

# DRAINAGE MEMORANDUM

## Maricopa Road (State Route 347): Riggs Road Traffic Interchange

Prepared for:

***Arizona Department of Transportation  
Infrastructure Delivery and Operations Division***



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RIGGS ROAD TRAFFIC INTERCHANGE

NOVEMBER 2024

Prepared By:

**Kimley»»Horn**

## Contents

1.0	Introduction .....	1
1.1.	Project Location .....	1
1.2.	Background .....	1
1.3.	Purpose .....	1
2.0	Concept Plan Development .....	1
2.1.	Local Watershed .....	1
2.2.	Floodplain Locations .....	1
2.3.	Previous Drainage Studies .....	1
3.0	On-Site Drainage.....	4
3.1.	Existing On-Site Drainage Features .....	4
3.2.	Design Criteria .....	4
3.3.	Proposed On-Site Drainage Features.....	4
3.4.	First Flush Requirements .....	4
4.0	Off-Site Drainage.....	4
4.1.	Existing Off-Site Drainage Features .....	4
4.2.	Proposed Off-Site Drainage Features.....	5
4.3.	Offsite Hydrology Model.....	5
4.4.	USGS Mapping .....	6
4.5.	Rainfall .....	6
4.6.	Hydraulic Structures .....	6
5.0	Results .....	7
6.0	References.....	8

## Figures

Figure 1.	Location Map .....	2
Figure 2.	Vicinity Map.....	3

## Tables

Table 1:	50-year Culvert Flow Summary .....	5
Table 2:	100-year Culvert Flow Summary .....	5
Table 3:	Soil Green and Ampt Parameters .....	7
Table 4:	Land Use Green and Ampt Parameters.....	7

## Appendices

Appendix A – FLO-2D Results

Appendix B - Hydrology Exhibits

## 1.0 NO TABLE OF FIGURES ENTRIES FOUND.INTRODUCTION

### 1.1. PROJECT LOCATION

The project improvements consist of providing a grade separated interchange on Maricopa Road/State Route (SR 347) at Riggs Road near milepost 185.29. The project is located within the Arizona Department of Transportation (ADOT) Central District within Maricopa County in south-central Arizona.

### 1.2. BACKGROUND

SR 347 is classified as a principal arterial highway with partial control of access. It is a major highway corridor in central Arizona, connecting the City of Maricopa to the Phoenix metropolitan area. The growing traffic demand has caused the SR 347 corridor to become increasingly congested during the morning and evening peak travel periods, and growth projections indicate congestion will worsen in the future. The increase in congestion and high speeds along the corridor contribute to higher rates for rear end collisions due to the signal and unexpected lengths of queuing. Improvements are needed that address the congestion and safety concerns. The purpose of this project is to evaluate the alternatives to reduce travel time, enhance regional mobility, improve safety by providing free-flow mainline movements along SR 347 by reconstructing the existing intersection at SR 347 and Riggs Road to a grade separated interchange. The primary goal of the project is to recommend a preferred alternative for constructing a TI at the intersection. A Design Concept Report (DCR) is being prepared to evaluate the proposed improvements and possible alternatives.

### 1.3. PURPOSE

The purpose of this report is to document the existing conditions and proposed drainage improvements within the project limits.

## 2.0 CONCEPT PLAN DEVELOPMENT

### 2.1. LOCAL WATERSHED

The existing topography through the project limits and surrounding area is undeveloped and slopes from southeast to northwest towards the Gila River. The surrounding undeveloped areas are located within the Gila River Indian Community (GRIC)

### 2.2. FLOODPLAIN LOCATIONS

The project is in Flood Insurance Rate Maps (FIRM) for Maricopa County, Arizona and incorporated areas, Panel Number 04013C3100L which was not printed. Therefore, there are no floodplains within the project limits.

### 2.3. PREVIOUS DRAINAGE STUDIES

At the time of this report, no drainage reports were located or reviewed for the project limits.

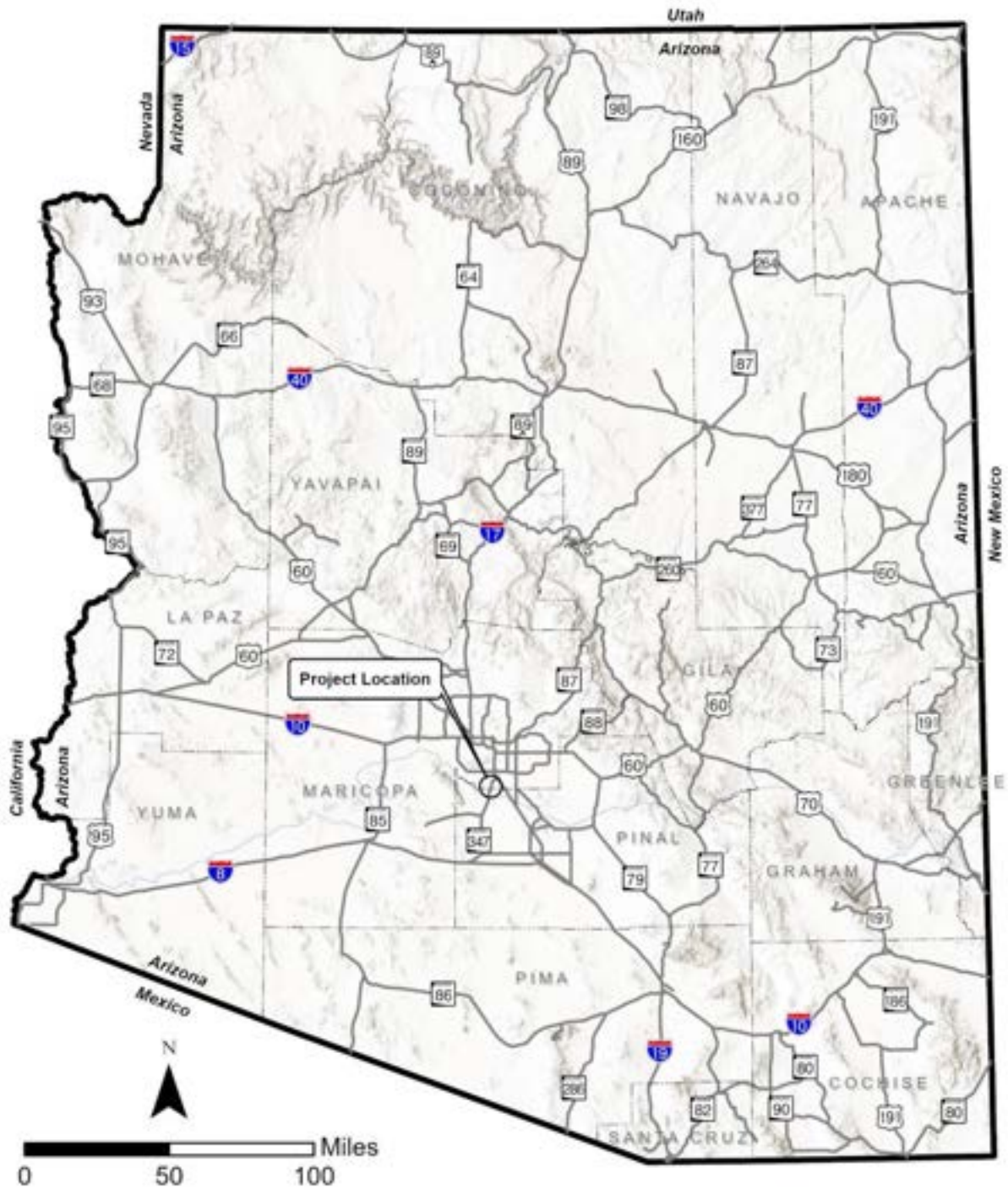


Figure 1. Location Map

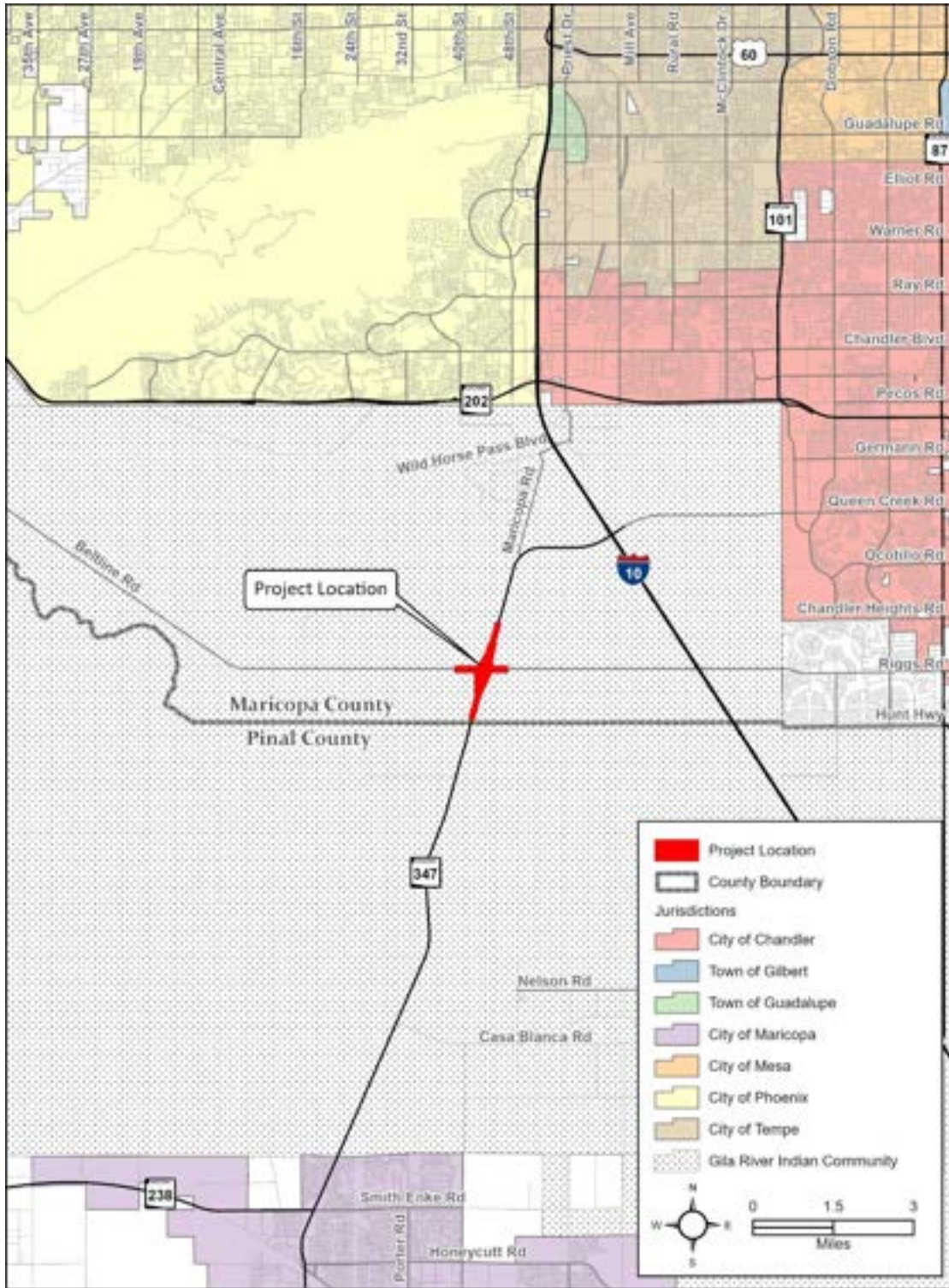


Figure 2. Vicinity Map



## 3.0 ON-SITE DRAINAGE

### 3.1. EXISTING ON-SITE DRAINAGE FEATURES

The mainline of SR-347 is a divided highway without curb and gutter throughout the limits of the project. The depressed median areas do not have any method of conveying runoff from the median. Riggs Road does not have any curb and gutter throughout the project limits. Pavement runoff sheet flows off the existing pavement into roadside areas. There is no on-site drainage infrastructure within the project limits.

### 3.2. DESIGN CRITERIA

The Rational Method will be used to calculate on-site peak discharges. A minimum time of concentration of 10-minutes will be used. The ADOT Roadway Design Guidelines (RDG) classifies SR-347 as a Class 3 highway. SR347 could be upgraded to Class 2 based on recent discussions with ADOT. Class 2 highways are required to convey the 50-year storm event for cross-culverts and offsite flows.

### 3.3. PROPOSED ON-SITE DRAINAGE FEATURES

No curb and gutter are being included with the improvements. Multiple alternatives are being evaluated for the grade separated interchange. Each of the alternatives will require onsite drainage improvements to drain the new infield areas. Area drains with small storm drains at low points in the infield areas will connect to the culverts. On-site improvements will be similar for all alternatives, and therefore ultimately the preferred alternative. Additional refinements or updates once the preferred alternative is selected shall be included in the Final Draft of this memorandum.

### 3.4. FIRST FLUSH REQUIREMENTS

Based on communications with GRIC Flood Control, first flush treatment basins are required with the preferred alternative. The basins will be designed to collect the adjacent sheet flow runoff from the roadway. The basins will be dissipated in 36-hours and infiltration testing will be completed. The basins will ultimately discharge to the storm drain system that will connect to the adjacent offsite culverts.

## 4.0 OFF-SITE DRAINAGE

### 4.1. EXISTING OFF-SITE DRAINAGE FEATURES

The land adjacent to SR-347 and Riggs Road is undeveloped and slopes from southeast to northwest towards the Gila River. Two concrete box culverts exist near the Riggs Rd TI. A three (3) barrel 6'x3' culvert is located approximately 80 feet north of Riggs Rd Centerline. A cattleguard passes runoff from the southeast corner of the intersection to the northeast corner where the existing culvert discharges into a channel along the north side of Riggs Road. A single barrel 8'x3' culvert is located approximately 915 feet south of Riggs Rd TI. The runoff continues west before ultimately reaching the Gila River. During a site visit on December 22, 2022, the concrete box culverts looked to be in very good condition with no areas of concern. Discussions with the District maintenance staff indicated that there have been no known incidents of flooding or damage from storm events in the past.



## 4.2. PROPOSED OFF-SITE DRAINAGE FEATURES

The drainage design approach for the TI improvements is to maintain capacity through the TI and not negatively impact the downstream patterns in the post-project conditions. SR-347 has a Class 3 drainage classification according to the ADOT roadway design guidelines. Class 3 roadways are required to pass the 25-year storm event with no overtopping. SR 347 could be upgraded to Class 2 in the near future based on recent discussions with ADOT. Class 2 highways are required to convey the 50-year storm event for cross-culverts and offsite flows. The existing culvert crossing under SR-347, north of Riggs Road, will be removed with the improvements. The results of the offsite hydrologic modeling were used to size a new culvert across SR-347. The new culvert is a 1-36-inch pipe culvert. A new channel will be constructed at the northwest corner to connect to the existing channel. The other culverts within the project are being extended for the TI improvements.

## 4.3. OFFSITE HYDROLOGY MODEL

An offsite hydrology model was prepared using FLO-2D. The watershed extended east of I-10 and downstream of SR-347 for approximately one (1) mile. The FLO-2D model used 15'x15' grid cells. The existing conditions was modelled for both the 50- and 100-year storm event. Each of the alternatives was also modelled for the 50- and 100-year storm events. Refer to **Appendix A** for model results. The following tables summarize the 50- and 100-year flows through the existing culverts.

**Table 1: 50-year Culvert Flow Summary**

Culvert Name	Culvert Location	50-year Peak Discharge (cfs)
Culv347-N2	Culvert north of Riggs Road under SR347	3
Culv347-N	Culvert at the Riggs Road Intersection under SR347	7
Culv347-S	Culvert south of Riggs Road Intersection under SR347	66

**Table 2: 100-year Culvert Flow Summary**

Culvert Name	Culvert Location	100-year Peak Discharge (cfs)
Culv347-N2	Culvert north of Riggs Road under SR347	3
Culv347-N	Culvert at the Riggs Road Intersection under SR347	12
Culv347-S	Culvert south of Riggs Road Intersection under SR347	98

#### 4.4. USGS MAPPING

United States Geological Society (USGS) 2022 mapping was used to develop a terrain. A gridded 2'x2' DEM was generated for the entire watershed.

#### 4.5. RAINFALL

The 50- and 100-year 6-hour rainfall depths were obtained from National Oceanic and Atmospheric Administration Atlas 14 (NOAA 14). The 50- and 100-year rainfall depths are 2.28 and 2.55 inches respectively. The 6 and 24-hour storm durations were evaluated, and the 6-hour storm duration generates the highest peak flow.

#### 4.6. HYDRAULIC STRUCTURES

The upstream watershed extends east of Interstate 10 (I-10). The existing culverts under SR-347 were included as general culvert equations in FLO-2D.

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#### Green and Ampt Parameters

Green and Ampt parameters were assigned for the watershed using NRCS soils and existing land uses. The soil data was downloaded from the ADOT Soil Data with predefined Green and Ampt predefined hydrology parameters for the Gila River Indian Reservation, AZ and Parts of Maricopa and Pinal County Soil Survey (NRCS Soil Survey AZ658). The watershed land use consists of mostly undeveloped desert range land. There is an industrial site west of SR347 and north of Riggs that was also included in the land use. The land use parameters were assigned based on the Flood Control District of Maricopa County (FCDMC) Hydrology Manual. The soil and land use Green and Ampt parameters are shown in the following tables. For the soils, XKSAT is the hydraulic conductivity, PSIF is the Suction, DTHETA is the initial soil moisture deficit. Per the land use, the initial soil moisture is dry for all land uses found within the watershed. The soils and land use exhibits are provided in **Appendix B**.

**Table 3: Soil Green and Ampt Parameters**

NRCS Soil Survey	MUSYM	MUKEY	Soil Name	XKSAT (in/hr)	PSIF (in)	Rock Outcrop (%)	DETHETA (Dry) Unitless	Limiting Infiltration Depth (ft)
AZ658	20	54279	Kamato complex, 0 to 5 percent slopes	0.22	8.68	0	0.28	0.25
AZ659	21	54281	Kamato loam, 0 to 2 percent slopes	0.1	18.31	0	0.26	0.25
AZ660	32	54305	Shontik-Redun complex, 0 to 3 percent slopes	0.79	4.3	0	0.33	0.25
AZ661	33	54307	Tatai silt loam, 0 to 2 percent slopes	0.18	23.94	0	0.3	0.25
AZ662	34	54309	Trix loam, saline-sodic, 0 to 1 percent slopes	0.38	11.75	0	0.33	0.25
AZ663	7	54334	Casa Grande complex, 0 to 5 percent slopes	0.17	8.84	0	0.28	0.25
AZ664	8	54336	Casa Grande fine sandy loam, 0 to 3 percent slopes	0.75	3.47	0	0.33	0.25

The Surface Detention Parameter (TOLGLOBAL = 0.004ft = 0.05inches) was subtracted from the initial abstraction to not double count the initial loss parameter in FLO-2D. The TOLGLOBAL value prescribes the flow depth for a floodplain or channel grid element below which no flood routing will be performed. TOLGLOBAL is analogous to the initial rainfall abstraction.

**Table 4: Land Use Green and Ampt Parameters**

Land Use	Initial Abstraction (in)	Percent Impervious (%)	Initial Saturation Condition	Manning's n-Value
Desert Rangeland	0.35	0	Dry	0.040
Industrial	0.15	55	Dry	0.035

## 5.0 RESULTS

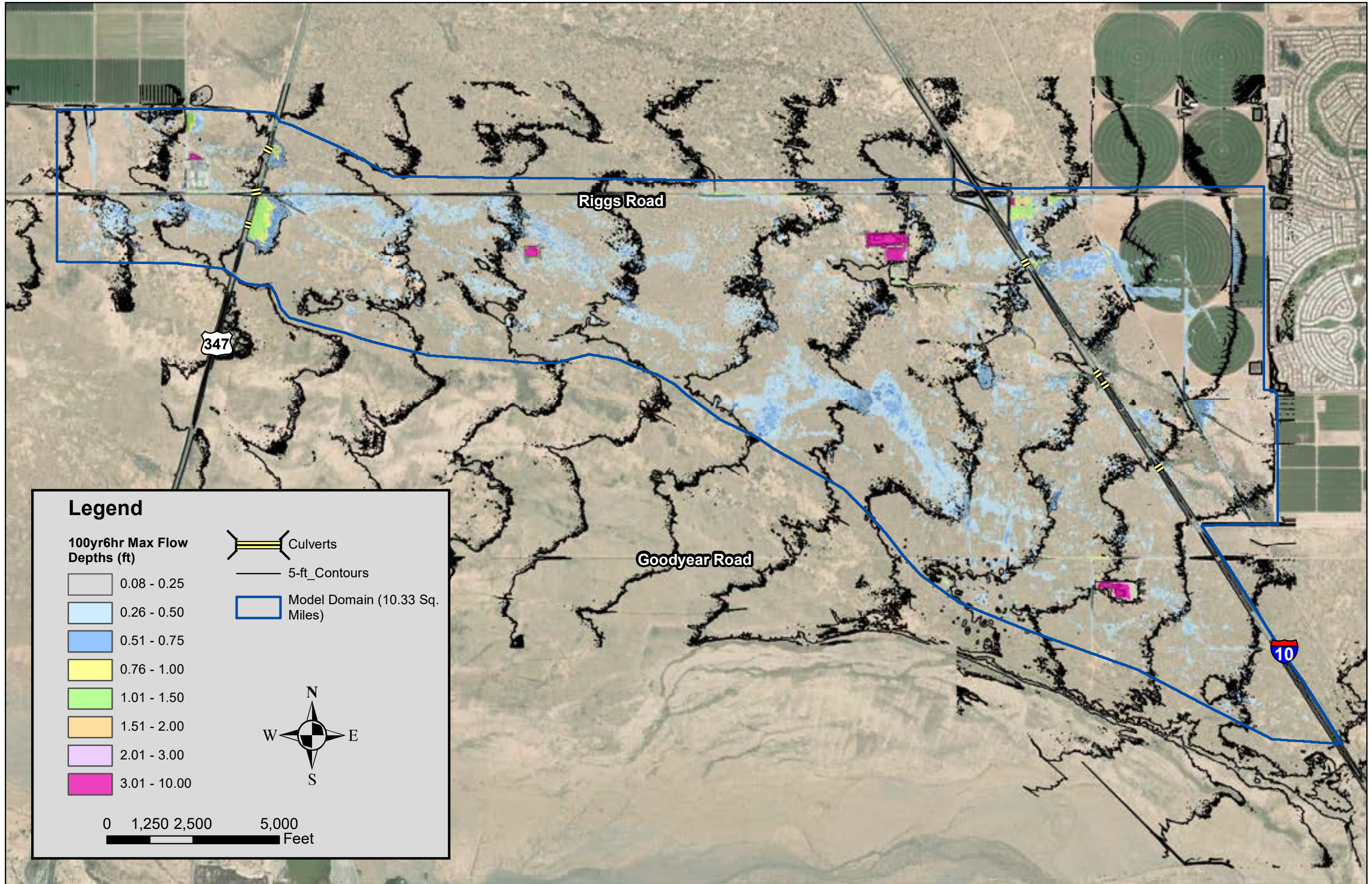
The results of the model showed no overtopping along SR-347. Runoff ponds along SR-347 before discharging through the intersection from the existing culverts. There is an existing cattle guard east of SR347 that bleeds flow from the southeast corner to the northeast corner of the intersection and flow is routed to the existing culvert that crosses SR347 immediately north of Riggs Road. This culvert discharges to an existing roadside swale and flows to the west adjacent to the existing industrial site to the north of Riggs Road.

## 6.0 REFERENCES

- Arizona Department of Transportation, *Highway Drainage Design Manual, Volume 2 - Hydrology* revised 2014
- Arizona Department of Transportation, Roadway Engineering Group, *Roadway Design Guidelines*, May 2012
- Arizona Department of Transportation, *Post-Construction Best Management Practices Manual for Water Quality*, January 2016
- Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydrology*, revised 2013.
- Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydraulics*, revised 2013.
- Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, revised 2016.
- Federal Highway Administration, *Hydraulic Engineering Circular No. 22, Urban Drainage Design Manual – Third Edition*, September 2009
- National Oceanic and Atmospheric Administration, NOAA Atlas 14, *Precipitation-Frequency Atlas of the United States*, 2011

## Appendix A – FLO-2D Results





**Legend**

**100yr6hr Max Flow Depths (ft)**

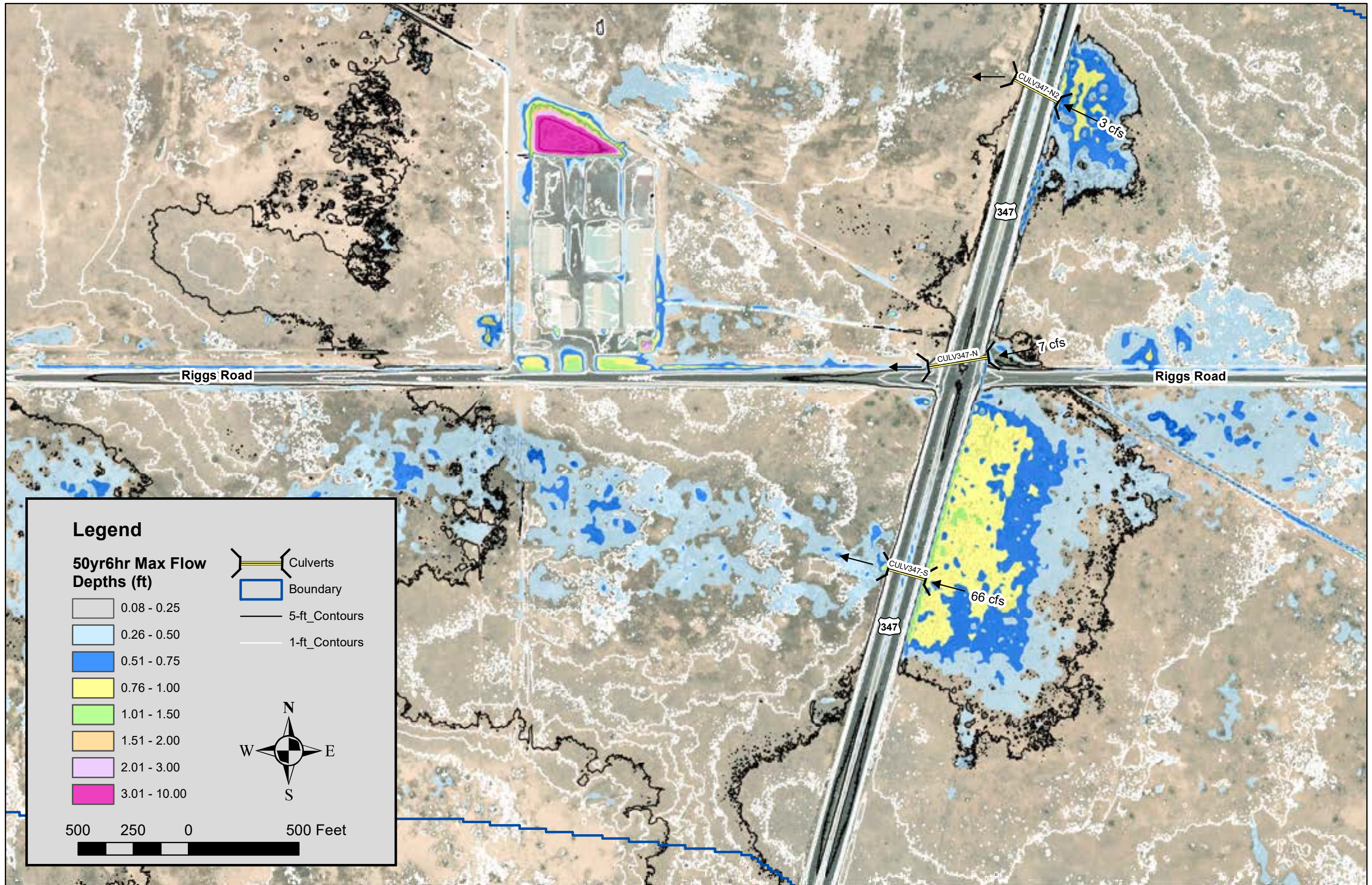
0.08 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 3.00
3.01 - 10.00

Culverts  
 5-ft Contours  
 Model Domain (10.33 Sq. Miles)

0 1,250 2,500 5,000  
 Feet

SCALE: 1" = 30.00 FT	DESIGNED BY: ATC	NO.	DATE	APPR.
SCALE: 1" = 30.00 FT	CHECKED BY: ZRS	NO.	DATE	APPR.
PROJECT NO. 291749000				
DRAWING NAME EX1				
EXISTING RIGGS TI 100yr-6hr Flow Depths Overall Map				
Kimley & Horn 2022 KIMLEY-HORN AND ASSOCIATES, INC. Engineering, Planning and Environmental Consultants 7740 North 16th Street, Suite 300 Phoenix, Arizona 85020 (602) 944-5500				
REVISION NO. BY DATE APPR.				





**Legend**

**50yr6hr Max Flow Depths (ft)**

0.08 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 3.00
3.01 - 10.00

Culverts  
 Boundary  
 5-ft\_Contours  
 1-ft\_Contours

500    250    0                      500 Feet

NO.	REVISION	BY	DATE	APPR.

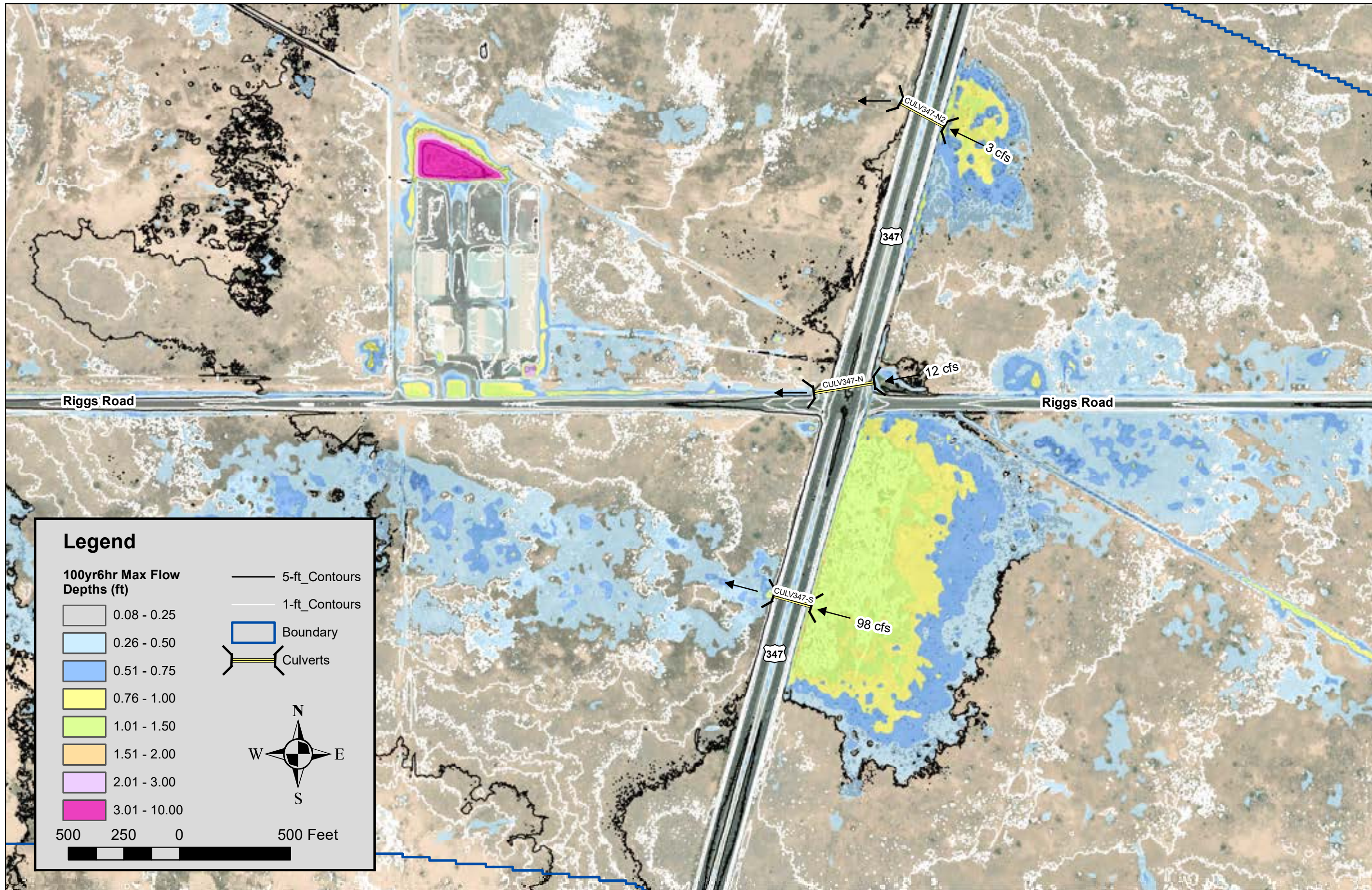
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 Engineering, Planning and Environmental Consultants  
 7740 North 16th Street, Suite 300  
 Phoenix, Arizona 85020 (602) 944-5500

SCALE: HORIZ. = 1" = 500 FT  
 SCALE: VERT. = 1" = 5 FT  
 DESIGNED BY: ATC  
 CHECKED BY: ZRS  
 DATE: 01/09/2023

Existing Riggs TI  
 50yr-6hr Flow Depths

PROJECT NO.  
 291749000  
 DRAWING NAME  
 EX-3





**Legend**

**100yr6hr Max Flow Depths (ft)**

0.08 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 3.00
3.01 - 10.00

5-ft\_Contours  
1-ft\_Contours  
Boundary  
Culverts

N  
W E  
S

500 250 0 500 Feet

NO	REVISION	BY	DATE	APPR.

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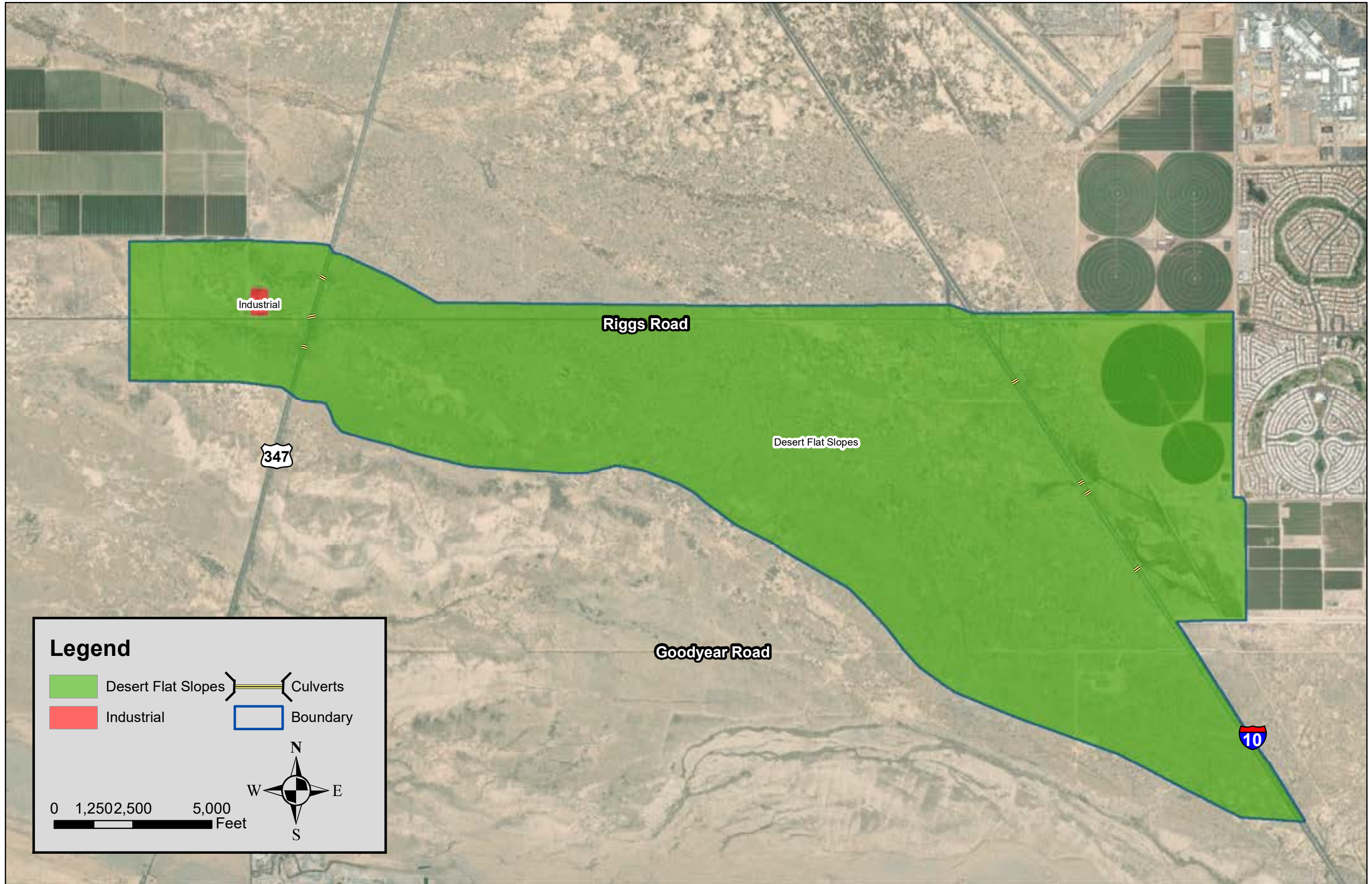
SCALE: (H) 1" = 500 FT  
 SCALE: (V) 1" = 5 FT  
 DESIGNED BY: ATC  
 CHECKED BY: ZRS  
 DATE: 01/09/2023

Existing Riggs TI  
 100yr-6hr Flow Depths

PROJECT NO. 291749000
DRAWING NAME EX-2



## **Appendix B – Hydrology Exhibits**



**Legend**

Desert Flat Slopes
  Industrial

Boundary
  Culverts

0 1,250 2,500 5,000 Feet

N  
 W —+— E  
 S

NO	REVISION	BY	DATE	APPR.

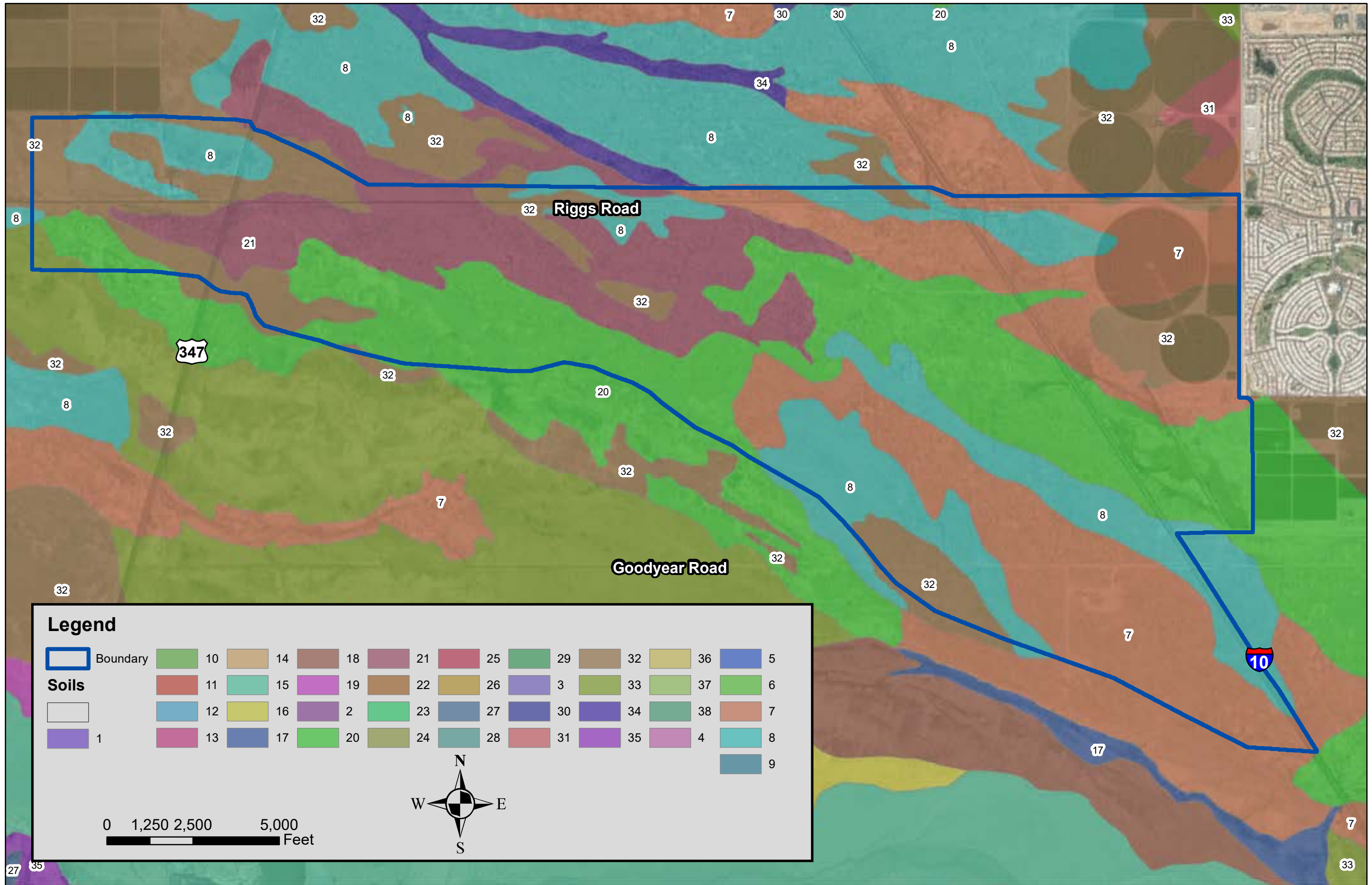
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SCALE: HORIZONTAL = 1" = 500.00 FT
DESIGNED BY: ATC
CHECKED BY: ZRS
DATE: 01/30/2023

**SR347 & Riggs TI  
 Land Use Map**

PROJECT NO. 291749000
DRAWING NAME LU





**Legend**

Boundary: [Blue line symbol]

**Soils**

[Green]	10	[Light Blue]	14	[Light Green]	18	[Light Purple]	21	[Light Yellow]	25	[Light Blue-Gray]	29	[Light Brown]	32	[Light Yellow-Green]	36	[Light Blue]	5
[Light Red]	11	[Light Green]	15	[Light Purple]	19	[Light Brown]	22	[Light Yellow]	26	[Light Purple]	3	[Light Green]	33	[Light Green]	37	[Light Green]	6
[Light Blue]	12	[Light Yellow]	16	[Light Purple]	2	[Light Green]	23	[Light Blue-Gray]	27	[Light Purple]	30	[Light Purple]	34	[Light Green]	38	[Light Red]	7
[Light Purple]	1	[Light Pink]	13	[Light Blue]	17	[Light Green]	20	[Light Yellow-Green]	24	[Light Blue-Gray]	28	[Light Red]	31	[Light Purple]	35	[Light Pink]	4
												[Light Purple]	35	[Light Pink]	4	[Light Blue-Gray]	9

Scale: 0 1,250 2,500 5,000 Feet

North Arrow

NO.	REVISION	BY	DATE	APPR.

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SCALE: 1"=30.00 FT  
 DESIGNED BY: ATC  
 CHECKED BY: ZRS  
 DATE: 01/12/2023

**SR347 & Riggs TI  
Soils Map**

PROJECT NO.: 291749000  
 DRAWING NAME: EX1