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SEASONAL VARIABILITY OF NEAR SURFACE SOIL WATER AND GROUNDWATER TABLES IN FLORIDA

PROBLEM STATEMENT

The water table and its range of fluctuation are required design factors for most projects that involve altering the landscape. In order to estimate the effect of a proposed alteration on surface water quality and quantity, it is necessary to determine the current or predevelopment water table conditions. Most regulations stipulate that no significant change can be imposed upon these conditions. Typically, the maximum or high water level is a required design criterion. Several terms have been adopted regarding the maximum high water level, one of the most common of which is the seasonal high groundwater table (SHGWT).

The Seasonal High Groundwater Table (SHGWT) is a critical measure for design projects requiring surface water permits including roadway design and detention or retention pond design. In addition to constructability issues, the long-term maintenance of retention ponds is impacted by these cited levels. In regions characterized by poorly drained soils and high seasonal water tables, the functional designs are highly sensitive to the SHGWT. In Florida, the Department of Environmental Protection and five Water Management Districts are responsible for issuing surface water permits. Currently, there are differences among the definitions and methods documented by the Water Management Districts for estimating the seasonal high groundwater table. These differences can potentially result in significantly different design standards at nearly coincident locations.

OBJECTIVES

The principal objective of this project was to review standard procedures and methods for estimating SHGWT levels. The major tasks to be performed included a literature review, SHGWT field monitoring, and analysis of water table levels and known boundary conditions, where the term “known boundary” refers to cases in which there is one known boundary condition that predominantly affects the water table. Two known boundary conditions were considered in this study: elevations affected by tidal boundaries and elevations affected by water levels in adjoining canals.

FINDINGS AND CONCLUSIONS

A literature review was performed to consider existing methods and procedures for estimating seasonal high groundwater table elevations. A summary of the literature review with recommendations is provided below:

- Based upon the numerous factors that affect the water table, it is evident that one indicator will not provide a reliable estimate for seasonal high water table levels under all conditions.

- A set of guidelines for estimating seasonal high water table elevations that take into account site-specific conditions should be established.

- Considerable differences exist among the definitions and methods presented by each regulating agency for determining SHGWT.

- Dialogue towards developing a statewide standard operating procedure for estimating SHGWT elevations needs to be encouraged.

Analytical solutions exist which relate tidal levels to water table elevations. For sites where water fluctuations are predominantly tidal (minimal wave activity), these analytical solutions can be used to estimate the inland extent of tidal variations based upon historic tidal information such as mean sea level, mean high water, mean higher high water.

For sites where there is significant wave activity and sloping beach faces, estimating the induced variation in the water table is a far more complex problem due to water table over-height or super-elevation conditions. In order to accurately estimate the magnitude of overheight, multiple contributing factors must be considered: the shape of the beach face contributing to overheight, wave generated overheight, and wind setup overheight. Each of these factors is variable and site-specific. As such, site specific observations are necessary in order to consider water table over-height conditions.

For sites with conditions similar to the Stuart, FL site (minimal wave activity), historic tidal information along with the methods discussed in this report can be applied to estimate the inland extent of tidal variations in the water table at a site of interest. However, for sites similar to the Cape Canaveral, Air Force Station site (considerable wave activity with a sloping beach face), the presence of water table over-height conditions make estimating water table elevations more difficult. Site specific observations would be required in order to evaluate water table over-height conditions.

BENEFITS

The results of this research can be used in the development of standard operating procedures for estimating the seasonal high groundwater table based upon site-specific characteristics and controlling boundary conditions while incorporating a measure of water table variability. By incorporating variability, the uncertainty associated with SHGWT estimates can be quantified and used to develop more confident design.

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