GEO-TECH, INC.
ENGINEERING CONSULTANTS IN GEOTECHNICAL • ENVIRONMENTAL • CONSTRUCTION MATERIALS TESTING

February 6, 2024
Project No. 24-3006.212.1

Oscar E. Tovar, P.E.
City of Ocala - Engineering Department
1805 NE 30th Avenue, Building 700
Ocala, Florida 34470

Reference: Pavement and Concrete Slab Voids, Existing Water Treatment Plant
1808 NE 36th Avenue, Ocala, Florida
Ground Penetration Radar (GPR) Survey

Dear Mr. Tovar:

Geo-Technologies, Inc. (Geo-Tech) performed a GPR survey at the site as requested by you. Services were conducted in accordance our correspondence with you. Our findings, evaluations and recommendations are presented in the following report.

Geo-Tech appreciates the opportunity to provide our services for this project. Should you have any questions regarding the contents of this report or if we may be of further assistance, please do not hesitate to contact the undersigned.

Sincerely,

Gerald W. Green, Jr.
Soil & Water Scientist

GWG/CAH

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Purposes

Purposes of this GPR survey were to help identify potential subsurface karst features in accessible areas of the site around the observed exterior pavement void and adjacent to the existing building. Additional purposes were to provide remediation recommendations for the observed pavement and concrete slab voids.

Site Description

The site is the existing Water Treatment Plant located at 1808 NE 36th Avenue in Ocala, Florida. Geo-Tech observed one (1) void in the exterior pavement area at the interface to the existing building and one (1) void in the concrete floor slab within the existing building on our initial site visit. The observed voids ranged from approximately two (2) to three (3) inches in diameter.

Geo-Tech understands an exterior plumbing leak flooded the interior and exterior of the existing building on the south side prior to our arrival to the site. The water drained through a small void in the concrete floor slab within the south end of the building and through a small void in the pavement adjacent to the south end of the building.

GPR Description

GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver; a profiling recorder which processes the received signal and produces a graphic display of the data; and a video display unit which processes and transmits the output signal to a color video display unit that records the data in a file base in a portable computer.

The transmitter radiates repetitive short-duration electromagnetic waves into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver by interfaces between materials with different dielectric constants. Travel times of the signal are used to estimate the depth of signal penetration. Intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material through which the wave is traveling, and the frequency of the signal. Subsurface features which commonly cause such reflections are: 1) natural geology such as changes in sediment composition, bedding and cementation horizons, voids, and water content; 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines and utilities. Moisture contents of underlying soils will limit the depth of the transmitted signal. The profiling recorder processes the signal from the receiver and produces a continuous cross-section of the subsurface interface reflections referred to as reflectors. GPR data output from the recorder is presents data as a continuous profile.

A GPR survey is conducted along transects which are measured paths along which the GPR antenna is moved. Calibrated survey wheel measurements are used to determine the antenna position during the survey.

Normal geologic conditions in the subsurface, as viewed on a GPR profile, are frequently characterized by the occurrence of relatively continuous and horizontal GPR reflectors, representing soil horizons. Anomalous subsurface features, such as sinkholes, exhibit GPR reflectors, which, in the area of the sinkhole, dip down toward the center of the sinkhole. In the

center of the sinkhole, the GPR reflectors associated with the suspected soil horizons either dip sharply downward or are discontinuous. Subsurface features such as water or air-filled voids are typically characterized by: 1) a relatively high-amplitude reflection of the GPR signals, and 2) a hyperbolic shape of the GPR signals. Fractures are typically characterized by an abrupt increase in the depth of penetration of the GPR signal and the occurrence of relatively high-angle reflectors near the boundaries of the suspected fracture.

GPR signal penetration is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity and moisture content of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays and brackish groundwater and lowest in relatively low-conductivity materials such as dry sand or rock. GPR signal penetration is also dependent on the antenna's transmitting frequency. GPR signal penetration generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased.

GPR antennas are internally shielded from above ground interference sources. Accordingly, the GPR response is minimally affected by overhead power lines, metallic buildings or nearby objects.

GPR Survey Results

The GPR survey was performed utilizing a shielded one hundred sixty (160) MHz antenna and the GX HDR monitor manufactured by Mala Geoscience of Mala, Vasterbotten Municipality, Sweden.

Data from the GPR survey was transferred from the GX HDR monitor to a desktop computer where processing was performed utilizing MALA Object Mapper Version 2.0.1804.102 software produced by Mala Geoscience of Mala, Vasterbotten Municipality, Sweden.

Preliminary GPR transects were performed on random areas of the project site to calibrate the GPR equipment and to characterize overall site conditions. Preliminary GPR survey data indicated that a shielded one hundred sixty (160) MHz antenna provided optimum penetration and resolution of the GPR data to identify potential subsurface karst features at the project site.

GPR transects were constructed by Geo-Tech in accessible areas around the observed pavement depression and adjacent to the existing building. We refer the reader to the GPR Survey Map presented in Appendix I for the approximate GPR survey area.

The GPR investigation was performed by towing the antenna along each transect line. The location of the antenna along a transect line is electronically marked on the GPR data to allow correlation of the data to actual ground locations.

Our GPR survey data indicated a maximum signal penetration depth of approximately twenty-seven (27) feet below existing site grade. The depth of investigation was based upon two-way travel times of the GPR signal traveling through unsaturated and saturated soils underlying the site. The depth was limited by attenuation of the GPR signal due to existing soil conditions at the

site. Subsurface features located below the maximum depth of penetration would not have been detected by the GPR.

Review of the GPR survey data presented no indications of downwarping, discontinuous strata and/or localized areas of deeper signal penetration.

Recommendations

Geo-Tech recommends injecting chemical grout directly into the observed pavement and concrete slab voids in order to fill and seal these areas. Actual chemical grout injection depths and chemical grout quantities should be determined in the field.

Chemical grout material shall consist of high-density polymer resins that create a rapidly expanding polyurethane (or equivalent) foam. Hydrophilic or permeation type chemical grouts should not be utilized.

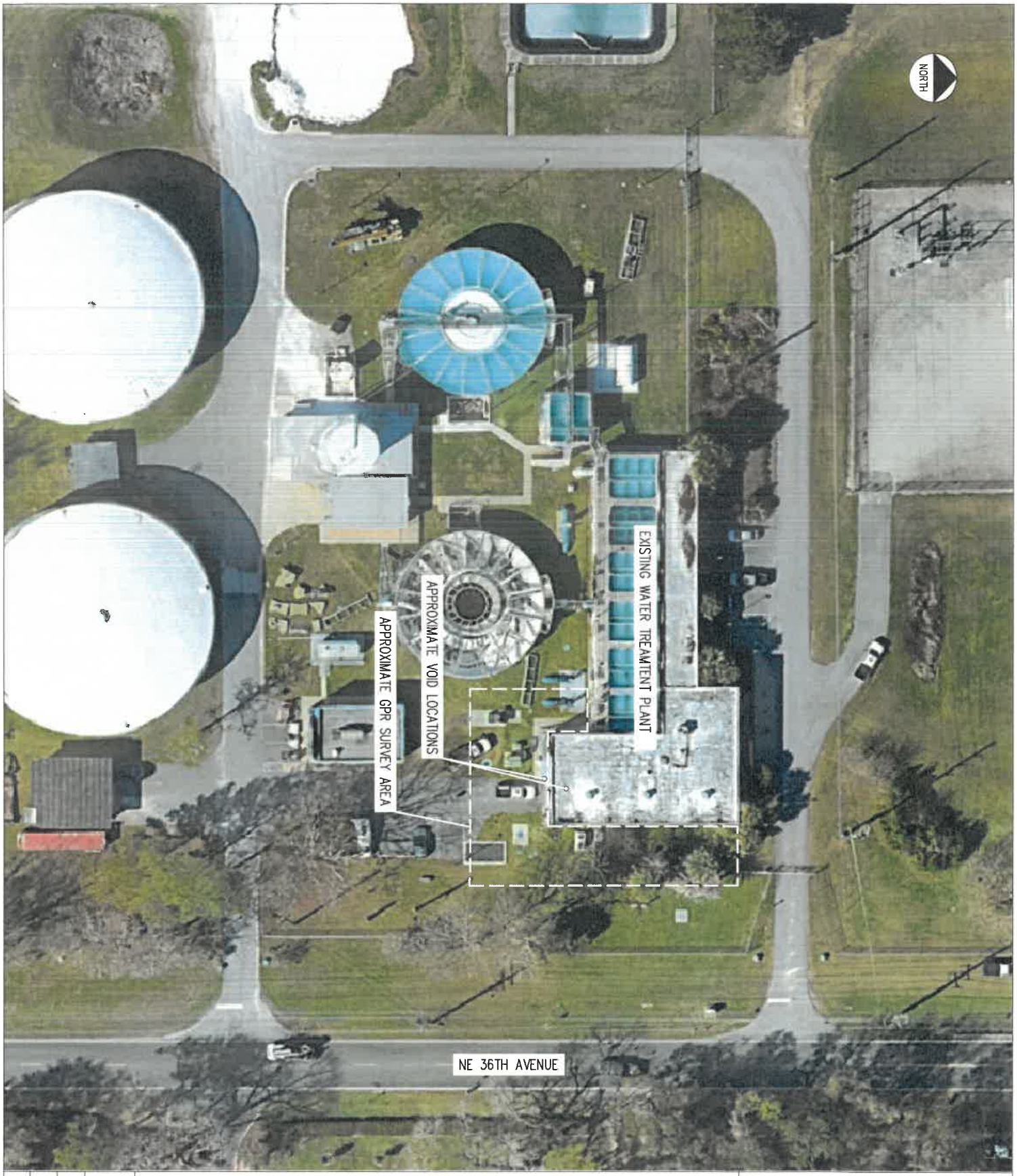
The existing building along with the interior building floor slab should be monitored with a laser type level or manual instrument to detect any heave during all chemical grouting procedures.

Closure/General Qualifications

This report has been prepared in order to aid in the evaluation of the project site. The scope is limited to the specific project and the location described herein. Findings, evaluations and recommendations submitted in this report are based on the GPR survey data and from any other information discussed in this report.

APPENDIX I

GPR SURVEY MAP



PROJECT NO.	24-3006.212.1
SCALE:	N.T.S.
DATE:	2-6-24
FIGURE:	1

CITY OF OCALA - ENGINEERING DEPARTMENT

PAVEMENT VOIDS
EXISTING WATER TREATMENT PLANT
1808 NE 36TH AVENUE, OCALA, FLORIDA

GPR SURVEY MAP

GEO-TECH, INC.
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