Estimating the Seasonal High Water Table: A Mix of Art & Science

FES STORMWATER DESIGNER'S COURSE

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This paper was originally written over 4 years ago & generated a lot of interest. The approach described in this paper is now being used by SWFWMD in their training workshops and is now recognized as acceptable by the NRCS.

What is the SHWT?

SHWT = Seasonal High Water Table

- A seasonal high water table (SHWT) is the shallowest depth to free water that stands in an unlined borehole or where the soil moisture tension is zero for a significant period (more than a few weeks) (Watts and Hurt, 1991).
- According to Rule 40C-42, Florida Administrative Code, the seasonal high groundwater table (SHWT) elevation means the highest level of the saturated zone in the soil in a year with *normal* rainfall.
- Groundwater professionals are routinely called upon by site grading and drainage engineers and other professionals to predict these groundwater elevations, typically to within an accuracy of ±6 inches

What is the Starting Point?

- Although the published sources of information (such as the NRCS publications) generally provide reliable preliminary guidance on the depth to the water table at a site, there is no substitute for a site-specific investigation for design level studies.
- The starting point is the measurement of the stabilized groundwater level in a newly opened borehole, or piezometer at a selected location and time. A stabilized reading, in this sense, means that the water level in the newly created borehole or well has equalized with the water table level in the aquifer. A minimum of 24 hours is usually allowed before taking a reading, although sandy soils require less time than silty or clayey soils to achieve equilibrium levels.
- The date of the water table measurement is very important and must be recorded since the groundwater table fluctuates throughout the year in response to seasonal rainfall. In addition, the soil profile in the test hole or boring should be described, noting soil texture (i.e., sand, silty sand, "hardpan", clayey sand, etc.), color (including mottling and staining, more formally known as redoximorphic features), and, if available, Standard Penetration Test boring "N" values variations which may manifest memory of the seasonal fluctuation.

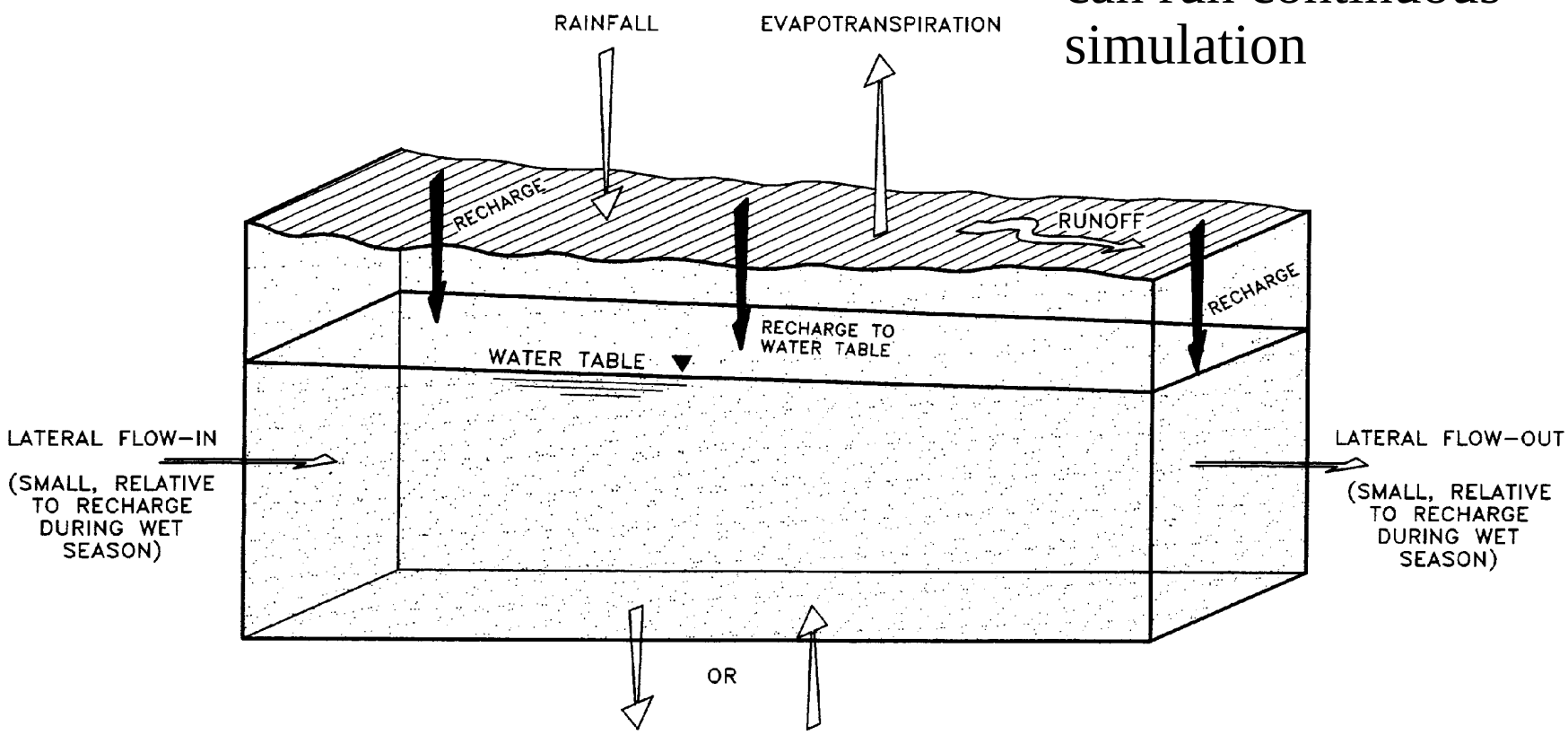
How do we adjust from the starting point?

- Antecedent rainfall (short-term as well as long-term)
- Soil map unit descriptions published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)
- Examination of the soil profile, including color variations (redoximorphic features), SPT "N" values, depth to "hardpan" or other impermeable horizons (such as clayey fine sands and clays), etc.
- Consistency of water levels with adjacent surface water bodies and knowledge of typical hydraulic gradients (water table slopes).
- Vegetative indicators
- Effects of existing and future development
- Hydrogeologic setting including potentiometric surface of Floridan aquifer and degree of connection between the water table aquifer and the Floridan aquifer.
- Mathematical Correlation With Soil Morphological Features

ANTECEDENT RAINFALL

FIG1OF6

can run continuous simulation



VERTICAL LEAKAGE TO LOWER AQUIFERS
(RECHARGE / DISCHARGE)
NOT TO SCALE

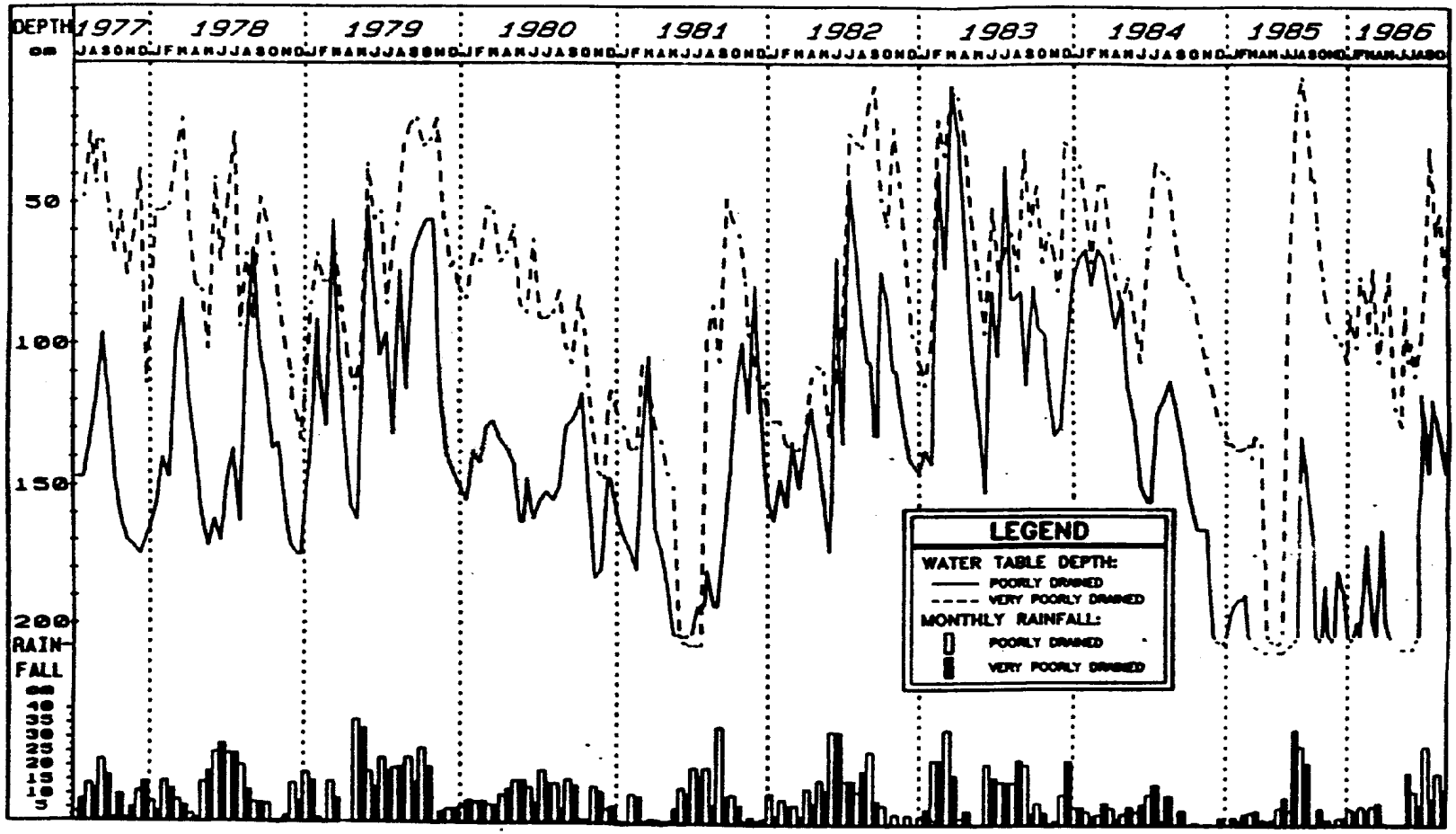
FIGURE 1

Hydrology of the Uppermost Aquifer

A Key Point To Note

It is first important to appreciate that, under natural conditions, the rate of lateral groundwater movement in the uppermost water table aquifer in Central Florida is no more than 300 to 400 feet per year and usually much less. Therefore, a water particle entering the water table aquifer at one end of a site may take several years before it exits the downgradient boundary of the site or discharges into a surface water body within the site. The reaction of the water table within a wet season, spanning typically about 4 months (June through September), is therefore not controlled signficantly by lateral groundwater inflows and outflows to the prism or by conditions which exist greater than a lateral distance of 300 to 400 feet.

Longest Continuous Seasonal High Water Table Investigation in the State of Florida



LONG–TERM FLUCTUATION OF THE WATER TABLE
(AFTER HYDE AND FORD, 1989)

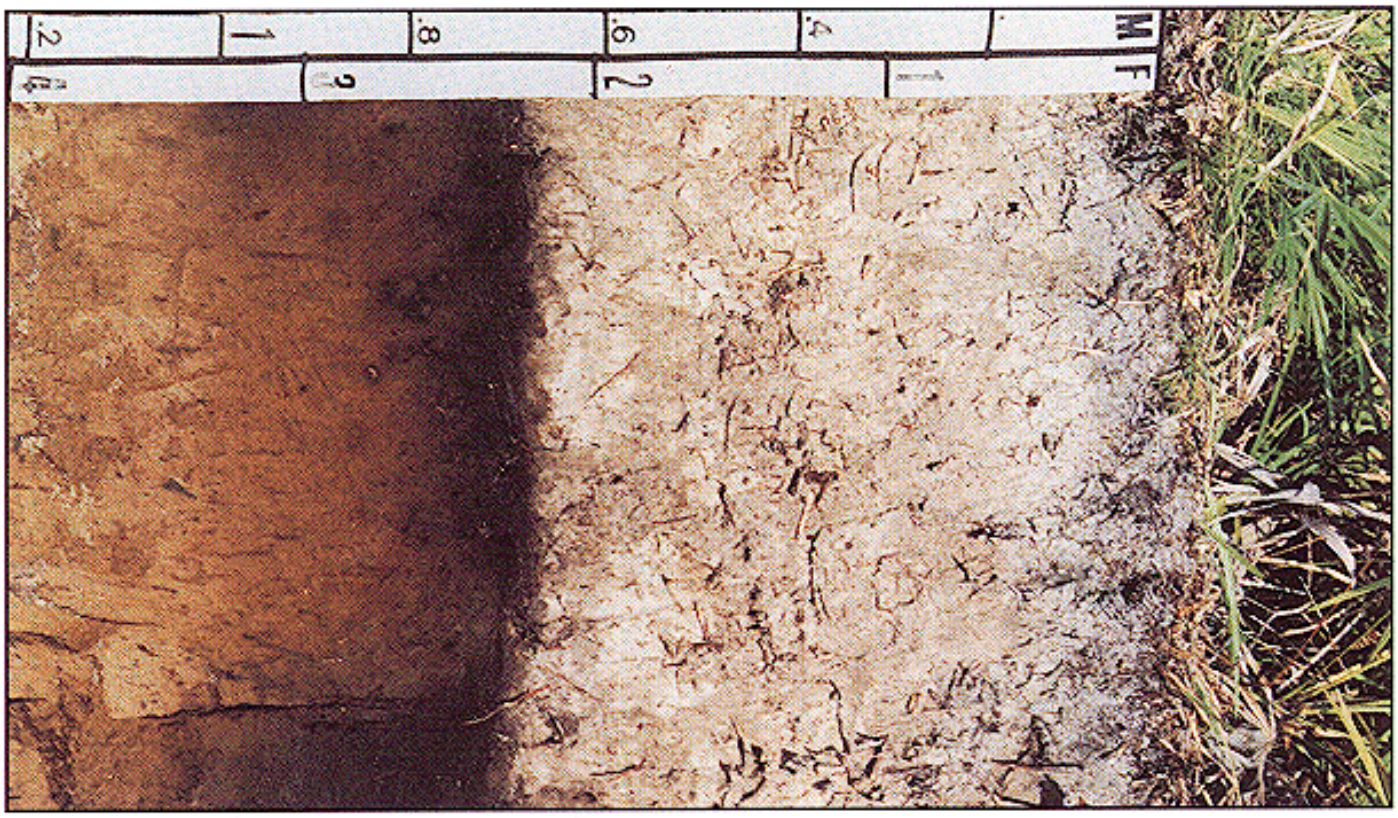
FIGURE 2

Estimating SHWT - The NRCS Methods

REDOXIMORPHIC FEATURES

- **NRCS procedure is based solely on morphology; i.e., identifying mottles and low chroma colors in a soil horizon which form by processes related to saturation and reduction of iron. These processes may be actively occuring during the year or have occured in the horizon at some time in the past.**
- **Soil mottling patterns can also be relicts of past moisture regimes.**
- **NRCS maps are on a scale of 1:20000 and are not a substitute for on-site investigations. Experience indicates that the NRCS estimates of SHWT are reliable in areas where recent development or long-term hydrogeologic changes have not influenced the shallow groundwater flow regime.**
- **NRCS data should always be reviewed as part of the water table evaluation.**

Myakka Fine Sand - The State Soil



SHWT determination in E horizon of Spodsoils (Soils with hardpan)

Chroma 1

no organic matter accumulation around root

SHWT

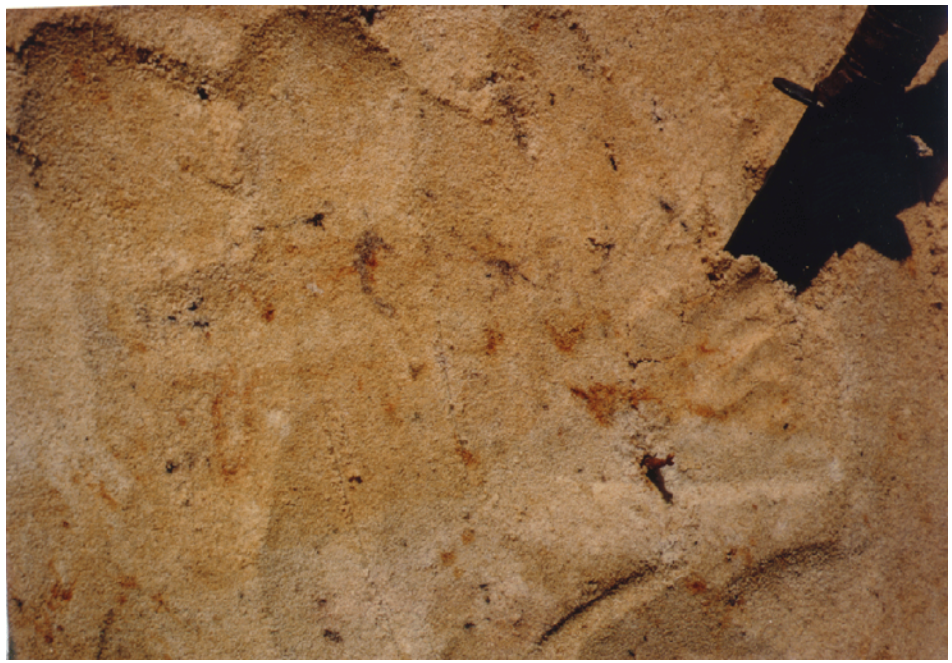
area where chroma 1 & 2 are mixed

Chroma 2

organic matter accumulation around root

Sandy Soil no mottles

Sandy Soil - few mottles not indicative of SHWT

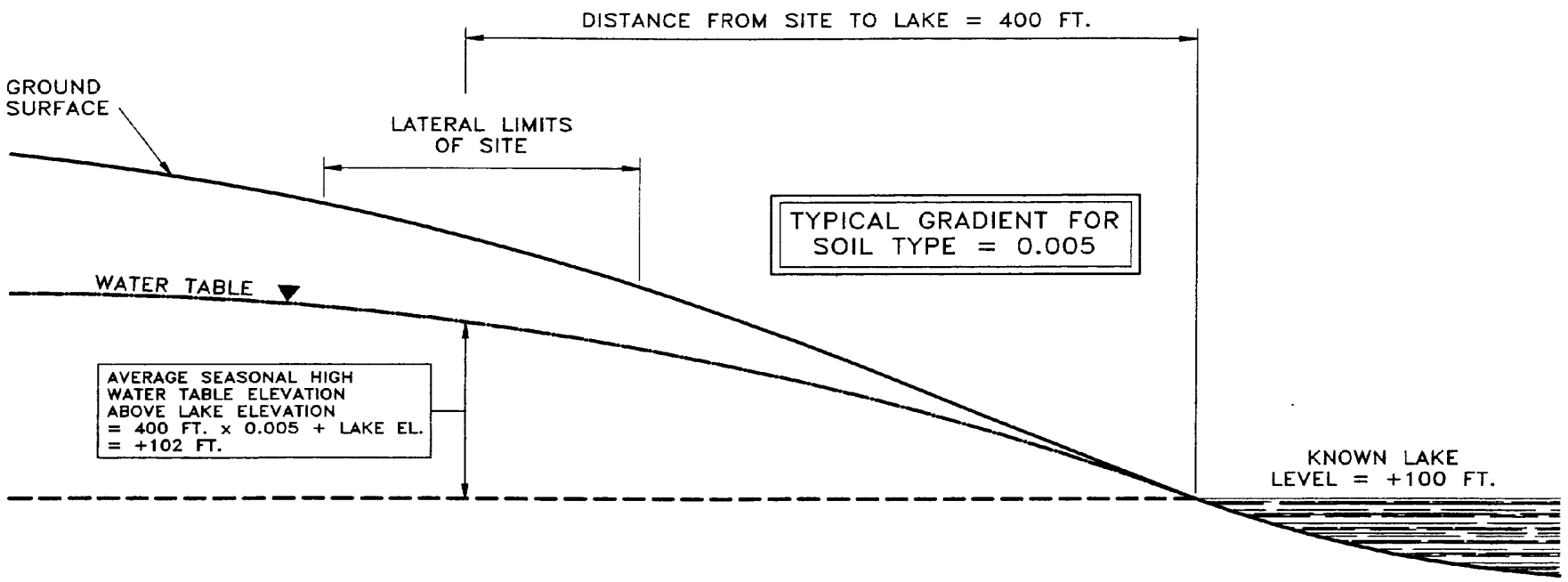


Sandy Soil Common iron bright colored mottles, indicative of SHWT

Sandy Soil - many iron bright colored mottles indicative of SHWT

Loamy soil:
gray at ped surfaces Indicative of SHWT

CORRELATION TO TYPICAL GRADIENTS

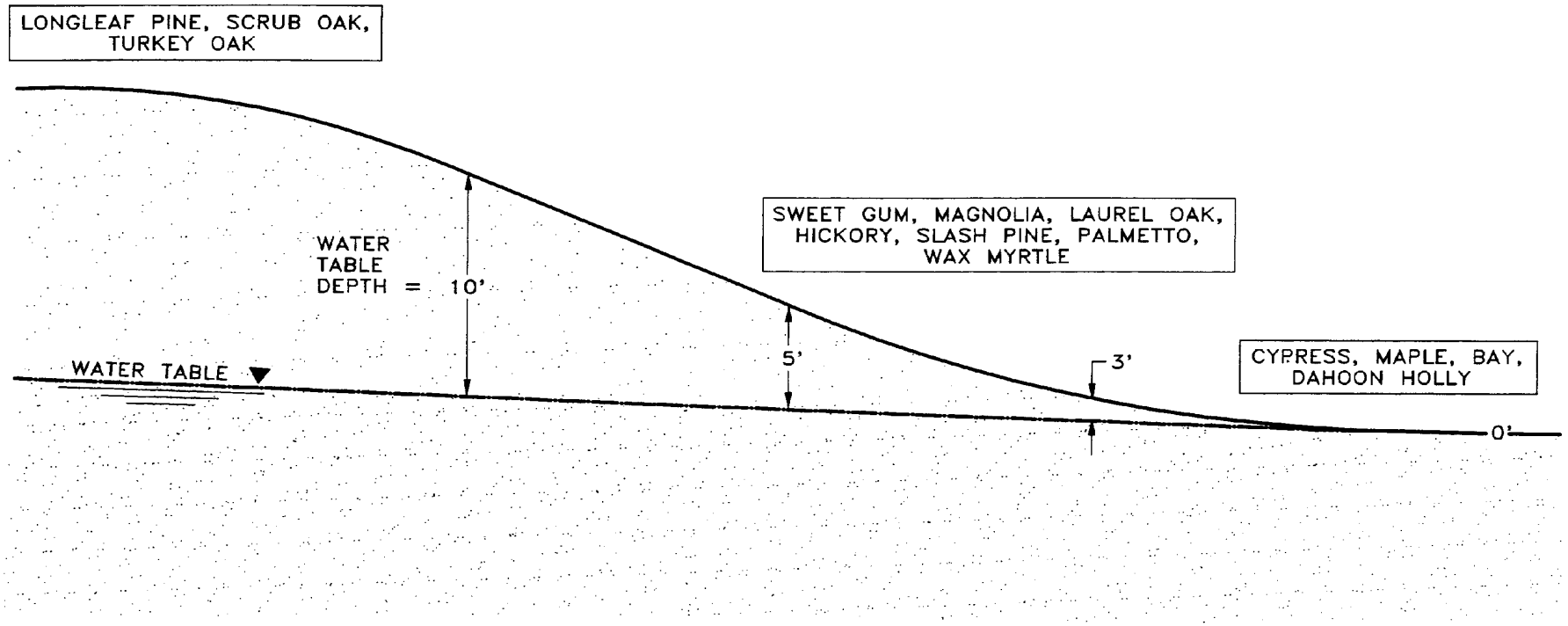


ESTIMATION OF SEASONAL HIGH WATER TABLE FROM WATER FEATURES AND TYPICAL GRADIENT FOR SOIL TYPES

NOT TO SCALE

FIGURE 3

VEGETATIVE INDICATORS



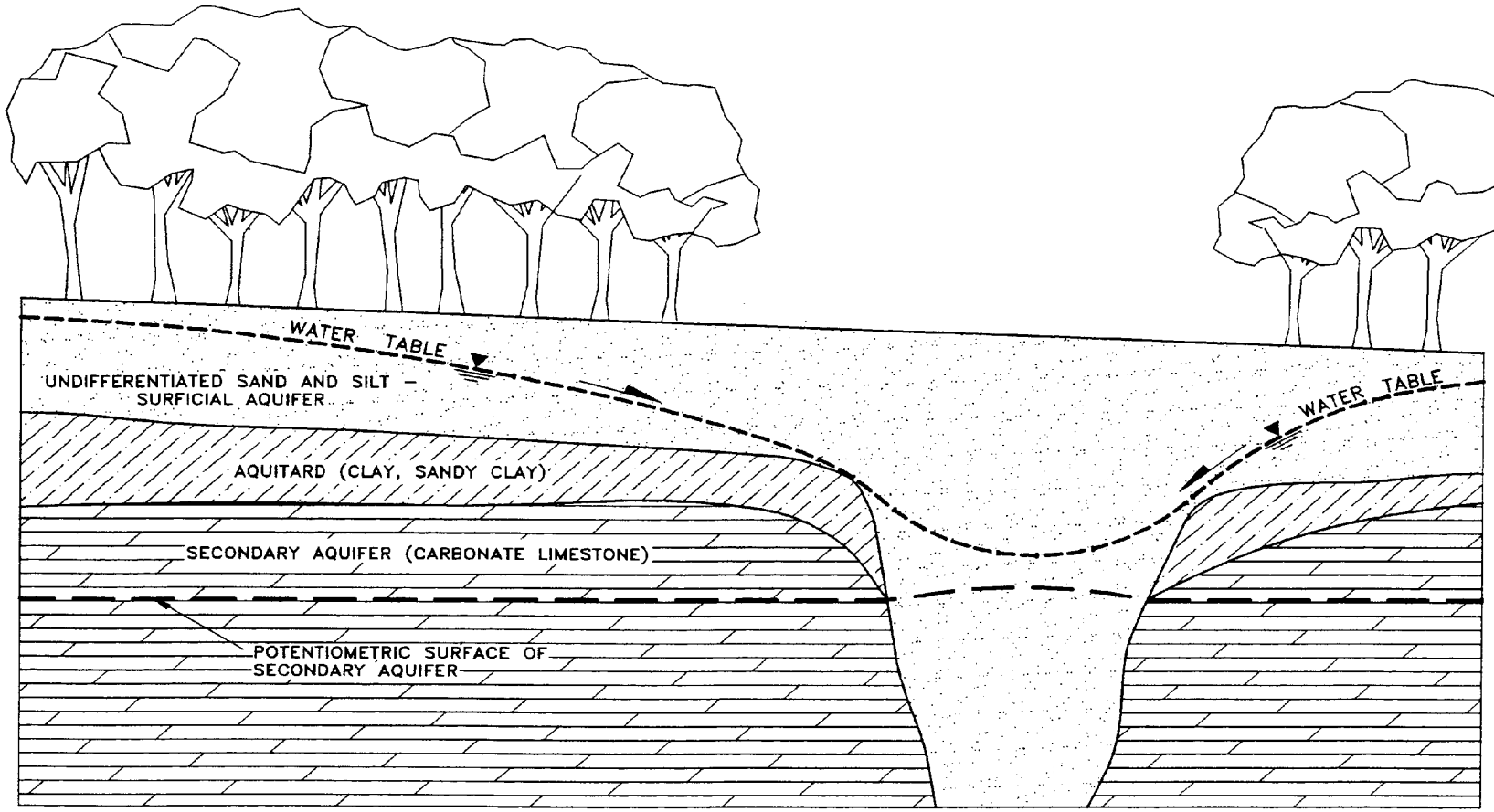
DEPTH TO SEASONAL HIGH WATER
VS. VEGETATIVE INDICATORS

NOT TO SCALE

FIGURE 4

BURIED PALEOSINKS - ORANGE GROVE AERIALS

FIG5OF6



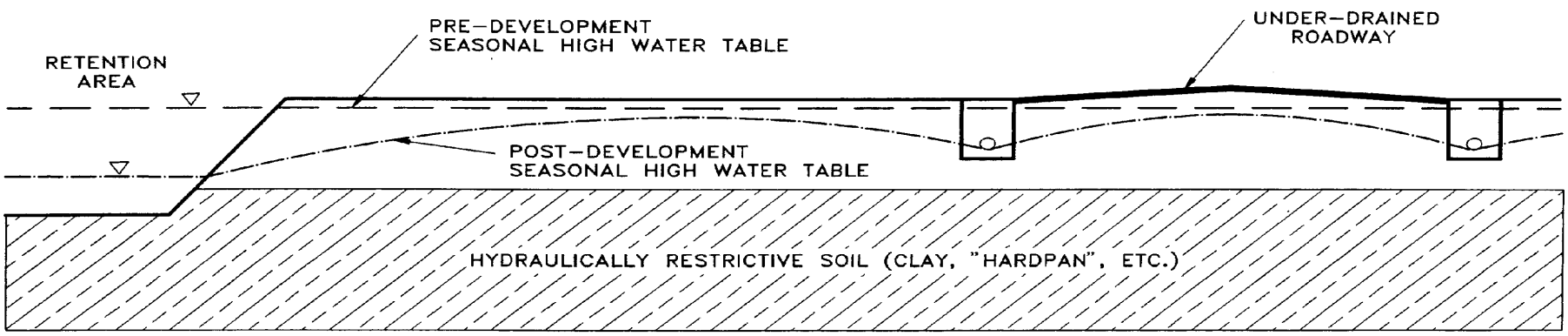
WATER TABLE SUPPRESSION AROUND PALEOSINK WITH NO/LITTLE SURFICIAL EXPRESSION

NOT TO SCALE

FIGURE 5

IMPACTS OF DEVELOPMENT

FIG6OF6



X

X

NOT TO SCALE

FIGURE 6