

**Geology in Central Florida
and
Update Regarding District Owned Road
and Storm Pipe
McLawren Terrace**

March 9, 2018

District 4 Board of Supervisors

The Villages®
Community Development Districts

Many Soil Types and Sub-Strata in Florida including...



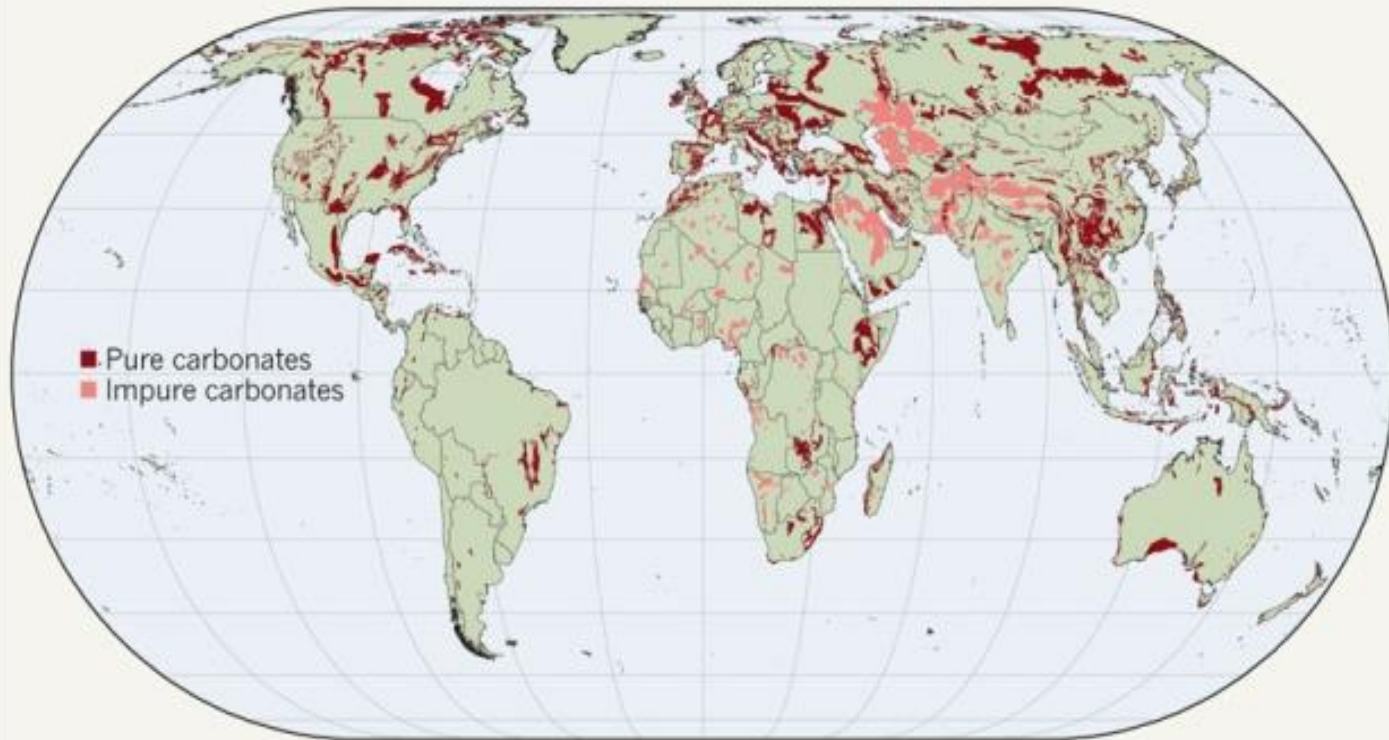
Karst

Geographical feature category



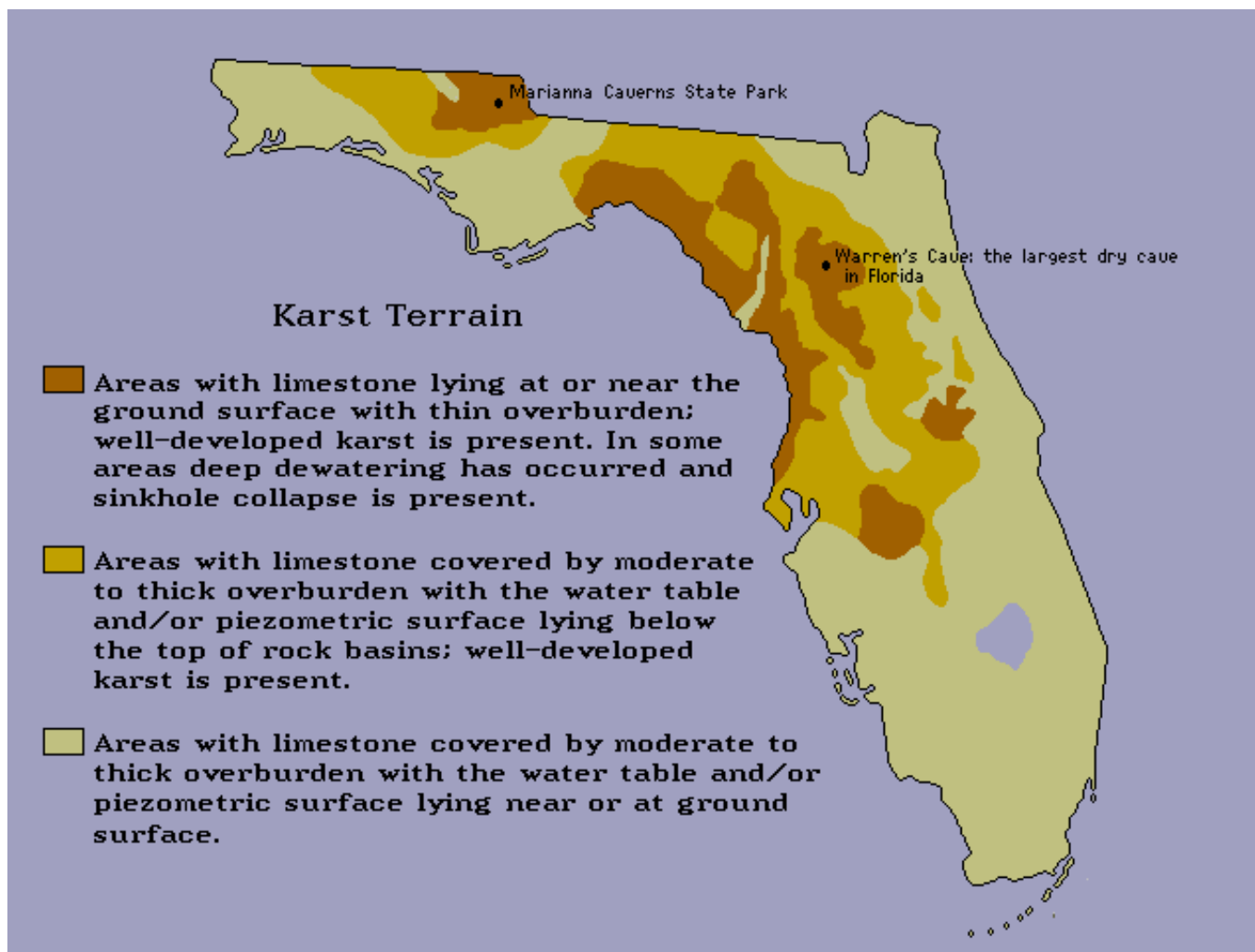
Karst is a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes and caves. [Wikipedia](#)

Carbonate rocks cover 13% of the world's land surface and are susceptible to erosion by running water.



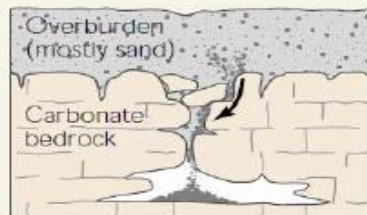
Source: Williams & Ford 2010



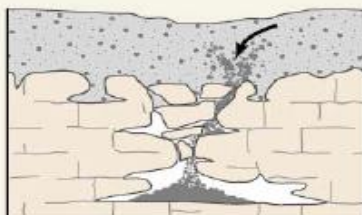


Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand.

Granular sediments spill into secondary openings in the underlying carbonate rocks.



A column of overlying sediments settles into the vacated spaces (a process termed "piping").



Dissolution and infilling continue, forming a noticeable depression in the land surface.

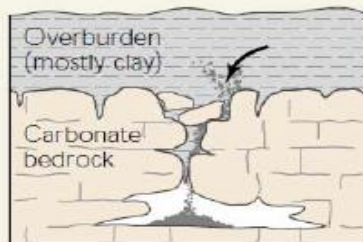


The slow downward erosion eventually forms small surface depressions 1 inch to several feet in depth and diameter.



Cover-collapse sinkholes may develop abruptly (over a period of hours) and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay.

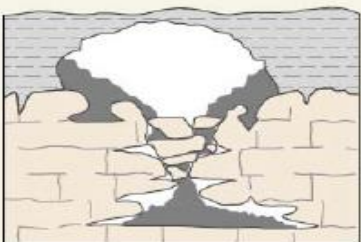
Sediments spill into a cavity. As spalling continues, the cohesive covering sediments form a structural arch.



The cavity migrates upward by progressive roof collapse.



The cavity eventually breaches the ground surface, creating sudden and dramatic sinkholes.



The entire state of Florida sits on top of several thousand feet of limestone.

Limestone is a rock that can form with natural void spaces called porosity. In limestone where the void spaces are connected, the rock is permeable. Porous and permeable limestone makes great aquifers and provide millions of gallons of fresh drinking water for residents and agriculture. The most significant factor in the development of sinkholes is the dissolution of the limestone underlying Florida by naturally acidic groundwater.

Karst Anomalies are a natural and common feature of Florida's landscape.

They are only one of many kinds of karst landforms, which include depressions, caves (both air and water filled), disappearing streams, springs and underground aquifer systems, all of which occur in Florida. Thousands of naturally occurring sinkholes can be seen throughout the state of Florida including many that connect underground to springs, rivers and lakes.

Depressions, anomalies, and such form in karst terrain from the collapse of surface sediments into underground voids.

In Florida one may see depressions, cover-subsidence depressions or cover-collapse depressions. The first two types will show very little topographical disturbance to the naked eye, while the third is the type which shows a abrupt change in topography and is most associated with the thought of depressions, voids, and/or sinkholes.

A Karst Anomaly occurred near me... should I be concerned?

Although depressions in Florida sometimes occur in sets, most are **isolated** events. The bedrock underlying the state is honeycombed with cavities of varying size, most of which will not collapse in our lifetimes. A quick inspection of your property for any sinking or soft areas might be prudent. Unless the depression is very large, there's likely to be little reason for concern.

Is there an area of Florida where there is no chance of these anomalies?

Technically, no. Since the entire state is underlain by carbonate rocks, sinkholes could theoretically form anywhere. In general, areas of the state where limestone is close to surface, or areas with deeper limestone but with a conducive configuration of water table elevation, stratigraphy, and aquifer characteristics have increased sinkhole activity.

SE 79th McLawren Terrace

- District Government
 - DPM
 - Community Watch
 - Public Safety

- Marion County
 - Emergency Management
 - Building Office

- Private Property

SE 79th McLawren Terrace

- District Government

- District Management

- Communication with Community Development District 4 Board, Marion County Emergency Management and responding to resident inquiries regarding District actions.

- Department of Property Management

- Responsible for District Property affected by depression: Street, Easement, Drain Pipe

- Public Safety

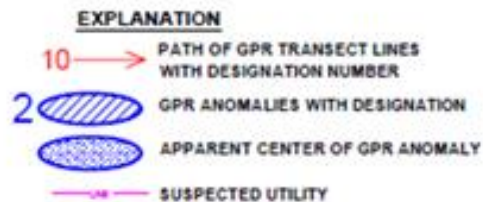
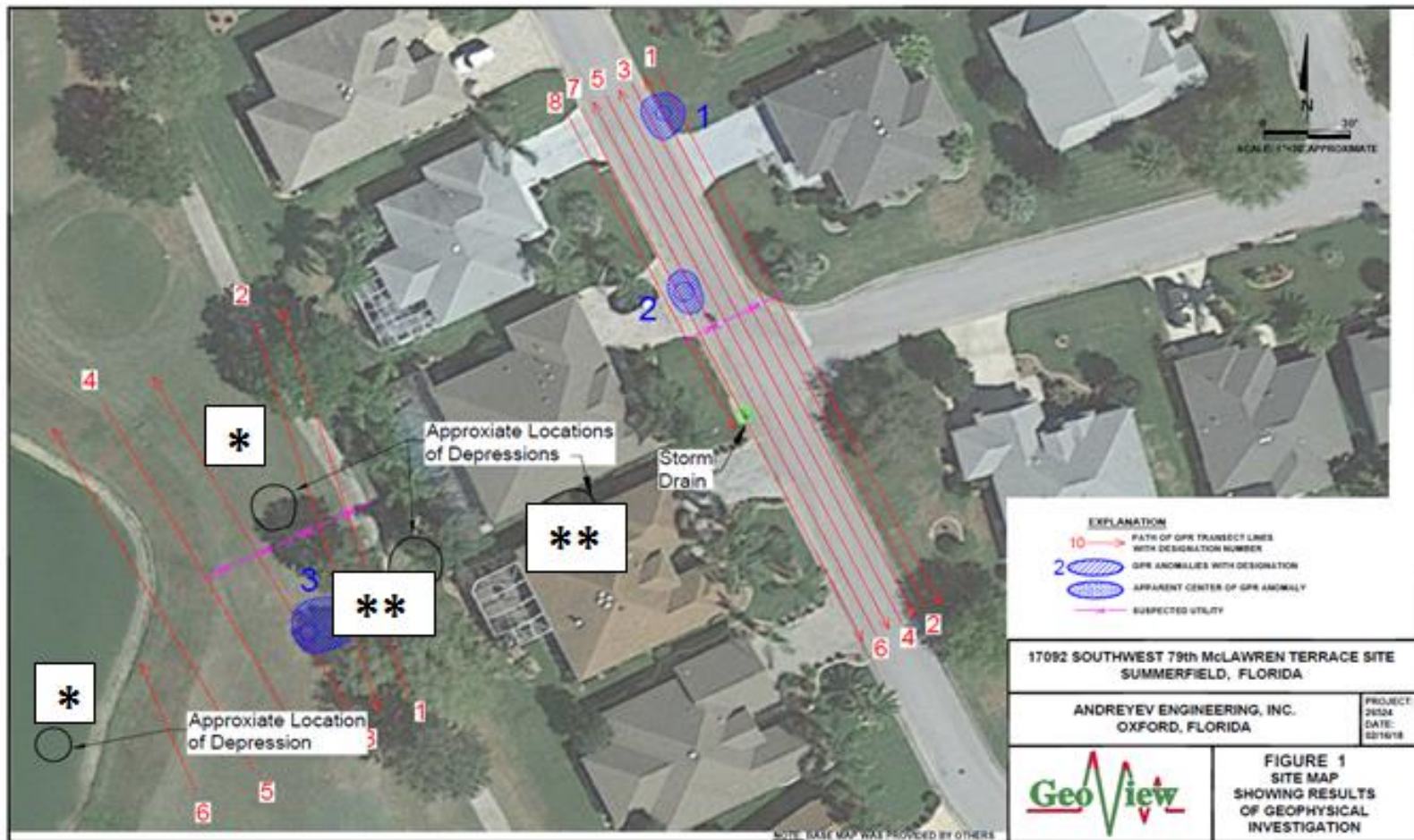
- Community Watch - Security and Safety of Residents walking, driving, and observing the area.

- Marion County

- (Attending District 4 Board Meeting – Friday, April 13th, 1:30 PM Savannah Center)

- Emergency Management
 - Building Office

- Private Property






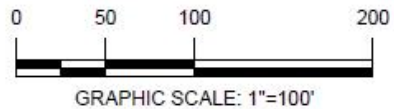
* Outside of District Maintained
Infrastructure Locations

** Depression Locations along
Stormwater Outfall Pipe



LEGEND:

-  APPROXIMATE LOCATION OF SPT BORING
-  APPROXIMATE LOCATION OF CPT BORING
-  APPROXIMATE LOCATION OF DEPRESSION



APPROXIMATE SCALE:	DATE: 03/05/18	ENGINEER: SB
1"=100'	PN: CPGT-18-039	DRAWN BY: DLS
	PN: CPGT-18-040	

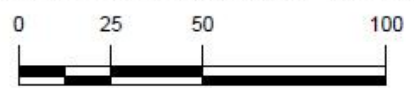
GEOTECHNICAL SINKHOLE INVESTIGATION
NANCY LOPEZ GOLF COURSE & McLAWREN TERRACE
 THE VILLAGES, MARION COUNTY, FL

BORING LOCATION PLAN
 FIGURE 3



LEGEND:

- APPROXIMATE LOCATION OF GROUT INJECTION POINT
- ◀● APPROXIMATE LOCATION OF ANGLED GROUT INJECTION POINT



GRAPHIC SCALE: 1"=50'



**Andreyev
Engineering,
Inc.**

GEOTECHNICAL SINKHOLE INVESTIGATION
**NANCY LOPEZ GOLF COURSE
& McLAWREN TERRACE**
THE VILLAGES, MARION COUNTY, FL
**GROUT INJECTION LOCATION
PLAN**

APPROXIMATE SCALE: 1"=50'	DATE: 03/02/18 PN: CPGT-18-039 PN: CPGT-18-040	ENGINEER: SB DRAWN BY: DLS
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District Government Next Steps

- Borings: Completed-Soil Gradation/Type
- Geophysical Investigation: Completed within Street ROW, easement, and along pond embankment
- Fill: Interim Stability Plan complete, work associated with storm water pipe 20% complete
- Grout: Underway along pipe sections associated with storm water pipe, Easement area grouting on-hold subject to receipt of private party engineering reports and subsequent mitigation plans.
- Pipe Replacement/Repair: 20% Completed (two sections), Easement center section on-hold subject to receipt of private party engineering reports and subsequent mitigation plans.
- Borings completed and under analysis
- Temporary storm water back up pump and plan completed

Preliminary Costs to Date

\$125,000 - \$170,000 (Invoices still being received)

Overall Cost Estimation

\$275,000 - \$500,000

Note- All costs are based on projections and information available to date. Estimated costs are formulated without information relating to private party depression mitigation and how such mitigation will impact District project completion.

Questions