DRAINAGE COMPLAINT

S.R. 29
From North of S.R. 78 to Chaparral Slough
(M.P. 4.709 – 6.877)

Reference No. 05090-1

Prepared for:

Florida Department of Transportation
District 1

Prepared By:

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January 2010

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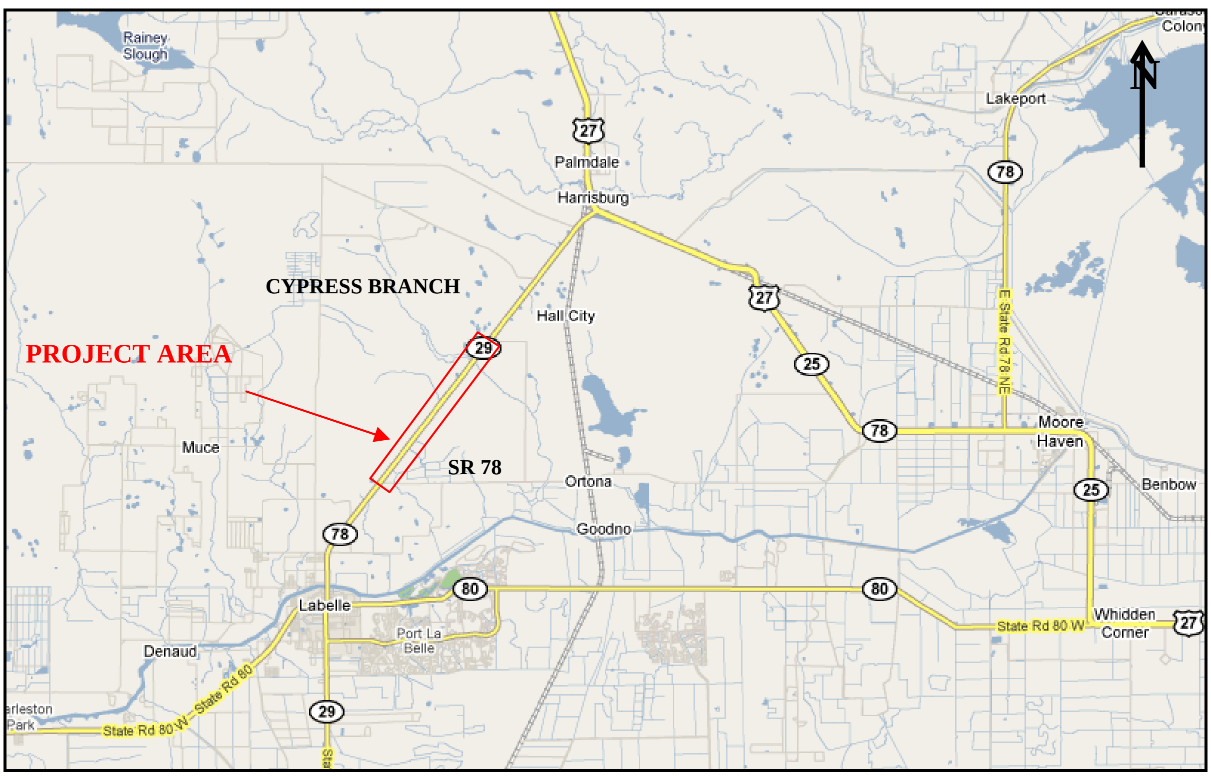
1.0 INTRODUCTION

The Florida Department of Transportation (FDOT), District One, has gathered drainage complaints from residents and maintenance staff throughout the district and compiled them into a drainage complaint inventory. The recorded complaints were ranked in importance based on frequency and severity of flooding as well as roadway classification and traffic data. This document specifically focuses on one particular drainage complaint in Glades County, Florida along State Road (S.R.) 29 from north of S.R. 78 to Chaparral Slough (see **Appendix A**). A location map is contained in **Figure 1**.

S.R. 29 is a major north/south connector between Labelle and Harrisburg. If this roadway is forced to close, traffic will have to be detoured either west to S.R. 731 or east along S.R. 78 to S.R. 25. Either option will require traffic to detour miles out of the way to other facilities that may also encounter flooding during these times.

The purpose of this report is to document the causes for the flooding problems along S.R. 29 as reported in the drainage complaint. It will also provide potential solutions, cost estimates and recommendations for mitigation.

Figure 1: Location Map



2.0 BACKGROUND RESEARCH

S.R. 29 is a two-lane undivided roadway with 5-ft paved shoulders and roadside ditches. The traffic volumes are medium. Water periodically encroaches the roadway as close as six feet from the travel lane between Lone Pine Creek and Cypress Branch bridges (Milepost (M.P.) 5 and M.P. 6). During severe storm events, water has overtopped the roadway.

Adjacent properties and ditches continually flood. The surrounding terrain is relatively flat. While the flow patterns are draining south to the Caloosahatchee River, there are no well defined channels. The adjacent properties are owned by Lykes Brothers and little to no maintenance has been performed over the years.

There are two cross drains and two bridges within the study area. As illustrated in the Straight Line Diagrams (**Appendix B**), the bridge over Lone Pine Creek is at M.P. 4.709, a triple 30" RCP at M.P. 5.500, a triple 36" RCP at M.P. 6.237 and the bridge over Cypress Branch is at M.P. 6.848. In 1977, the cross drains were extended out 24' on both sides to the right of way as part of a resurfacing project. The existing pipes remained in place.

These crossings are located within FEMA Floodplain Zone A (see **Appendix C**). Flooding of S.R. 29 has been observed at this location as far back as 1970. The drainage inventory provided by the FDOT notes that severe flooding and roadway encroachment has only occurred twice in the past 10 years during the rainy season. During their investigation, FDOT Drainage collected rainfall data from August 18th through August 21st, year unknown, and conducted a field review. The gage data obtained is shown in **Table 1** below.

Table 1: Rainfall Data

Duration	Rainfall	Frequency (per FDOT Drainage)
1 Day	3.0 in.	10 Year
2 Day	6.4 in.	25 Year
4 Day	7.7 in.	10 Year

The FDOT staff noted overtopping in the ditches and that the surrounding properties were flooded. The bridges at Lone Pine Creek and Cypress Branch were free of debris and appeared to be flowing full. The triple 30" cross drain and the triple 36" cross drain appeared to be free of debris as well. No damage was observed at the drainage structures.

A scour report was obtained for bridge number 050033 (Cypress Branch Bridge). Cypress Branch is a riverine waterway that flows perennially. The velocity measured at the bridge during a field review was less than one foot per second. All piles and bents have no known lengths or embedments. The measured scour over 10 years is 5.8 feet. Therefore, the bridge was given a medium priority scour susceptible rating. There were no scour reports available for the Lone Pine Creek Bridge number 050035.

A field meeting was held with FDOT Maintenance staff of July 1, 2009 (see **Appendix D**). Mr. John Anderson pointed out the areas of concern and how the historical and existing flow patterns function. He indicated that flooding in the area is a major concern and occurs on a yearly basis, more often than originally indicated. In fact, the road flooded over the July 4th weekend and the traffic had to be rerouted. Another field review was conducted on July 22, 2009 to follow up on the recent flooding and to photograph the area (see **Appendix E**).

3.0 FINDINGS

An initial overview of the drainage complaint revealed that the rainfall frequencies measured in the field by FDOT drainage do not closely match the frequencies provided in the Drainage Manual for the area. See a comparison in **Table 2** below.

Table 2: Rainfall Comparison

Duration	Frequency	Rainfall (per FDOT review)	Rainfall (Precipitation Data-Drainage Manual)
1 Day	10 Year	3.0 in.	7.0 in.
2 Day	25 Year	6.4 in.	9.5 in.
4 Day	10 Year	7.7 in.	9.0 in.

According to FDOT Maintenance, the major flooding occurs at the two cross drains. The triple 30" cross drain floods more severely than the triple 36" cross drain. The two bridges at Lone Pine Creek and Cypress Branch appear to be functioning properly. The field reviews and analysis confirm this initial observation.

The original 1956 drawings, more recent resurfacing plans, and Lone Pine Creek Bridge widening plan sets were obtained from the FDOT Maintenance Office. The original drainage maps were reviewed and still appear to be appropriate (see **Appendix F**).

Based on the performed cross drain analysis (see **Appendix G**), the triple 30" cross drain appears to be undersized. This cross drain backs up and in turn floods the triple 36" cross drain upstream. Both cross drains are severely silted in, as well as the adjacent ditches, the flow path along the right of way fence. The photographs taken on July 22, 2009 (see **Appendix E**) show the water elevations approaching the top of the endwalls. The amount of silt could not be measured due to the amount of standing water present. The build up of sediment could easily be blocking flow through the pipe and even preventing water from reaching the outfall. The joints where the pipes were extended could have shifted or collected debris and in turn also cause the cross drains to flood. Furthermore, the high water elevation for the triple 30" pipes is at 35.3 ft. This is almost two feet higher than the high water elevation for the triple 36" and both bridges. The high water values were taken from the original 1956 drainage map (**Appendix F**), and still seem reasonable based on present conditions. Flow lines for both cross drains are at an approximate elevation of 30 feet. Pictures taken in the field show the water level to be at the crown of the pipe for both cross drains. This would equate to a water elevation of approximately 33 feet. Since the pictures were taken during the wet season, the water elevation closely coincides with the high water elevations.

The side drain pipe to the north of the Lone Pine Creek Bridge may also be undersized. According to the photographs taken on July 22, 2009, the cross drain is holding back a significant amount of water. The *Analysis of Flooding Problem for S.R. 29 West of Chaparral Slough*, PBS&J, October 1999 (**Appendix H**), identifies this side drain pipe at 30" and documents flooding problems here as well. The report suggests double 72" pipes be installed to address the flooding. Currently, this side drain consists of two 54" CMP pipes based on correspondence from Labelle Maintenance (Appendix D). This can be verified from the pictures located in **Appendix E**. There is a significant amount of runoff coming to this side drain from the surrounding area. During the field review, the side drain pipes were flooded more significantly on the northern side than the southern side. Even though the existing conditions suggest a blockage, the side drain was under water and it could not be determined if there was anything blocking the pipes. However, based on the findings of the crossdrains in the area, it is assumed that the side drain is full of silt and needs to be cleaned as well.

4.0 HYDRAULIC ANALYSIS

A drainage map was developed based on the original plans. Due to the flat and unchanged topography of the area, these historic drainage maps did not appear to have any significant changes to them and therefore were closely modeled for this drainage analysis. This map is located in **Appendix F** as well as an updated drainage map that breaks apart the areas specifically traveling to the cross drains and side drain. All elevations and areas were taken from State Job No. 0504-201, Fiscal Year 1956 and verified from FPID 193957-2-52-01, Fiscal Year 2004. Using the rational method, flow rates for 25 year, 50 year, and 100 year were determined. The 500 year design flow was then approximated using a log graph of the flow rate vs. the design frequency. These values were then entered into the HY-8 program to analyze the existing cross drains. All calculations can be found in **Appendix G**. **Table 3** summarizes the results.

Table 3: Existing Overtopping Rates

Cross Drain	Overtopping Flow Rate	Frequency
Triple 30 inch	30.42 cfs	<< 25 Year
Triple 36 inch	193.86 cfs	> 500 Year

The existing triple 30" cross drain is clearly undersized. It overtops the roadway well before the 25 year design flood of 94.35 cfs. The existing triple 36" pipe has enough capacity to handle flow rates higher than the 50 year design flood.

Several scenarios were analyzed for improving the cross drain including upsizing each existing culvert separately and both of them together. The downstream bridges and culverts on S.R. 78 were also reviewed to determine if these locations were restricting the flow and causing flooding along S.R. 29. It appears that the least impact to the function of traffic along S.R. 29 would be to replace the existing triple 30" pipes with quadruple 48" pipes. For this improvement, the overtopping flow rate for this cross drain would be 113.3 cfs. This is between the 50 year and 100 year design floods. Also with the existing roadway elevation at elevation 35.45, the proposed 48" pipes should be set at a lower flow line than the existing triple 30" pipe in order to provide adequate clearance. Calculations for quadruple 30" and 36" pipes resulted in overtopping before the 25 year flood frequency as did triple 48" pipes. This analysis is based upon the structures acting independently. However, based on the flat terrain observed during field reviews and review of old plans, during larger rain events the structures may function together. Increasing the pipe sizes could also cause problems further down stream. Water that is currently being restricted will have free range flow that could impact the drainage structures along S.R. 78.

The existing double 54” side drain north of Lone Pine Creek was also analyzed. This pipe was originally a single 30” pipe according to the *Analysis of Flooding Problem for S.R. 29 West of Chaparral Slough*, PBS&J, October 1999. It is unknown when the pipe was replaced. The report, however, recommended double 72” pipes in this area. The double 54” pipes are undersized. They have the capacity for 135.04 cfs, however the runoff generated by the offsite area coming to the cross drain is 202.3 cfs for the 10 year design flood. A minimum of 2-66” pipes or pipes of equal capacity are needed to intercept this runoff.

5.0 RECOMMENDATIONS

This particular area of Glades County is consistently wet. The large offsite areas are extremely flat. The main causes of the flooding consist of heavy siltation, flat roadway profiles, undersized cross drains, and no distinct channel for water to flow. Runoff is essentially being constrained until a large event occurs which forces it to the outfall where it then floods the low point along the road.

The permanent solution to reduce flooding in this area is to raise the profile of the road and recreate the roadside ditches. However in order to provide an immediate and cost feasible solution to this problem, it is recommended to de-silt and dig out the cross drains, side drain, and adjacent ditches. Clearing the cross drains and the adjacent ditches within the right of way shall allow more unrestricted flow. Removal and replacement of the existing triple 30’ cross drain pipes with quadruple 48” pipes will significantly improve the flooding. Water is currently backing up at this location and flooding the existing triple 36” cross drain upstream since the existing triple 30” cross drain is undersized. However, if this area is not maintained, it will silt up and flooding will still be a concern. In severe rain events the roadway may still overtop. This could have adverse impacts down stream however, if the flow is not maintained. The existing triple 36” pipes are also recommended for replacement. This is mainly due to the fact that the cross drain contains the pipes from the original construction over 50 years ago. They were extended in 1977. The joints may be bad and the condition of the pipes is unknown. The pipes will remain the same size since the hydraulic analysis verified that the pipes have more than adequate capacity.

Therefore, the recommended temporary improvements to this area includes de-silting of the existing pipes and ditches, replacing the existing triple 30” pipes with quadruple 48” pipes at the first cross drain and replacement of the existing triple 36” pipes to the north due to failing joints.

This alternative may provide relief for the area, decreasing the potential for the road to flood until the facility is improved. This portion of S.R. 29 is included in the PD&E study that is currently being completed. This study may recommend that the roadway is raised which is the ultimate remedy to prevent flooding of the travel lanes.

Two preliminary cost estimates were developed using the FDOT Area 9 costs (see **Appendix I**). The first is for the proposed temporary solutions including upsizing the first cross drain, replacing the second and regrading the ditches adjacent to the crossings. For this option, the estimated cost is $143,300. The second cost estimate includes leaving both of the existing cross drains in place with desiliting and minor ditch regrading adjacent to the crossings. For this option, the estimated cost is $11,500.

Appendix A
Original Drainage Complaint

1

Drainage Complaint - Inventory Data Sheet

SECTION I. LOCATION

County Glades

State Road SR 29 **Reference No.** 05090-1

Location - SR 29, north of SR 78 to Chaparral Slough

Road Description - 2-lane undivided roadway with shoulders and roadside ditches, with medium traffic volumes

Section/Township/Range Sec 36, T41S, R29E; Sec 1, 2, 11, 14, 15, T42S, R29E

SECTION II. PROBLEM DESCRIPTION

Problem: Flooding of right-of-way. Road does not flood.

How frequent does problem occur? 2 times in the past 10 years during the summer rainy season.

Estimate High Water Water is within 5 to 6 feet of roadway. High water is estimated to be at approximately 33.0 estimated from Historical Drainage Map (attached)

History of Problem High water in the right-of-way has occurred several times. Mr. Talbert Melton saw this section of roadway underwater in 1970.

Outfall description: Canals and natural tributaries

Persons Interviewed - FDOT personnel - Talbert Melton, Assistant Maintenance Engineer

SECTION III. PROBLEM ANALYSIS

What is the cause of the flooding? Cause of flooding in 1970 is unknown. Natural ground in areas adjacent to SR 29 just north of SR 78 is shown on the quadrangle map at approx. elevation 35. Possibly, a cross drain could be damaged or crushed. Photographs of flooded areas show one side of the roadway ditch more flooded than the other.

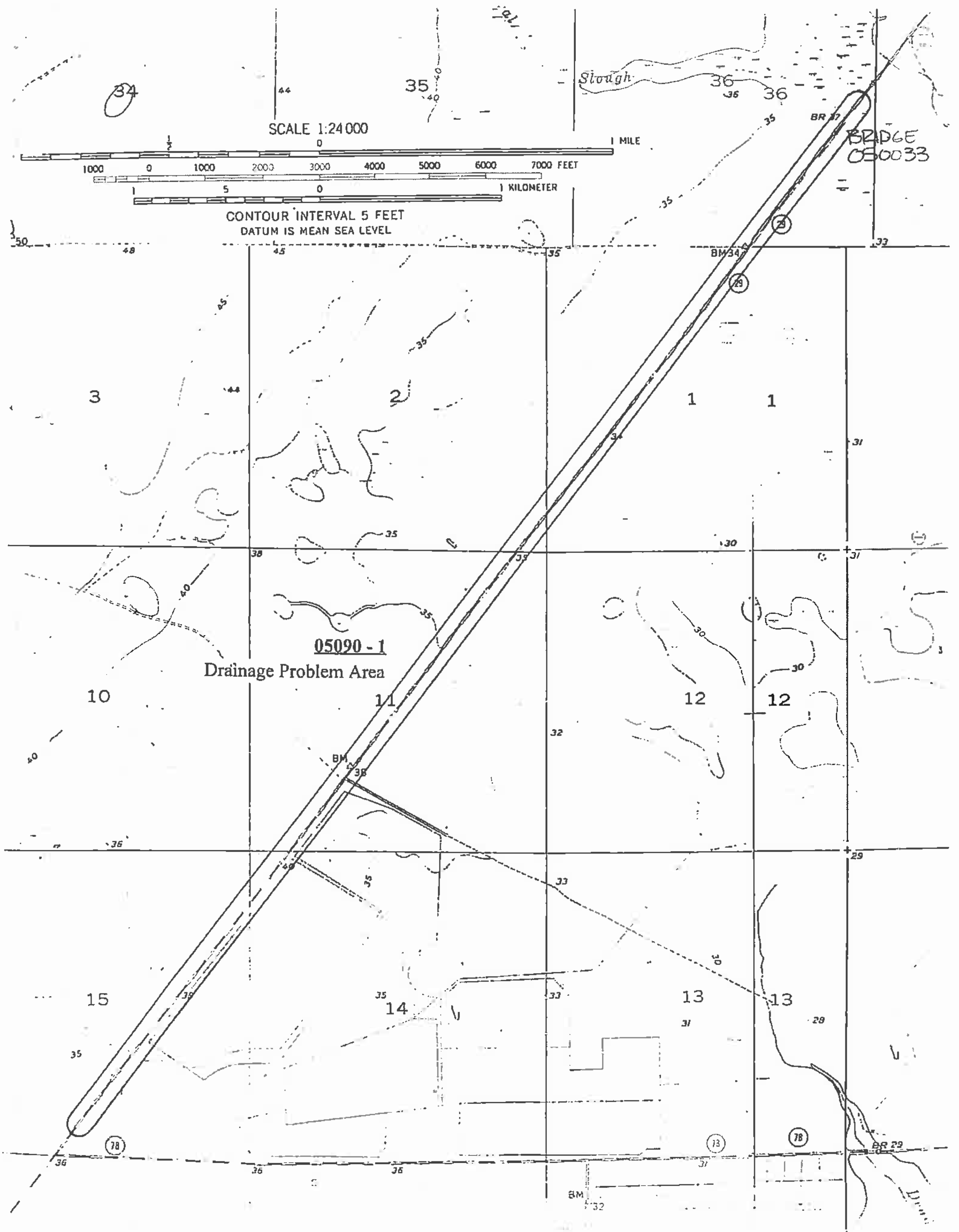
Responsible entity for maintenance of the outfall: Unknown

What efforts have been made to fix the problems? FDOT cleans and maintains the side ditches

Damages or harm resulting from the flooding: Water in the shoulder area is not desirable.

SECTION IV. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Monitor the area for future flooding events. Collect elevations at the roadway and side ditch profile elevations.


SCALE 1:24 000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
Slough
BRIDGE
050033
05090 - 1
Drainage Problem Area
BM 34
BR 29

Drainage Complaint - Inventory Data Sheet

Reference No. 05090 - 1

SR 29 - Between Bridge 050033 and SR 78 on June 29, 1992 - wet season.

SR 29 - Between Bridge 050033 and SR 78 on June 29, 1992 - wet season.

Glades

SR 29 - Roadway ID 05090 000 **MP 4.709 – 6.877** **Location A**

From Lone Pine Creek to Cypress Branch

SFWMD Rainfall
Gage Location
SR78

Day	Rainfall
Aug. 18	0.17 in.
Aug. 19	3.44 in.
Aug. 20	2.95 in.
Aug. 21	1.14 in.

Duration	Rainfall	Frequency
1 day	3.0 in.	10 Year
2 day	6.4 in.	25 Year
4 day	7.7 in.	10 Year

Maintenance reported roadway overtopping over this stretch of SR 29. During Drainage's field visit, water had reached the low member elevations of the Lone Pine Creek and Cypress Branch bridges. Water levels in the creeks matched the elevations of water in the roadside ditches and surrounding properties. Between Mile Post 5 and 6, water encroached up to 6 feet of the WB / SB travel lane, but no overtopping was observed. The roadside ditches were overtopped and surrounding properties were inundated with water. The bridges for Lone Pine Creek and Cypress Branch were observed to be free of debris and flowing full. The cross drains at M.P. 5.5 and 6.2 appeared to be free of debris. Water stages exceeded the headwall elevation at each culvert, and water flowing through the pipes with high velocities.

During this visit no damage to any drainage structures was visible at this location. Once water levels have receded, the drainage structures will be checked again by Drainage. The flooding issues appear to be caused by the low elevation of the roadway in relation to the surrounding land. To correct this issue the roadway would need to be raised. Maintenance should continue to post signs at any location where water is encroaching upon the roadway.

5.5 - re-address second visit. soft spots. Water was high still.
6.2 - they may not have any problems.

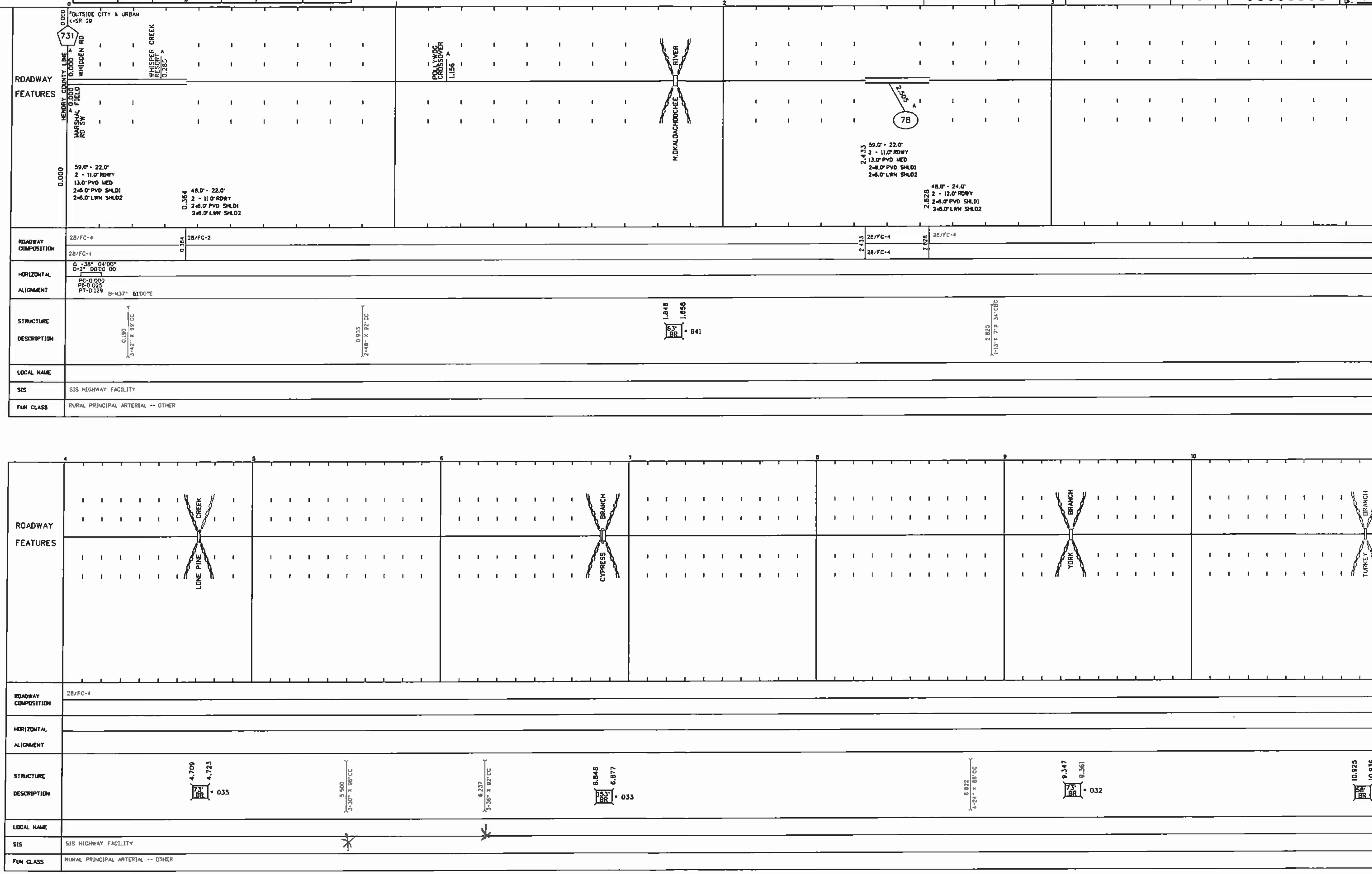
STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT ONE MAINTENANCE STATISTICS OFFICE

DATE	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	06/26/06	07/19/06				
BY	FTE	RWG				

INTERIM REVISIONS: BMP, EMP, INV, SLD REV

INT. or US ROUTE NO.	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET
	SR 29	GLADES	1	05090000	NO. 1 OF. 2

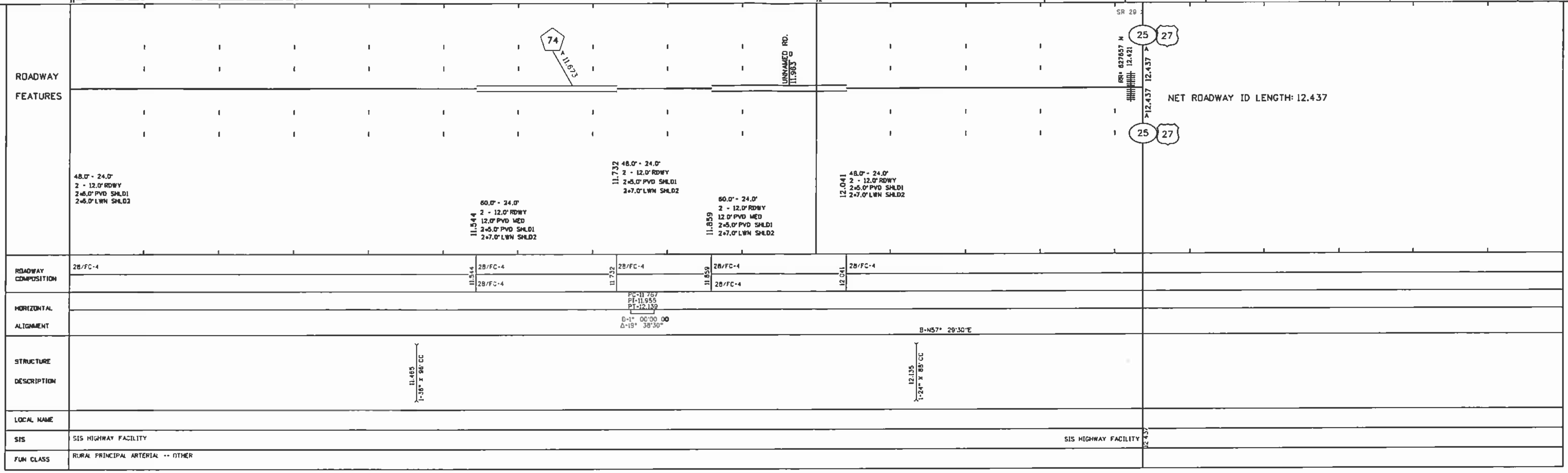


STRAIGHT LINE DIAGRAM OF ROAD INVENTORY
FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT ONE MAINTENANCE STATISTICS OFFICE

	5 YR INV	SLD REV
DATE	06/28/06	07/19/06
BY	FTE	RWG

INTERIM REVISIONS BMP	EMP	INV	SLD REV

INT. or US ROUTE NO	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET
	SR 29	GLADES	1	05090000	NO. 2 OF. 2



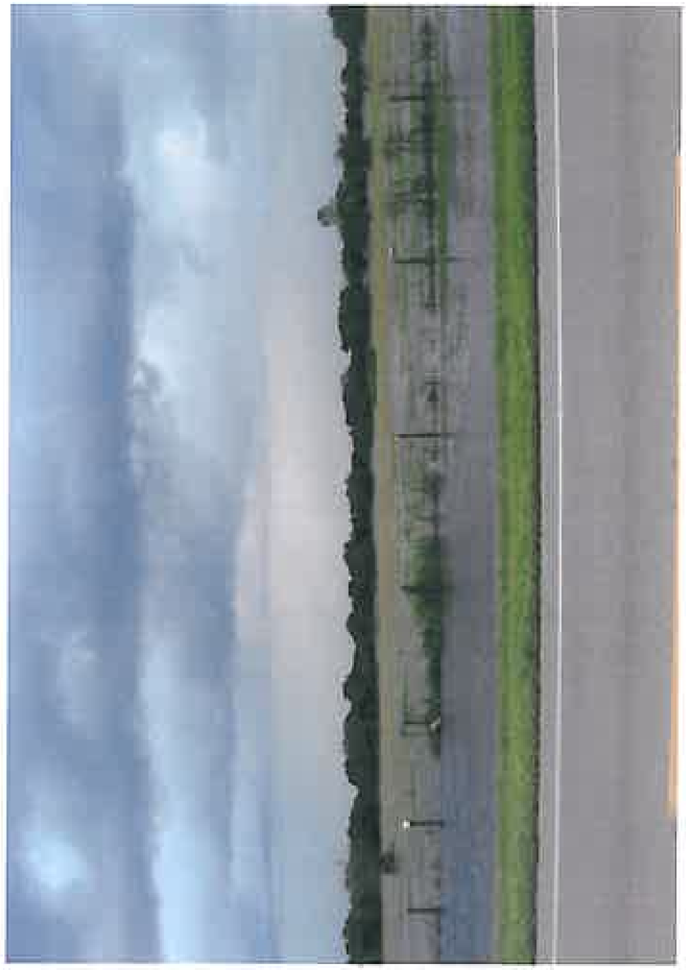



























SR 29 Cross Drains (mp. 5.50 and 6.237) Glades




SR 29 Cross Drains (mp 5.50 and 6.237) Glades




SE29 Cross drain MP. 5.50 and 6.237 Glades

Appendix B
FDOT Straight Line Diagram

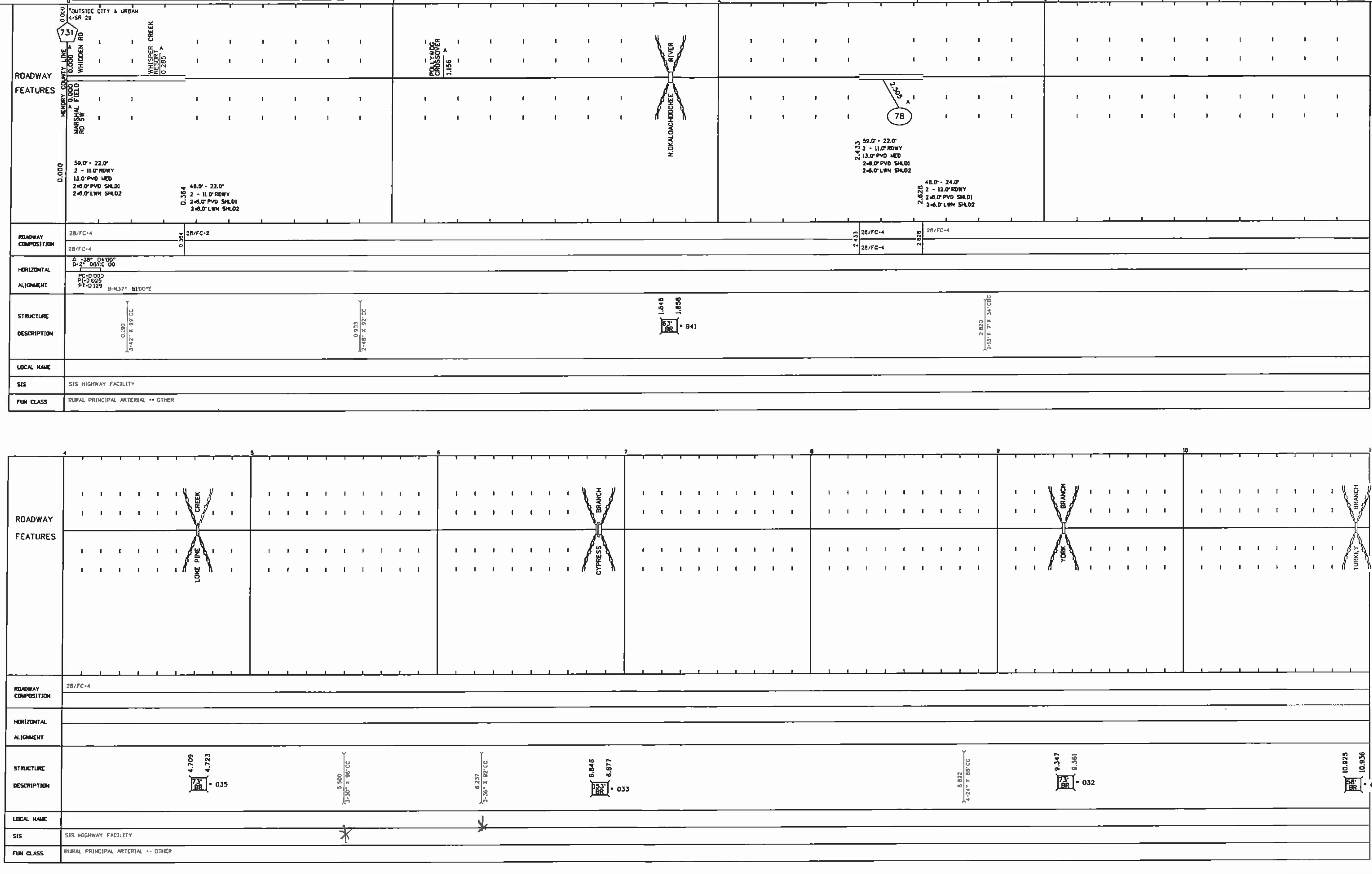
STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT ONE MAINTENANCE STATISTICS OFFICE

	5 YR INV	SLD REV	BMP	EMP	INV	SLD REV
DATE	06/28/06	07/19/06				
BY	FTE	RWG				

(BMP, EMP, INV and SLD REV appear under the heading INTERIM REVISIONS.)

INT. or US ROUTE NO	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET
	SR 29	GLADES	1	05090000	NO. 1 OF. 2

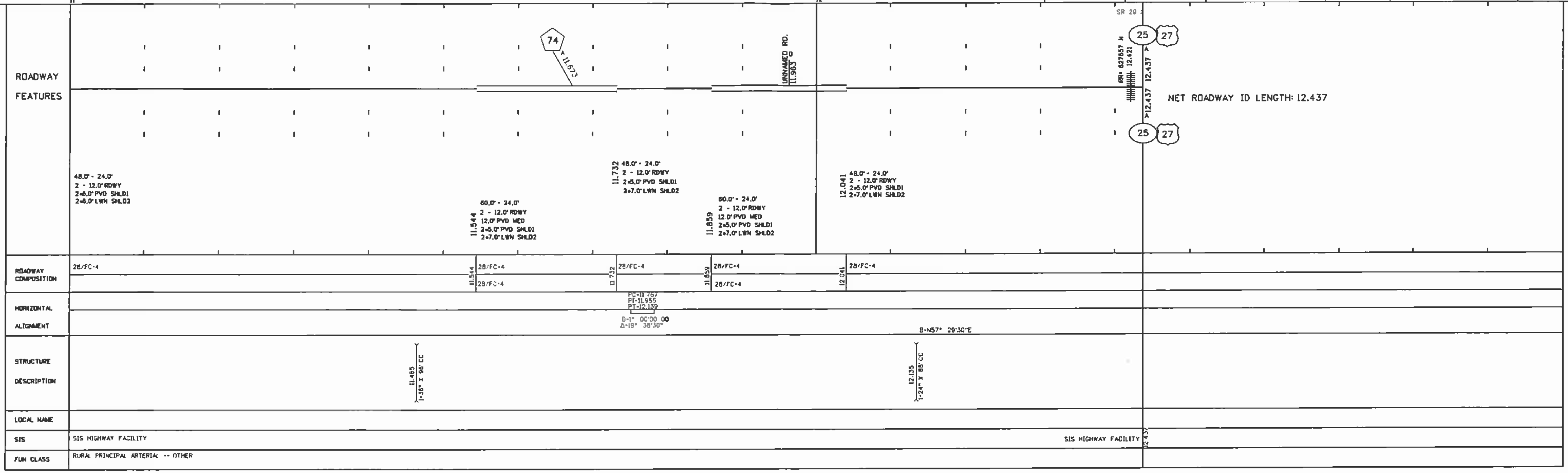


STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

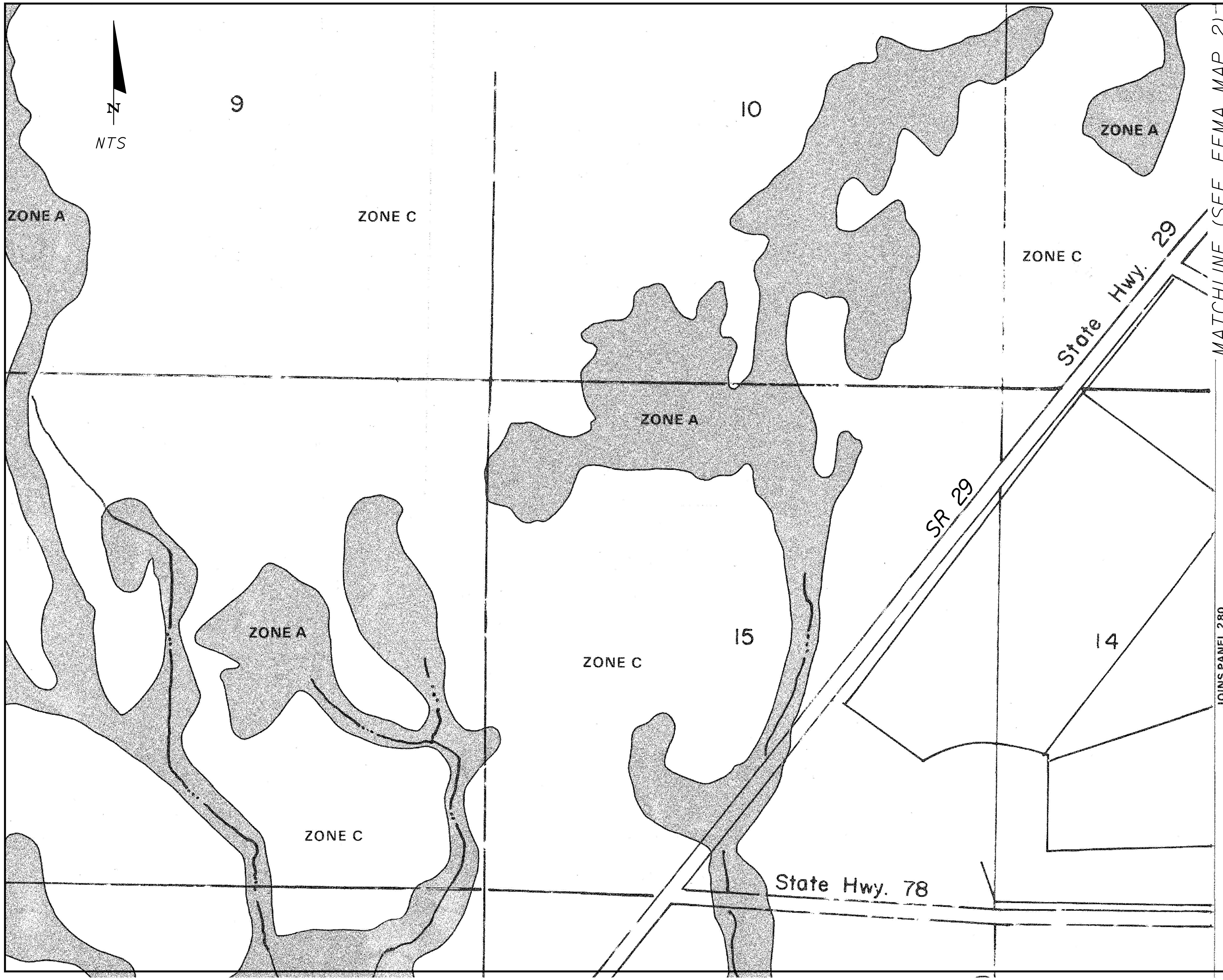
FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT ONE MAINTENANCE STATISTICS OFFICE

DATE	5 YR INV	SLD REV	BMP	EMP	INTERIM REVISIONS INV	SLD REV
	06/28/06	07/19/06				
BY	FTE	RWG				

INT. or US ROUTE NO	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET
	SR 29	GLADES	1	05090000	NO. 2 OF. 2



Appendix C
FEMA Maps



COMMUNITY-PANEL NUMBER
120095 0260 B

EFFECTIVE DATE:

KEY TO MAP

500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE A1
Zone Designations*	ZONE A5
100-Year Flood Boundary	
500-Year Flood Boundary	ZONE B
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

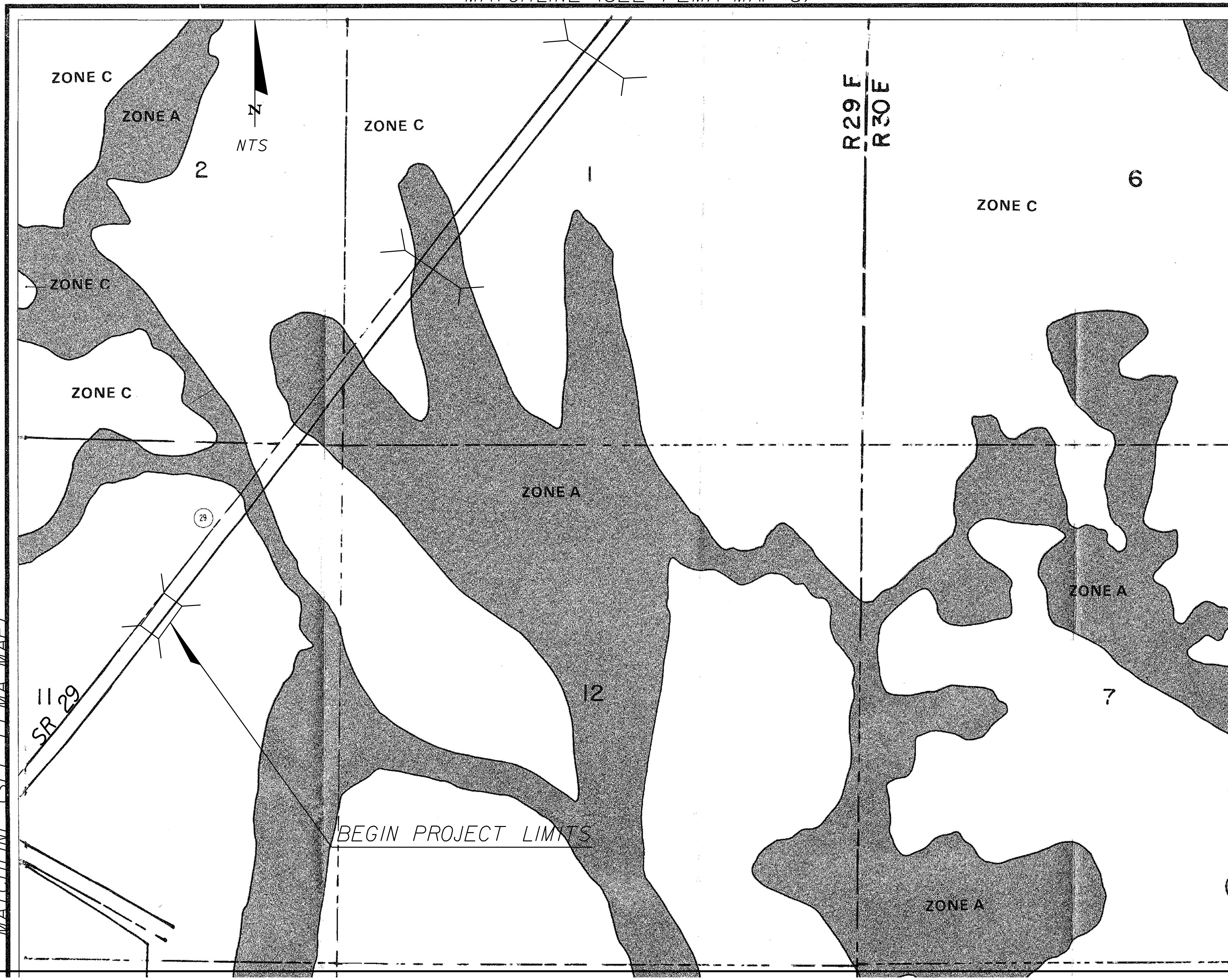
AIM Engineering & Surveying, Inc.
5802 BRECKENRIDGE PARKWAY STE. 100
TAMPA, FLORIDA 33610
TELEPHONE (888) 627-4144
FAX (813) 664-1899
CERTIFICATE OF AUTHORIZATION NO. 3114
E.O.R. DAWN M. RATICAN, P.E. NO. 60226

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
29	GLADES	

FEMA MAP

SHEET NO.



COMMUNITY-PANEL NUMBER
120095 0280 B

EFFECTIVE DATE:

KEY TO MAP

500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE A1
Zone Designations*	ZONE A5
100-Year Flood Boundary	ZONE B
500-Year Flood Boundary	
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

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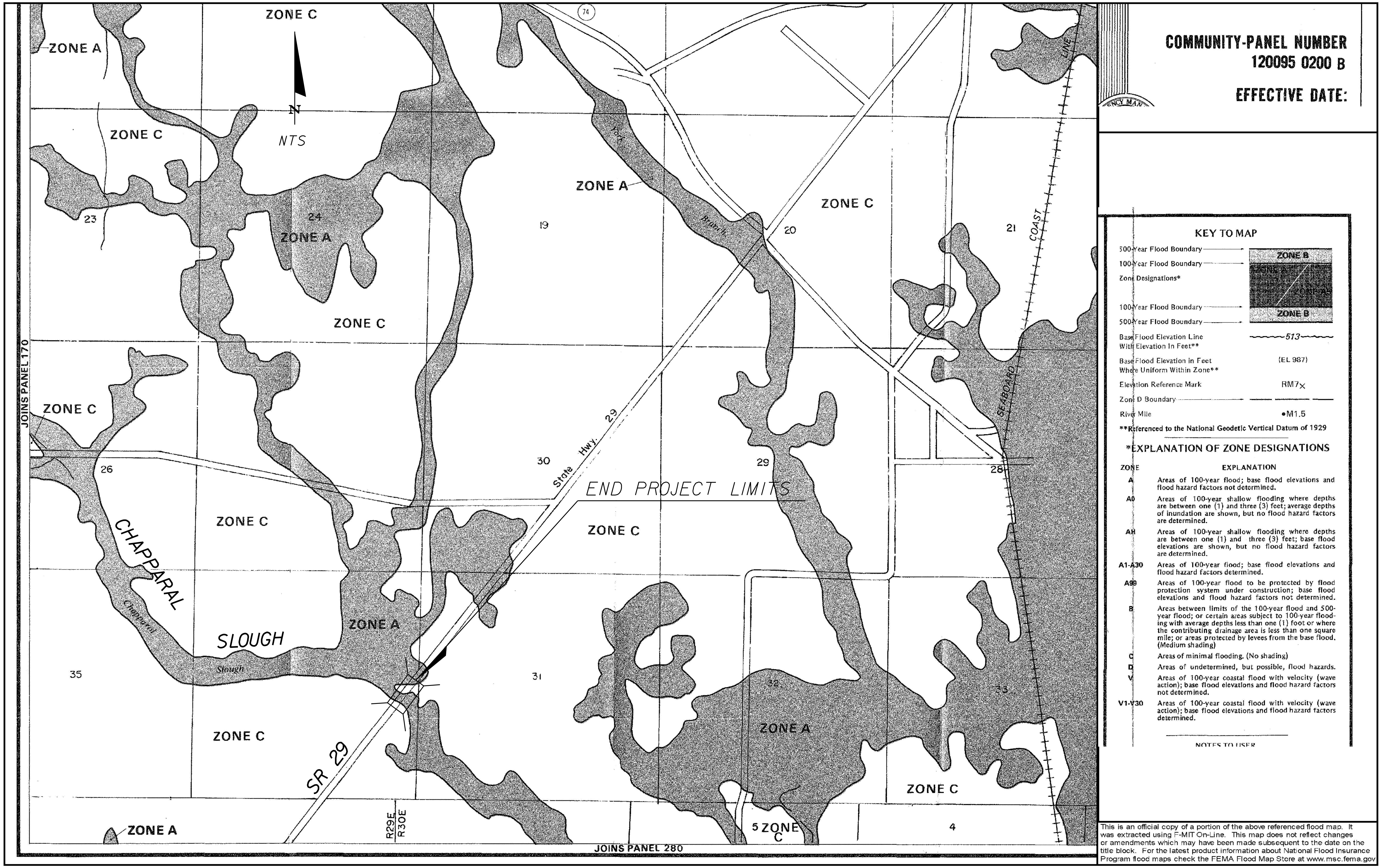
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
29	GLADES	

FEMA MAP 2

SHEET NO.



MATCHLINE (SEE FEMA MAP 2)

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DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
29	GLADES	

FEMA MAP 3

SHEET NO.

ecaswell 8/6/2009 9:20:26 AM T:\PROJECTS\ENVIRONMENTAL\DIDW Permit and MIt\Task #II Drainage Complaint Analyses\V_SR29_

Appendix D
Correspondence

AIM Engineering & Surveying, Inc.

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Toll Free: 888-627-4144

Lehigh Acres (Corporate Office) • Bartow • **Tampa** • Naples • Riviera Beach • Brooksville

Project: Drainage Complaint Analysis Task #11 Project 1 and 2

Subject: Field Meeting

Location: SR 29 and SR 78 **Date:** July 1, 2009

Attendees: John Anderson (FDOT LaBelle Operations)
Dawn Ratican (AIM)

Recorded By: Dawn Ratican

SR 29 - between Lone Pine and Cypress Branch

- 0.5 miles of roadway under water
- Sheet flow – wide open pasture both sides of road
- Channels downstream are not maintained
- Roadway shut down last year because of flooding
- Water stacks to the edge of the road on south side once a year
- 5-ft shoulders and resurfacing done 3-4 years ago. No money for pipe improvements.
- No planned projects for future
- At the culvert water is stacked up to shoulder (present) and water is stacked up to the fence in the south side.
- Both sides of roadway owned by Lykes Brothers
- No apparent flow, just a lot of standing water
- At Pine Fields water just sheet flows, nothing to restrict it.

SR 78

- 0.25 miles of roadway under water
- Lykes owns surrounding property
- 4-ft paved shoulders and pipes were replaced not upsized
- Ditches on both sides of roadway
- Right of way required for berm or dual ditch
- Deadman's branch – north side own 300-ft no issues with drainage
- Cross drain no issues some ownership to the north
- Culvert at driveway – flow from north around driveway
- Offsite single point discharge floods roadway

The meeting minutes contained herein represent the author's understanding of the discussions which occurred during the referenced meeting. Any attendee who does not entirely agree with the summary or can offer additional information that should be noted within these minutes, please call the author at the number provided above within two days.

From: Anderson, John C [John.Anderson@dot.state.fl.us]
Sent: Wednesday, July 29, 2009 7:50 AM
To: Dawn Ratican
Subject: RE: Drainage Complaints - Glades County SR 29 & SR 78

SR78: We have only seen the flooding in the area of the driveway with the side drain (no flooding at the bridges)

SR29: The flooding is between the two bridges (starting at the two bridges) (Lone Pine and Cypress) but it does get the worst at the two culverts and the worst of the two is the south culvert.

This past July 4th both areas flooded (SR78 and SR29). Like a dummy, I didn't take any pictures. I thought about it later, but I will try to find some old pictures of the area.

From: Dawn Ratican [mailto:dratican@aimengr.com]
Sent: Monday, July 27, 2009 10:37 AM
To: Anderson, John C
Subject: RE: Drainage Complaints - Glades County SR 29 & SR 78

Thank John. We were back out reviewing these projects last week. I wanted to verify that the only flooding on SR 78 is at the driveway with the side drain. Have you seen any flooding at the bridges? Also was this area flooded the July 4th weekend as well? On SR 29, does the flooding start at the culverts/bridges and then spread or occur in between the crossings? Do you have any photos of this most recent flooding?

Thanks again for your assistance. We will be wrapping up our review in the next couple of weeks.

Dawn

From: Anderson, John C [mailto:John.Anderson@dot.state.fl.us]
Sent: Wednesday, July 22, 2009 8:56 AM
To: Dawn Ratican
Subject: RE: Drainage Complaints - Glades County SR 29 & SR 78

Answers to your questions:

1. All of our bridge information comes from District Bridge in Tampa.
   (Jose Garcia 813-744-6050 ext. 21227)
   (jose.garcia1@dot.state.fl.us)
2. On SR29 the water flows from the west to the east. It will flow over the entire roadway (both lanes). Approximately a week after I meet with you (July 4th weekend) the road went under water due to heavy rains in the area, and yes almost every year this accurse.
3. SR 78 is the same. SR 29 goes under water then approximately 8 to 10 hours later SR78 will go under water. SR78 also went under water the July 4th weekend.

From: Dawn Ratican [mailto:dratican@aimengr.com]
Sent: Tuesday, July 21, 2009 3:14 PM
To: Anderson, John C
Subject: Drainage Complaints - Glades County SR 29 & SR 78

Good afternoon John. I will be picking up the plans tomorrow that were copied for the SR 29 and SR 78 projects that we met on a few weeks back. I wanted to ask you a couple of more questions.

1. I am looking for the BHRs and Bridge Inspection Reports for all of the bridges. I believe that includes the Lone Pine Creek and Cypress Branch along SR 29 and Deadman's Branch and Cypress Branch along SR 78. Do you

have these or can you tell me who I should contact to obtain these?

2. I wanted to verify that during our discussions regarding the SR 29 flooding area, that water overtops the road from the downstream side (east side of road). I know that the road was shut down last year. Do you recall at what time of the year, also does this occur every year?

3. For the SR 78 flooding, when was the last time that the road overtopped? Again, is this a regular occurrence, or did the flooding take place during the construction of the shoulder improvements along this section?

Feel free to email me or call, whatever is most convenient for you. I will be heading down to Labelle tomorrow, so I can be reached on my cell phone (813-918-0280).

Thank you again for your help with these projects.

Dawn

Dawn Ratican, P.E.
AIM Engineering & Surveying, Inc.
5802 Breckenridge Parkway, Suite 100
Tampa, Florida 33610
813.627.4144 (o)
813.918.0280 (c)

Dawn Ratican

From: Anderson, John C [John.Anderson@dot.state.fl.us]
Sent: Tuesday, November 24, 2009 3:17 PM
To: 'dratican@aimengr.com'
Subject: Fw: SR 29 and SR 78 Drainage Complaints

Sorry, it is in this one. It is the pipes at the cow pines.

John C. Anderson
LaBelle Operation Center
Telephone: 863-674-4027
Fax: 863-674-4030
Cell: 863-673-4056
E-Mail: john.anderson@dot.state.fl.us

From: McCormick, Steve
To: Anderson, John C
Sent: Tue Nov 24 10:52:34 2009
Subject: RE: SR 29 and SR 78 Drainage Complaints

The pipes at the cow pens appear to be 2- 54" corrugated pipe, they are still under water. The next headwall north of there is 3- 30" pipe and the one to the north of that is 3- 36" pipe.

Steve

Steve McCormick
Contracts Manager
LaBelle Operation Center
Florida Department Of Transportation
(863)674-4027 , Cell (863)673-4054
steve.mccormick@dot.state.fl.us

From: Anderson, John C
Sent: Tuesday, November 24, 2009 8:27 AM
To: McCormick, Steve
Subject: Fw: SR 29 and SR 78 Drainage Complaints

Can you get me the size and number of pipes at these head walls on SR29. It is the two were it always floods. Thanks

John C. Anderson
LaBelle Operation Center
Telephone: 863-674-4027
Fax: 863-674-4030
Cell: 863-673-4056
E-Mail: john.anderson@dot.state.fl.us

From: Dawn Ratican
To: Anderson, John C
Sent: Mon Nov 23 10:14:31 2009
Subject: SR 29 and SR 78 Drainage Complaints
Good morning John. I wanted to see if you had an opportunity to review the draft reports we submitted to you for the SR 29 and SR 78 Drainage Complaints. We are finalizing the reports based on comments we received from FDOT D-1 Drainage Staff and want to include any revisions based on your comments.

Also, we are trying to determine the size of the side drain pipe on the west side of SR 29 just north of Lone Pine Creek. In 1999 we know that there was one 30” pipe. Today there are two CMPs however due to the high elevation of standing water we were not able to determine the size. Do you know when these were replaced, who replaced them and what the current sizes are? Attached is a photo of the side drain.

Thanks for your assistance,

Dawn

Dawn Ratican, P.E.
AIM Engineering & Surveying, Inc.
5802 Breckenridge Parkway, Suite 100
Tampa, Florida 33610
813.627.4144 (o)
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Appendix E
Photos

S.R. 29

Bridge Culvert at Lone Pine Creek:


Looking south along S.R. 29 from the bridge culvert.


Ditch on southeast side of bridge.

Bridge structure number and name of water body.


East side of bridge.


Looking east from east side of bridge.


Ditch on northeast side of bridge.


Ditch on northwest side of bridge.


Looking west from west side of bridge.


West side of bridge.


Ditch on southwest side of bridge.


Water stains on west side of bridge.


Sidedrain at cow pens, just north of bridge on S.R. 29. Ditch almost at capacity.


Ditch on north side of driveway facing north.

Triple 30" Cross Drain:


Looking south along S.R. 29 from cross drain.


Looking east from east side of cross drain.


Ditch on northeast side of cross drain.


Erosion at headwall on east side of cross drain.


Erosion at headwall on east side of cross drain.


Staining on headwall on east side of cross drain.


Ditch on northwest side of cross drain.


Looking west from headwall on west side of cross drain.


Ditch on southwest side of cross drain.


Headwall on west side of cross drain.


Water stains on headwall on west side of cross drain.

Triple 36" Cross Drain:


Ditch on southeast side of cross drain.


Looking east from east side of cross drain.


Headwall on east side of cross drain.


Looking northeast from east side of cross drain.


Ditch on northeast side of cross drain.


Ditch on northwest side of cross drain.


Looking west from west side of cross drain.


Ditch on southwest side of cross drain.

Bridge at Cypress Branch:

Bridge number.


Ditch on southeast side of bridge.


Ditch on northwest side of bridge.


East side of bridge.

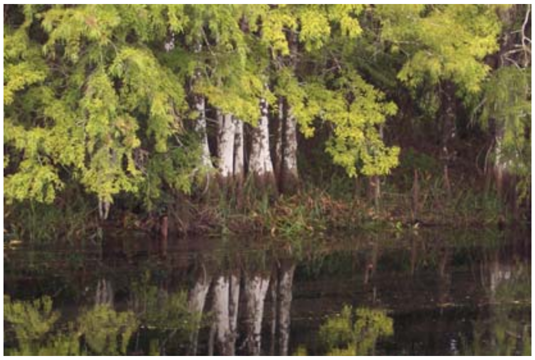

Facing south along shoulder, west side of bridge.


Looking east from east side of bridge.


West side of bridge.

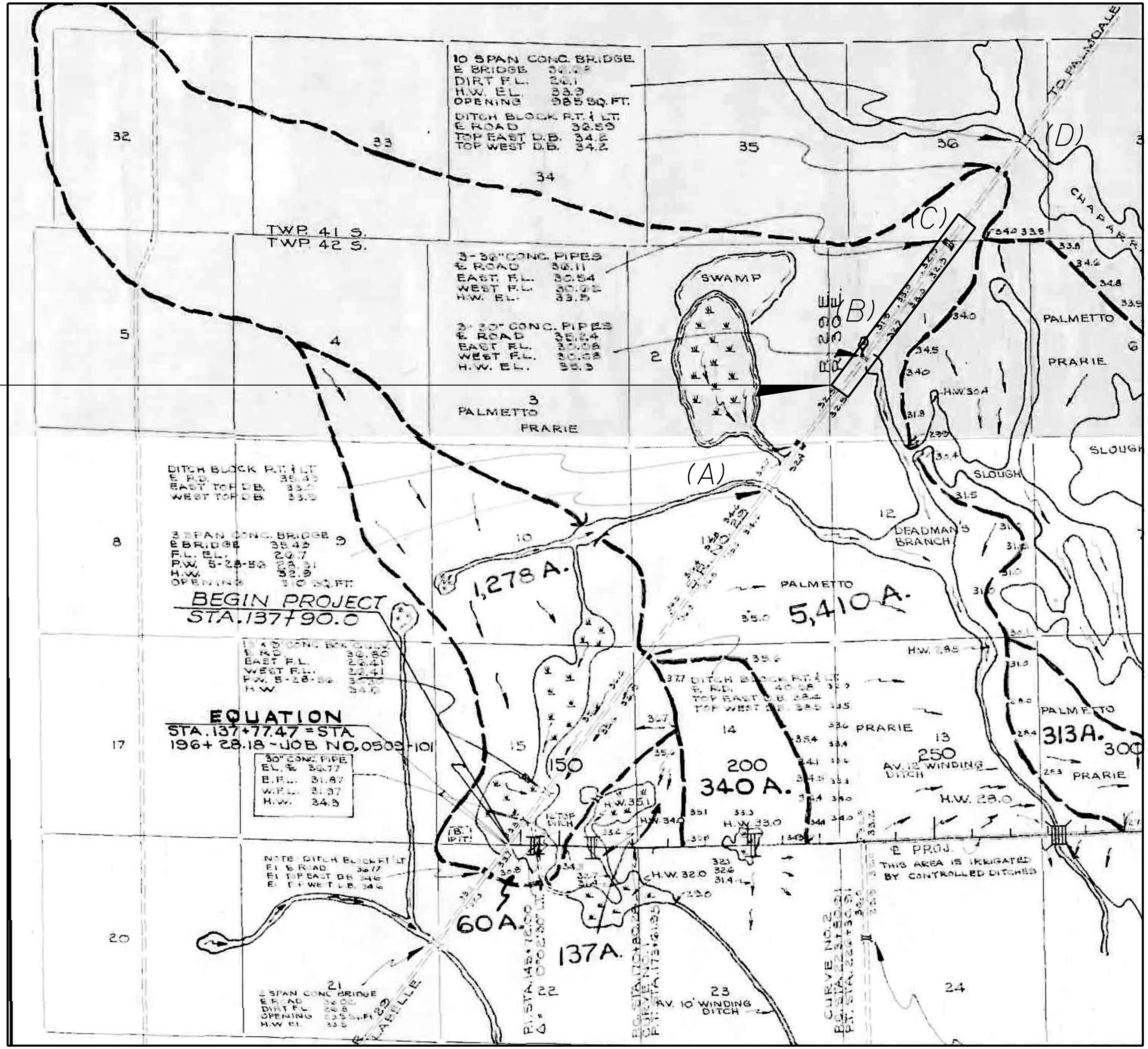

Ditch on northeast side of bridge.


Facing west from west side of bridge.


Facing southwest from west side of bridge. Trees appear to have water stains pretty high.


Ditch on southwest side of bridge.

Appendix F
Drainage Maps



(A)

3 SPAN CONC BRIDGE
℄ BRIDGE: 35.43
FL: 26.7
PW (5/28/56): 28.31
HW: 32.9
OPENING: 310 SQ FT

(B)

3 30" CONC PIPES
℄ ROAD: 35.24
FL (E): 30.08
FL (W): 30.08
HW: 35.3

(C)

3 36" CONC PIPES
℄ ROAD: 36.11
FL (E): 30.54
FL (W): 30.62
HW: 33.5

(D)

10 SPAN CONC BRIDGE
℄ BRIDGE: 36.62
FL: 26.1
HW: 33.9
OPENING: 985 SQ FT

NOTE: MAP WAS TAKEN FROM JOB NO. 0504-201, SR 78, GLADES COUNTY, FISCAL YEAR 1956

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

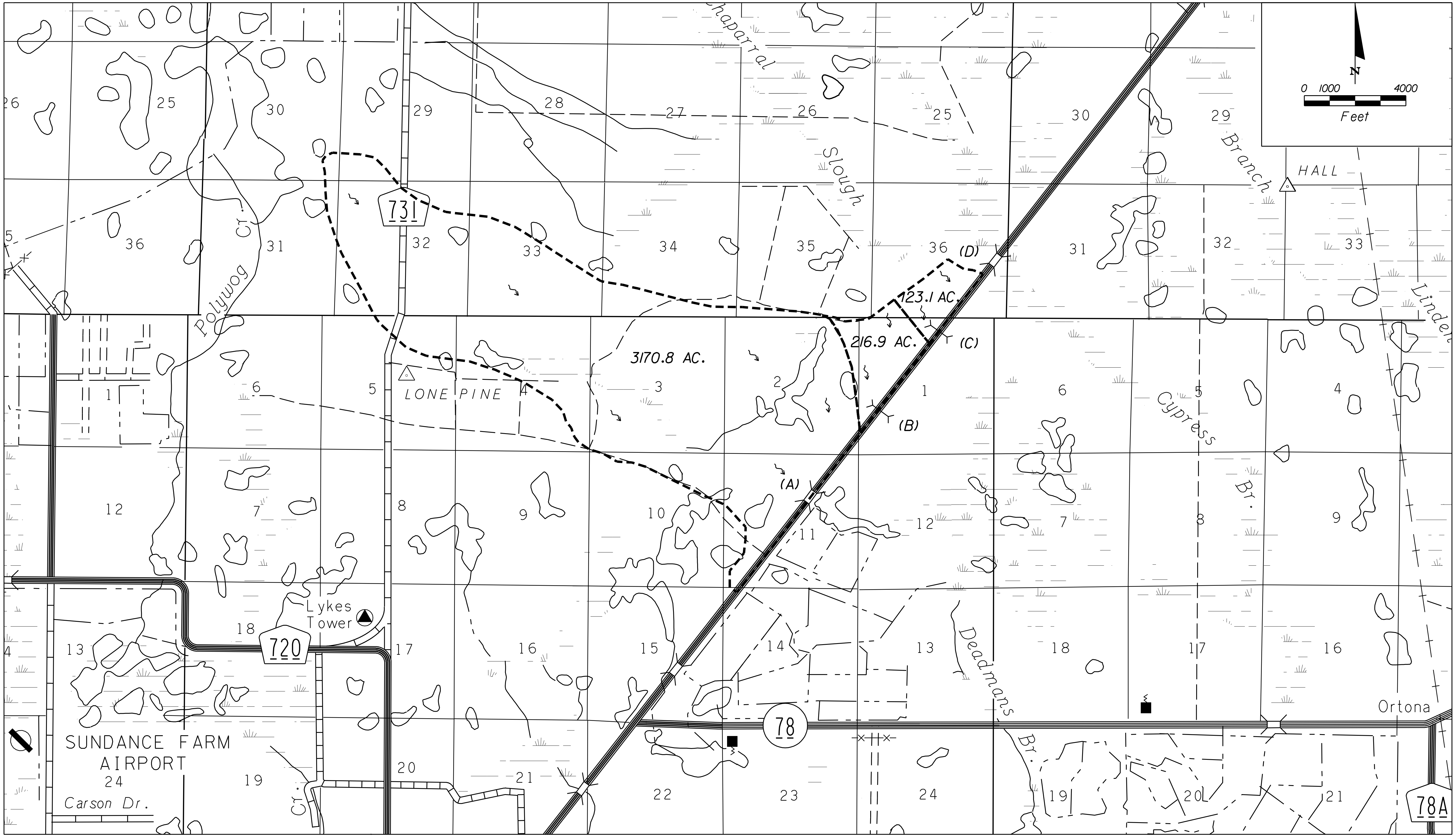
AIM Engineering & Surveying, Inc.
5802 BRECKENRIDGE PARKWAY STE. 100
TAMPA, FLORIDA 33610
TELEPHONE (888) 627-4144
FAX (813) 664-1899
CERTIFICATE OF AUTHORIZATION NO. 3114
E.O.R. DAWN M. RATICAN, P.E. NO. 60226

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
29	GLADES	

HISTORICAL DRAINAGE MAP

SHEET NO.



(A) LONE PINE CREEK BRIDGE
(B) TRIPLE 30" PIPES
(C) TRIPLE 36" PIPES
(D) CYPRESS BRANCH BRIDGE

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

AIM Engineering & Surveying, Inc.
5802 BRECKENRIDGE PARKWAY STE. 100
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
29	GLADES	

DRAINAGE MAP

SHEET NO.

ecastwell 8/6/2009 9:54:08 AM T:\PROJECTS\ENVIRONMENTAL\DI DW Permit and Mit\Task #II Drainage Complaint Analyses_SR29_

Appendix G
Design Calculations

SR 29

Triple 30" Pipe

From Drainage Map: Total area is 216.9 Acres
Project is located in Zone 8.
Design Frequency is 50 years.
Time of concentration is 3.7 hours.
Area is grass and dirt and very flat, therefore the runoff coeficient is 0.3

Rational Method

$$Q = CIA$$

Q: Flow Rate (cfs)
C: Runoff Coeficient
I: Rainfall Distribution (in/hr)
A: Area (acres)

Frequency (years)	I (in/hr)	Probability
25	1.45	
50	1.60	0.02
100	1.75	0.01
500		0.002

$$Q_{25} = 0.3*1.45*216.9$$
$$Q_{25} = 94.35 \text{ cfs}$$

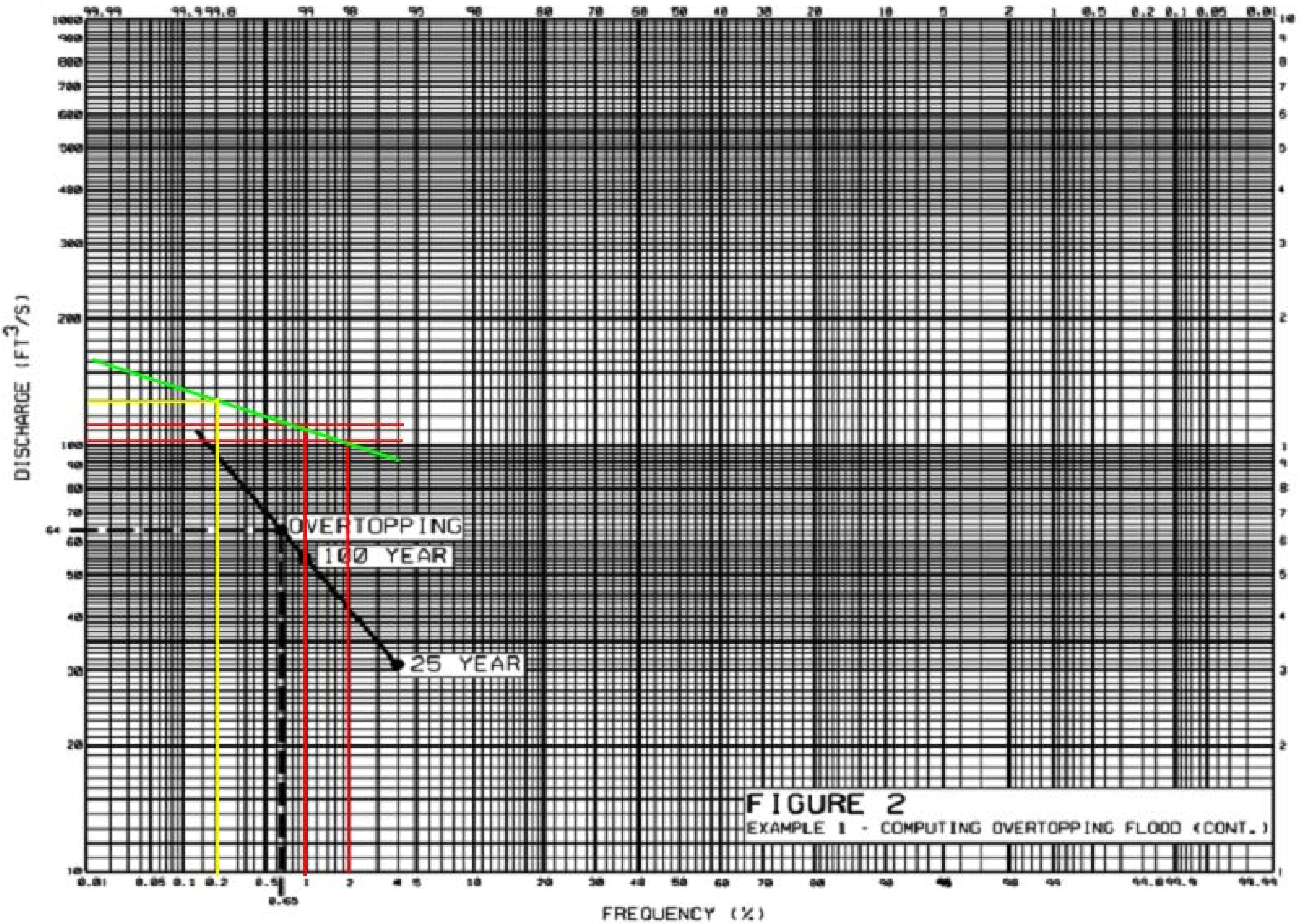
$$Q_{50} = 0.3*1.60*216.9$$
$$Q_{50} = 104.11 \text{ cfs}$$

$$Q_{100} = 0.3*1.75*216.9$$
$$Q_{100} = 113.87 \text{ cfs}$$

From graph:

$$Q_{500} = 130 \text{ cfs}$$

Figure 2, Example 1 taken from Drainage Handbook Culvert Design.



500 year design discharge (yellow) was found by drawing in the calculated Q values vs. the design frequency (red) and plotting a best fit line (green).

Project: **SR 29**	By: DMR	Date:	
Subject: **Time of Concentration, Tc**	Check:	Date:	
	Revised:	Date:	

Existing Conditions

Triple 30" Cross Drain

Sheet Flow

		Segment ID		AB				
1.	Surface description (table 3-1, TR-55)			Grass				
2.	Manning's Roughness coefficient, n (table 3-1, TR-55)			0.13				
3.	Two year 24 hour rainfall, P2		in	4.50				
4.	Flow length, L (total L< 300 ft)		ft	300				
5.	Land slope , s	Begin Elev.	ft	35.00				
		End Elev.	ft	34.80				
	Slope = (E1-E2)/L	Slope	ft/ft	0.001				
6.	Tt = (0.007*(nL)^0.8)/((P2^0.5)(s^0.4)) * 60	Compute Tt	min.	69.2	+		=	69.2

Shallow Concentrated Flow

	Grass	Segment ID		BD				
7.	Surface description (paved or unpaved)			Unpaved				
	Velocity Coefficient K (Paved = 20.328, Unpaved = 16.1345)			16.1345				
8.	Flow length, L		ft	3700				
9.	Watercourse slope, s	Begin Elev.	ft	34.8				
		End Elev.	ft	32.5				
	Slope = (E1-E2)/L	Slope	ft/ft	0.001				
10.	Average velocity, V (V = K*S^0.5)		ft/s	0.40				
11.	Tt = L/(60*V)	Compute Tt	min.	153.3	+		=	153.3

Channel Flow (Ditch)

		Segment ID					
12.	Hydraulic radius, R = A / WP (Depth of Flow)		ft				
13.	Flow length, L		ft				
14.	Slope, s	Begin Elev.	ft				
		End Elev.	ft				
	Slope = (E1-E2)/L	Slope	ft/ft				
15.	Manning's roughness coefficient, N (table 3-1, TR-55)						
16.	V = (1.49*R^.67*s^0.5)/N		ft/s				
17.	Tt = L/(60*V)	Compute Tt	min.			=	0.0

18.	Total of 6, 11 and 17	min.		=	222.5
	Minimum Time of Concentration	min.	10.0		
	Time of Concentration	min.			222.5
		hr			3.71

SR 29 – Existing Triple 30” Cross Drain

Project Notes

Project Title: Drainage Complaint SR 29

Designer: EC

Project Date: Monday, August 03, 2009

Notes: The roadway overtops at a flow rate of 30.42 cfs. This is below the flow rate for the 25 year design frequency. The cross drain is undersized. All elevations were taken from old plans.

Table 1 - Summary of Culvert Flows at Crossing: Triple 30" Cross Drain

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
36.10	94.35	70.51	23.89	5
36.14	97.91	72.05	25.85	3
36.17	101.48	73.55	27.91	3
36.20	104.11	74.65	29.44	3
36.24	108.61	76.48	32.10	3
36.28	112.18	77.90	34.25	3
36.31	115.74	79.28	36.44	3
36.35	119.30	80.63	38.66	3
36.38	122.87	81.94	40.90	3
36.42	126.44	83.23	43.18	3
36.45	130.00	84.47	45.50	3

*Highlighted values represent the 25 year, 50 year, and 500 year design frequencies.

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
94.35	70.51	36.10	2.600	6.021	4-FFf	2.500	1.645	2.500	5.220	4.788	0.000
97.91	72.05	36.14	2.641	6.056	4-FFf	2.500	1.664	2.500	5.220	4.892	0.000
101.48	73.55	36.17	2.682	6.092	4-FFf	2.500	1.682	2.500	5.220	4.994	0.000
104.11	74.65	36.20	2.712	6.118	4-FFf	2.500	1.696	2.500	5.220	5.069	0.000
108.61	76.48	36.24	2.763	6.163	4-FFf	2.500	1.718	2.500	5.220	5.194	0.000
112.18	77.90	36.28	2.803	6.198	4-FFf	2.500	1.736	2.500	5.220	5.290	0.000
115.74	79.28	36.31	2.843	6.233	4-FFf	2.500	1.752	2.500	5.220	5.383	0.000
119.30	80.63	36.35	2.882	6.267	4-FFf	2.500	1.766	2.500	5.220	5.475	0.000
122.87	81.94	36.38	2.920	6.302	4-FFf	2.500	1.779	2.500	5.220	5.564	0.000
126.44	83.23	36.42	2.958	6.336	4-FFf	2.500	1.792	2.500	5.220	5.652	0.000
130.00	84.47	36.45	2.996	6.370	4-FFf	2.500	1.804	2.500	5.220	5.736	0.000

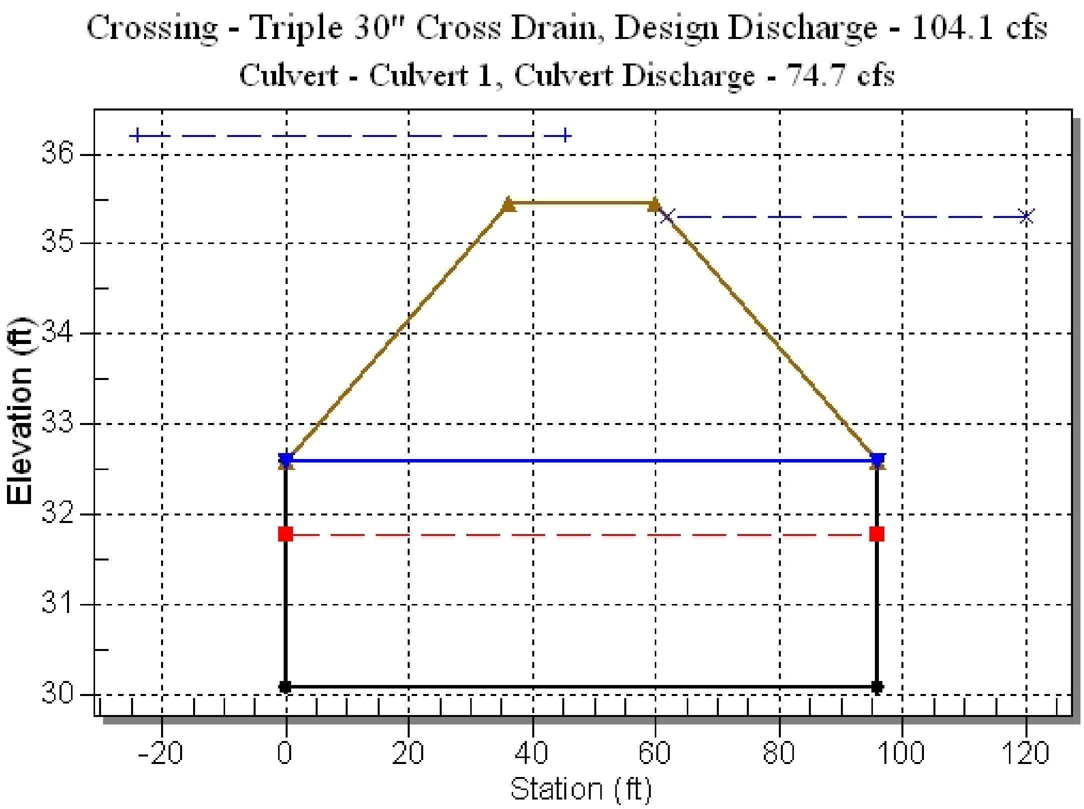
****

Inlet Elevation (invert): 30.08 ft, Outlet Elevation (invert): 30.08 ft

Culvert Length: 96.00 ft, Culvert Slope: 0.0000

****

Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.08 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Outlet Station: 96.00 ft (Straight Line Diagrams 05090000)

Outlet Elevation: 30.08 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Number of Barrels: 3

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Tailwater Channel Data - Triple 30" Cross Drain

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 35.30 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Roadway Data for Crossing: Triple 30" Cross Drain

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 15.00 ft

Crest Elevation: 35.45 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

SR 29

Triple 36" Pipe

From Drainage Map: Total area is 123.1 Acres
Project is located in Zone 8.
Design Frequency is 50 years.
Time of concentration is 2.7 hours.
Area is grass and dirt and very flat, therefore the runoff coeficient is 0.3

Rational Method

$$Q = CIA$$

Q: Flow Rate (cfs)
C: Runoff Coeficient
I: Rainfall Distribution (in/hr)
A: Area (acres)

Frequency (years)	I (in/hr)	Probability
25	1.80	
50	2.00	0.02
100	2.20	0.01
500		0.002

$$Q_{25} = 0.3*1.80*123.1$$
$$Q_{25} = 66.47 \text{ cfs}$$

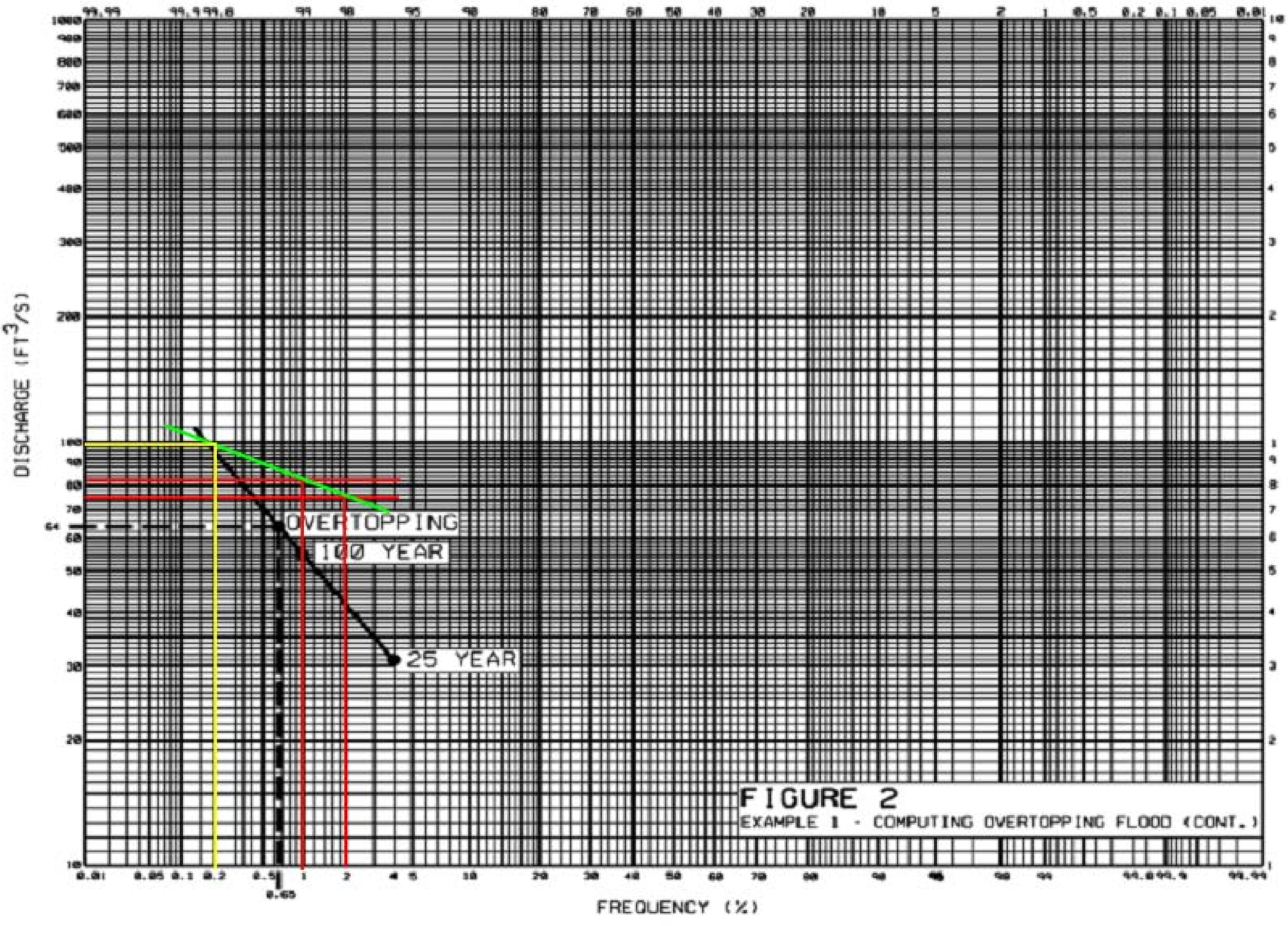
$$Q_{50} = 0.3*2.00*123.1$$
$$Q_{50} = 73.86 \text{ cfs}$$

$$Q_{100} = 0.3*2.20*123.1$$
$$Q_{100} = 81.25 \text{ cfs}$$

From graph:

$$Q_{500} = 100 \text{ cfs}$$

Figure 2, Example 1 taken from Drainage Handbook Culvert Design.



500 year design discharge (yellow) was found by drawing in the calculated Q values vs. the design frequency (red) and plotting a best fit line (green).

Project: **SR 29** By: DMR Date:

Subject: **Time of Concentration, Tc** Check: Date:

Revised: Date:

Existing Conditions

Sheet Flow

		Segment ID		AB				
1.	Surface description (table 3-1, TR-55)			Grass				
2.	Manning's Roughness coefficient, n (table 3-1, TR-55)			0.13				
3.	Two year 24 hour rainfall, P2		in	4.50				
4.	Flow length, L (total L< 300 ft)		ft	300				
5.	Land slope , s	Begin Elev.	ft	35.00				
		End Elev.	ft	34.50				
	Slope = (E1-E2)/L	Slope	ft/ft	0.002				
6.	Tt = (0.007*(nL)^0.8)/((P2^0.5)(s^0.4)) * 60	Compute Tt	min.	47.9	+		=	47.9

Shallow Concentrated Flow

	Grass	Segment ID		BD				
7.	Surface description (paved or unpaved)			Unpaved				
	Velocity Coefficient K (Paved = 20.328, Unpaved = 16.1345)			16.1345				
8.	Flow length, L		ft	2700				
9.	Watercourse slope, s	Begin Elev.	ft	34.5				
		End Elev.	ft	32.9				
	Slope = (E1-E2)/L	Slope	ft/ft	0.001				
10.	Average velocity, V (V = K*S^0.5)		ft/s	0.39				
11.	Tt = L/(60*V)	Compute Tt	min.	114.6	+		=	114.6

Channel Flow (Ditch)

		Segment ID					
12.	Hydraulic radius, R = A / WP (Depth of Flow)		ft				
13.	Flow length, L		ft				
14.	Slope, s	Begin Elev.	ft				
		End Elev.	ft				
	Slope = (E1-E2)/L	Slope	ft/ft				
15.	Manning's roughness coefficient, N (table 3-1, TR-55)						
16.	V = (1.49*R^.67*s^0.5)/N		ft/s				
17.	Tt = L/(60*V)	Compute Tt	min.			=	0.0

18.	Total of 6, 11 and 17	min.		=	162.5
	Minimum Time of Concentration	min.	10.0		
	Time of Concentration	min.			162.5
		hr			2.71

SR 29 – Existing Triple 36" Cross Drain

Project Notes

Project Title: Drainage Complaint SR 29

Designer: EC

Project Date: Monday, August 03, 2009

Notes: The roadway overtops at a flow rate of 193.86 cfs which is well beyond the flow rate for the 500 year design frequency. This cross drain seems to be sized properly. All elevations were taken from old plans.

Table 1 - Summary of Culvert Flows at Crossing: Triple 36" Cross Drain

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
33.81	66.47	66.47	0.00	1
33.85	69.82	69.82	0.00	1
33.88	73.18	73.18	0.00	1
33.89	73.86	73.86	0.00	1
33.96	79.88	79.88	0.00	1
34.00	83.23	83.23	0.00	1
34.04	86.59	86.59	0.00	1
34.08	89.94	89.94	0.00	1
34.12	93.29	93.29	0.00	1
34.17	96.65	96.65	0.00	1
34.22	100.00	100.00	0.00	1

*Highlighted values represent the 25 year, 50 year, and 500 year design frequencies.

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
66.47	66.47	33.81	2.237	3.192	7-M1t	2.605	1.513	2.960	2.880	3.156	0.000
69.82	69.82	33.85	2.305	3.229	3-M2t	3.000	1.550	2.960	2.880	3.316	0.000
73.18	73.18	33.88	2.372	3.263	3-M2t	3.000	1.587	2.960	2.880	3.475	0.000
73.86	73.86	33.89	2.386	3.270	3-M2t	3.000	1.594	2.960	2.880	3.507	0.000
79.88	79.88	33.96	2.504	3.337	7-M2t	3.000	1.661	2.960	2.880	3.793	0.000
83.23	83.23	34.00	2.569	3.377	7-M2t	3.000	1.698	2.960	2.880	3.953	0.000
86.59	86.59	34.04	2.634	3.418	7-M2t	3.000	1.735	2.960	2.880	4.112	0.000
89.94	89.94	34.08	2.699	3.460	7-M2t	3.000	1.771	2.960	2.880	4.271	0.000
93.29	93.29	34.12	2.764	3.505	7-M2t	3.000	1.807	2.960	2.880	4.430	0.000
96.65	96.65	34.17	2.829	3.550	7-M2t	3.000	1.838	2.960	2.880	4.589	0.000
100.00	100.00	34.22	2.894	3.598	7-M2t	3.000	1.870	2.960	2.880	4.749	0.000

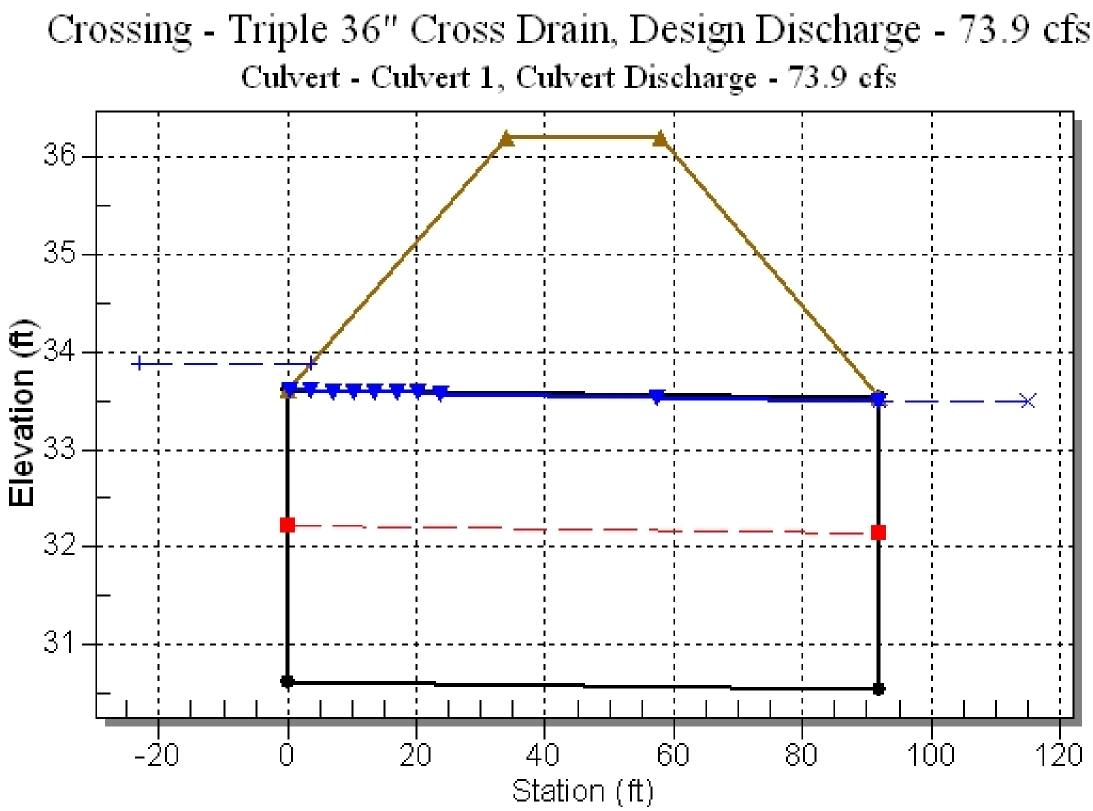
****

Inlet Elevation (invert): 30.62 ft, Outlet Elevation (invert): 30.54 ft

Culvert Length: 92.00 ft, Culvert Slope: 0.0009

****

Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.62 ft

Outlet Station: 92.00 ft

Outlet Elevation: 30.54 ft

Number of Barrels: 3

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Tailwater Channel Data - Triple 36" Cross Drain

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 33.50 ft (design highwater from historical plans)

Roadway Data for Crossing: Triple 36" Cross Drain

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 36.20 ft

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

SR 29 – Proposed Quadruple 48" Cross Drain

Project Notes

Project Title: Drainage Complaint SR 29

Designer: EC

Project Date: Monday, August 03, 2009

Notes: The roadway would overtop at a flow rate of 113.3 cfs if this scenario were used. This falls between the 50 year and 100 year design floods and would be acceptable.

Table 1 - Summary of Culvert Flows at Crossing: Quadruple 48" Cross Drain

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
35.40	94.35	94.35	0.00	1
35.41	97.91	97.91	0.00	1
35.42	101.48	101.48	0.00	1
35.43	104.11	104.11	0.00	1
35.44	108.61	108.61	0.00	1
35.45	112.18	112.18	0.00	1
35.46	115.74	115.74	0.02	3
35.47	119.30	119.25	0.09	3
35.48	122.87	122.73	0.18	3
35.49	126.44	126.17	0.30	3
35.50	130.00	129.71	0.44	3

*Highlighted values represent the 25 year, 50 year, and 500 year design frequencies.

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
94.35	94.35	35.40	1.985	5.324	4-FFf	4.000	1.421	4.000	5.220	1.877	0.000
97.91	97.91	35.41	2.030	5.332	4-FFf	4.000	1.450	4.000	5.220	1.948	0.000
101.48	101.48	35.42	2.077	5.340	4-FFf	4.000	1.478	4.000	5.220	2.019	0.000
104.11	104.11	35.43	2.111	5.347	4-FFf	4.000	1.499	4.000	5.220	2.071	0.000
108.61	108.61	35.44	2.168	5.358	4-FFf	4.000	1.536	4.000	5.220	2.161	0.000
112.18	112.18	35.45	2.213	5.367	4-FFf	4.000	1.564	4.000	5.220	2.232	0.000
115.74	115.74	35.46	2.257	5.377	4-FFf	4.000	1.593	4.000	5.220	2.303	0.000
119.30	119.25	35.47	2.300	5.386	4-FFf	4.000	1.617	4.000	5.220	2.372	0.000
122.87	122.73	35.48	2.342	5.396	4-FFf	4.000	1.639	4.000	5.220	2.442	0.000
126.44	126.17	35.49	2.383	5.406	4-FFf	4.000	1.662	4.000	5.220	2.510	0.000
130.00	129.71	35.50	2.424	5.417	4-FFf	4.000	1.684	4.000	5.220	2.581	0.000

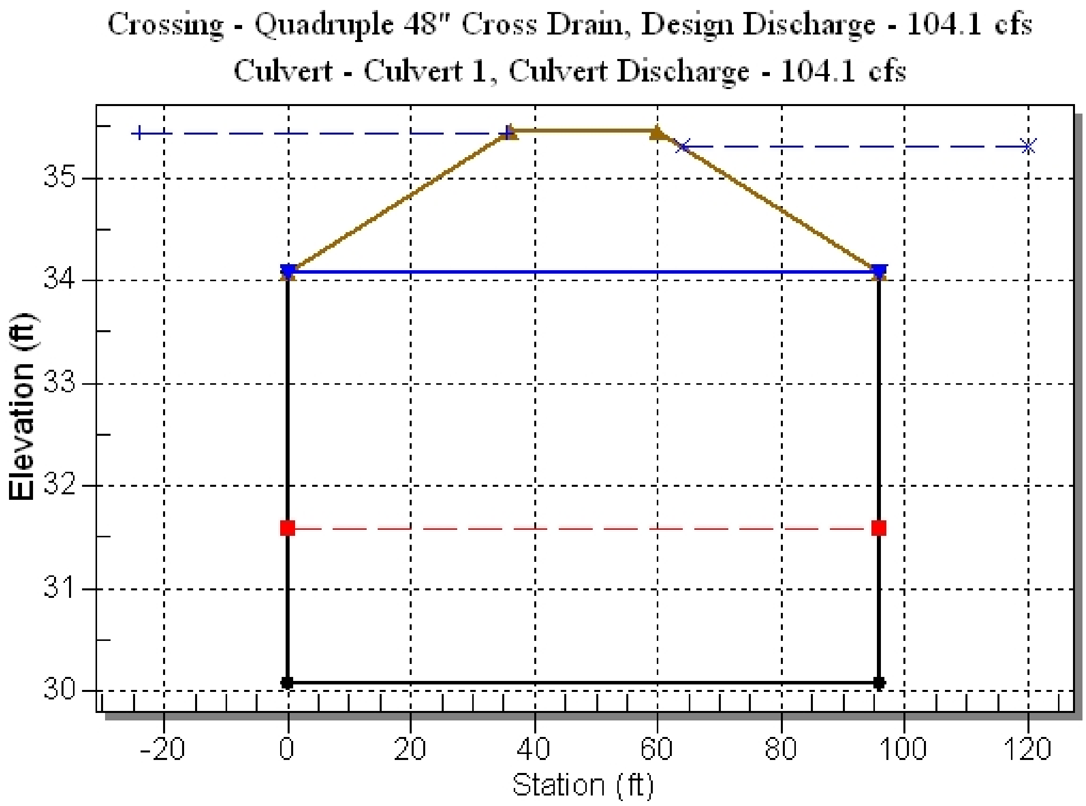
****

Inlet Elevation (invert): 30.08 ft,   Outlet Elevation (invert): 30.08 ft

Culvert Length: 96.00 ft,   Culvert Slope: 0.0000

****

Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 30.08 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Outlet Station: 96.00 ft (Straight Line Diagrams 05090000)

Outlet Elevation: 30.08 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Number of Barrels: 4

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Tailwater Channel Data - Quadruple 48" Cross Drain

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 35.30 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Roadway Data for Crossing: Quadruple 48" Cross Drain

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 15.00 ft

Crest Elevation: 35.45 ft (SR 78, Job No. 0504-201, Glades County, Fiscal Year 1956)

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

SR 29

Project is located in Zone 8.
Area is grass and dirt and very flat, therefore the runoff coeficient is 0.3
Areas were taken from the drainage map

Rational Method

Existing flow rates generated from runoff

$$Q = CIA$$

Q: Flow Rate (cfs)
C: Runoff Coeficient, **0.3**
I: Rainfall Distribution (in/hr), **1.1**
A: Area (acres), **612.9**

54" Side drain pipe

Q_{10} = 0.3*1.1*612.9
Q_{10} = 202.3 cfs

Manning's Equation

Side drain pipe capacity

$$Q = 1.49/n\ (A)(R)^{2/3}(S)^{1/2}$$

Q: Flow Rate (cfs)
n: Roughness Coefficient
A: Area of Pipe (ft^2)
R: Hydraulic Raduis (ft)
S: Slope of Pipe

Pipe Size	Area, A	Wetted Perimeter, WP	Hydraulic Radius, R	n	S	Q (per Barrel)
54.00	**15.90**	**14.13**	**1.13**	**0.012**	**0.001**	**67.52**
60.00	19.63	15.70	1.25	0.012	0.001	89.42
66.00	23.75	17.27	1.38	0.012	0.001	115.29

*existing pipe size is bolded

Project: **SR 29**		By:	DMR	Date:
Subject: **Time of Concentration, Tc**		Check:		Date:
		Revised:		Date:

Existing Conditions

Double 54" Side Drain

Sheet Flow

		Segment ID		AB				
1.	Surface description (table 3-1, TR-55)			Grass				
2.	Manning's Roughness coefficient, n (table 3-1, TR-55)			0.13				
3.	Two year 24 hour rainfall, P2		in	4.50				
4.	Flow length, L (total L< 300 ft)		ft	300				
5.	Land slope , s	Begin Elev.	ft	48.00				
		End Elev.	ft	46.00				
	Slope = (E1-E2)/L	Slope	ft/ft	0.007				
6.	Tt = (0.007*(nL)^0.8)/((P2^0.5)(s^0.4)) * 60	Compute Tt	min.	27.5	+		=	27.5

Shallow Concentrated Flow

	Grass	Segment ID		BD				
7.	Surface description (paved or unpaved)			Unpaved				
	Velocity Coefficient K (Paved = 20.328, Unpaved = 16.1345)			16.1345				
8.	Flow length, L		ft	8300				
9.	Watercourse slope, s	Begin Elev.	ft	46.0				
		End Elev.	ft	35.0				
	Slope = (E1-E2)/L	Slope	ft/ft	0.001				
10.	Average velocity, V (V = K*S^0.5)		ft/s	0.59				
11.	Tt = L/(60*V)	Compute Tt	min.	235.5	+		=	235.5

Channel Flow (Ditch)

		Segment ID					
12.	Hydraulic radius, R = A / WP (Depth of Flow)		ft				
13.	Flow length, L		ft				
14.	Slope, s	Begin Elev.	ft				
		End Elev.	ft				
	Slope = (E1-E2)/L	Slope	ft/ft				
15.	Manning's roughness coefficient, N (table 3-1, TR-55)						
16.	V = (1.49*R^.67*s^0.5)/N		ft/s				
17.	Tt = L/(60*V)	Compute Tt	min.			=	0.0

18.	Total of 6, 11 and 17	min.		=	263.1
	Minimum Time of Concentration	min.	10.0		
	Time of Concentration	min.			263.1
		hr			4.38

Appendix H
Analysis of Flooding Report

ANALYSIS OF FLOODING PROBLEM FOR S.R. 29 WEST OF CHAPARRAL SLOUGH

05090
Glade Co.

Financial Project ID 198356-1-32-04
Work Program Item No. 1119960
S.R. 29 between S.R. 78 and Chaparral Slough

Prepared for:

The Florida Department of Transportation
District One
801 North Broadway
Bartow, FL 33831-12349

Prepared by:

PBS&J, Inc.
5300 W. Cypress Street
Suite 300
Tampa, FL 33607-1066

October 1999

Larry Dailey
10/26/99

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	1
EXISTING DRAINAGE PATTERNS	1
POTENTIAL CAUSES OF FLOODING	2
RECOMMENDATIONS	3

FIGURE	TITLE	FOLLOWS PAGE
1	EXISTING DRAINAGE PATTERNS	1

APPENDICES

APPENDIX A	Photographs of Flooding
APPENDIX B	Flooding Correspondence
APPENDIX C	Hydraulic Calculations
APPENDIX D	Drainage Maps

INTRODUCTION

The project is located in Glades County, just east of the City of Labelle. It is a two lane rural highway constructed in the late 1940's. See Appendix D for the original drainage map, dated 1947 and a drainage map for SR 78 dated 1956 which includes this section of roadway. As noted on the original map, the section of roadway between Lone Pine Creek Bridge and 600 ft west of Chaparral Slough Bridge (between Stations 366+00 and 426+00) is flat, with a profile elevation of 35.4. This section of roadway has flooded twice since sometime in the early 1970's, see Appendix B for flooding correspondence. See Appendix A for photographs of a flooding event on March 20, 1998 and a near flood event on February 18, 1998.

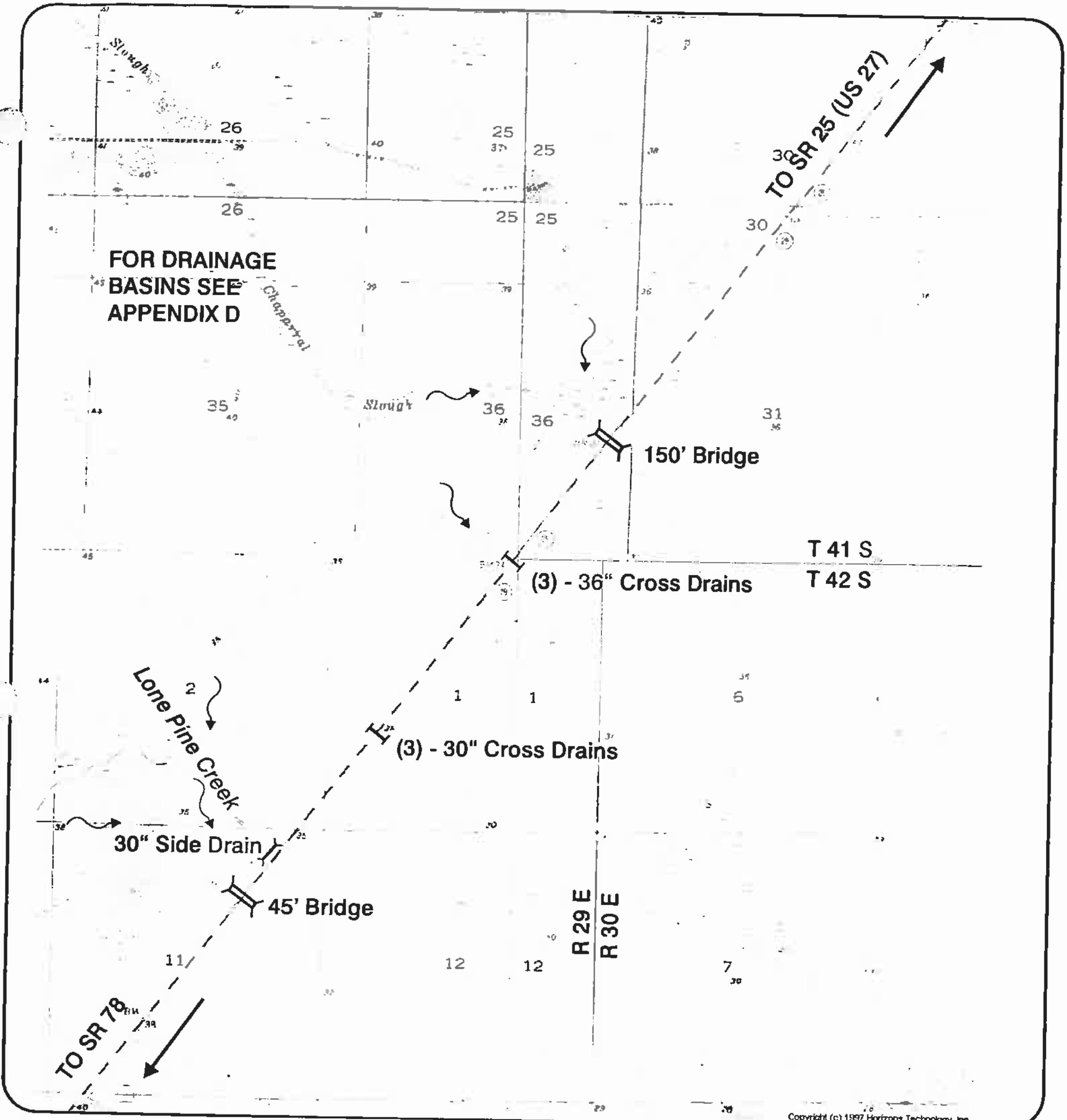
The intent of this engineering analysis is to determine the cause of the flooding and provide recommendations regarding the most cost effective remedy.

EXISTING DRAINAGE PATTERNS

Drainage is generally toward the south and consists of shallow sloughs, marshes, and wetlands. Because the terrain is so flat, flow is at low velocity and the difference between flood stages and normal wet season water levels is only a few feet. There is significant storage within the basins. Drainage structures within and near the flooding area consist of a 45' bridge at Lone Pine Creek, a 150' bridge at Chaparral Slough, (3) - 30" cross drain pipes at approximately Sta. 354+00, (3) – 36" cross drain pipes at approximately Sta. 392+00, and a 30" side drain pipe under a drive approximately 700 ft northeast of Lone Pine Creek Bridge. All structures except the side drain and (3) - 36" pipe were constructed on the original project. Time of construction and reason for the (3) - 36" pipes are unknown.

The original roadway project provided a large R/W ditch on the northwest side of SR 29 between Lone Pine Creek Bridge and a slough approximately 1500 ft northeast of the bridge. It connected the slough, which drains a 2618 acre basin (see original project drainage map), with Lone Pine Creek Bridge. The old plans show the R/W ditch begins at station 315+70.50 and ends at approximately 325+00. The ditch has a 20 ft bottom width and a 0.15% profile grade (Elv 28.65 @ Sta 316+00 to Elv 30.00 @ Sta 325+00).

During flood conditions, a large area northwest of SR 29 stores runoff and rises to elevation 35.4 before overtopping occurs. There is a slight gradient on the pool due to its movement toward the southwest.



LEGEND

FLORIDA DEPARTMENT OF TRANSPORTATION

S.R. 29
STUDY
West of Chaparral Slough
Glades County, Florida

EXISTING DRAINAGE PATTERNS

FIGURE 1

COREL \ DRAINAGE '9 GLADES COUNTY \ REPORT \ FIG_1.CDR \ 10-25-99

POTENTIAL CAUSES OF FLOODING

<u>A review of the area drainage was performed using the following sources:</u>

Two field reviews. (August 26, 1999 and September 7, 1999)
Drainage maps for SR 29, Project 05090-1 (date 1947) and SR 78, Project 05040- (date 1956)
USGS Quadrangle maps
Photographs of flood events.
Interviews with Talbert Melton (FDOT Maintenance - Labelle), George Vialas (Engineer for Lykes Bros.), Joseph Phillips (FDOT SWAO Drainage Engineer)
District One Flood Inventory, 1996
Bridge Hydraulic Report for Lone Pine Creek Bridge, by JMI Engineers, March 7, 1996
Aerial reconnaissance, August 29, 1999

Potential causes and their evaluations are listed below:

- The flow capacity of Chaparral Slough Bridge could be significantly reduced by partial blockage resulting from accumulation of Water Hyacinths. This could cause diversion of flow to the southwest and overload the pipes and Lone Pine Creek bridge. *A review of the photograph taken at Chaparral Slough bridge during flooding conditions on February 18, 1998 shows low velocities through the bridge, thus significant head losses would not be possible.*

- The large R/W ditch northeast of Lone Pine Creek Bridge is restricted by a 30" side drain pipe under a driveway, approximately 700 ft from the bridge. This restriction could be contributing to the flooding problem in two ways. It could increase the head losses, which will cause immediate and direct impacts to flood stages and/or it could indirectly raise flood stages by raising the seasonal high waters, thus reducing available storage. *This could be a significant problem, depending on the ratio between the flow carried in the R/W ditch and that carried overland in shallow depth flow. It is obvious that the 30" pipe violates the design intent of the R/W ditch, since its capacity is so much less than the ditch.*

- The water elevation observed on August 26, 1999 at Chaparral Slough was approximately 1 ft below the bottom slab of the bridge. This is estimated to be elevation 34.0, which is the same elevation of the highwater shown on the old drainage map. Since no significant rainfall had occurred within several days it suggest the seasonal high water stages downstream of Chaparral Slough Bridge may have been raised through land alterations. This would raise flood elevations for two reasons, bridge hydraulics and the loss of storage. *No land alterations south of the bridge were observed during aerial reconnaissance.*

- Chaparral Slough may overtop its western basin boundary during flood stages and increase flow to the (3)–30", (3)–36", and Lone Pine Creek Bridge above that anticipated in the original design. This diversion of flow could be natural or caused by land alteration. *Survey efforts and comprehensive modeling will be required to determine if this is occurring, however it is not warranted at this time. It is obvious that the discharge to the pipes and Lone Pine Creek Bridge exceed their capacity, regardless of source.*

- The location of the (3)-30" pipes offers a more efficient path for removal of flood waters than either Lone Pine Creek or Chaparral Slough. This is apparent from the photographs of flooding. It is obvious that the tailwater stages at this site are 2' to 3' below upstream stages. Low velocities at the bridge, observed during flood events, indicate losses through the bridges are low. If the headwaters are near 35.5, as shown in the photograph, then the tailwaters at the bridges are much closer to the 35.5 than at the pipes. An examination of the USGS Quadrangle map adds further support to the hypothesis that tailwater stages are lower at the pipes than at the two bridges. Based on these facts, the original design may not have been the most hydraulically effective. *Clearly, the most certain remedy for the flood condition is a significant enlargement of the (3)-30" pipes, however such alteration can have far reaching impacts. The increased discharge rate downstream would require concurrence of property owners and the Water Management District.*

RECOMMENDATIONS

Improvements should be implemented in a two step process as follows:

- Replace the 30" side drain pipe in the R/W ditch at approximately Sta 320+22 with 40 ft of double 72" pipes at approximately elevation 28.8. This will provide capacity which conforms to the original design intent at a relatively economical expense, especially if FDOT Maintenance employees perform the work. This improvement will reduce flood levels in two ways; (1) it will reduce head losses through the side drain and (2) it will draw down water levels more rapidly which, in turn, will increase storage available, and thus will lower flood stages. Benefits provided by this action are unknown without a significant surveying and modeling effort since they depend on the ditch conveyance as compared to overland conveyance. It is more cost effective to invest in the pipe than in the study to predict their benefits.

- Step two is to be implemented if the side drain enlargement does not reduce flooding to an acceptable level. It requires replacement of the (3)-30" cross drain pipes with a box culvert. This modification will involve design, permitting, and possible acquisition of flood rights from downstream property owners.

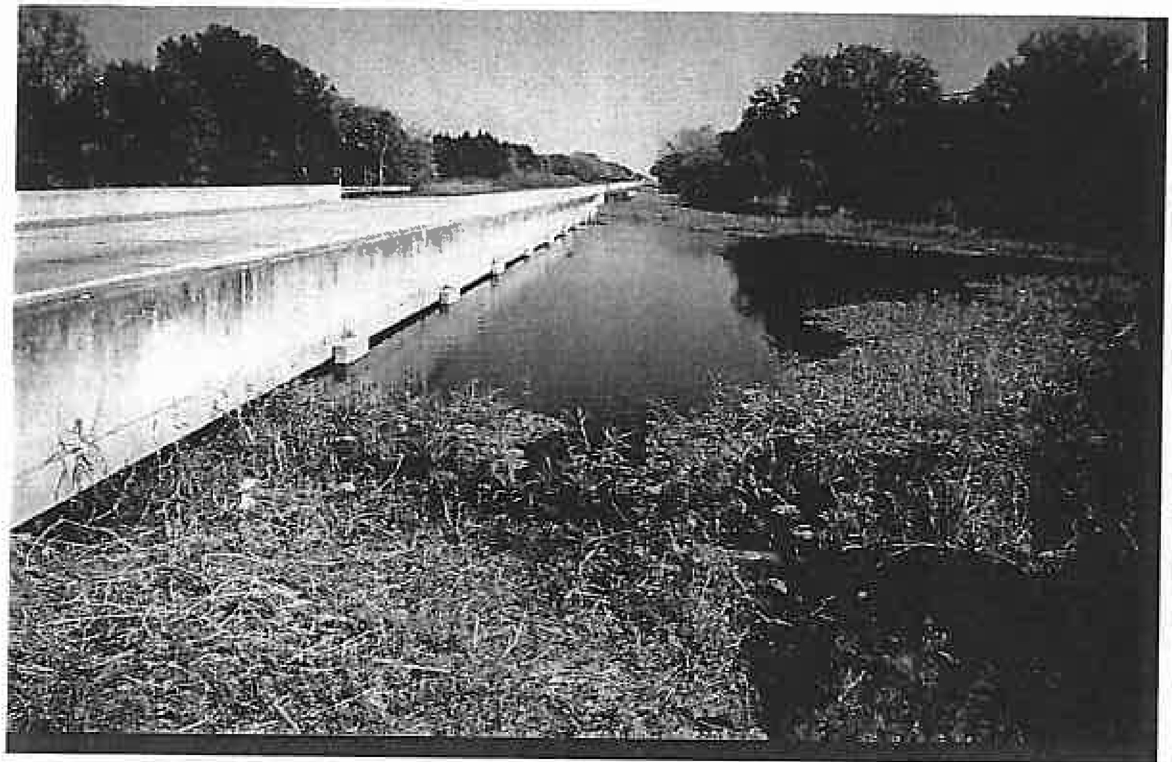
If Step Two cannot be implemented, two options are available, both of which are significantly more expensive:

- Option One requires raising the roadway grade for approximately 2 miles, extending cross drains, and adding 48" cross drains uniformly spaced along the raised segment. Weirs with crest elevations to match existing roadway elevation (35.4) will be affixed to the 48" cross drains to serve as control structures to match existing conditions, i.e. restricted pipe flow up to 35.4 and a large capacity increase above 35.4. This modification can be designed to provide stage-discharge characteristics similar to existing overtopping conditions, thus maintaining existing flow conditions. There are significant construction cost attached to this option.

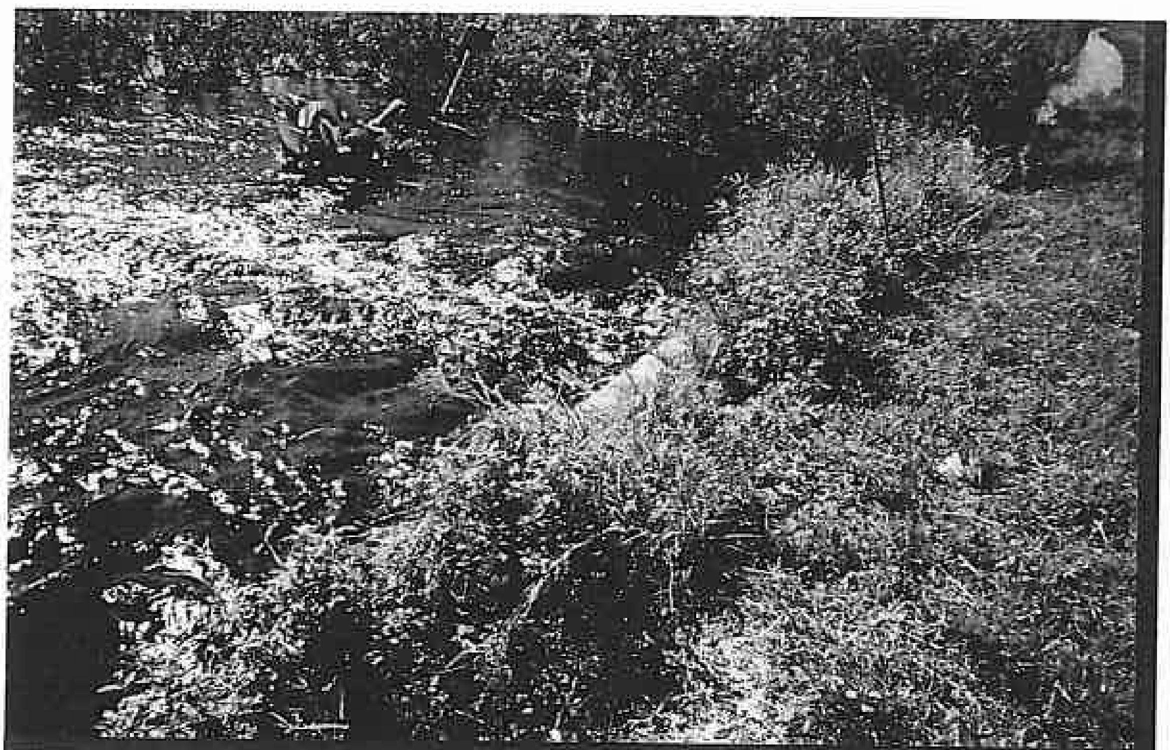
- Option Two will provide a raised berm along the northwest R/W line at elevation 35.4 with openings equivalent to existing pipes. Several 48" cross drains will be provided under the roadway to carry the large berm overtopping flow and distribute it along the southeast R\W line in a manner similar to what happens during existing roadway overtopping. Construction cost will be less than Option One, however it will require a R\W strip along the northwest side in order to provide sufficient width to construct the berm and ditches (one on either side of the berm). Option Two will be more economical than option one because R/W acquisition will involve undeveloped property in one ownership.

APPENDIX A

PHOTOGRAPHS OF FLOODING



LOOKING NORTHEAST ALONG S.R. 29 AT CHAPARRAL SLOUGH BRIDGE

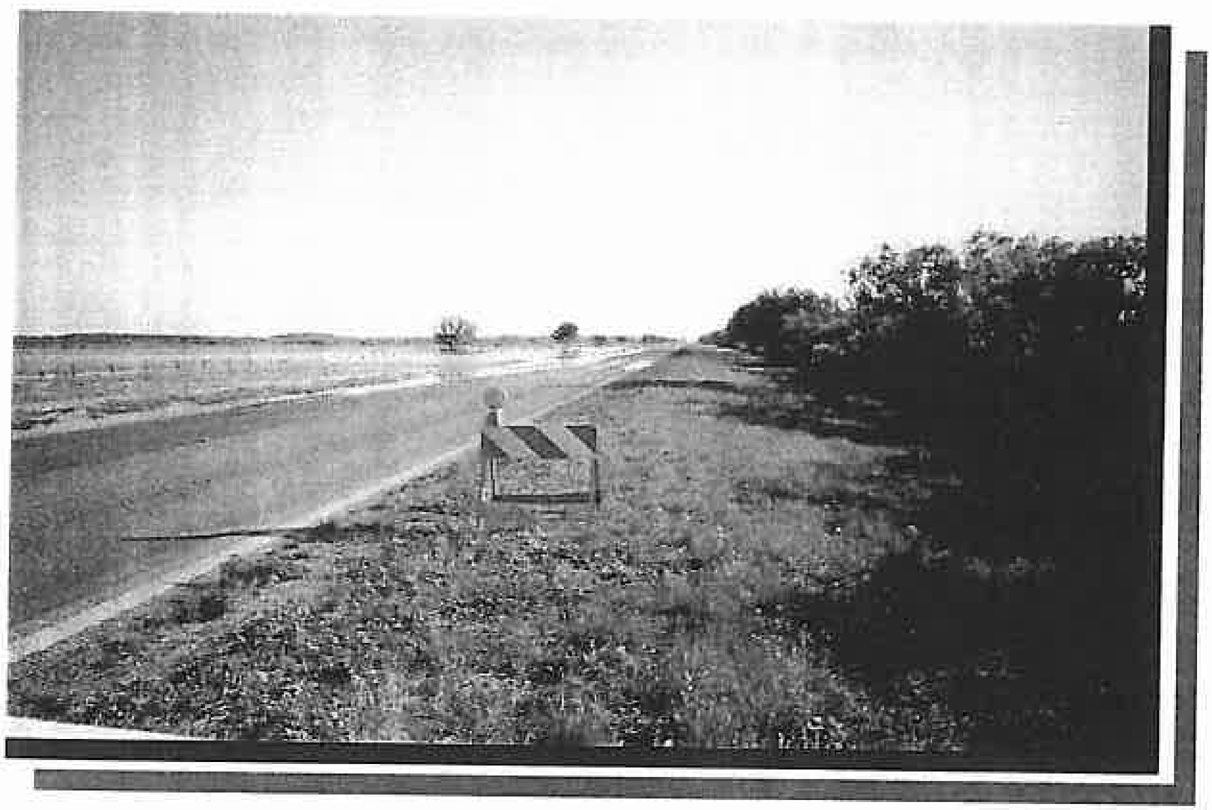


LOOKING SOUTH ALONG S.R. 29 AT (3) 30" RCP APPROXIMATELY STA. 354+00

LOOKING SOUTHWEST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

LOOKING SOUTHWEST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

LOOKING NORTHEAST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH



LOOKING NORTHEAST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

APPENDIX B

FLOODING CORRESPONDENCE

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 10:29 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Talbert Melton

Subject: Flooding on SR29

I asked Mr. Melton specifically about June 1995 when Ken Howard recalls there was a need for barricades on a portion of SR 29 where water was coming onto the roadway. He does not remember ever having to take barricades out there. He said that the water frequently comes up and will quickly runoff the roadway. At times they have gone out and driven fluorescent painted stakes at the edge of the pavement, however they have not had to drive stakes in a while.

He also spoke with field superintendent Robert Crawford who would actually gone out into the field. Mr. Crawford does not remember water over the road or bridges. He did not take barricades out during this event.

The other field superintendent, Wally Thalen, was out of the office but will call when he gets in.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 11:40 AM **CALL ~~PLACED~~/RECEIVED BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Wallace Thalen

Subject: Flooding on SR29

The area of flooding during June 1995 was at a 36" cross drain located between bridges 050033 and 050035. It is approximately 0.5 - 0.6 miles south of bridge 050033. This is the area that they have the most problems with. During June the water was up to the edge of pavement. It lacked only a few inches to overtop the road. You could not pull off the highway.

Water flows 'real good' through bridge 050035. It washes sand up on the east side of the highway. He does not remember the water level ever coming up to the bridge.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 09:23 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Emergency Management **TELEPHONE #** (941) 946-1217

SPOKE WITH: Ken Howard, Director

Subject: Flooding on SR29

I called Mr. Howard about the flooding which occurred around June 23, 1995 (per Art de Laski). He stated that the road was never completely closed during this time. There was an area where the water was over the road, however the road was still passible. A Florida Highway Patrol first noticed the water on the road and notified the EMA, who notified the Glades Co. Road Department who put up barricades and warnings for travelors.

Mr. Howard stated that this area was located about 5 miles south of the intersection of SR 29 and US 27. He said that it was not at a bridge, it was only the roadway. The water receded in about 24 hours.

Mr. Howard stated that all this information was his own personal experience. This past year was unusual due to several tropical storms, hurricanes, etc. and there were a lot of areas flooded which usually don't. In the last 7-10 years, he does not remember SR 29 ever overtopping. The EMA does not have detailed records of flooding and road closures. Since this is a state road, he recommended contacting the FDOT Maintenance.

He mentioned contacting Tommy Greenwood, Director of the Glades County Road Department for possibly more information. (941) 946-0771

cc: File, Dave, Art

Project/Proposal 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 09:11 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Schools **TELEPHONE #** (941) 946-0323 ext.13

SPOKE WITH: Norman (Sonny) Hughes, Dir. of Transportation

Subject: Flooding on SR 29

Mr. Hughes has been with the Glades Co. School Department for 29 years. Glades Co. School buses travel SR 29 from LaBelle to Palmdale and are not allowed to drive on roads which have water overtopping them. He said that during the period of time he has been with Glades Co., SR 29 has never been blocked for the school buses. He said that there have been other roads which have been blocked but not SR 29.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 10:01 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 946-0533

SPOKE WITH: Jerry Harris, Building Director

Subject: Flooding on SR 29

Mr. Harris is the former Glades Co. Emergency Management Director (1978-1995). He also has been the FEMA Flood Program Administrator since 1982. He was born and raised in Clewiston and considers himself a "Sawgrass Mugrat".

Speaking with Mr. Harris about flooding on SR 29, he mentioned that the only location where they have had trouble on this road is at Chaparral Slough. He recalls that the water has come up very high at this location, enough to damage the roadway base, but has not overtopped the roadway.

He said that during heavy rains water will spread out on both sides of SR 29, and sheetflow across the floodplain approximately 200 square miles. He said that all the water in this area is trying to reach the Caloosahatchee River regardless of the direction it travels.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/26/96 **PROJECT NO:** 9523

TIME: 11:59 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 675-0124

SPOKE WITH: David Whiddon, Former Road Department Superintendent

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Subject: Flooding on SR29

Mr. Whiddon was with the road department from 1980-93, prior to Tommy Greenwood. He has lived in Glades County all his life, 48 years.

To his knowledge, SR 29 has never overtopped. He stated that the land to the west of SR 29, north of SR 78 approximately 3-4 miles stays wet for most of the year.

He warned that if the flow was increased through SR 29, this could cause increased flooding at SR 78. He said that the residents on Marshall Field Road get mad every year because of flooding. If we increase the risk of flooding for these residents, he said for us to expect a lawsuit.

He said that during heavy rains, the water already comes up to the edge of pavement on SR 78.

Project/Proposal

cc: File, Dave, Art 9523

APPENDIX C

HYDRAULIC CALCULATIONS

BSJ

COMP. BY: MDM
CHK. BY: REG
DATE: 9/14/99
SHEET NO:
JOB NO:

SUBJECT: SR 29 - 50yr Flow Rate for Lone Pine Creek

Q_{50yr} = 598cfs (See BHR for SR29 Crossing for Lone Pine Creek Bridge No. 050035, JMI Engineers March 7, 1996)

Drainage Area = 4833 Ac (From original Drainage Map)

Area blocked by Driveway = 2618 Ac
(Existing 30" cmp side Drain)

$$Q_{50yr\ @\ Ex\ 30"cmp} = \frac{2618\ Ac}{4833\ Ac} \times 598_{cfs} = 324_{cfs}$$

Size Proposed Side Drain for a velocity of 6 fps for 50yr event.

$$Q = VA$$

$$A = \frac{Q}{V} = \frac{324}{6} = 54\ ft^2$$

USE (2)-72" RCP

$$A = 2 \times \frac{6^2}{4} \times 3.142 = 56.6\ ft^2$$

Peak Basin Discharge				
	USGS Regression Equations, Region A		FHWA Regression Equations, Zone 1	
Storm (yr.)	Flow (m^3/m)	Flow (cfs)	Flow (m^3/m)	Flow (cfs)
2	234	138	514	303
50	1015	598	2138	1258
100	1164	685	2498	1470
500	1485	874	N/A	N/A

Table 1. Peak Basin Discharge

The resistance to flow, Manning's "n" coefficients, in the main channel and the flood plain have been calculated using procedures and equations found in the Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, FHWA-TS-84-204. Very high amounts of vegetation, a severe degree of irregularity, and a negligible effect of obstructions in the main channel are factors which effect the resistance to flow. A Manning's Roughness Coefficient of 0.10 was used to account for this resistance to flow in the main channel of Lone Pine Creek (calculations provided in Appendix B).

The Manning's Roughness Coefficients for the flood plain were computed without using the vegetation-density method. Since the roughness is not uniformly distributed across the flood plain it has been subdivided into two sections. These sections include an area with trees and area of pasture (no trees). The computed "n" value for the pasture section is 0.06 and 0.15 for the section with trees (calculations and photographs provided in Appendix B).

Hydraulic Analysis

FHWA's Bridge Waterways Analysis Model (WSPRO) was used to create a hydraulic model of Lone Pine Creek at the crossing of SR 29.

APPENDIX D

DRAINAGE MAPS

Appendix I
Cost Estimate

AIM ENGINEERING & SURVEYING, INC.
5802 Breckenridge Prky.
Tampa, Florida 33610
(813) 627-4144

ENGINEER'S ESTIMATE OF CONSTRUCTION COST

Project Name: SR 29 From North of SR 78 to Chaparral Slough (M.P 4.709 to 6.877) - Ditch Regrading

County: Glades County

Engineer of Record: Dawn Ratican, P.E. AIM Project No: 09-9662

Type of Estimate: Preliminary Planning (X) Phase I ( ) Phase II ( ) Phase III ( ) Phase IV ( ) Final ( )

Estimated By: Liz Cashwell Date: 08/26/09 Spec Year:

Checked By: Dawn Ratican Date: 08/28/09

	Estimated Cost	Percent of Total Cost
COMPONENT GROUPS		
200 - ROADWAY	$ 7,930.65	100.00%
COMPONENT SUB-TOTAL	$ 7,930.65	100.00%
(101-1) MOBILIZATION (10%)	$ 793.07	10.00%
(102-1) MAINTENANCE OF TRAFFIC (10%)	$ 793.07	10.00%
(999-25) CONTINGENCY (Do Not Bid) (25%)	$ 1,982.66	25.00%
PROJECT GRAND TOTAL =	**$ 11,499.44**	

NOTES : Unit costs were determined from previously bid unit cost averages of Area 9 and Statewide.

Pay Item Number	Item Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
ROADWAY					
101-1	Mobilization	1.0	LS	$0.00	$ -
102-1	Maintenance of Traffic	1.0	LS	$0.00	$ -
104-11	Floating Turbidity Barrier	100.0	LF	$5.73	$ 573.00
104-12	Staked Turbidity Barrier	50.0	LF	$5.97	$ 298.50
104-13-1	Silt Fence Staked (Type III)	400.0	LF	$7.60	$ 3,040.00
110-1-1	Clearing & Grubbing	0.75	AC	$551.96	$ 413.97
120-1	Excavation, Regular	350	CY	$1.81	$ 633.50
430-94-2	Desilt Pipe (25" - 36")	656	LF	$4.53	$ 2,971.68
430-94-4	Desilt Pipe (49" - 60")	100.0	LF	$10.60	$ 1,060.00
570-1-2	Turf Complete (Sodding)	3,630	SY	$1.31	$ 4,755.30

	Subtotal =	**$ 7,930.65**

AIM ENGINEERING & SURVEYING, INC.
5802 Breckenridge Prky.
Tampa, Florida 33610
(813) 627-4144

ENGINEER'S ESTIMATE OF CONSTRUCTION COST

Project Name: SR 29 From North of SR 78 to Chaparral Slough (M.P 4.709 to 6.877) - Culvert Replacement			
County: Glades County			
Engineer of Record: Dawn Ratican, P.E.	AIM Project No: 09-9662		
Type of Estimate: Preliminary Planning (X) Phase I ( ) Phase II ( ) Phase III ( ) Phase IV ( ) Final ( )			
Estimated By: Liz Cashwell	Date: 08/26/09	Spec Year:	
Checked By: Dawn Ratican	Date: 08/28/09		

		Estimated Cost	Percent of Total Cost
COMPONENT GROUPS			
200 - ROADWAY	$	98,798.51	100.00%
COMPONENT SUB-TOTAL	$	98,798.51	100.00%
(101-1) MOBILIZATION (10%)	$	9,879.85	10.00%
(102-1) MAINTENANCE OF TRAFFIC (10%)	$	9,879.85	10.00%
(999-25) CONTINGENCY (Do Not Bid) (25%)	$	24,699.63	25.00%
PROJECT GRAND TOTAL =	**$**	**143,257.84**	

NOTES : Unit costs were determined from previously bid unit cost averages of Area 9 and Statewide.

Pay Item Number	Item Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
ROADWAY					
101-1	Mobilization	1.0	LS	$0.00	$ -
102-1	Maintenance of Traffic	1.0	LS	$0.00	$ -
104-11	Floating Turbidity Barrier	100.0	LF	$5.73	$ 573.00
104-12	Staked Turbidity Barrier	50.0	LF	$5.97	$ 298.50
104-13-1	Silt Fence Staked (Type III)	400.0	LF	$0.76	$ 304.00
110-1-1	Clearing & Grubbing	0.75	AC	$551.96	$ 413.97
120-1	Excavation, Regular	350	CY	$1.81	$ 633.50
400-1-2	Conc Class I (Endwalls)	43.6	CY	$773.16	$ 33,725.24
430-175-102	Pipe Culv (Opt Matl) (Round 25" to 36" S/CD)	276.0	LF	$69.23	$ 19,107.48
430-175-103	Pipe Culv (Opt Matl) (Round 37 to 48" S/CD)	384	LF	$101.53	$ 38,987.52
570-1-2	Turf Complete (Sodding)	3,630	SY	$1.31	$ 4,755.30

Subtotal = $	**98,798.51**