

September 14, 2021
Revised November 12, 2021Poulos and Bennett
2602 E. Livingston Street
Orlando, Florida 32803Attention: Mr. Richard Bobletz, P.E.
rbobletz@poulosandbennett.comReference: **Roadway Underdrain Evaluation**
Cyrils Drive Roadway Widening
Osceola County, Florida
UES Project No. 0130.1700290.0013
UES Report No. **1898849v2**

Dear Mr. Bobletz:

At your request, Universal Engineering Sciences (UES) has completed the roadway underdrain evaluation for the above-referenced project based on the provided plan and profile sheets for the site located in Osceola County, Florida. Our findings, together with our assumptions and conclusions, are presented in the following paragraphs.

1.0 PROJECT DESCRIPTION

The proposed project consists of improvements to the Cyrils Drive and Narcoossee Road intersection in Osceola County, Florida. UES has previously issued a Geotechnical Report for this project (UES Report No. 1765631.V3, dated February 1, 2021). The results of the previous exploration were used for this analysis.

2.0 ROADWAY UNDERDRAIN EVALUATION

In accordance with Osceola County Engineering Standards, the required separation between the estimated seasonal high water table and the bottom of the base course (limerock) is 24 inches. If this separation criterion is not met by grading, roadway underdrains are required. Where the estimated seasonal high water table will be greater than 24 inches below the bottom of the base course, underdrains will not be required.

Based on the Roadway Plan and Profile sheets provided to us by Poulos & Bennett, LLC (Cyrils Drive / Narcoossee Road to Asher Road – Road Widening, Sheet No. 15 through 33, dated August 31, 2021) a comparison was made between the finished pavement grades and the plot of the estimated seasonal high groundwater elevation contours in order to determine those areas of the proposed pavements where the estimated seasonal high groundwater elevation will be within 24 inches of the estimated bottom of the base course elevation. Accounting for the thickness of the proposed roadway base course and surface course, the required seasonal high water table separation, and the approximate roadway cross-slope, underdrains will be required where the estimated seasonal high water table occurs within approximately 3.2 feet (3'-2") of the finished pavement surface grades, based on the roadway sections provided by Poulos & Bennett.

After review of the borings drilled by UES and completed for UES report No. 1765631.V3 we can confirm that the plotted estimated seasonal high water (ESHW) line within the plans provided to us by Poulos & Bennett is consistent with our anticipated levels from our previous exploration.

3.0 RECOMMENDATIONS

For all areas where the estimated seasonal high water table is expected to form within 24 inches of the bottom of the base course, underdrains will be required. The following table presents the pavement sections where underdrains are recommended along both sides of the roadway.

**TABLE I
 RECOMMENDED MINIMUM UNDERDRAIN LOCATIONS**

Roadway	From Station	To Station
Cyrils Drive	12+60	18+60
Approximate Total Length of Roadway Underdrain, linear feet (includes both sides of roadways)		1200

The remaining proposed pavement grades shown on the provided plan and profile sheets were found to be at least 3.2 feet above the estimated seasonal high water table.

However, UES typically recommends that the minimum separation between the estimated seasonal high groundwater table and the bottom of the base course be 12 inches for Soil Cement or RCA (Recycled Concrete Aggregate); or 18 inches for Limerock. Therefore, if RCA base course were to be used in lieu of limerock, the required separation would occur when the groundwater is at least 2.2 feet from the surface of the pavement.

All of the proposed pavement grades shown on the provided plan and profile sheets were found to be at least 2.2 feet above the estimated seasonal high water table.

Please note that if Osceola County accepts reducing the separation from 24-inches to 12-inches, then based on our analysis (assuming RCA base course), underdrains will not be required for the Cyrils Drive improvements.

4.0 UNDERDRAIN RECOMMENDATIONS

If Osceola County deems underdrains to be necessary then, we recommend the following underdrain design guidelines to provide adequate separation between the pavement grades and the estimated seasonal high groundwater levels. Underdrain and cleanout details have been attached for your use.

1. Roadway underdrains should be constructed with a minimum 6-inch diameter underdrain pipe, wrapped with filter fabric (ADS "Drainguard," or equivalent) or smooth wall HDPE pipe without filter sock.
2. Underdrains should be constructed along both sides of the roadways for the portions requiring underdrains to provide separation between the bottom of the base course and the seasonal high groundwater level. UES notes that constructing beneath curbing is acceptable and will not impact the performance of the roadway or curbing.
3. The bottom of the underdrain piping should be placed a minimum of 24-inches below the bottom of base course.
4. The underdrains should be constructed in a trench a minimum of 18-inches wide, with the underdrain centered in the trench. Further, the underdrain trench should extend 6-inches below the invert of the underdrain piping.

5. Backfill placed in the underdrain trench should consist of "clean" filter sand meeting FDOT specifications for filter sand (FDOT Specification 902-4). Filter sand backfill should extend to 12 inches above the top of the underdrain pipe. Backfill above the FDOT filter sand may consist of clean native material, provided these materials contain less than 10 percent soil fines.
6. Prior to the placement of underdrain piping or filter sand backfill, the perimeter of the underdrain trench should be lined with filter fabric (Mirafi 140N, or equivalent) to minimize the potential for intrusion of soil fines from the surrounding subgrade. The filter fabric should completely line the perimeter of the underdrain trench and overlap a minimum of 12 inches at the top of the filter sand backfill. In addition, the top of the filter sand shall be covered with 10-mil polyethylene or 70 lb. felt prior to placing the compacted backfill and topsoil, as shown in the attached underdrain detail.
7. Underdrains should be routed to a positive outfall.
8. Underdrains should include capped and sealed inspection and clean-out ports extending to the ground surface at spacing no greater than 300 feet, at every bend or 45 degrees or greater, and at the terminus of each underdrain segment. We also recommend that a maintenance program be established to flush and inspect the underdrains on a periodic basis. Please note that without a proper maintenance program, the intended performance of the underdrains may be compromised.
9. We recommend installing landscape drains along all medians, landscape areas and along all roadways where irrigation is present to protect the underdrains from excess fines deposits. Please understand that landscape drains are functionally different than roadside underdrains, in that it is intended mostly to handle or capture excess irrigation that could migrate laterally onto the pavement components and eventually compromise the roadway underdrain.
10. We further recommend that all underdrains be installed under the full-time observation of a representative of UES.

5.0 CLOSURE

We appreciate the opportunity to be working with you on this project and look forward to a continued association. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully Submitted,
UNIVERSAL ENGINEERING SCIENCES, LLC
Certificate of Authorization No. 549



Luke Shafer, E.I.
Geotechnical Staff Engineer



Ricardo C. Kiriakidis L., Ph.D., P.E.
Date: 11/12/2020
Geotechnical Department Manager
Florida Registration No. 70602