## Appendix 2B-1: Trends in Tidal Water Levels at Coastal Structures

Nicole A. Cortez and Tibebe Dessalegne

Chapter 2B presented a summary of the statistical trend analysis of tidal elevation data (also called tailwater level or tidal water level) for all 32 South Florida Water Management District-operated coastal structures and of the observed data over the last 20 years (see Table 2B-2 in Chapter 2B). This appendix provides the plotted average annual tailwater stage and trendline at each of these structures. **Figures 1** through **32** provide visual representations of the trends observed in the tidal elevation data of over the entire period of record available at each station. The locations of these structures are provided in Figure 2B-2 in Chapter 2B.

In the figures, the blue line is the average annual tailwater stage and the red line is the linear trend of average annual tailwater stage. The average annual stage is measured in feet (ft) National Geodetic Vertical Datum of 1929 (NGVD) and the change over the period of record is provided in millimeters per year (mm/yr). The period of record varies for each structure and is indicated under the x-axis title in each figure.

To assess trends in tidal elevation data, the Mann-Kendall (MK) test was utilized to determine if there is a statistically significant trend in average annual tidal elevation for each coastal structure, and Kendall Tau's correlation coefficient was employed to determine the direction of the trend. For the analysis, average annual tidal elevation data were averaged by calendar year. The data were treated as independent, and the analysis did not require that the data be normally distributed or linear. Any missing values were disregarded during the analysis. R2 is the coefficient of determination and p-value the probability value for the MK test. The MK test was performed using a 95% confidence band around the trend slope for the available tidal elevation data. A trend is considered statistically significant if the probability value is lower than the significance level of 0.05, which allows for rejection of the null hypothesis, that there is no significant trend in the data, and confirms that there is indeed evidence of a trend. Conversely, a probability value above 0.005, indicates that there is no significant trend detected in the data within the 95% confidence level.



Average Annual Tailwater Stage at COCO1 - [4.31 mm/year]

**Figure 1.** Plotted average annual tailwater stage and trendline at the COCO1 structure along South Florida's east coast.



Average Annual Tailwater Stage at FU1 - [5.24 mm/year]

Figure 2. Plotted average annual tailwater stage and trendline at the FU1 structure along South Florida's east coast.

![](_page_3_Figure_2.jpeg)

Average Annual Tailwater Stage at G54 - [3.48 mm/year]

Figure 3. Plotted average annual tailwater stage and trendline at the G-54 structure along South Florida's east coast.

![](_page_4_Figure_2.jpeg)

Average Annual Tailwater Stage at G56 - [2.35 mm/year]

**Figure 4.** Plotted average annual tailwater stage and trendline at the G-56 structure along South Florida's east coast.

![](_page_5_Figure_2.jpeg)

Average Annual Tailwater Stage at G57 - [5.69 mm/year]

**Figure 5.** Plotted average annual tailwater stage and trendline at the G-57 structure along South Florida's east coast.

![](_page_6_Figure_2.jpeg)

Average Annual Tailwater Stage at G93 - [5.09 mm/year]

Figure 6. Plotted average annual tailwater stage and trendline at the G-93 structure along South Florida's east coast.

![](_page_7_Figure_2.jpeg)

Average Annual Tailwater Stage at GG1 - [5.99 mm/year]

Figure 7. Plotted average annual tailwater stage and trendline at the GG1 structure along South Florida's east coast.

![](_page_8_Figure_2.jpeg)

Average Annual Tailwater Stage at HC1 - [7.84 mm/year]

Figure 8. Plotted average annual tailwater stage and trendline at the HC1 structure along South Florida's east coast.

![](_page_9_Figure_2.jpeg)

Average Annual Tailwater Stage at \$123 - [5.19 mm/year]

Figure 9. Plotted average annual tailwater stage and trendline at the S-123 structure along South Florida's east coast.

![](_page_10_Figure_2.jpeg)

Average Annual Tailwater Stage at S13 - [5.96 mm/year]

Figure 10. Plotted average annual tailwater stage and trendline at the S-13 structure along South Florida's east coast.

![](_page_11_Figure_2.jpeg)

Average Annual Tailwater Stage at \$155 - [4.79 mm/year]

Figure 11. Plotted average annual tailwater stage and trendline at the S-155 structure along South Florida's east coast.

![](_page_12_Figure_2.jpeg)

Average Annual Tailwater Stage at S18C - [5.41 mm/year]

Figure 12. Plotted average annual tailwater stage and trendline at the S-18C structure along South Florida's east coast.

![](_page_13_Figure_2.jpeg)

Average Annual Tailwater Stage at \$197 - [3.81 mm/year]

Figure 13. Plotted average annual tailwater stage and trendline at the S-197 structure along South Florida's east coast.

![](_page_14_Figure_2.jpeg)

Average Annual Tailwater Stage at S20 - [2.04 mm/year]

Figure 14. Plotted average annual tailwater stage and trendline at the S-20 structure along South Florida's east coast.

![](_page_15_Figure_2.jpeg)

Average Annual Tailwater Stage at S20F - [4.53 mm/year]

Figure 15. Plotted average annual tailwater stage and trendline at the S-20F structure along South Florida's east coast.

![](_page_16_Figure_2.jpeg)

Average Annual Tailwater Stage at S20G - [4.36 mm/year]

Figure 16. Plotted average annual tailwater stage and trendline at the S-20G structure along South Florida's east coast.

![](_page_17_Figure_2.jpeg)

Average Annual Tailwater Stage at S21 - [3.97 mm/year]

Figure 17. Plotted average annual tailwater stage and trendline at the S-21 structure along South Florida's east coast.

![](_page_18_Figure_2.jpeg)

Average Annual Tailwater Stage at S21A - [4.19 mm/year]

Figure 18. Plotted average annual tailwater stage and trendline at the S-21A structure along South Florida's east coast.

![](_page_19_Figure_2.jpeg)

Average Annual Tailwater Stage at S22 - [5.3 mm/year]

Figure 19. Plotted average annual tailwater stage and trendline at the S-22 structure along South Florida's east coast.

![](_page_20_Figure_2.jpeg)

Average Annual Tailwater Stage at S25 - [3.52 mm/year]

Figure 20. Plotted average annual tailwater stage and trendline at the S-25 structure along South Florida's east coast.

![](_page_21_Figure_2.jpeg)

Average Annual Tailwater Stage at S25B - [5.36 mm/year]

Figure 21. Plotted average annual tailwater stage and trendline at the S-25B structure along South Florida's east coast.

![](_page_22_Figure_2.jpeg)

Average Annual Tailwater Stage at S26 - [5.06 mm/year]

Figure 22. Plotted average annual tailwater stage and trendline at the S-26 structure along South Florida's east coast.

![](_page_23_Figure_2.jpeg)

Average Annual Tailwater Stage at S27 - [3.4 mm/year]

Figure 23. Plotted average annual tailwater stage and trendline at the S-27 structure along South Florida's east coast.

![](_page_24_Figure_2.jpeg)

Average Annual Tailwater Stage at S28 - [4.43 mm/year]

Figure 24. Plotted average annual tailwater stage and trendline at the S-28 structure along South Florida's east coast.

![](_page_25_Figure_2.jpeg)

Average Annual Tailwater Stage at S29 - [3.7 mm/year]

Figure 25. Plotted average annual tailwater stage and trendline at the S-29 structure along South Florida's east coast.

![](_page_26_Figure_2.jpeg)

Average Annual Tailwater Stage at S33 - [4.11 mm/year]

Figure 26. Plotted average annual tailwater stage and trendline at the S-33 structure along South Florida's east coast.

![](_page_27_Figure_2.jpeg)

Average Annual Tailwater Stage at S36 - [4.57 mm/year]

![](_page_27_Figure_4.jpeg)

![](_page_28_Figure_2.jpeg)

Average Annual Tailwater Stage at S37A - [2.46 mm/year]

Figure 28. Plotted average annual tailwater stage and trendline at the S-37A structure along South Florida's east coast.

![](_page_29_Figure_2.jpeg)

Average Annual Tailwater Stage at S41 - [6.52 mm/year]

Figure 29. Plotted average annual tailwater stage and trendline at the S-41 structure along South Florida's east coast.

![](_page_30_Figure_2.jpeg)

Average Annual Tailwater Stage at S44 - [4.02 mm/year]

Figure 30. Plotted average annual tailwater stage and trendline at the S-44 structure along South Florida's east coast.

![](_page_31_Figure_2.jpeg)

Average Annual Tailwater Stage at S46 - [5.09 mm/year]

Figure 31. Plotted average annual tailwater stage and trendline at the S-46 structure along South Florida's east coast.

![](_page_32_Figure_2.jpeg)

Average Annual Tailwater Stage at S49 - [4.67 mm/year]

Figure 32. Plotted average annual tailwater stage and trendline at the S-49 structure along South Florida's east coast.