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MEMORANDUM

Date: March 4, 2021
Revised April 1, 2021
Revised April 29, 2021

To: Kelsey Lucas, P.E. – RS&H (Kelsey.Lucas@rsandh.com)

From: Gene Williford, P.E., and Gary L. Kuhns, P.E.

Subject: Report of Preliminary Geotechnical Engineering Evaluation
NORTHEAST CONNECTOR EXPRESSWAY PHASE I PD&E STUDY
From Cyrils Drive to Nova Road (CR 532)
Osceola County, Florida
CFX Contract No. 001546
CFX Project No. 599-228
RS&H Project No. 107-0102-000
GEC Project No. 4647G

The Central Florida Expressway Authority (CFX) is studying a new expressway connection between Cyrils Drive and Nova Road (also referred to as CR 532) in Osceola County. The study area begins at the terminus of the planned SR 534 near Cyrils Drive and extends to Nova Road, a distance of approximately 4.3 miles. The geotechnical evaluation for this Project Development and Environment (PD&E) Study consists of a desktop data review to identify critical geotechnical conditions.

Quadrangle Map Review

Based on review of the U.S. Geologic Survey (USGS) Narcoossee, Florida Quadrangle Map, the Northeast Connector alternatives generally have a flat topography with natural grades ranging between +65 feet and +75 feet NGVD. The alternatives are depicted on an excerpt of the U.S. Geological Survey (USGS) Narcoossee, Florida Quadrangle map (**Figure 1**) in the **Appendix**.

According to the USGS Quadrangle Map, the alternatives cross a lake, swamps and existing ponds as discussed below:

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- The western portion of the Partial Cloverleaf Interchange alternative extends over wetlands to the northwest of Bullock Lake (approximately 1,600 linear feet), as well as a small portion of Bullock Lake (approximately 500 linear feet).
- The western portion of the Diamond Interchange alternative extends over wetlands to the northwest of Bullock Lake (approximately 1,900 linear feet), as well as a small portion of Bullock Lake (approximately 1,300 linear feet).
- The eastern portion of the Partial Cloverleaf alternative extends over wetlands to the east-southeast of Bullock Lake (approximately 1,200 linear feet).
- The eastern portion of the Diamond Interchange alternative extends over wetlands to the east-southeast of Bullock Lake (approximately 1,500 linear feet).
- Both alternatives then pass over the canal connecting Trout Lake and Lake Joel approximately 3,900 feet northwest of Nova Road.
- Approximately 2,500 feet northwest of Nova Road, the Nova Road Connection – Option 1 crosses a circular pond.

NRCS Soil Survey Map Review

The Natural Resources Conservation Service (NRCS) Soil Survey for Osceola County was reviewed for near-surface soil and groundwater information. The NRCS Soil Survey map of the alternatives is attached (**Figure 2**) and the depicted soils are summarized in **Table 1**.

Table 1: Osceola County NRCS Soils

Unit No.	Soil Name	Depth (inches)	Soil Description	Classification		Depth to Seasonal High Groundwater Depth (ft)	Hydrologic Group
				Unified	AASHTO		
5	Basinger fine sand, 0 to 2 percent slopes	0 – 2 2 – 18 18 – 36 36 – 80	Fine sand Fine sand Fine sand Fine sand	SP-SM, SM SP-SM, SM SP-SM, SM SP-SM, SM	A-2-4, A-3 A-3, A-2-4 A-2-4, A-3 A-3, A-2-4	+0.5 – 0.0	A/D
6	Basinger fine sand, depressional, 0 to 1 percent slopes	0 – 3 3 – 24 24 – 80	Fine sand Fine sand Fine sand	SP-SM SP, SP-SM SP, SP-SM	A-2-4 A-2-4, A-3 A-3	+2.0 – 0.0	A/D
15	Hontoon muck, frequently ponded, 0 to 1 percent slopes	0 – 5 5 – 65	Mucky peat Muck	PT PT	A-8 A-8	+2.0 – 0.0	A/D
16	Immokalee fine sand, 0 to 2 percent slopes	0 – 54 54 – 80	Fine sand Fine sand, loamy fine sand, sand	SP-SM, SM SM, SP-SM	A-3, A-2-4 A-2-4, A-3	0.5 - 1.5	B/D
22	Myakka fine sand, 0 to 2 percent slopes	0 – 6 6 – 20 20 – 36 36 – 80	Fine sand Fine sand, sand Fine sand, sand Fine sand, sand	SP-SM, SM SP-SM, SM SP-SM, SM SP-SM, SM	A-3, A-2-4 A-3, A-2-4 A-2-4, A-3 A-3, A-2-4	0.5 - 1.5	A/D

Unit No.	Soil Name	Depth (inches)	Soil Description	Classification		Depth to Seasonal High Groundwater Depth (ft)	Hydrologic Group
				Unified	AASHTO		
32	Placid fine sand, frequently ponded, 0 to 1 percent slopes	0 – 24 24 – 80	Fine sand Fine sand, sand	SP-SM, SM SM, SP-SM	A-3, A-2-4 A-3, A-2-4	+2.0 – 0.0	A/D
40	Samsula muck, frequently ponded, 0 to 1 percent slopes	0 – 32 32 – 35 35 – 44 44 – 80	Muck Sand, fine sand Sand, fine sand Sand, fine sand	PT SM, SP-SM SP-SM, SM SM, SP-SM	A-8 A-3, A-2-4 A-2-4, A-3 A-2-4, A-3	+2.0 – 0.0	A/D
42	Smyrna fine sand, 0 to 2 percent slopes	0 – 4 4 – 13 13 – 49 49 – 80	Fine sand Fine sand, sand Fine sand, sand Fine sand, sand	SP-SM, SM SP-SM, SM SP-SM, SM SP-SM, SM	A-3, A-2-4 A-3, A-2-4 A-2-4, A-3 A-3, A-2-4	0.5 - 1.5	A/D

Information contained in the NRCS Soil Survey is very general and may be outdated. It may not, therefore, be reflective of actual soil and groundwater conditions, particularly if recent development in the site vicinity has modified soil conditions or surface/subsurface drainage. The NRCS seasonal high groundwater levels summarized above do not account for changes in groundwater due to development and are only relevant for the natural, undisturbed condition of the soils.

Sand and Shallow Groundwater

An excerpt of the NRCS Soil Survey highlighting the study area is shown on **Figure 2**. The shallow soils depicted on the Soil Survey map are predominantly fine sand with varying silt content (A-3, A-2-4), except in the swamps and lakes, where depressional (organic/muck) soils are present. Seasonal high groundwater level estimates for the majority of the soils in the area of interest range from 2.0 feet above ground surface to 1.5 feet deep. Sands with shallow groundwater are highlighted in blue on **Figure 2**.

The sand soils are generally suitable for roadway construction and are classified by FDOT as Select material. Shallow groundwater can impact roadway grades and stormwater pond site selection, design and construction.

Muck and Ponded Water

Hontoon Muck and Samsula Muck (Soil Unit Nos. 15 and 40) are located within the alternative alignments. These soil units are classified as very poorly drained, organic soil (PT) associated with freshwater drainageways, marshes and swamps. According to the NRCS, the organic soils extend to approximate depths of 5.5 and 2.5 feet for Hontoon Muck and Samsula Muck, respectively.

However, relic sinkholes often located within lakes and wetlands can contain muck deposits more than 100 feet deep. The muck soil units at water features are highlighted in pink on **Figure 2**.

Organic soils, classified as A-8 in the American Association of State Highway and Transportation Officials (AASHTO) system, are highly compressible and can have severe limitations for development if left untreated. Removal of the muck, or treatment by means of soil surcharge, is typically required to provide adequate support for the roadway embankment. Extreme muck depths may make removal impractical and a surcharge ineffective, and in that case, a bridge may be the only feasible alternative.

In addition, the NRCS Soil Survey identifies soil units (Soil Unit Nos. 5, 6, and 32) classified as very poorly to poorly drained located in low, wet depressions sloughs and swamps. The NRCS estimates seasonal high groundwater levels to be ponded for 6 to 12 months of the year. According to the NRCS, water typically ponds from 0.5 to 2 feet above the ground surface. The sand with ponded water soil units are highlighted in green on **Figure 2**.

The alternative alignments include areas of muck, lakes, wetlands, ponds, and ponded water along their respective alignments. Preliminary estimates of total acreages within each alignment are as follows:

- Partial Cloverleaf Interchange
    - 9 acres of organic soil (muck) / lakes and other water features
    - 22 acres of sand / ponded water
- Diamond Interchange
    - 18 acres of organic soil (muck) / lakes and other water features
    - 28 acres of sand / ponded water
- Nova Road Connection – Option 1
    - 34 acres of sand / ponded water
- Nova Road Connection – Option 2
    - 37 acres of sand / ponded water

Subsurface Drainage

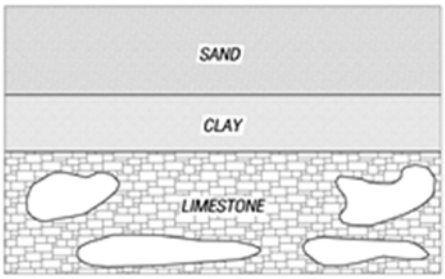
The soils present within the study area are generally identified by NRCS as a dual hydrologic soil group A/D; however, Group D is the predominant soils group. Group A soils identify drained areas and Group D soils represent undrained areas. Group A soils possess low runoff potential due to their sandy, permeable nature. Group D soils have high runoff potential due to a shallow groundwater table and/or impervious near-surface silt, clay or organic fines. Group A soils can be conducive to stormwater infiltration and design of dry retention ponds. Group D soils indicate

poor infiltration characteristics and are more conducive to the design of wet detention ponds. Knowledge of geotechnical conditions within the study area, as well as published sources of geotechnical data, will be used to identify soil/groundwater conditions that could impact feasibility of the concept alternatives.

Potentiometric Map Data

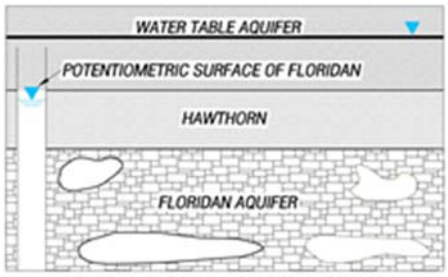
Artesian groundwater conditions can be predicted based on comparison of the Floridan aquifer potentiometric surface and ground surface elevations. According to the Florida Department of Environmental Protection (FDEP) September 2017 Upper Floridan Aquifer Potentiometric Surface map (the most recent map available), the potentiometric surface of the Floridan aquifer along the alternative alignments ranges from approximately +42 to +44 feet National Geodetic Vertical Datum (NGVD). The existing ground surface along the alternative alignments ranges from approximately +65 to +70 ft NGVD; therefore, artesian flow conditions are not anticipated.

Regional Geology

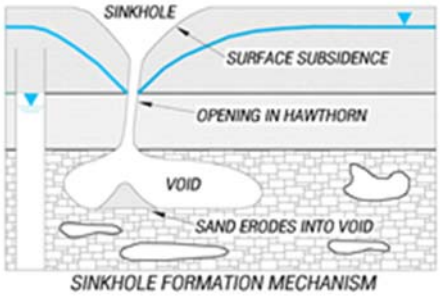


KARST GEOLOGY OF CENTRAL FLORIDA

Due to its prevalent geology, referred to as karst, Central Florida is prone to the formation of sinkholes, or large, circular depressions created by local subsidence of the ground surface. The nature and relationship of the three sedimentary layers typical of Central Florida geology cause sinkholes. The deepest, or basement, layer is a massive cavernous limestone formation known as the Floridan aquifer. The Floridan aquifer limestone is overlain by a silty or clayey sand, clay, phosphate, and limestone aquitard (or flow-retarding layer) ranging in thickness from nearly absent to greater than 100 feet and locally referred to as the Hawthorn Group (Hawthorn). The Hawthorn is in turn overlain by a 40 to 70-foot thick surficial layer of sand, bearing the water table aquifer. The likelihood of sinkhole occurrence at a given site within the region is determined by the relationship among these three layers, specifically by the water (and soil)-transmitting capacity of the Hawthorn at that location.



CENTRAL FLORIDA AQUIFER SYSTEMS



SINKHOLE FORMATION MECHANISM

The water table aquifer is comprised of Recent and Pleistocene sands and is separated from the Eocene limestone of the Floridan aquifer by the Miocene sands, clays and limestone of the Hawthorn. Since the thickness and consistency of the Hawthorn layer is variable across Central Florida, the likelihood of groundwater flow from the upper to the lower aquifer (known as aquifer recharge) will also vary by geographical location. In areas where the Hawthorn is absent, water table groundwater (and associated sands) can flow downward to cavities within the limestone aquifer, like sand through an hourglass, recharging the Floridan aquifer, and sometimes causing the formation of surface sinkholes. This process of subsurface erosion associated with recharging the Floridan aquifer is known as raveling. Thus, in Central Florida, areas of effective groundwater recharge to the Floridan aquifer have a higher potential for the formation of surface sinkholes.

Sinkhole Risk

No method of geological, geotechnical, or geophysical exploration is known that can accurately predict the occurrence of sinkholes. It is common geotechnical practice in Central Florida to make a qualitative prediction of sinkhole risk on the basis of local geological conditions in the vicinity of a particular site.

Based on our review of the U.S. Geological Survey Map entitled "Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida," 1984, the alternatives lie within an area of low to moderate recharge and, therefore, we can conclude based solely on this data that the alternative alignments are located in an area where the relative risk of sinkhole formation is low compared to the overall risk across Central Florida.

Limitations

This report has been prepared for the exclusive use of RS&H, and CFX, and for specific application to this project. GEC will not be held responsible for any other party's interpretation or use of this report's subsurface data or engineering analysis without our written authorization.

The sole purpose of this evaluation was to provide preliminary indications of subsurface conditions along the alternative alignments as part of a preliminary geotechnical exploration program. This evaluation is preliminary in nature and is intended for project planning purposes only.

The information contained in this report should be disregarded if the nature, design, or location of the facilities is changed. If such changes are contemplated, GEC should be retained to review the new plans to assess the applicability of this report in light of the proposed changes.

GEC has performed the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

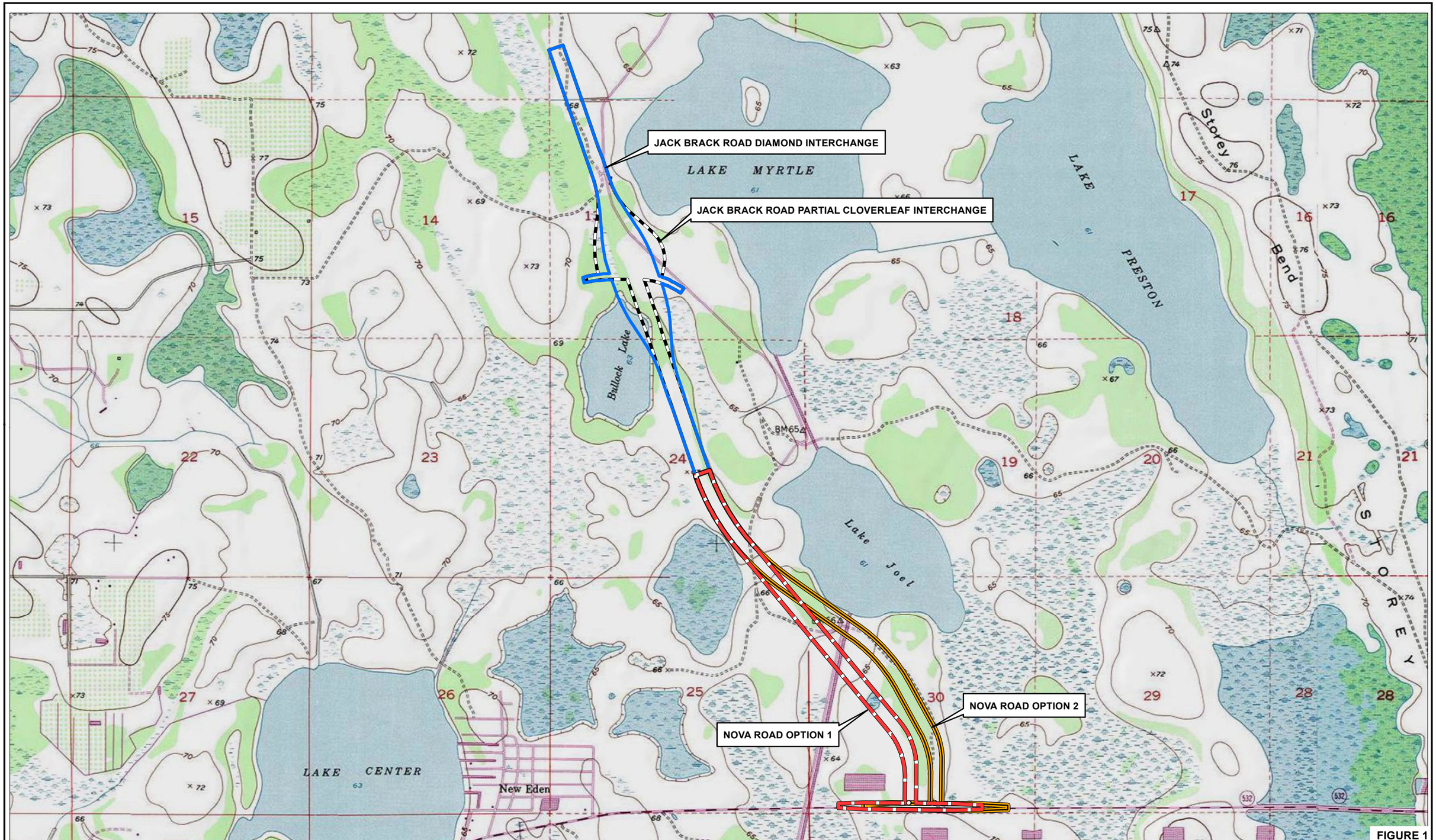


FIGURE 1

Narcoossee, FL.Quadrangle Map
Dated: 1970

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Feet

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NORTHEAST CONNECTOR
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CENTRAL FLORIDA EXPRESSWAY AUTHORITY

USGS QUADRANGLE MAP

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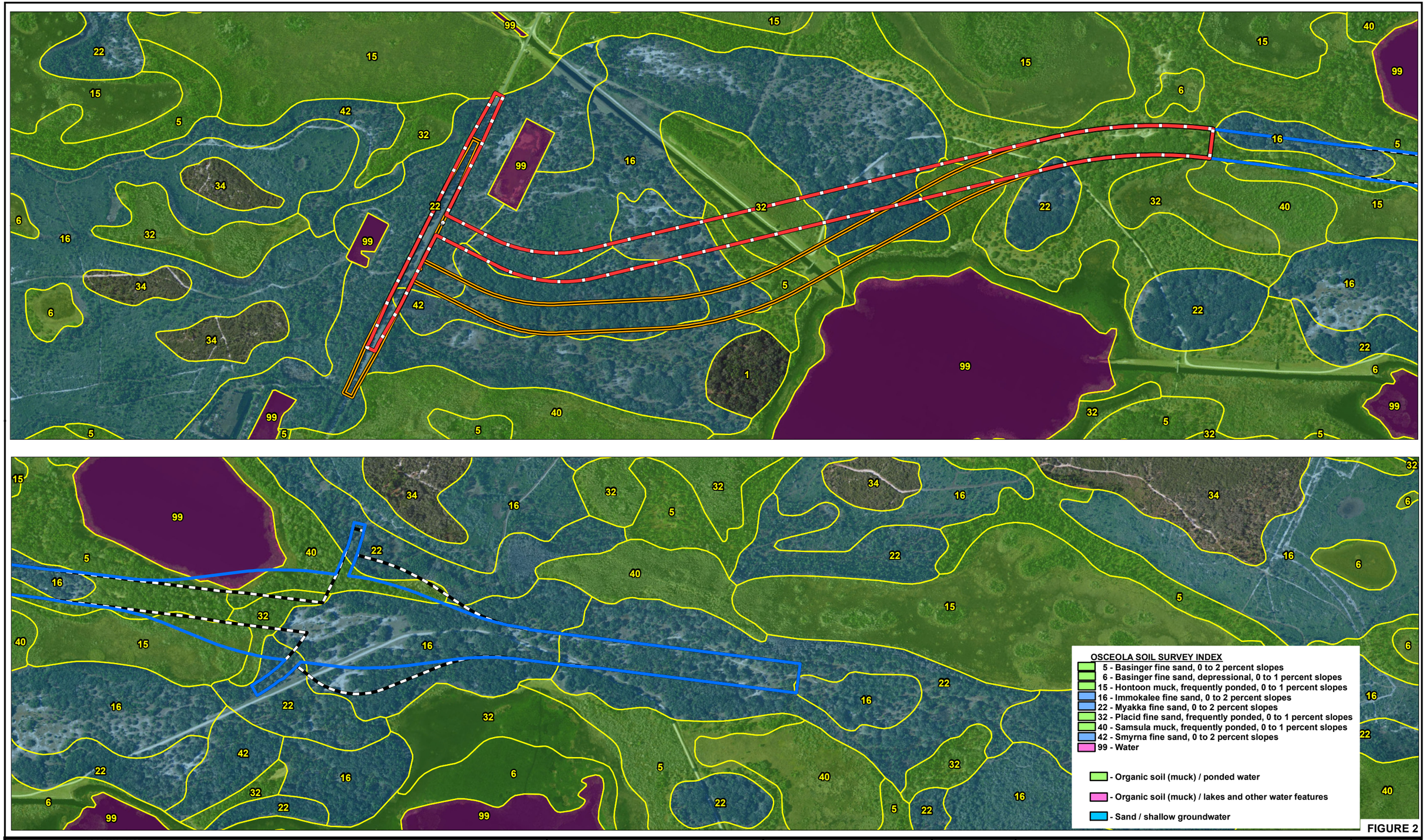

FIGURE 2

ALTERNATIVES
- JACK BRACK ROAD DIAMOND INTERCHANGE
- JACK BRACK ROAD PARTIAL CLOVERLEAF INTERCHANGE
- NOVA ROAD OPTION 1
- NOVA ROAD OPTION 2

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Feet

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NRCS SOIL SURVEY MAP

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