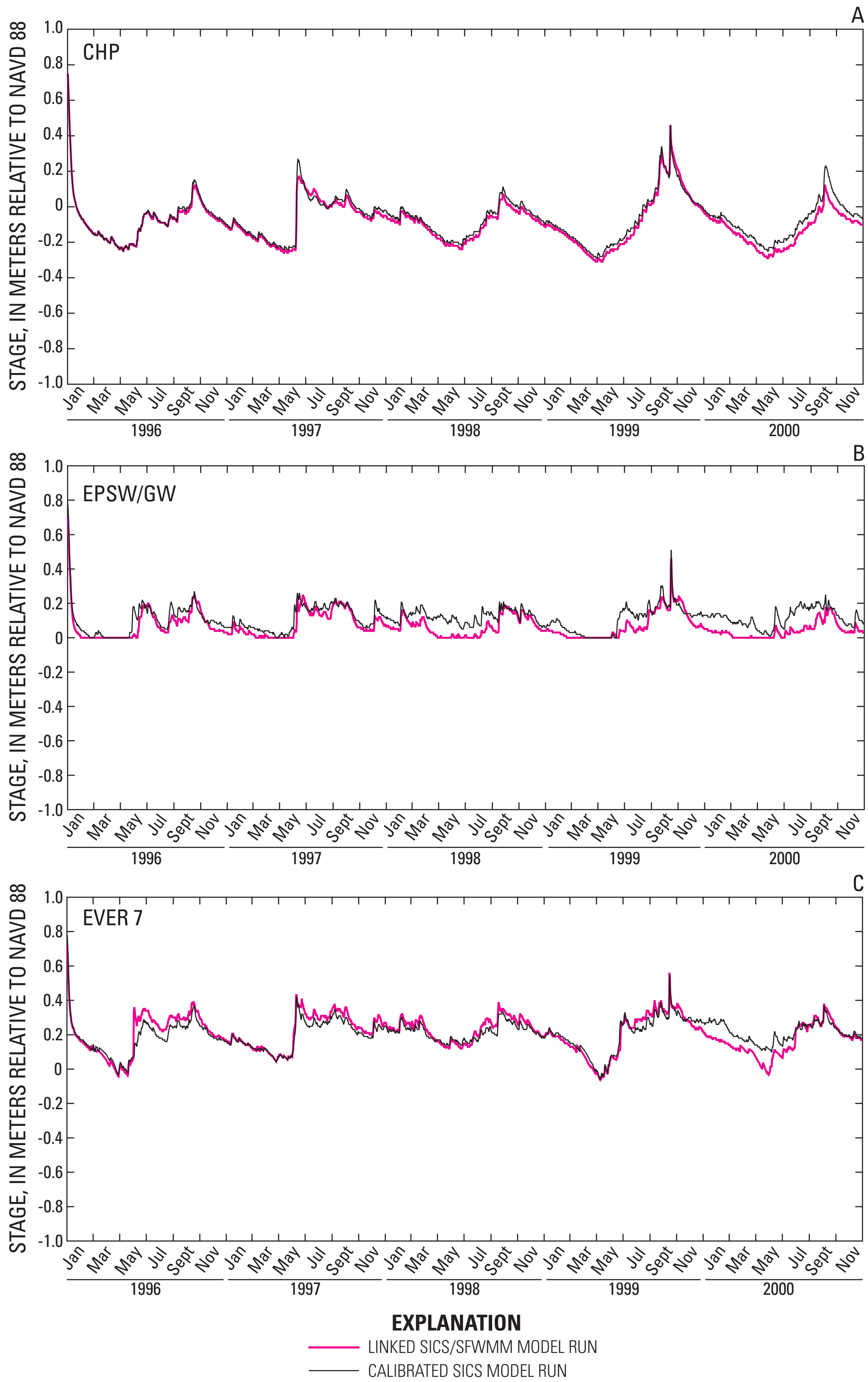


Figure A7. Surface-water stage from the calibrated and verification linked model runs at selected wetland stations in Everglades National Park, 1996-2000, using FTLOADDS. Site locations are shown in figure 8.

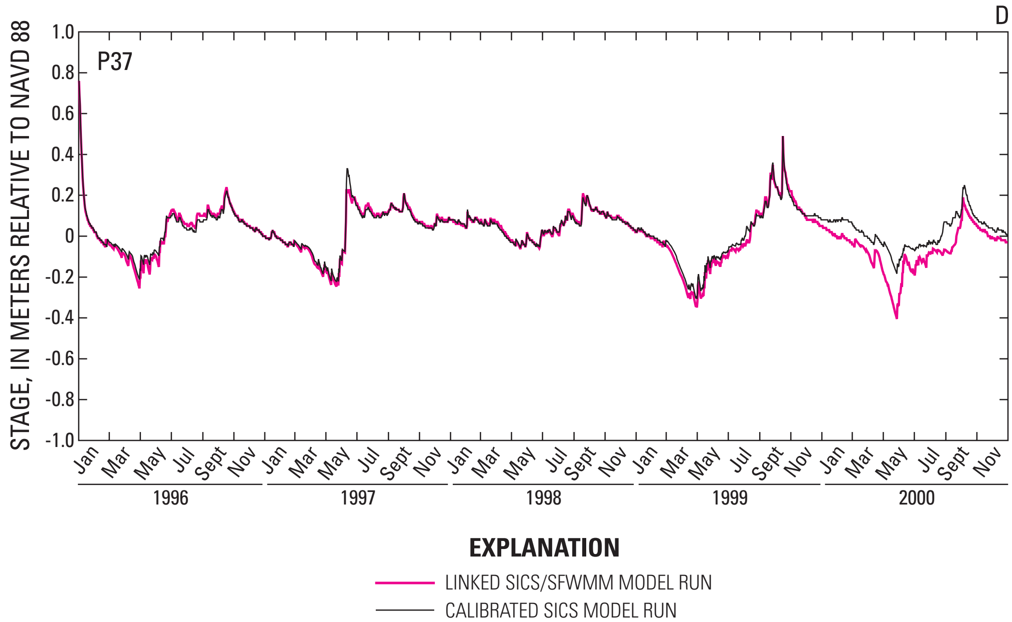


Figure A7. Surface-water stage from the calibrated and verification linked model runs at selected wetland stations in Everglades National Park, 1996-2000, using FTLOADDS. Site locations are shown in figure 8.—Continued

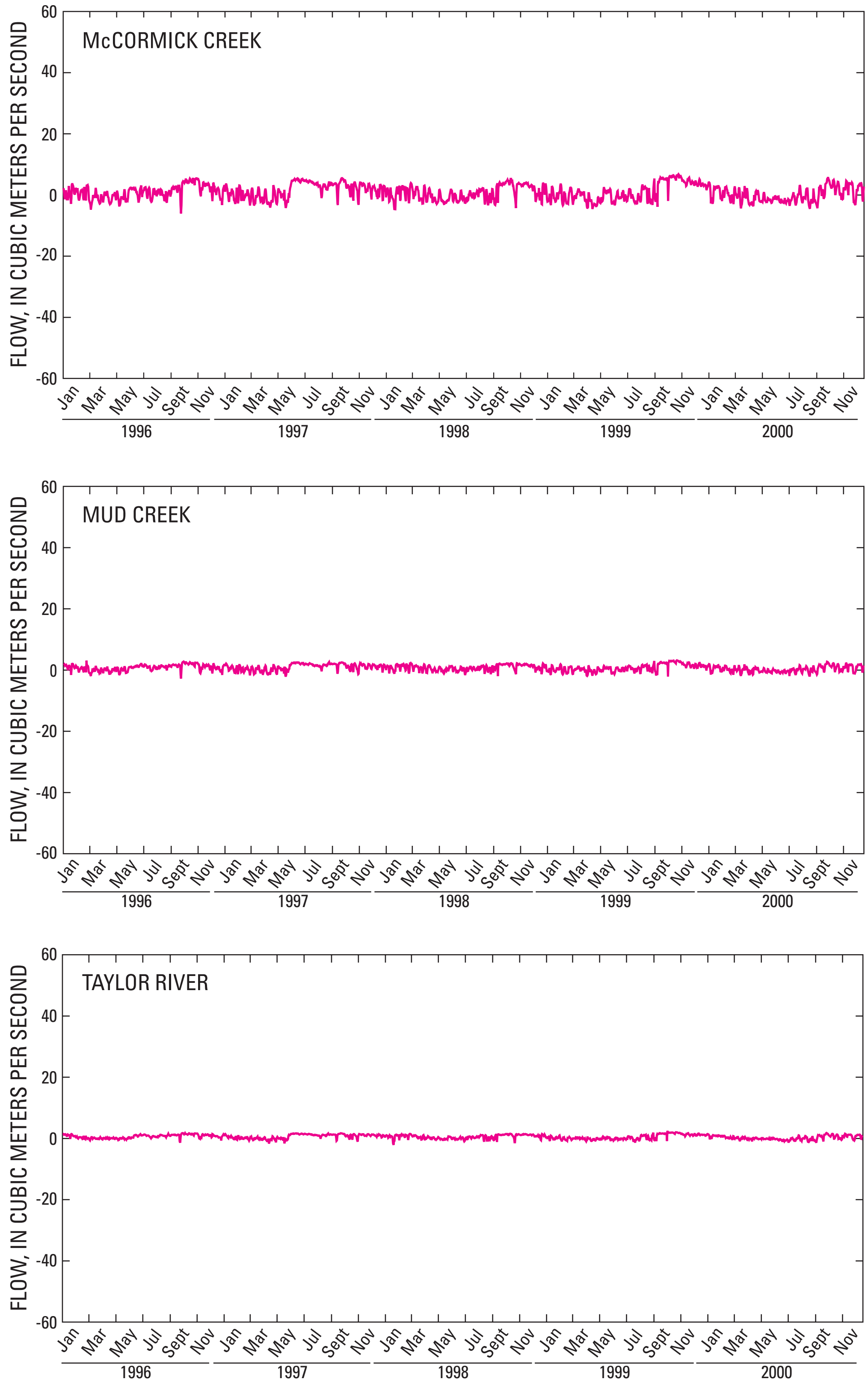
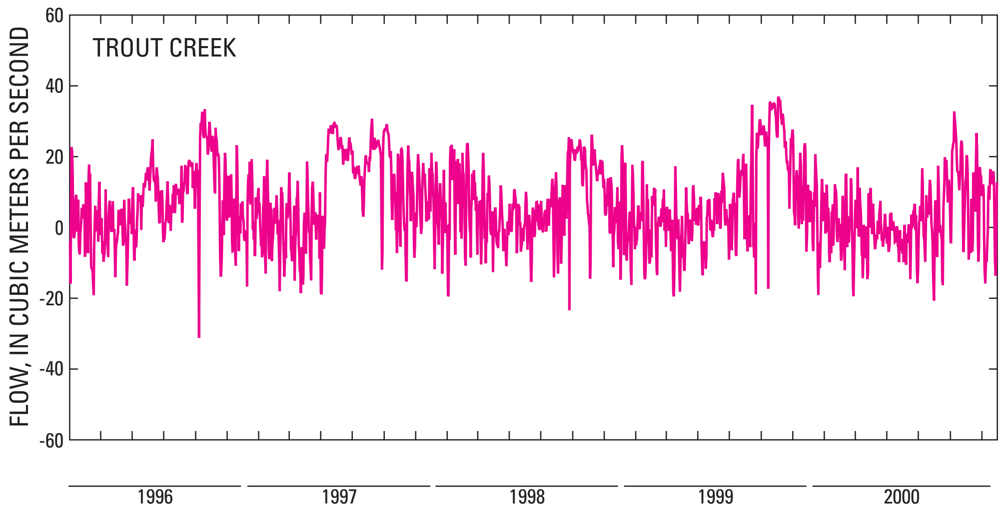


Figure A8. Simulated flow for scenario 1 (2000B2_SICS) at selected coastal creeks along northeastern Florida Bay, 1996-2000.



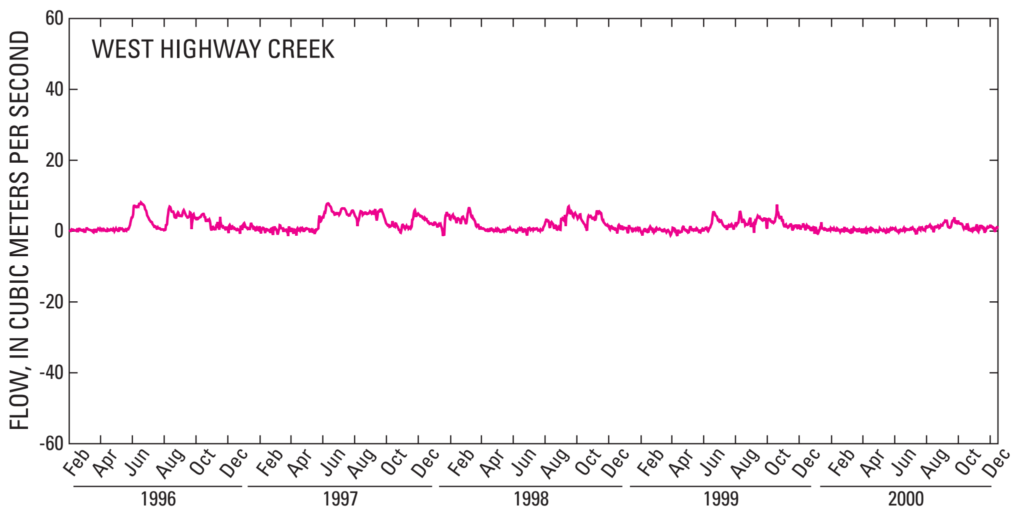


Figure A8. Simulated flow for scenario 1 (2000B2_SICS) at selected coastal creeks along northeastern Florida Bay, 1996-2000.—Continued

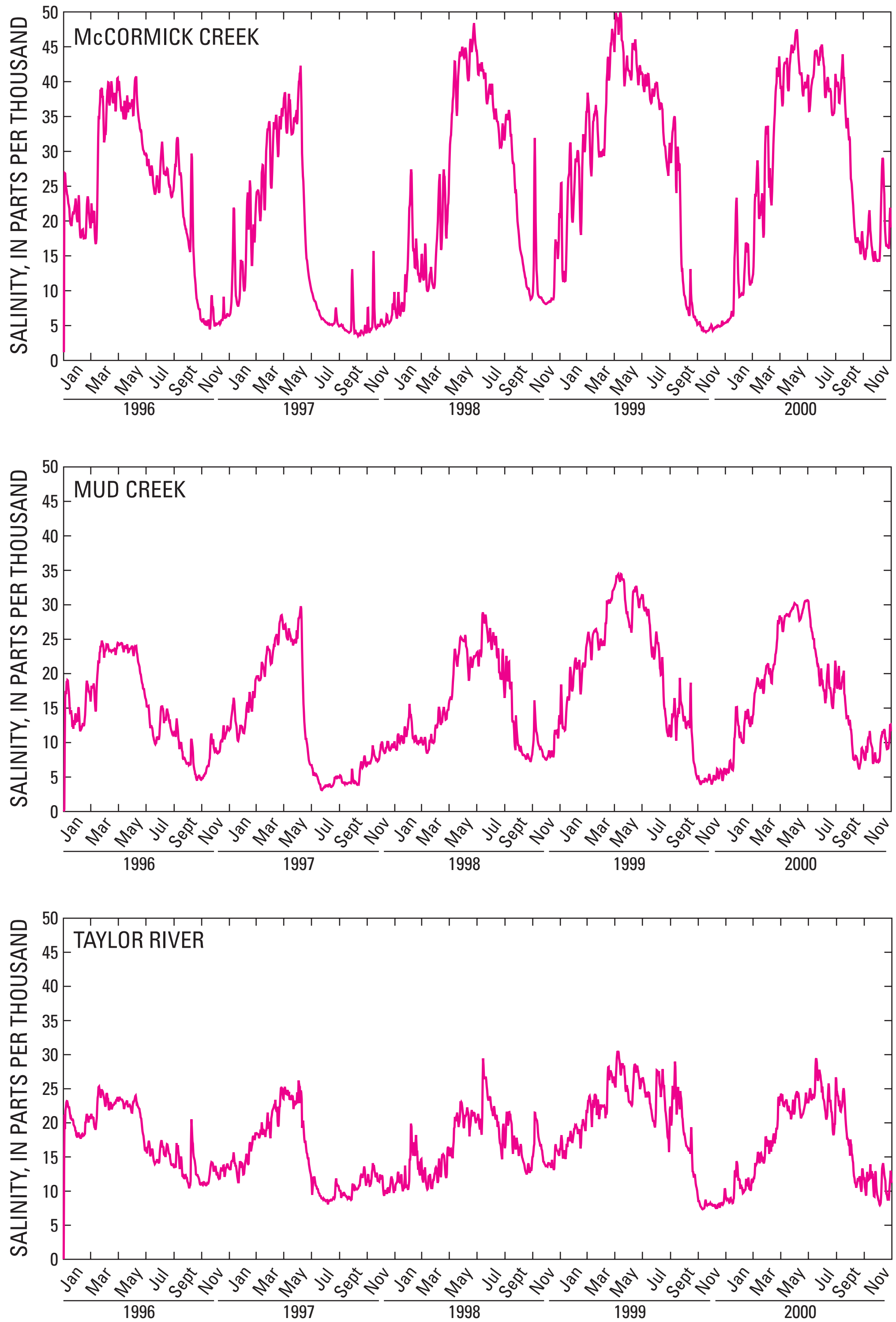


Figure A9. Simulated salinity for scenario 1 (2000B2_SICS) at selected coastal creeks along northeastern Florida Bay, 1996-2000.

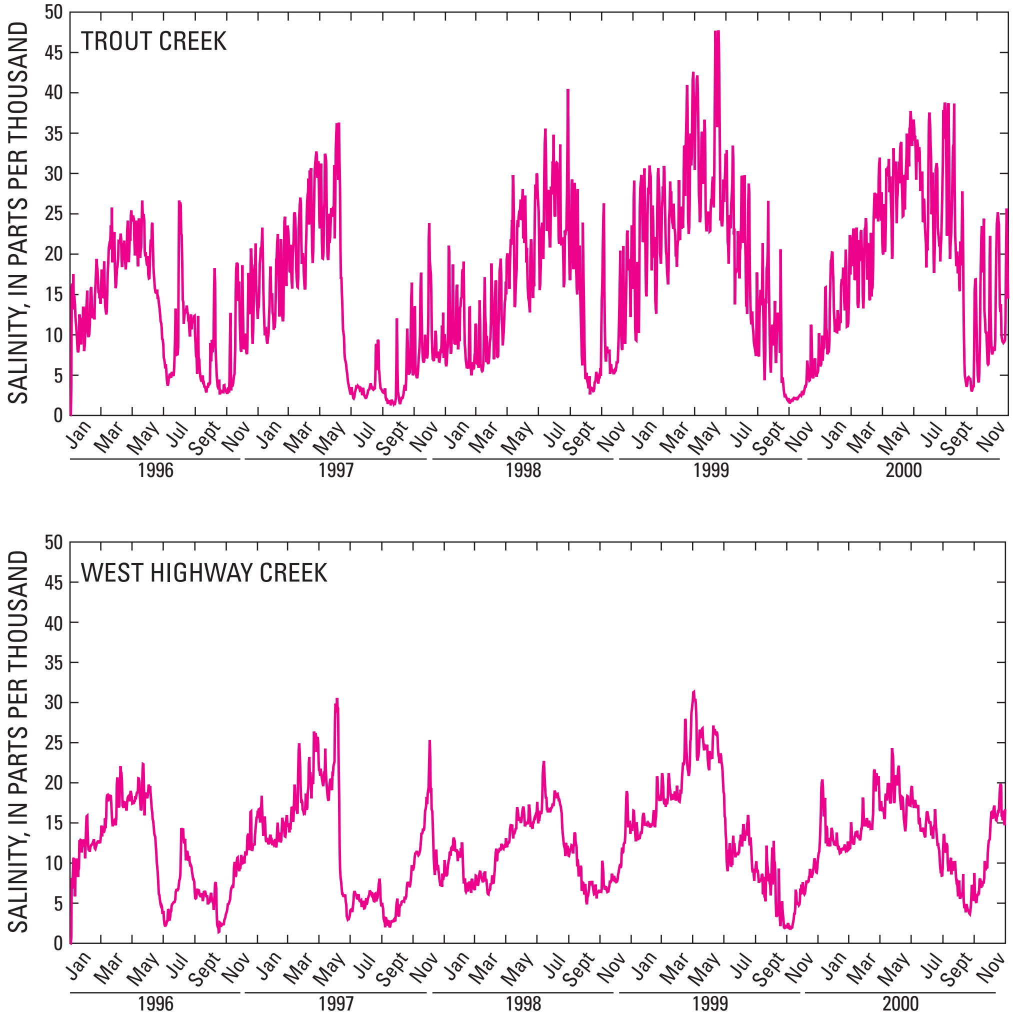


Figure A9. Simulated salinity for scenario 1 (2000B2_SICS) at selected coastal creeks along northeastern Florida Bay, 1996-2000.—Continued

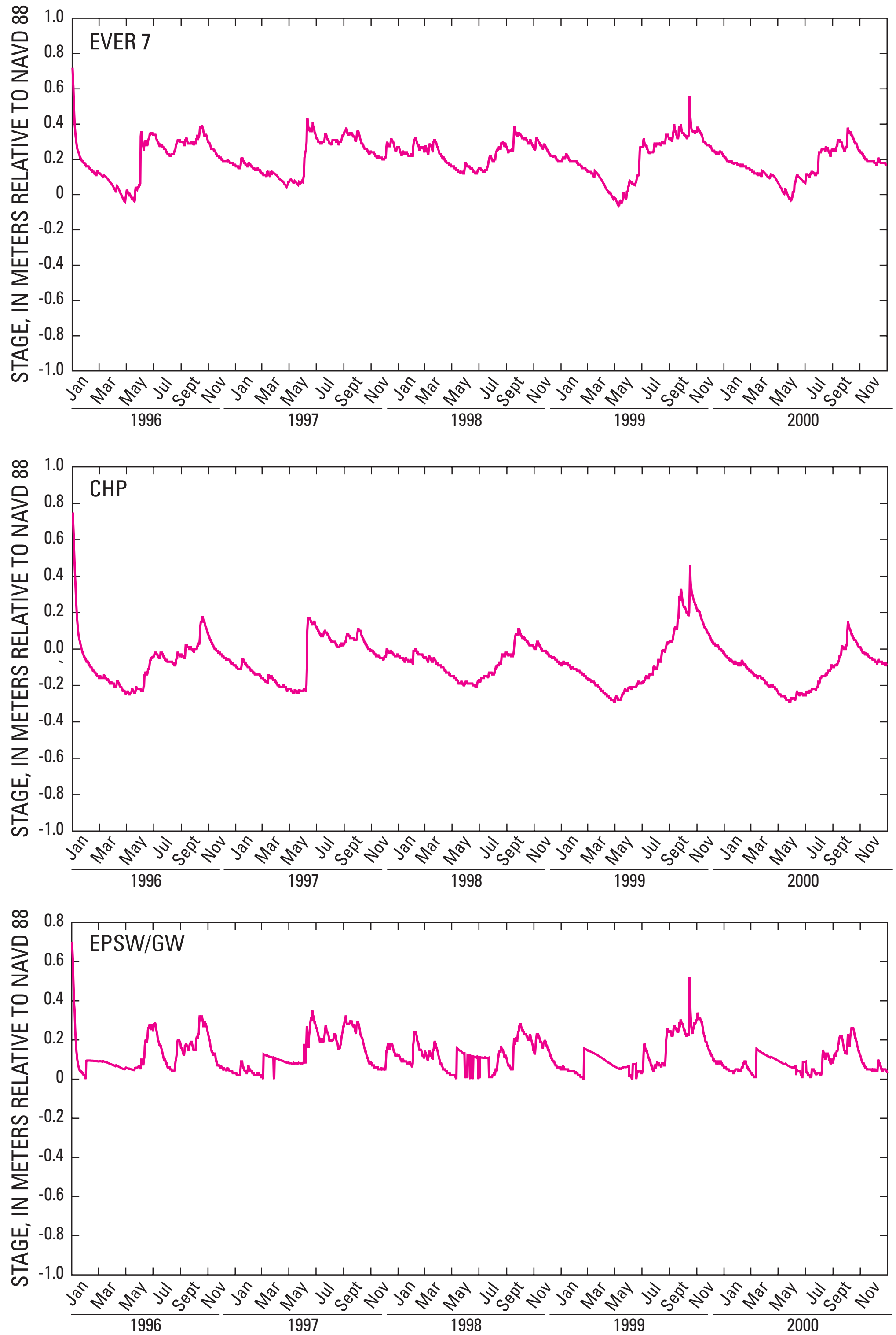
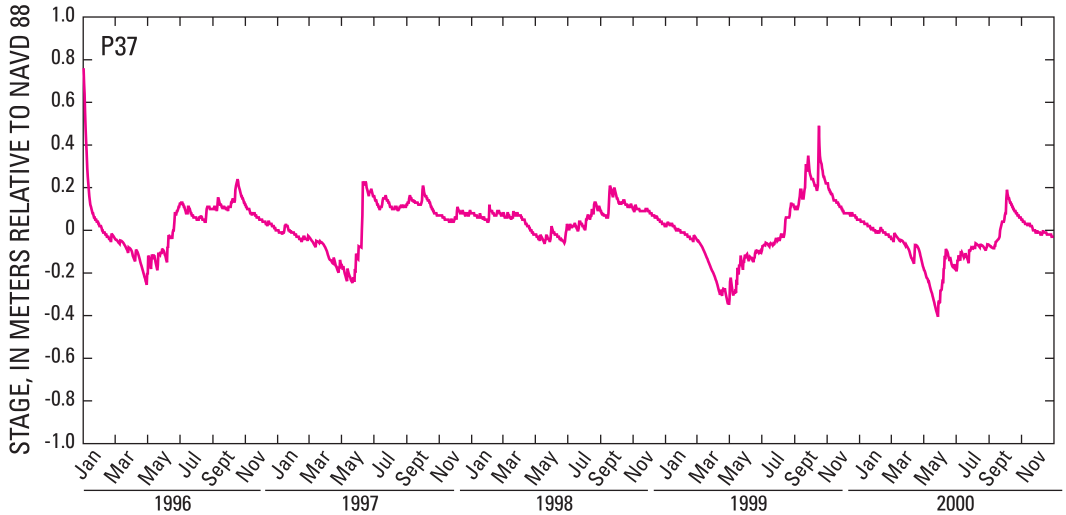


Figure A10. Simulated surface-water stage for scenario 1 (2000B2_SICS) at selected wetland stations in Everglades National Park, 1996-2000.



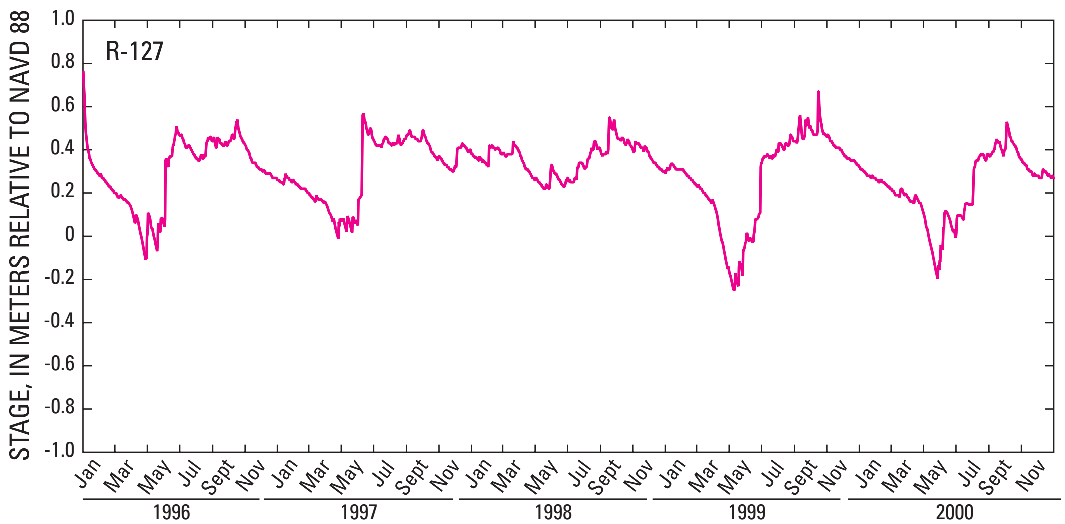


Figure A10. Simulated surface-water stage for scenario 1 (2000B2_SICS) at selected wetland stations in Everglades National Park, 1996-2000.—Continued

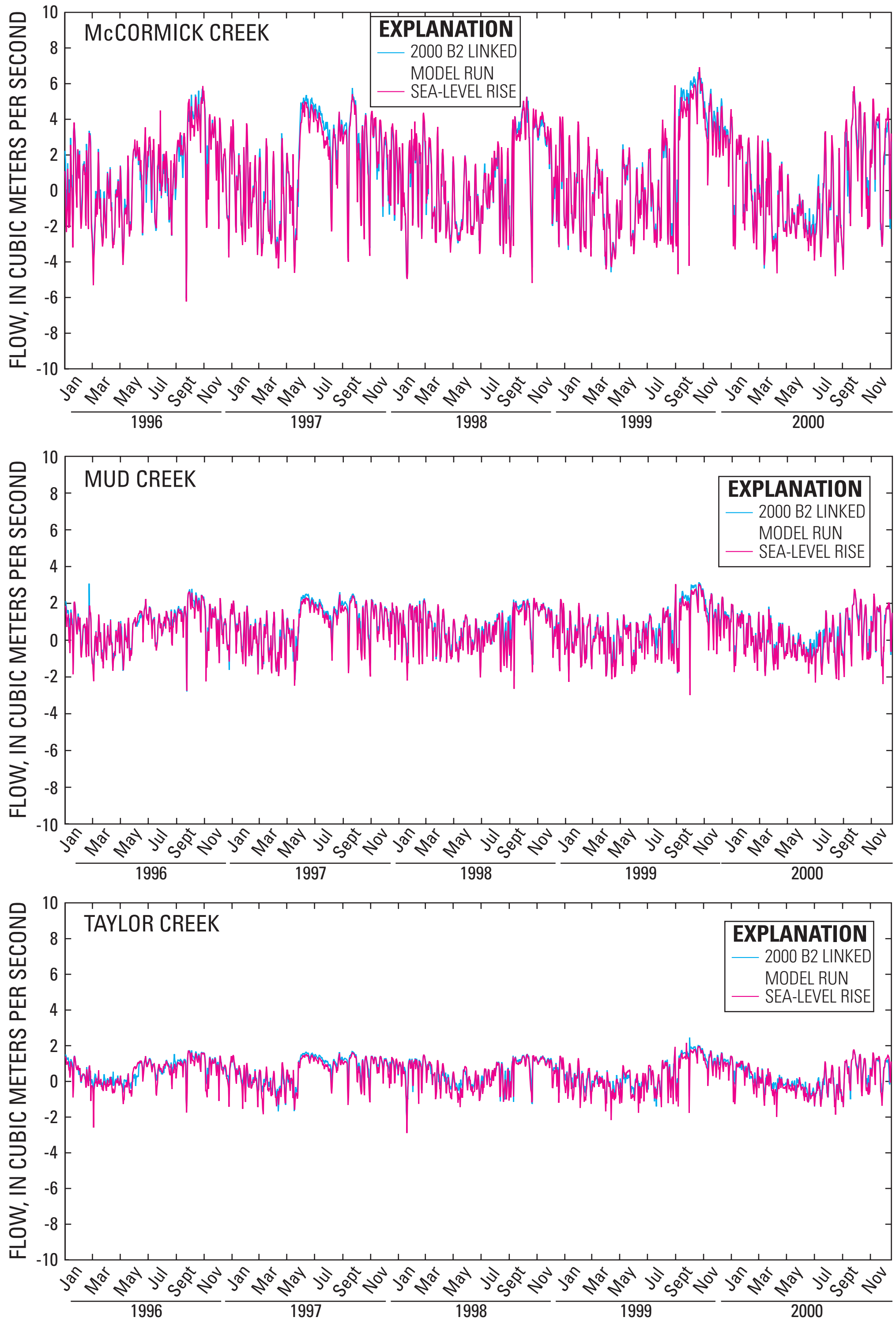


Figure A11. Effects of sea-level rise on flows at selected coastal creeks along northeastern Florida Bay, 1996-2000.

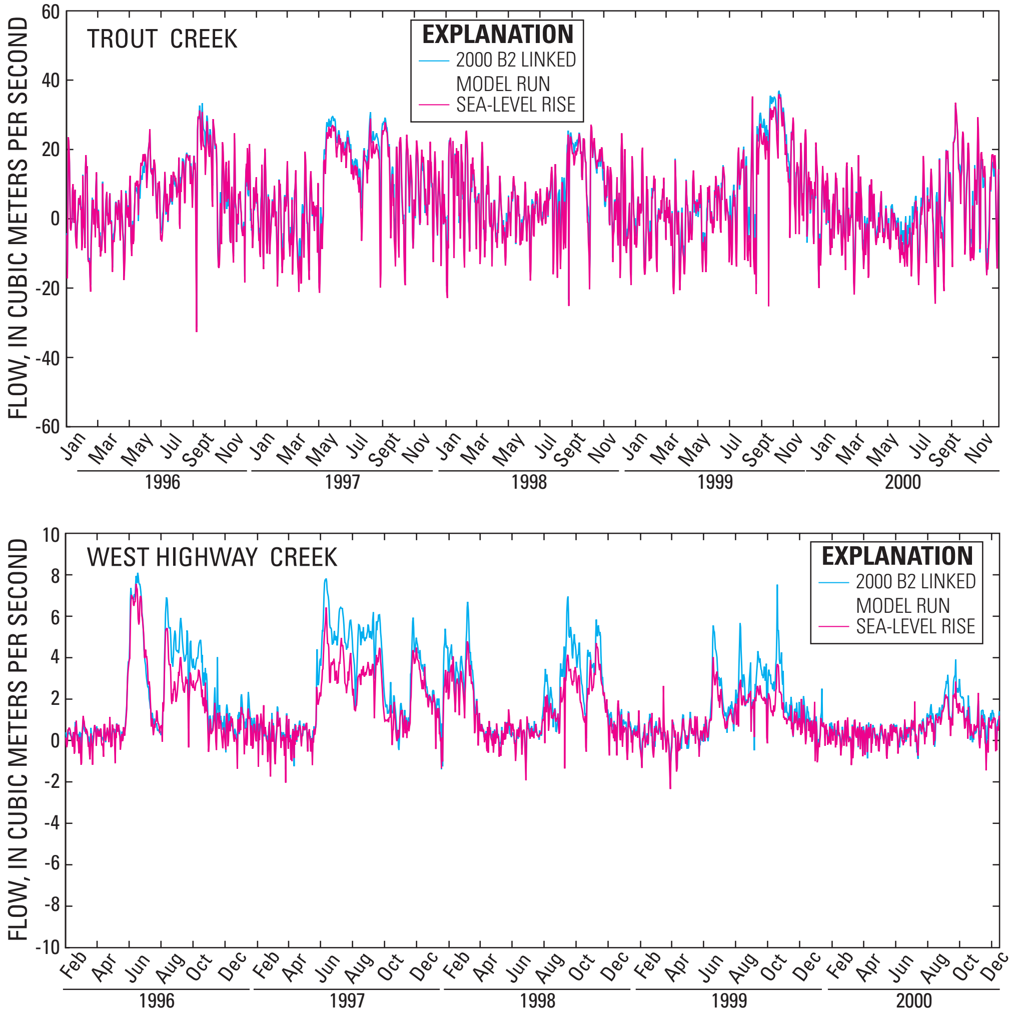


Figure A11. Effects of sea-level rise on flows at selected coastal creeks along northeastern Florida Bay, 1996-2000.—Continued

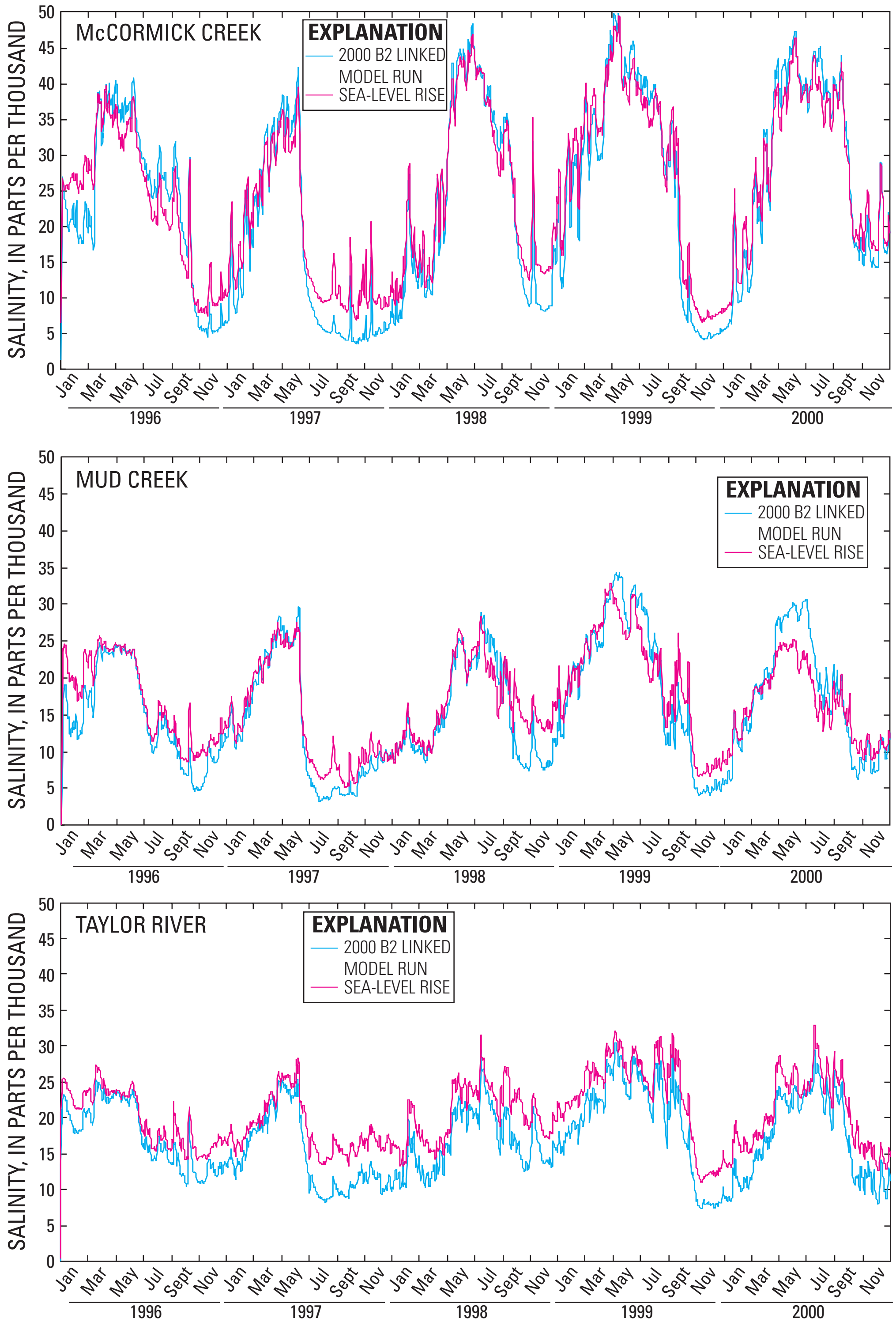
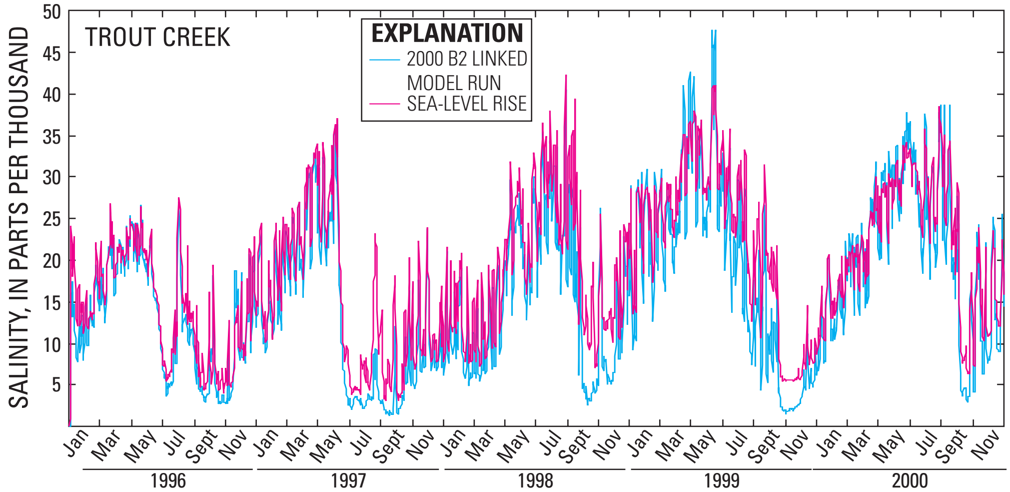


Figure A12. Effects of sea-level rise on salinities at selected coastal creeks along northeastern Florida Bay, 1996-2000.



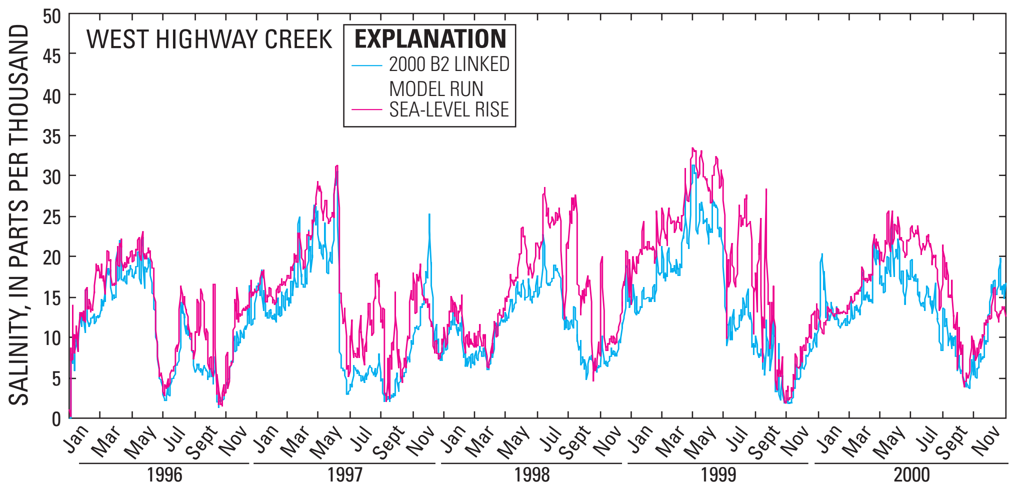


Figure A12. Effects of sea-level rise on salinities at selected coastal creeks along northeastern Florida Bay, 1996-2000.—Continued

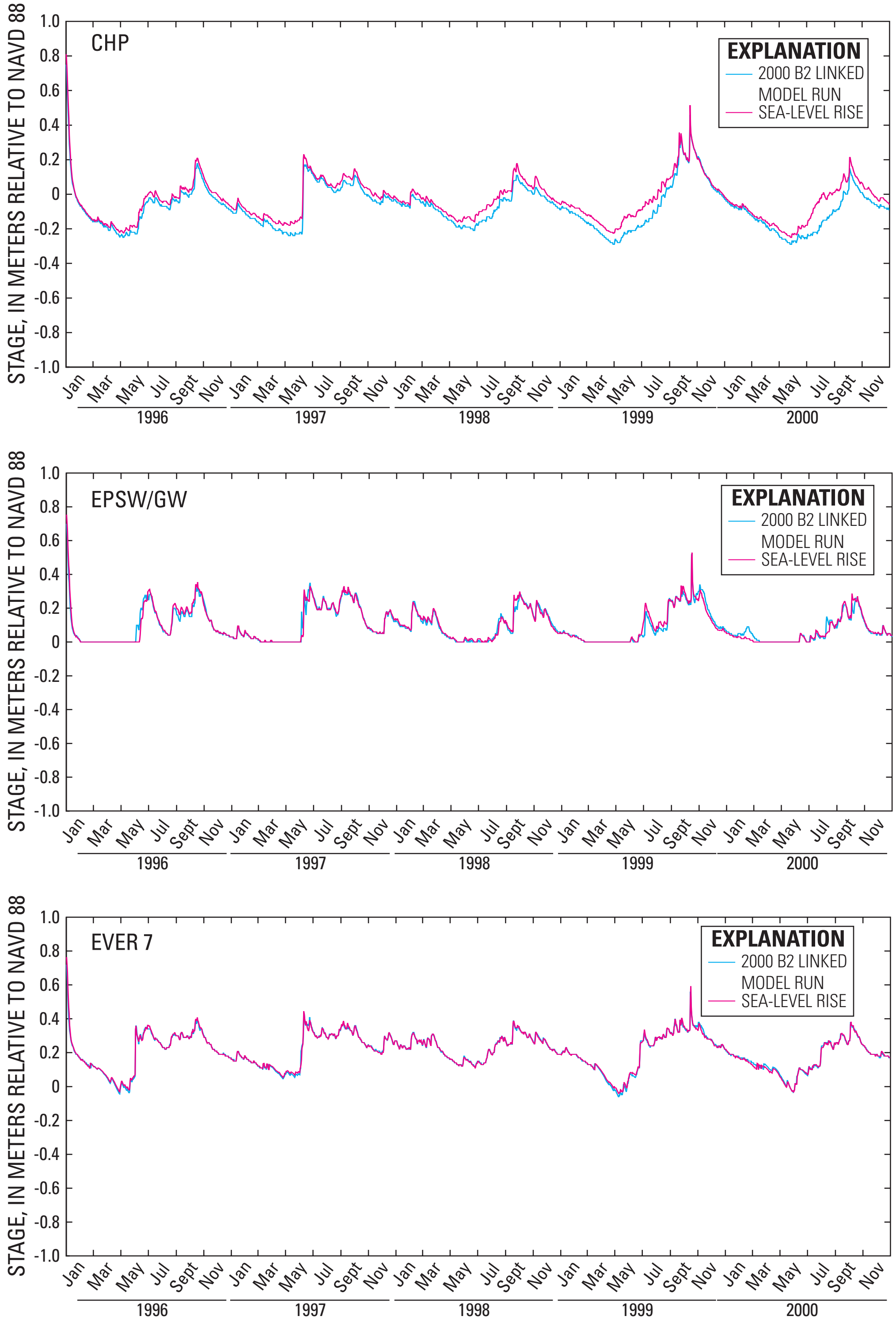


Figure A13. Effects of sea-level rise on stages at selected wetland stations in Everglades National Park, 1996-2000.

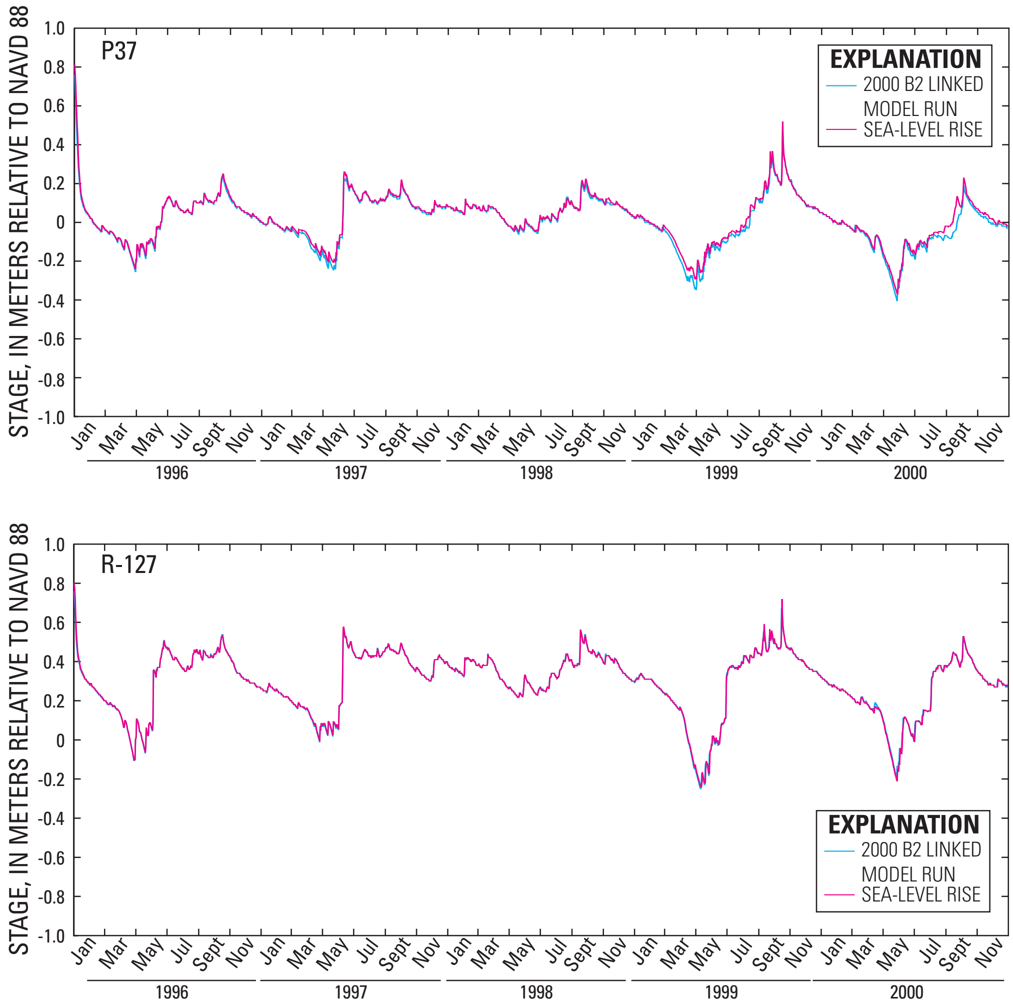


Figure A13. Effects of sea-level rise on stages at selected wetland stations in Everglades National Park, 1996-2000.—Continued

Appendix 2 - Parameters for FTLOADDS Input Files

File	Parameter
TIME.INP	Surface Water: Cell corner topography, boundary conditions, enclosure listings, and values of parameters
VEGMAN061505.DAT	Surface Water: Manning's *n* for wetlands
CVAL050905.f	Surface Water: Resistance for Main Park Road, Buttonwood Embankment, and Florida Bay creeks
RIVERC052005.DAT	Surface Water: Manning's *n* for west coast rivers
OIHWIND.BIN	Surface Water: Binary file of wind stresses
MSR130RAIN.DAT	Surface Water: Zonal rainfall
MODELPET.DAT	Surface Water: ET values
USGSTROUT.DAT	Surface Water: Low-frequency tidal fluctuations
ROADLINE.DAT	Surface Water: Location of Main Park Road
EmbankU.dat	Surface Water: Location of coastal embankment in x direction
EmbankV.dat	Surface Water: Location of coastal embankment in x direction
culvflows.bin	Surface Water: Binary file of inflows from structures
timeflows.bin	Surface Water: Binary file of overland inflows
TIME.BAS	Ground Water : Active cells in each ground-water layer
TIME.BCF	Ground Water: Aquifer conductivities and land-surface altitude
TIME.GHB	Ground Water: General head boundary data
TIME.BTN	Ground Water: salt transport