# Drainage Report

## *Eagle Lake Development Off-Site Roundabout*

## *Old Kings Road*

***Prepared For:***

**Kolter Group Acquisitions, LLC**

***Prepared by:***

Kimley»Horn

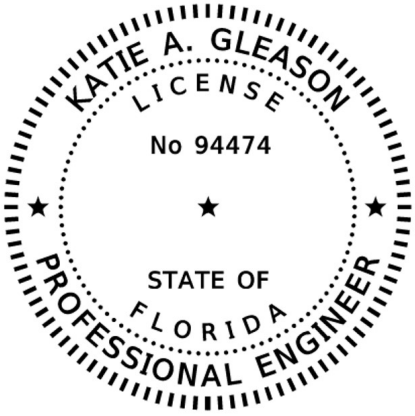
Orlando, FL

July 2023

Kimley»Horn

This drainage report contains engineering information that fulfills the purpose and need for the proposed roundabout at the intersection of Old Kings Road and Bulow Boulevard in Volusia County, Florida. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of transportation engineering as applied through professional judgment and experience.

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Kimley-Horn and Associates Inc., and that I have prepared or approved the evaluation, findings, opinions, conclusions, or technical advice for this project.




This item has been digitally signed and sealed by Katie A. Gleason, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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## LIST OF ATTACHMENTS

Attachment A – Project Location Map

Attachment B – Soils Map

Attachment C – Drainage Map

Attachment D – Ditch Calculations

Attachment E – Spread Calculations

Attachment F – FEMA Floodplain Map

## PROJECT DESCRIPTION

Kolter Group Acquisitions, LLC is proposing a roundabout at the intersection of Old Kings Road and Bulow Boulevard to connect to the proposed development to the west and to maintain traffic flow to the existing entrance to Bulow Plantation (Audubon Way) to the east. This project is located in Flagler County, approximately 3 miles south of the intersection of Old Kings Road and SR 100. A project location map is included in **Attachment A**.

## EXISTING CONDITIONS

Old Kings Road is an existing two-lane undivided roadway with swales on both sides of the road. The project intersection is the high point in the basin. Runoff flows northwest and southeast in the roadside ditches along both sides of the road, eventually draining to existing low points on nearby private property. A soils map is included in **Attachment B** and a drainage map is included in **Attachment C**.

## PROPOSED IMPROVEMENTS

The proposed improvements to the Old Kings Road intersection consist of changing the existing intersection to a single lane modern roundabout. This includes modifying the existing drainage system by regrading the roadside ditch to maintain existing drainage patterns. The total impervious area within the limits of widening in proposed conditions is 0.05 acres less than in existing conditions. See the table provided below for more details:

| | Pre -Development | Post Development |
|---|---|---|
| **Impervious (AC)** | 1.23 | 1.18 |
| **Pervious (AC)** | 1.17 | 1.22 |
| **Total (AC)** | 2.40 | 2.40 |

## DITCH CALCULATIONS

Ditch design calculations have been performed to analyze flow capacity where the existing ditches are being regraded to accommodate the proposed improvements. Proposed ditches have been designed for a 10-year storm event in accordance with Chapter 2.2 of the FDOT Drainage Manual (January 2023). A minimum allowable time of concentration of 10 minutes was used for calculations. All proposed ditches maintain a minimum longitudinal slope of 0.05%, and 0.5 foot of channel freeboard has been provided. All ditch calculations are included in **Attachment D**.

## SPREAD ANALYSIS

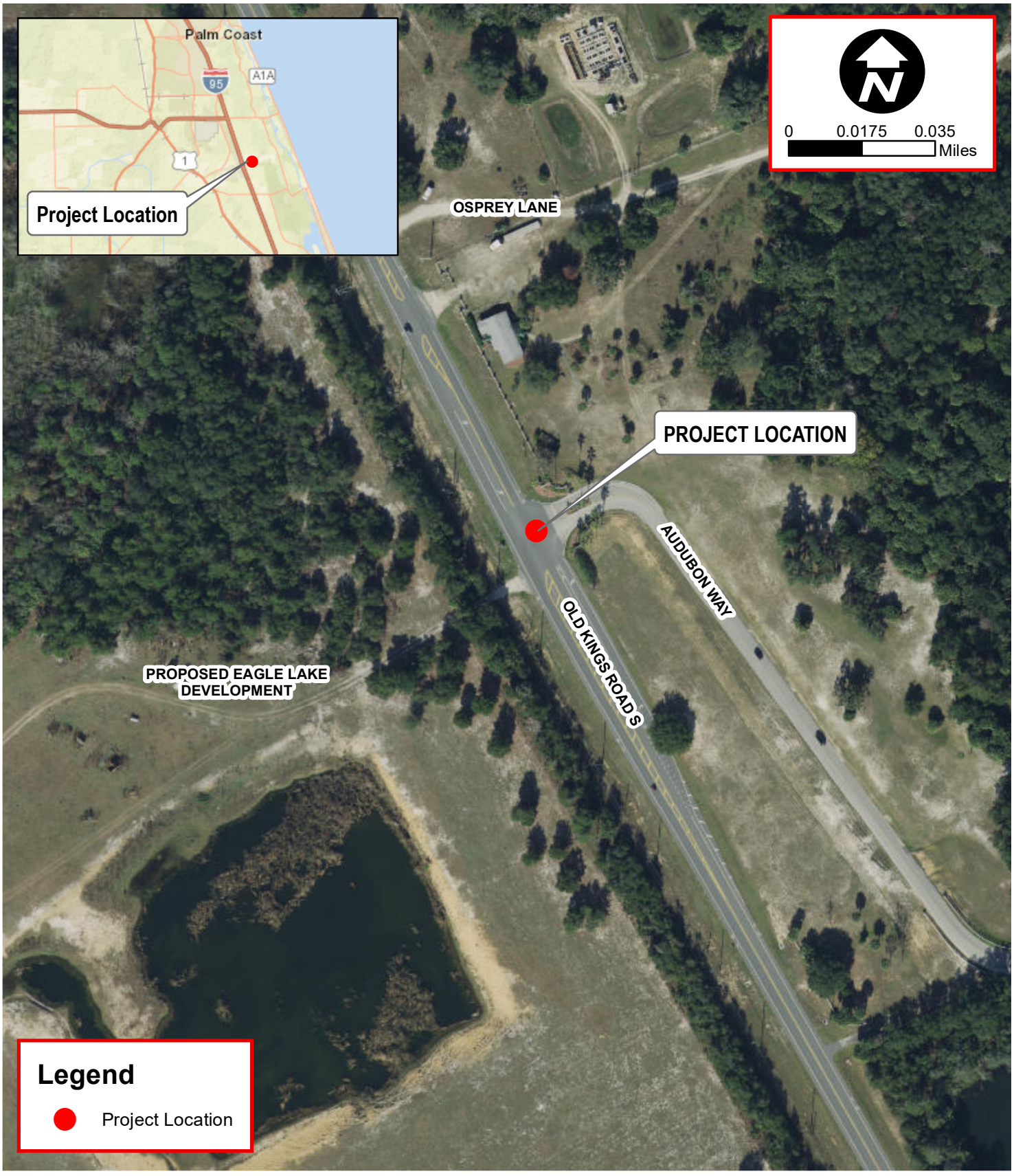
Spread calculations were completed to ensure the proposed improvements meets spread limit criteria. Flume have been placed accordingly to control spread. The design speed of the roundabout approaches is 45 MPH. Spread standards are based on Chapter 3.9 of the FDOT Drainage Manual (January 2023), which states that spread can reach up to half of the lane width. Spread Calculations are included in **Attachment E**.

## FLOODPLAIN

This project is located on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Numbers 12035C0245E (dated 06/06/2018) and 12035C0242E (dated 06/06/2018) in Flagler County. The entire project lies within Zone X, areas determined to be outside the 0.2% annual chance floodplain. The FEMA FIRM map is included in **Attachment F**.

# ATTACHMENT A

Project Location Map

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Sarasota, FL 34236
www.kimley-horn.com CA 00000696

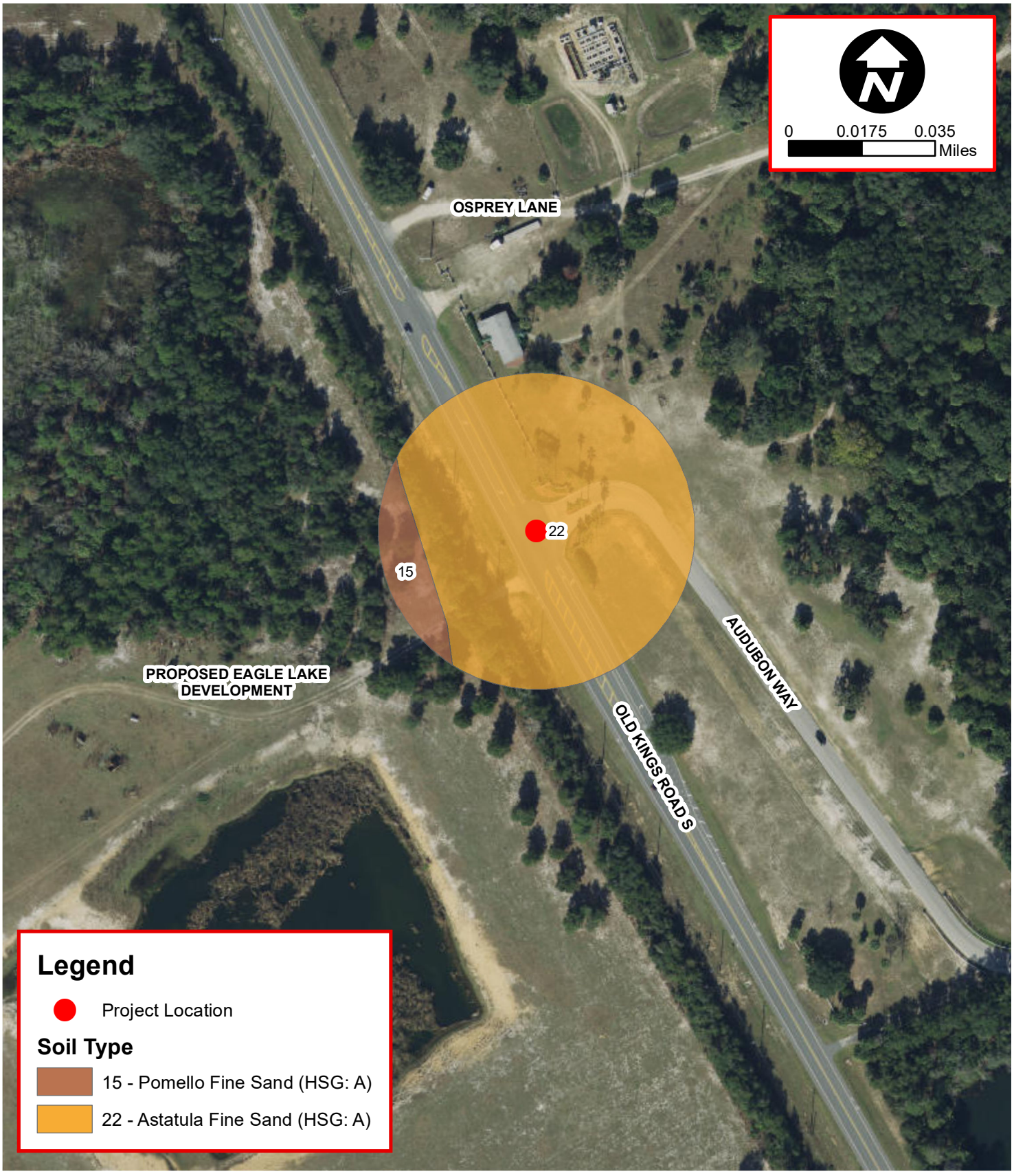
LOCATION MAP

# EAGLE LAKE DEVELOPMENT OFF-SITE ROUNDABOUT

FLAGLER COUNTY, FLORIDA

# ATTACHMENT B

Soils Map

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Sarasota, FL 34236
www.kimley-horn.com CA 00000696

**SOIL MAP**

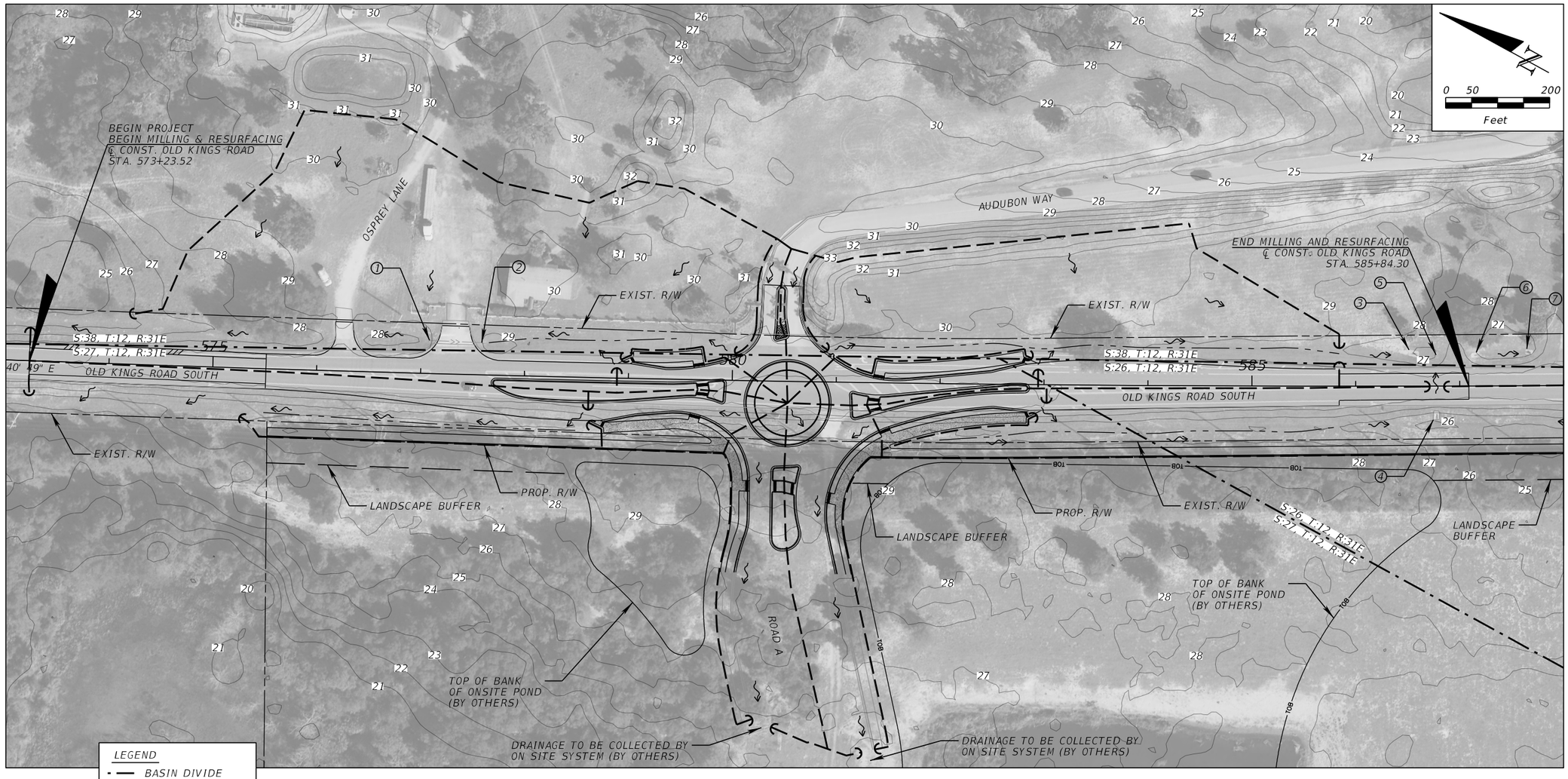
# EAGLE LAKE DEVELOPMENT OFF-SITE ROUNDABOUT

**FLAGLER COUNTY, FLORIDA**

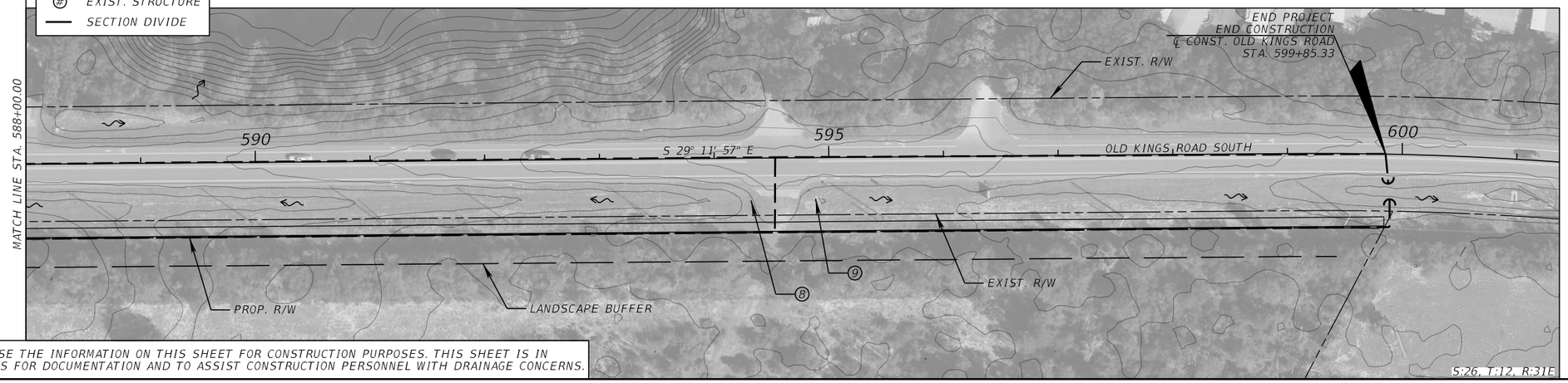
# ATTACHMENT C

Drainage Map

① 15" RCP PIPE FL. 27.08 ② 15" RCP PIPE FL. 27.25 ③ PIPE SIZE UNK. FL. UNK. ④ 24" RCP PIPE FL. 26.07 ⑤ 24" RCP PIPE FL. 26.22 ⑥ PIPE SIZE UNK. FL. UNK. ⑦ PIPE SIZE UNK. FL. UNK. ⑧ PIPE SIZE UNK. FL. UNK. ⑨ PIPE SIZE UNK. FL. UNK.




LEGEND
- BASIN DIVIDE
- FLOW DIRECTION
- # EXIST. STRUCTURE
- SECTION DIVIDE




DO NOT USE THE INFORMATION ON THIS SHEET FOR CONSTRUCTION PURPOSES. THIS SHEET IS IN THE PLANS FOR DOCUMENTATION AND TO ASSIST CONSTRUCTION PERSONNEL WITH DRAINAGE CONCERNS.



| No. | REVISIONS | DATE | BY |
|---|---|---|---|

Kimley»Horn
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REGISTRY No. 696

LICENSED PROFESSIONAL
KATIE A. GLEASON, P.E.
LICENSE NUMBER 94474

| | |
|---|---|
| KHA PROJECT | 249027001 |
| DATE | JANUARY 2023 |
| SCALE: | AS SHOWN |
| DESIGNED BY: | XXX |
| DRAWN BY: | XXX |
| CHECKED BY: | XXX |

# DRAINAGE MAP

EAGLE LAKES SINGLE FAMILY - SOUTH
FLAGLER COUNTY, FLORIDA

SHEET NUMBER

# ATTACHMENT D

Ditch Calculations

Kimley»Horn

| Polynomial Coeffcients : | |
|---|---|
| A = | 10.92111 |
| B = | 0.5171 |
| C = | -0.9348 |
| D = | 0.09473 |

Project: Eagle Lake Road Roundabout

Date: 3/23/2023
Date: 3/23/2023

Zone: 7
Design Event: 10 Yr

Max Vel. 4.00 fps

| Begin Station / Elevation | End Station / Elevation | Side | Longitudinal Slope (%) | Increment Area (ac) | Increment $C_{10}$ | Increment CA | Total CA | $T_c$ (min) | i (in/hr) | Q (cfs) | Ditch Section F.S (1:_) | Ditch Section BW (ft) | Ditch Section BS (1:_) | n | $d_n$ (ft) | Vel (fps) | Ditch Lining | Sidedrain Pipe Area Req. | Allowable $d_n$ (ft) | Remarks (Freeboard) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 578+50.00<br>29.05 | 578+00.00<br>28.90 | RT | 0.300 | 0.17<br>0.10 | 0.95<br>0.20 | 0.18 | 0.18 | 10.00 | 8.31 | 1.50 | 6 | 1.40 | 4 | 0.06 | 0.55 | 0.64 | NO | | 1.20 | 0.65 |
| 578+00.00<br>28.90 | 577+50.00<br>28.45 | RT | 0.900 | 0.03<br>0.03 | 0.95<br>0.20 | 0.04 | 0.22 | 11.30 | 8.03 | 1.77 | 6 | 4.05 | 4 | 0.06 | 0.33 | 0.94 | NO | | 1.28 | 0.94 |
| 577+50.00<br>28.45 | 577+00.00<br>28.00 | RT | 0.900 | 0.03<br>0.04 | 0.95<br>0.20 | 0.04 | 0.26 | 12.18 | 7.85 | 2.04 | 6 | 6.60 | 4 | 0.06 | 0.28 | 0.90 | NO | | 1.20 | 0.92 |
| 577+00.00<br>28.00 | 576+50.00<br>27.55 | RT | 0.900 | 0.03<br>0.04 | 0.95<br>0.20 | 0.04 | 0.30 | 13.11 | 7.68 | 2.30 | 6 | 9.00 | 4 | 0.06 | 0.26 | 0.88 | NO | | 1.20 | 0.94 |
| 576+50.00<br>27.55 | 576+00.00<br>27.25 | RT | 0.600 | 0.03<br>0.04 | 0.95<br>0.20 | 0.04 | 0.34 | 14.06 | 7.51 | 2.55 | 6 | 10.45 | 4 | 0.06 | 0.28 | 0.76 | NO | | 1.40 | 1.12 |
| 576+00.00<br>27.25 | 575+50.00<br>26.95 | RT | 0.600 | 0.03<br>0.04 | 0.95<br>0.20 | 0.04 | 0.38 | 15.15 | 7.32 | 2.78 | 6 | 10.75 | 10 | 0.06 | 0.29 | 0.78 | NO | | 0.98 | 0.68 |

16.52108

| Polynomial Coeffcients : | | |
|---|---|---|
| | A = | 12.49556 |
| | B = | -1.67116 |
| | C = | -0.34901 |
| | D = | 0.05017 |

Project: Eagle Lake Road Roundabout

Date: 3/31/2023
Date: 3/31/2023

Zone: 7
Design Event: 10 Yr

Max Vel. 4.00 fps

| Begin Station / Elevation | End Station / Elevation | Side | Longitudinal Slope (%) | Increment: Area (ac) | Increment: $C_{10}$ | Increment: CA | Total CA | $T_c$ (min) | i (in/hr) | Q (cfs) | Ditch Section: F.S (1:_) | Ditch Section: BW (ft) | Ditch Section: BS (1:_) | n | $d_n$ (ft) | Vel (fps) | Ditch Lining | Sidedrain Pipe Area Req. | Allowable $d_n$ (ft) | Remarks (Freeboard) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 579+80.00<br>29.60 | 579+50.00<br>29.20 | LT | 1.333 | 0.06<br>0.16 | 0.95<br>0.20 | 0.09 | 0.09 | 10.00 | 7.41 | 0.67 | 4 | 5.40 | 4 | 0.06 | 0.15 | 0.75 | NO | | 1.10 | 0.95 |
| 579+50.00<br>29.20 | 579+00.00<br>28.20 | LT | 2.000 | 0.06<br>0.28 | 0.95<br>0.20 | 0.11 | 0.11 | 10.66 | 7.25 | 0.80 | 4 | 6.00 | 4 | 0.06 | 0.14 | 0.89 | NO | | 1.20 | 1.06 |
| 579+00.00<br>28.20 | 578+50.00<br>27.60 | LT | 1.200 | 0.01<br>0.19 | 0.95<br>0.20 | 0.05 | 0.16 | 11.60 | 7.04 | 1.13 | 6 | 6.00 | 4 | 0.06 | 0.19 | 0.82 | NO | | 1.88 | 1.68 |
| 578+50.00<br>27.60 | 578+00.00<br>27.50 | LT | 0.200 | 0.05<br>0.16 | 0.95<br>0.20 | 0.08 | 0.24 | 12.61 | 6.83 | 1.64 | 6 | 5.45 | 4 | 0.06 | 0.42 | 0.52 | NO | | 2.25 | 1.83 |
| 578+00.00<br>27.50 | 577+65.00<br>27.25 | LT | 0.714 | 0.04<br>0.18 | 0.95<br>0.20 | 0.08 | 0.32 | 14.20 | 6.54 | 2.09 | 6 | 5.15 | 4 | 0.06 | 0.34 | 0.87 | NO | 0.52 | 2.18 | 1.83 |

14.86919

Kimley»Horn

| Polynomial Coeffcients : | |
|---|---|
| A = | 12.49556 |
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Project: Eagle Lake Road Roundabout

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 581+10.00<br>29.90 | 581+50.00<br>29.70 | LT | 0.330 | 0.06<br>0.01 | 0.95<br>0.20 | 0.06 | 0.06 | 10.00 | 7.41 | 0.44 | 6 | 9.55 | 4 | 0.06 | 0.13 | 0.35 | NO | | 0.85 | 0.72 |
| 581+50.00<br>29.70 | 582+00.00<br>29.00 | LT | 1.400 | 0.00<br>0.14 | 0.95<br>0.20 | 0.03 | 0.09 | 12.38 | 6.88 | 0.62 | 4 | 10.30 | 4 | 0.06 | 0.10 | 0.62 | NO | | 0.70 | 0.60 |
| 582+00.00<br>29.00 | 582+50.00<br>28.95 | LT | 0.100 | 0.00<br>0.13 | 0.95<br>0.20 | 0.03 | 0.12 | 13.74 | 6.62 | 0.79 | 4 | 4.90 | 3 | 0.06 | 0.37 | 0.35 | NO | | 0.98 | 0.60 |
| 582+50.00<br>28.95 | 583+00.00<br>28.85 | LT | 0.200 | 0.16<br>0.18 | 0.95<br>0.20 | 0.19 | 0.31 | 16.10 | 6.23 | 1.93 | 6 | 6.95 | 4 | 0.06 | 0.41 | 0.53 | NO | | 1.00 | 0.59 |
| 583+00.00<br>28.85 | 583+50.00<br>28.70 | LT | 0.300 | 0.03<br>0.14 | 0.95<br>0.20 | 0.06 | 0.37 | 17.67 | 6.01 | 2.22 | 6 | 9.30 | 4 | 0.06 | 0.34 | 0.60 | NO | | 1.05 | 0.71 |
| 583+50.00<br>28.70 | 584+00.00<br>28.50 | LT | 0.400 | 0.03<br>0.14 | 0.95<br>0.20 | 0.06 | 0.43 | 19.07 | 5.82 | 2.50 | 6 | 8.65 | 4 | 0.06 | 0.35 | 0.70 | NO | | 1.10 | 0.75 |
| 584+00.00<br>28.50 | 584+50.00<br>28.40 | LT | 0.200 | 0.03<br>0.13 | 0.95<br>0.20 | 0.05 | 0.48 | 20.26 | 5.67 | 2.72 | 6 | 10.95 | 4 | 0.06 | 0.39 | 0.54 | NO | | 1.10 | 0.71 |
| 584+50.00<br>28.40 | 585+00.00<br>28.25 | LT | 0.300 | 0.02<br>0.15 | 0.95<br>0.20 | 0.05 | 0.53 | 21.81 | 5.50 | 2.91 | 6 | 13.15 | 4 | 0.06 | 0.33 | 0.60 | NO | | 1.15 | 0.82 |
| 585+00.00<br>28.25 | 585+50.00<br>28.20 | LT | 0.100 | 0.02<br>0.08 | 0.95<br>0.20 | 0.04 | 0.57 | 23.20 | 5.35 | 3.05 | 6 | 14.50 | 4 | 0.06 | 0.44 | 0.42 | NO | | 1.20 | 0.76 |
| 585+50.00<br>28.20 | 585+84.30<br>28.26 | LT | 0.175 | 0.01<br>0.04 | 0.95<br>0.20 | 0.02 | 0.59 | 25.20 | 5.15 | 3.04 | 6 | 7.55 | 4 | 0.06 | 0.52 | 0.57 | NO | | 0.93 | 0.41 |

26.19978

Kimley»Horn

| Polynomial Coeffcients : | |
|---|---|
| A = | 12.49556 |
| B = | -1.67116 |
| C = | -0.34901 |
| D = | 0.05017 |

Project: Eagle Lake Road Roundabout

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Date: 3/23/2023

Zone: 7
Design Event: 10 Yr

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| Begin Station / Elevation | End Station / Elevation | Side | Longitudinal Slope (%) | Increment Area (ac) | Increment $C_{10}$ | Increment CA | Total CA | $T_c$ (min) | i (in/hr) | Q (cfs) | Ditch Section F.S (1:_) | Ditch Section BW (ft) | Ditch Section BS (1:_) | n | $d_n$ (ft) | Vel (fps) | Ditch Lining | Sidedrain Pipe Area Req. | Allowable $d_n$ (ft) | Remarks (Freeboard) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 582+00.00<br>29.50 | 582+50.00<br>28.80 | RT | 0.330 | 0.02<br>0.03 | 0.95<br>0.20 | 0.03 | 0.03 | 10.00 | 7.41 | 0.22 | 4 | 2.55 | 4 | 0.06 | 0.18 | 0.39 | NO | | 1.73 | 1.54 |
| 582+50.00<br>28.80 | 583+00.00<br>27.40 | RT | 2.800 | 0.01<br>0.03 | 0.95<br>0.20 | 0.02 | 0.05 | 12.11 | 6.93 | 0.35 | 4 | 6.25 | 4 | 0.06 | 0.07 | 0.68 | NO | | 2.08 | 2.00 |
| 583+00.00<br>27.40 | 583+50.00<br>27.15 | RT | 0.500 | 0.17<br>0.05 | 0.95<br>0.20 | 0.17 | 0.22 | 13.33 | 6.70 | 1.47 | 6 | 7.30 | 4 | 0.06 | 0.26 | 0.65 | NO | | 2.45 | 2.19 |
| 583+50.00<br>27.15 | 584+00.00<br>27.10 | RT | 0.100 | 0.03<br>0.05 | 0.95<br>0.20 | 0.04 | 0.26 | 14.62 | 6.47 | 1.68 | 6 | 7.45 | 4 | 0.06 | 0.44 | 0.39 | NO | | 2.40 | 1.96 |
| 584+00.00<br>27.10 | 584+50.00<br>27.05 | RT | 0.100 | 0.03<br>0.05 | 0.95<br>0.20 | 0.04 | 0.30 | 16.74 | 6.14 | 1.84 | 6 | 6.70 | 6 | 0.06 | 0.48 | 0.40 | NO | | 2.10 | 1.62 |
| 584+50.00<br>27.05 | 585+00.00<br>27.00 | RT | 0.100 | 0.03<br>0.05 | 0.95<br>0.20 | 0.04 | 0.34 | 18.82 | 5.85 | 1.99 | 6 | 6.15 | 6 | 0.06 | 0.52 | 0.42 | NO | | 1.90 | 1.38 |
| 585+00.00<br>27.00 | 585+50.00<br>26.95 | RT | 0.100 | 0.03<br>0.05 | 0.95<br>0.20 | 0.04 | 0.38 | 20.82 | 5.61 | 2.13 | 6 | 7.05 | 6 | 0.06 | 0.51 | 0.42 | NO | | 1.73 | 1.22 |
| 585+50.00<br>26.95 | 585+84.30<br>26.90 | RT | 0.146 | 0.03<br>0.05 | 0.95<br>0.20 | 0.04 | 0.42 | 22.82 | 5.39 | 2.26 | 6 | 3.75 | 6 | 0.06 | 0.60 | 0.51 | NO | | 1.58 | 0.98 |
| | | | | | | | | 23.93511 | | | | | | | | | | | | |

# ATTACHMENT E

Spread Calculations

# Eagle Lake Road Roundabout

## Proposed Gutter Spread Calculations

**Q (cfs) = (0.56/n)*$S_x$^(1.67)*S^(0.5)*T^(2.67)**

Design Speed = 45 MPH (RAB Approach Design Speed)

Spread Criteria = Keep 1/2 of lane clear

| Structure ID | Structure Sta (ft) | Side | Total Area (Ac) | Basin Area c=0.95 (Ac) | Basin Area c=0.25 (Ac) | I Intensity (in/hr) | Q Flow (cfs) | $S_x$ Cross Slope (ft/ft) | S Longitudinal Slope (ft/ft) | n Manning's | $T_{calc}$ Spread (ft) | $T_{allowable}$ Spread (ft) | Status | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| End of Curb | 578+60 | RT | 0.200 | 0.140 | 0.060 | 4.00 | 0.592 | 2.000% | 0.300% | 0.016 | 7.42 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |
| | | | | | | | | | | | | | | |
| End of Curb | 578+90 | LT | 0.110 | 0.080 | 0.030 | 4.00 | 0.334 | 2.000% | 0.300% | 0.016 | 5.99 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |
| | | | | | | | | | | | | | | |
| Flume | 580+00 | LT | 0.100 | 0.070 | 0.030 | 4.00 | 0.296 | 2.300% | 0.300% | 0.016 | 5.24 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |
| | | | | | | | | | | | | | | |
| Flume | 581+00 | LT | 0.080 | 0.070 | 0.010 | 4.00 | 0.276 | 2.000% | 0.300% | 0.016 | 5.57 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |
| | | | | | | | | | | | | | | |
| End of Curb | 582+90 | LT | 0.180 | 0.150 | 0.030 | 4.00 | 0.600 | 2.000% | 0.300% | 0.016 | 7.46 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |
| | | | | | | | | | | | | | | |
| End of Curb | 583+00 | RT | 0.130 | 0.110 | 0.020 | 4.00 | 0.438 | 2.000% | 0.300% | 0.016 | 6.63 | 7.50 | OK | 1/2 Lane Width + Type F C&G = 6' + 1.5' |

# ATTACHMENT F

FEMA Floodplain Map

# National Flood Hazard Layer FIRMette

FEMA

81°9'41"W 29°26'19"N


81°9'3"W 29°25'48"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

*Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/23/2023 at 4:32 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.