Forest Street and First Avenue Technical Memorandum

Prepared for:

Town of Windermere

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1.0 Overview

The purpose of this drainage study is to evaluate the existing stormwater collection system located along Forest Street, between First Avenue and Second Avenue; and First Avenue, between Forest Street and Butler Street. It has been reported that the existing stormwater collection system floods during normal storm events.

2.0 Methodology

On a video dated July 7, 2019, excessive flooding was shown at 110 Forest Street. The road was flooded, and the existing inlets were filled with water. Although the road was flooded, at certain locations, the excess runoff was not entering the system due to grate tops being higher than the dirt road. As built plans from a drainage improvements project dated December 2017 (by others) showed the existing condition of the road higher than the roadside swales. The road appears to have eroded 12“ to 18” in recent years with the road grade lower than the inlet top elevations. This is illustrated in Figure 1 below.

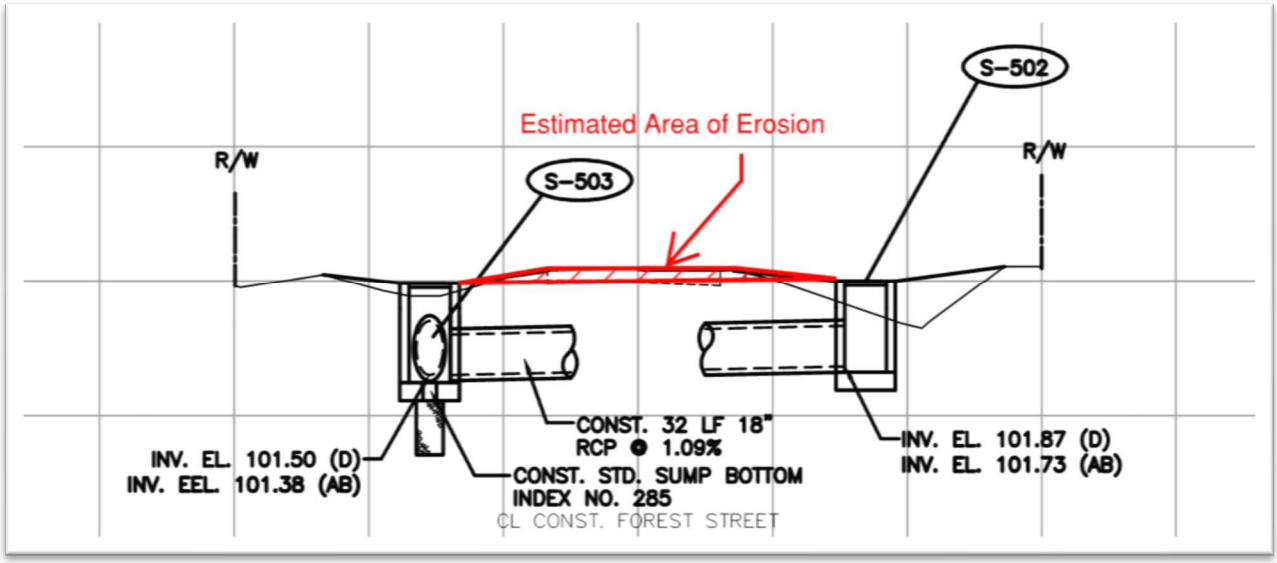

Figure 1

From First Avenue and Forest Street Drainage Improvements Record Drawings dated 08/14/2018

During a field visit on September 23, 2019, standing water was observed in the existing ditch bottom inlets at an average of 3’ below the grates. The inlets are connected by a French drain system which includes perforated pipes. Standing water in the system would indicate a groundwater table elevation 2’ higher than the original design seasonal high groundwater table. Also, this could be an indication of poor exfiltration possibly due to siltation and sediment transfer from the road.

A channel and pond routing model developed for the design of the original French drain installation, from the record drawings dated 08/14/2018, was analyzed to determine whether the erosion and siltation condition may have affected the system’s efficiency. A revised conditions model, basin boundaries, and

curve number values were used to try to replicate the flooding event. With the information from the video and the field review, the following modifications were calibrated in the model:

- The existing pipes only provide 50% capacity due to siltation.
- The existing French Drains provide no storage (no exfiltration).
- Simulate a 2YR-8HR storm event (3" Rainfall)

3.0 Findings

Modifying the ICPR model with the assumptions listed above resulted in 2.5 inches of overtopping of the existing inlets but did not replicate the severity of flooding at Forest Street. Based on these results, the flooding is likely due to severe clogging of the existing pipes and possible groundwater infiltration in the French drains. The estimated runoff could be underestimated as a result of significant impervious areas added upstream in recent years. During the design phase, a more detailed investigation of the existing upstream basin boundaries would be required to determine updated curve number values. The existing ground at the R/W supports that the flooding is contained within the R/W during the 2YR-8hr (3" rainfall) storm event. During the design phase, survey will be necessary to further analyze potential impacts to adjacent parcels during the design storm.

4.0 Recommendations

Below are two alternatives that we have developed to help alleviate the flooding along Forest Avenue:

Alternative A – Keep the Existing Dirt Roads

- Upsize the existing 15-inch outfall pipe to a 24-inch pipe.
- Improve existing ditches
    - Add a berm tp reduce siltation
    - Add articulated ditch block
    - Add erosion matting to prevent washing out
- Add additional ditches to the corner of First Ave and Forest Street
- Lower ditch bottom inlets elevations or raise the elevation of the dirt road
- Desilt existing system
- Create a maintenance plan that involves maintaining ditches and roadway profiles

Alternative B – Pervious Pavement

- Construct pervious pavement along First Ave and Forest Street
- Add a curb and flume system to tie into existing ditch bottom inlets
- Upsize the existing 15-inch outfall pipe to a 24-inch pipe.

Based on avoiding modifications to the existing French drain system, both alternatives could fall within a South Florida Water Management District permit exemption under minor roadway safety improvements. See Appendix G for a cost estimate for each alternative.

5.0 Additional Considerations

The backyards of the homes located along Forest Street and First Avenue have a history of flooding. To mitigate this flooding, consider adding an additional inlet pipe system with a separate outfall to capture

the runoff in this location. This would require a drainage easement to construct and maintain the system. The estimated cost of construction for this area would be $70,000. This is based on FDOT historical data; actual cost may vary. Appendix G includes a cost estimate breakdown. See Appendix E for a conceptual layout.

Appendix A – ICPR Model

==========
==== Basins ==========
==========

Name: BS-116 Node: S-116 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 15.00
Area(ac): 0.690 Time Shift(hrs): 0.00
Curve Number: 98.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-200 Node: S-501 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.180 Time Shift(hrs): 0.00
Curve Number: 66.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-201 Node: S-501 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 30.00
Area(ac): 1.620 Time Shift(hrs): 0.00
Curve Number: 58.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-202 Node: S-501 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 45.00
Area(ac): 3.500 Time Shift(hrs): 0.00
Curve Number: 58.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-203 Node: S-500 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.880 Time Shift(hrs): 0.00
Curve Number: 58.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-204 Node: S-500 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 30.00
Area(ac): 1.540 Time Shift(hrs): 0.00
Curve Number: 58.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-205 Node: S-500 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0

Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 15.00
Area(ac): 0.730 Time Shift(hrs): 0.00
Curve Number: 60.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-500 Node: S-500 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.010 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-501 Node: S-501 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.010 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-502 Node: S-502 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.190 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-503 Node: S-503 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.230 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-504 Node: S-504 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.170 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-505 Node: S-505 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 15.00
Area(ac): 0.380 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-507 Node: S-507 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.140 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-508 Node: S-508 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Flmod Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 13.00
Area(ac): 0.510 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-509 Node: S-509 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 0.060 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BS-510 Node: S-510 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 14.00
Area(ac): 0.410 Time Shift(hrs): 0.00
Curve Number: 57.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

==========
==== Nodes ==========
==========

Name: S-116 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	101.500
60.00	101.500

Name: S-500 Base Flow(cfs): 0.000 Init Stage(ft): 101.870
Group: BASE Warn Stage(ft): 105.010
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.870	0.0010
105.000	0.0010
105.250	5.0000

Name: S-501 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Plunge Factor: 1.00 Warn Stage(ft): 105.040
Type: Manhole, Flat Floor

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
99.260	0.0001
99.680	0.0001
100.000	0.0001

101.000	0.0001
101.260	0.0001
101.500	0.0001
102.000	0.0001
102.500	0.0001
103.000	0.0001
103.500	0.0001
103.740	0.0001
104.240	0.0001
105.000	0.0001
105.500	0.1000

Name: S-502 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 104.910
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.870	0.0010
105.200	0.0010
105.210	0.5000

Name: S-503 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Plunge Factor: 1.00 Warn Stage(ft): 104.910
Type: Manhole, Flat Floor

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
99.260	0.0001
99.680	0.0001
100.000	0.0001
100.260	0.0001
101.500	0.0001
102.000	0.0001
102.500	0.0001
103.000	0.0001
103.500	0.0001
103.740	0.0001
104.240	0.0001
104.920	0.0001
104.930	0.0001
105.100	0.1000
105.250	0.5000

Name: S-504 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 104.920
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.880	0.0001
105.200	0.0001
105.210	0.5000

Name: S-505 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 105.010
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
99.260	0.0001
99.680	0.0001
100.000	0.0001
101.000	0.0001
101.260	0.0001
101.500	0.0001
102.000	0.0001
102.500	0.0001
103.000	0.0001
103.500	0.0001
103.740	0.0001
104.240	0.0001
105.000	0.0001
105.100	0.1000
105.200	0.5000

Name: S-506 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 104.920
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.500	0.0001
105.250	0.0001
105.260	0.5000

Name: S-507 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 105.250
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.500	0.0001
105.400	0.0001
105.410	0.0001

Name: S-508 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 105.560
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
99.260	0.0001
99.680	0.0001
100.000	0.0001
101.000	0.0001
101.260	0.0001
101.500	0.0001
102.000	0.0001
102.500	0.0001
103.000	0.0001
103.500	0.0001
103.740	0.0001
104.240	0.0001
105.500	0.0001
105.600	0.1000

Name: S-509 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 105.490
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
101.880	0.0001
105.200	0.0001
105.210	0.1000
105.220	0.5000

Name: S-510 Base Flow(cfs): 0.000 Init Stage(ft): 101.500
Group: BASE Warn Stage(ft): 105.680
Type: Stage/Area

FOREST STREET SYSTEM

Stage(ft)	Area(ac)
98.680	0.0001
99.260	0.0001
100.000	0.0001
101.000	0.0001
101.260	0.0001
101.500	0.0001
102.000	0.0001
102.500	0.0001
103.000	0.0001
103.500	0.0001
103.740	0.0001
104.240	0.0001
105.680	0.0001
105.690	0.1000

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==== Cross Sections ==========

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Name: WEIR_XSECTION Group: BASE
Encroachment: No

EXISTING SWALE OUTFALL

Station(ft)	Elevation(ft)	Manning's N
0.000	103.050	0.013000
26.500	103.150	0.013000
30.100	103.000	0.013000
44.700	102.580	0.013000
46.000	102.540	0.013000
46.000	101.270	0.013000
49.000	101.270	0.013000
49.000	102.580	0.013000
52.300	102.600	0.013000
59.300	102.540	0.024000
102.700	103.020	0.024000
113.000	103.450	0.024000
116.000	103.530	0.024000

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==== Operating Tables ==========
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Name: Group: BASE
Type: Bottom Clip
Function: Time vs. Depth of Clip

Time(hrs)	Clip Depth(in)

==========
==== Pipes ==========
==========

Name: RS-500 From Node: S-500 Length(ft): 37.00
Group: BASE To Node: S-501 Count: 1
Friction Equation: Automatic
Solution Algorithm: Most Restrictive
Flow: Both
Entrance Loss Coef: 0.50
Exit Loss Coef: 0.00
Bend Loss Coef: 0.70
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dc
Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	9.00	9.00
Rise(in):	9.00	9.00
Invert(ft):	101.870	101.500
Manning's N:	0.013000	0.013000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-500 TO S-501

Name: RS-501 From Node: S-501 Length(ft): 37.00
Group: BASE To Node: S-503 Count: 1
Friction Equation: Automatic
Solution Algorithm: Most Restrictive
Flow: Both
Entrance Loss Coef: 0.00
Exit Loss Coef: 1.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dc
Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	9.00	9.00
Rise(in):	9.00	9.00
Invert(ft):	101.590	101.380
Manning's N:	0.012000	0.012000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name: RS-502 From Node: S-502 Length(ft): 37.00
Group: BASE To Node: S-503 Count: 1
Friction Equation: Automatic

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Solution Algorithm:	Most Restrictive
Span(in):	9.00	9.00	Flow:	Both
Rise(in):	9.00	9.00	Entrance Loss Coef:	0.50
Invert(ft):	101.870	101.500	Exit Loss Coef:	0.00
Manning's N:	0.013000	0.013000	Bend Loss Coef:	0.70
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec:	Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dc
			Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-502 TO S-503

Name:	RS-503	From Node:	S-503
Group:	BASE	To Node:	S-505

Length(ft): 57.00
Count: 1
Friction Equation: Automatic

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Solution Algorithm:	Most Restrictive
Span(in):	12.00	12.00	Flow:	Both
Rise(in):	12.00	12.00	Entrance Loss Coef:	0.00
Invert(ft):	101.500	101.500	Exit Loss Coef:	0.50
Manning's N:	0.013000	0.013000	Bend Loss Coef:	0.70
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec:	Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dc
			Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name:	RS-504	From Node:	S-504
Group:	BASE	To Node:	S-505

Length(ft): 35.00
Count: 1
Friction Equation: Automatic

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Solution Algorithm:	Most Restrictive
Span(in):	9.00	9.00	Flow:	Both
Rise(in):	9.00	9.00	Entrance Loss Coef:	0.50
Invert(ft):	101.860	101.500	Exit Loss Coef:	0.00
Manning's N:	0.013000	0.013000	Bend Loss Coef:	0.50
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec:	Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dc
			Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-504 TO S-505

Name:	RS-505	From Node:	S-505
Group:	BASE	To Node:	S-506

Length(ft): 84.00
Count: 1
Friction Equation: Automatic

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Solution Algorithm:	Most Restrictive
Span(in):	12.00	12.00	Flow:	Both
Rise(in):	12.00	12.00	Entrance Loss Coef:	0.50
Invert(ft):	101.500	101.500	Exit Loss Coef:	0.00
Manning's N:	0.013000	0.013000	Bend Loss Coef:	0.50
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec:	Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dc
			Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name:	RS-506	From Node: S-506	Length(ft): 29.00
Group:	BASE	To Node: S-507	Count: 1
			Friction Equation: Automatic
	UPSTREAM	DOWNSTREAM	Solution Algorithm: Most Restrictive
Geometry:	Circular	Circular	Flow: Both
Span(in):	12.00	12.00	Entrance Loss Coef: 0.50
Rise(in):	12.00	12.00	Exit Loss Coef: 0.00
Invert(ft):	101.500	101.500	Bend Loss Coef: 0.70
Manning's N:	0.013000	0.013000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-506 TO S-507

Name:	RS-507	From Node: S-507	Length(ft): 41.00
Group:	BASE	To Node: S-508	Count: 1
			Friction Equation: Automatic
	UPSTREAM	DOWNSTREAM	Solution Algorithm: Most Restrictive
Geometry:	Circular	Circular	Flow: Both
Span(in):	8.00	8.00	Entrance Loss Coef: 0.50
Rise(in):	8.00	8.00	Exit Loss Coef: 0.00
Invert(ft):	101.500	101.500	Bend Loss Coef: 0.50
Manning's N:	0.013000	0.013000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name:	RS-508	From Node: S-508	Length(ft): 25.00
Group:	BASE	To Node: S-509	Count: 1
			Friction Equation: Automatic
	UPSTREAM	DOWNSTREAM	Solution Algorithm: Most Restrictive
Geometry:	Circular	Circular	Flow: None
Span(in):	12.00	12.00	Entrance Loss Coef: 0.50
Rise(in):	12.00	12.00	Exit Loss Coef: 0.00
Invert(ft):	102.750	102.250	Bend Loss Coef: 0.50
Manning's N:	0.013000	0.013000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-508 TO S-509

Name:	RS-509	From Node: S-509	Length(ft): 182.00
Group:	BASE	To Node: S-116	Count: 1
			Friction Equation: Automatic
	UPSTREAM	DOWNSTREAM	Solution Algorithm: Most Restrictive
Geometry:	Circular	Circular	Flow: Both
Span(in):	15.00	15.00	Entrance Loss Coef: 0.50
Rise(in):	15.00	15.00	Exit Loss Coef: 0.00
Invert(ft):	104.160	101.900	Bend Loss Coef: 0.50
Manning's N:	0.024000	0.014000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

FROM S-509 TO S-116

Name:	RS-510	From Node:	S-510	Length(ft):	87.00
Group:	BASE	To Node:	S-508	Count:	1
				Friction Equation:	Automatic
	UPSTREAM	DOWNSTREAM		Solution Algorithm:	Most Restrictive
Geometry:	Circular	Circular		Flow:	Both
Span(in):	8.00	8.00		Entrance Loss Coef:	0.50
Rise(in):	8.00	8.00		Exit Loss Coef:	0.00
Invert(ft):	101.500	101.500		Bend Loss Coef:	0.50
Manning's N:	0.013000	0.013000		Outlet Ctrl Spec:	Use dc or tw
Top Clip(in):	0.000	0.000		Inlet Ctrl Spec:	Use dc
Bot Clip(in):	0.000	0.000		Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

==========
==== Hydrology Simulations ==========
==========

Name: 002Y001H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y001H.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.25

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 002Y002H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y002H.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 2.70

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 002Y004H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y004H.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 3.25

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 002Y008H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y008H.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 3.70

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 002Y024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y024H.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 005Y001H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y001H.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.75

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 005Y002H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y002H.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.50

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 005Y004H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y004H.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 4.13

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 005Y008H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y008H.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 4.73

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 005Y024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y024H.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 6.20

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010-024HYD.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 7.50

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010Y001H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y001H.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.05

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010Y002H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y002H.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.75

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010Y004H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y004H.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 4.68

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010Y008H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y008H.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 5.43

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 010Y024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y024H.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 7.25

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 025-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\025-024HYD.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 8.60

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 100-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\100-024HYD.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 10.60

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 3in-8hr
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\in-.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 3.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: MA-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\MA-024HYD.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 4.50

Time(hrs)	Print Inc(min)
30.000	5.00

==========
==== Routing Simulations ==========
==========

Name: 002Y001HSIM Hydrology Sim: 002Y001H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y001HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 2-YEAR FREQUENCY, 1-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 002Y002HSIM Hydrology Sim: 002Y002H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y002HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 4.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 2-YEAR FREQUENCY, 2-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 002Y004HSIM Hydrology Sim: 002Y004H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y004HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 8.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 2-YEAR FREQUENCY, 4-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 002Y008HSIM Hydrology Sim: 002Y008H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y008HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 16.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 2-YEAR FREQUENCY, 8-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 002Y024HSIM Hydrology Sim: 002Y024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\002Y024HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500

```
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                   End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:

FDOT 2-YEAR FREQUENCY, 24-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


------------------------------------------------------------------------------------------------------
         Name: 005Y001HSIM         Hydrology Sim: 005Y001H
     Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\005Y001HSIM.I32


      Execute: No          Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                   End Time(hrs): 2.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:

FDOT 5-YEAR FREQUENCY, 1-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


------------------------------------------------------------------------------------------------------
         Name: 005Y002HSIM         Hydrology Sim: 005Y002H
     Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\005Y002HSIM.I32


      Execute: No          Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                   End Time(hrs): 4.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:

FDOT 5-YEAR FREQUENCY, 2-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


------------------------------------------------------------------------------------------------------
         Name: 005Y004HSIM         Hydrology Sim: 005Y004H
     Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\005Y004HSIM.I32


      Execute: No          Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                   End Time(hrs): 8.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:

FDOT 5-YEAR FREQUENCY, 4-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000
```

Group	Run
BASE	Yes

Name: 005Y008HSIM Hydrology Sim: 005Y008H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y008HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 16.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 5-YEAR FREQUENCY, 8-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 005Y024HSIM Hydrology Sim: 005Y024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\005Y024HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 5-YEAR FREQUENCY, 24-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 010-024SIM Hydrology Sim: 010-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010-024SIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 010Y001HSIM Hydrology Sim: 010Y001H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\010Y001HSIM.I32

```
     Execute: No          Restart: No            Patch: No
  Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                    End Time(hrs): 2.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                         Boundary Flows:

FDOT 10-YEAR FREQUENCY, 1-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
        Name: 010Y002HSIM         Hydrology Sim: 010Y002H
    Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\010Y002HSIM.I32


     Execute: No          Restart: No            Patch: No
  Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                    End Time(hrs): 4.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                         Boundary Flows:

FDOT 10-YEAR FREQUENCY, 2-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
        Name: 010Y004HSIM         Hydrology Sim: 010Y004H
    Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\010Y004HSIM.I32


     Execute: No          Restart: No            Patch: No
  Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                    End Time(hrs): 8.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                         Boundary Flows:

FDOT 10-YEAR FREQUENCY, 4-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 010Y008HSIM         Hydrology Sim: 010Y008H
    Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised
03042018\010Y008HSIM.I32


     Execute: No          Restart: No            Patch: No
  Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                    End Time(hrs): 16.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                         Boundary Flows:

FDOT 10-YEAR FREQUENCY, 8-HOUR DURATION STORM EVENT SIMULATION
```

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 01OY024HSIM Hydrology Sim: 01OY024H
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\01OY024HSIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

FDOT 10-YEAR FREQUENCY, 24-HOUR DURATION STORM EVENT SIMULATION

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 025-024SIM Hydrology Sim: 025-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\025-024SIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 100-024SIM Hydrology Sim: 100-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\100-024SIM.I32

Execute: No Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 3in-8hr Hydrology Sim: 3in-8hr

Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\3in-uhr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 16.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: MA-024SIM Hydrology Sim: MA-024HYD
Filename: K:\ORL_Roadway\049018002_Windermere Drainage Study\ENGINEERING\ICPR\Proposed - Revised 03042018\MA-024SIM.I32

Execute: No Restart: No Patch: No
Alternative: No

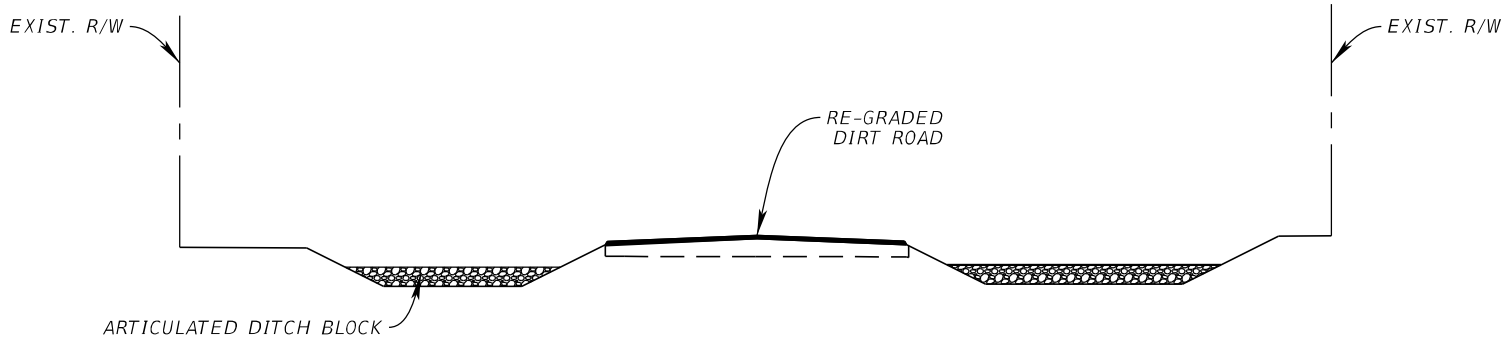
Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

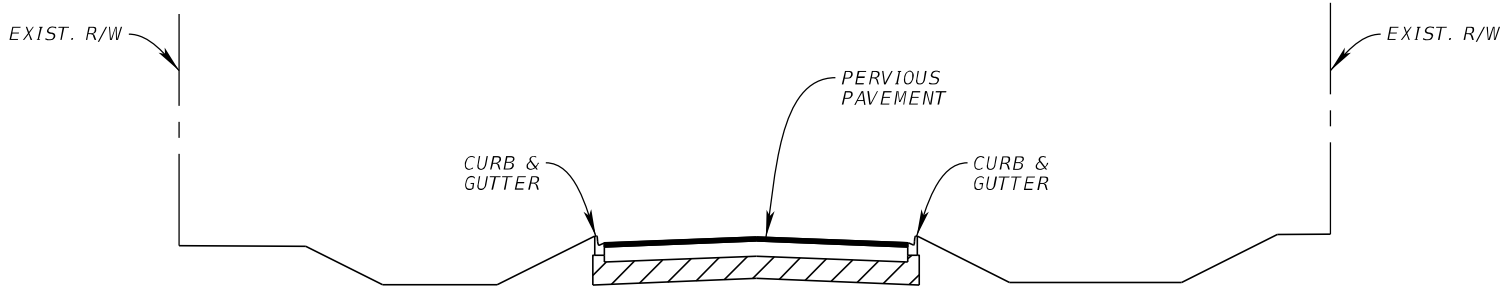
Group	Run
BASE	Yes

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
S-116	BASE	3in-8hr	0.00	101.50	0.00	0.0000	6	4.00	0.86	0.00	0.00
S-500	BASE	3in-8hr	11.48	105.11	105.01	0.0045	98713	5.00	0.35	4.05	0.35
S-501	BASE	3in-8hr	8.14	105.12	105.04	0.0049	1031	5.08	0.73	5.09	0.63
S-502	BASE	3in-8hr	8.13	105.12	104.91	-0.3700	114	4.08	0.02	5.18	0.03
S-503	BASE	3in-8hr	8.14	105.12	104.91	0.0050	6458	5.09	0.57	5.09	0.46
S-504	BASE	3in-8hr	8.13	105.12	104.92	-0.3600	114	4.08	0.02	5.12	0.06
S-505	BASE	3in-8hr	8.13	105.12	105.01	0.0050	7524	4.08	0.44	4.05	0.35
S-506	BASE	3in-8hr	8.09	105.12	104.92	0.0049	116	4.05	0.35	5.12	0.31
S-507	BASE	3in-8hr	8.07	105.12	105.25	0.0050	114	5.12	0.32	4.03	0.19
S-508	BASE	3in-8hr	8.01	105.12	105.56	0.0043	115	4.17	0.21	0.00	0.00
S-509	BASE	3in-8hr	8.83	102.33	105.49	-0.3800	119	4.08	0.01	0.00	0.00
S-510	BASE	3in-8hr	8.01	105.12	105.68	0.0050	114	5.00	0.04	7.29	0.04

Appendix B – Alternative Typical Sections



ALTERNATIVE A
FOREST ST. TYPICAL SECTION



ALTERNATIVE B
FOREST ST. TYPICAL SECTION

REVISIONS			
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TOWN OF WINDERMERE

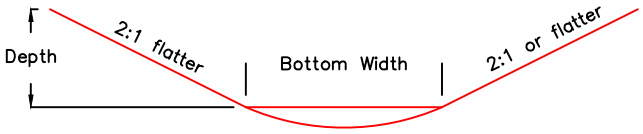
FOREST ST AND FIRST AVE CONCEPT

ALTERNATIVE TYPICAL SECTIONS

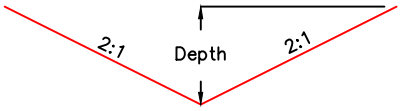
SHEET NO.

Appendix C – Ditch Examples

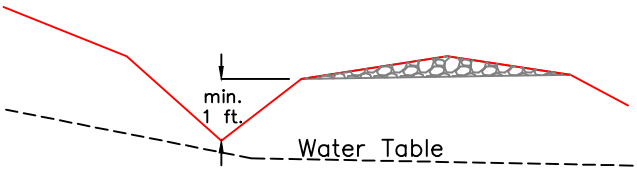
2.2 ROADSIDE DITCHES



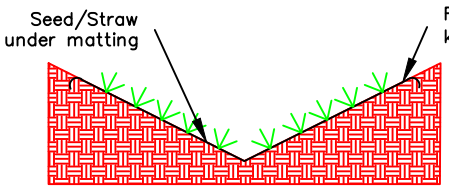
TRAPEZOIDAL/PARABOLIC



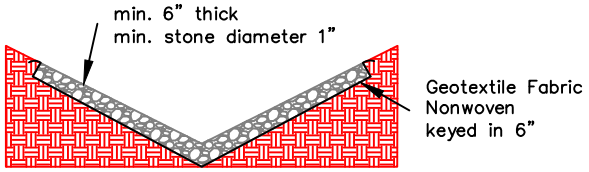
V–DITCH



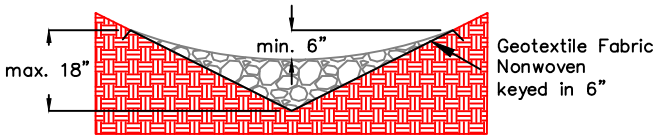
*Avoid the interception of ground water



Fiber Matting



Stone Lining



Rock Check Dam

*use 2" to 3" stone, combine with riprap for heavier flows.

Description:
Roadside ditches collect runoff from the road and abutting properties and drain it away from the road. Ditches can be on both sides of the road or one side. Typical ditches are v–shaped for ease of construction and maintenance. A trapezoidal or parabolic ditch are preferred to slow and disperse road runoff. Ditches should be vegetated or where needed lined with stone.

Limitations:
- Bedrock and narrow right–of–way can prevent the shaping of ditches.
- Entrenched or u–shaped roads have limited space for ditches.
- Steep Slopes increase erosion potential.

Construction:
1. Sizing is based on the volume of runoff and should be done by an experienced or qualified professional. Design flows should be based on the 10–year peak flow for channel capacity and velocity.
2. Avoid excavating the ditch below the water table if possible. Use subsurface drains to convey excess water away from ditch.
3. Ditches should be constructed on cut soils. If fill is used to create the ditch, the fill will need to be compacted and lined with fiber matting or stone.
4. A wide grass–lined trapezoidal or parabolic ditch is preferred. Bottom width of between 2 and 4 feet.
5. Ditch should have a shallow drop off from road surface. Side slopes of 2:1 or flatter; with a 3:1 side slope preferred.
6. Grass established with sod is preferred for immediate vegetated cover. The sod should be rolled out perpendicular to the flow of water and pegged. Temporary stabilization matting should be used if seeding the ditch. Ensure the matting is installed with continuous contact with the soil per manufacturer specifications.
7. Ditch Slopes greater than 2% should be lined with fiber matting and check dams.
8. Ditch Slopes greater than 5% should be lined with stone suitable for the flow velocity.
9. Disconnect ditches from stream channels, wetlands and ponds whenever possible, see Clearwater Crossing practice.
10. Avoid directing ditch flows toward wells, septic tanks, and drain fields.

Maintenance:
- Remove sediments and debris to maintain ditch capacity and vegetation.
- Ditches should be checked for erosion. Stabilize with matting or rock as needed. Consider the use of turnouts or cross culverts to minimize erosive flows.
- Remove unnecessary berms or debris windrows along the shoulder of the road to ensure sheet flow off the road surface.
- Reseed and mulch whenever soil is disturbed. Seed in fall for cool season lawn grass mix or spring for warm season grass mix. Maintain a cover density of 75%.

Resources:

- Virginia Erosion and Sediment Control Handbook, 3rd edition. 1992. Stormwater Conveyance Channel Spec. 3.17; RipRap Spec. 3.19; Rock Check Dams Spec. 3.20; and Stabilization Matting Spec. 3.36
- Gravel Road Maintenance Manual: A Guide for Landowners on Camp and Other Gravel Roads. April 2010. Maine Department of Environmental Protection. Bureau of Land and Water Quality. Kennebec County Soil and Water Conservation District. Ditches Pg. 39.
- Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads. April 2012. USDA Forest Service. 1177 1802 SDTDC. Chapter 4 Low Maintenance Ditch and Berm Removal.

Excerpt from Dirt and Gravel Road Best Management Practice Guide of Culpeper Soil and Water Conservation District

Appendix D – Plan View for Upsizing 15” pipe to 24” pipe

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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TOWN OF WINDERMERE

FOREST ST AND FIRST AVE CONCEPT

PLAN VIEW FOR UPSIZING

SHEET NO.

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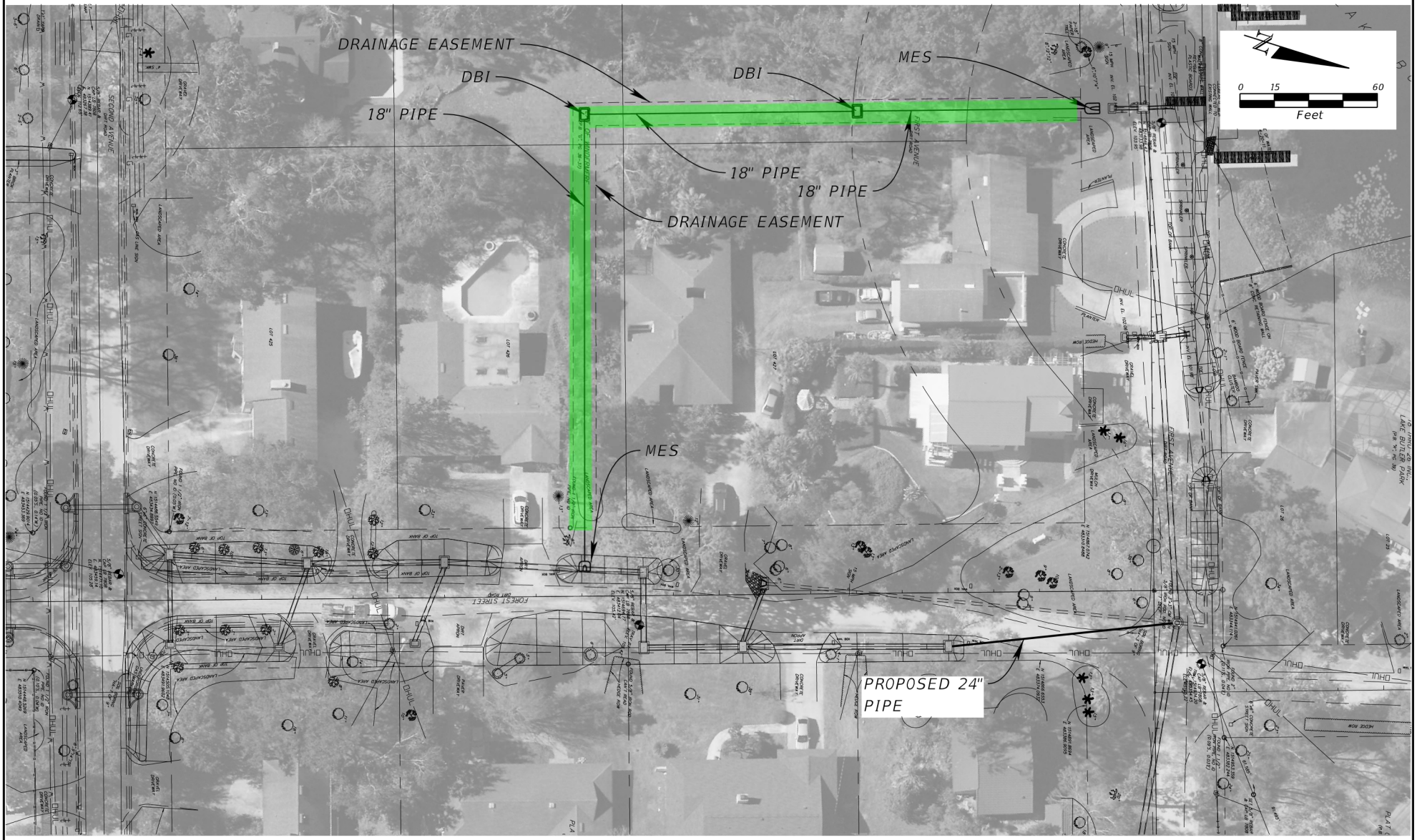
Appendix E – Plan View for Additional Considerations



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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TOWN OF WINDERMERE

FOREST ST AND FIRST AVE CONCEPT

ADDITIONAL CONSIDERATION

SHEET NO.

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Appendix F – Maintenance Plan Example

Maintenance Schedule

Maintenance is generally done as needed for most gravel roads. Regular inspections and maintenance will protect a good road from becoming degraded. The following maintenance schedule table was adapted from: Gravel Road Maintenance Manual: A Guide for Landowners on Camp and Other Gravel Roads; Kennebec County Soil and Water Conservation District and Maine Department of Environmental Protection, Bureau of Land and Water Quality; April 2010.

Task	Spring	Fall	Major Storms	Inspection Date & Condition
ROADWAYS				
Clear accumulated winter sand along the roadway and remove false berms	X			
Maintain the crown of the road surface and shoulder, as needed at least once per year.	X		X	
Clean out sediment within Diversions; Dips; Fords; or High Water Bypass.	X	X	X	
SIDE SLOPES				
[1]Replant bare areas or areas with sparse growth. Seed or plant at appropriate time.	X	X		
[2]Collect Soil Sample and Test, every 3 years	X			
Eroding Areas: armor with riprap or stabilization matting; or divert erosive flows to a stable area.			X	
DITCHES AND CULVERTS				
Remove obstruction and accumulated sediments, leaves, or debris.	X	X	X	
Stabilize any erosion			X	
Mow grass ditches		X		
Remove woody vegetation		X		
Repair slumping side slopes			X	
Replace stone lining where underlying geotextile fabric is showing or where stones have dislodged.			X	
Repair any erosion damage at the culvert's inlet			X	
OUTLETS AND RIPARIAN BUFFERS				
Mow vegetation in non-wooded buffer no shorter than 6 inches and no more than 2 times per year.		X		
Repair erosion below culverts and turnouts	X		X	
Install more level spreaders or ditch turnouts if needed for better distribution of flow		X		
Clean out accumulation of sediment within the level spreader or turnout.	X	X	X	

[1]Consider a drought or shade tolerant seed mix or plugs for problematic areas. www.mgnv.org/plants/ground-cover

[2]Soil Sampling refer to VCE Publication 452-129. www.pubs.ext.vt.edu/452/452-129/452-129.html

Inspection Checklists

Photocopy this page to use it, and keep it for your records.

If you observe 'yes' for any of these conditions on your road, promptly take action to resolve the problem.

Road Segment Inspected: _____ Date: _____

Roadway

Yes No

__ __ Erosion of the road surface; or sediment washed into streams, ditches or waterways

__ __ Washboarding, potholes, or rutting of the surface

__ __ Displacement of surfacing gravel

__ __ Spots in the road that remain soft and wet throughout the year

__ __ Soil is being tracked or washed out onto the public roadway

__ __ Over-hanging trees and limbs that cast abundant shade onto the road surface

__ __ Tree limbs and shrubs that obscure a driver's vision at the public road entrance

Side Slopes

__ __ Soil slumping or eroding down the face of cut banks and fill slopes

__ __ Bare areas or areas with sparse growth

__ __ Groundwater seepage coming out from cut bank

Ditches and Culverts

__ __ Clogged culverts or obstructions in ditches

__ __ Erosion in the ditch or scour around culverts

__ __ Rust, corrosion or deformation of metal pipes

__ __ Caving-in atop of a culvert pipe

__ __ Stream flow undermining culvert

__ __ Ruts in the stream bottom at a ford crossing; or stream flow dammed up at the ford

Outlets and Riparian Buffers

__ __ Sediment being washed away into the woods or onto neighbor's property

__ __ Sediment build-up within dips, turnouts, diversions, or level spreaders

__ __ Bare areas or areas with sparse growth within 35-feet of outlet.

Appendix G – Cost Estimate

PREPARED BY:

Kimley»Horn

OPINION OF PROBABLE CONSTRUCTION COSTS
Town of Windermere - First and Forest Alternative A
ACTUAL CONSTRUCTION COSTS WILL VARY

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST*	TOTAL
425-2-41	MANHOLE, P-7, <10	LS	1	$4,000	$4,000
524-3	ARTICULATED DITCH BLOCK	CY	10	$1,500	$15,000
110-1-1	CLEARING & GRUBBING	AC	0.50	$9,500	$4,750
120-1	REGULAR EXCAVATION	CY	3170	$6	$19,020
571-1-11	PLASTIC EROSION MAT	SY	120	$7	$840
425-4	ADJUST INLET	EA	11	$1,700	$18,700
430-175-124	PIPE CULV, OPT MATL, ROUND, 24"S/CD	LF	110	$80	$8,800
430-94-1	DESILTING PIPE, 0-24"	LF	420	$7	$2,940
570-1-2	PERFORMANCE TURF, SOD	SY	600	$1	$600

COST	$74,650
15% CONTINGENCY	$11,198
TOTAL COST	$85,848

NOTE: THE CONSULTANT HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, EQUIPMENT, OR OVER THE CONTRACTOR'S METHODS OF DETERMINING PRICES OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. OPINIONS OF PROBABLE COSTS PROVIDED HEREIN ARE BASED ON THE INFORMATION KNOWN TO CONSULTANT AT THIS TIME AND REPRESENT ONLY THE CONSULTANT'S JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. THE CONSULTANT CANNOT AND DOES NOT GUARANTEE THAT PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM ITS OPINIONS OF PROBABLE COSTS.

PREPARED BY:

Kimley»Horn

OPINION OF PROBABLE CONSTRUCTION COSTS
Town of Windermere - First and Forst Alternative B
ACTUAL CONSTRUCTION COSTS WILL VARY

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST*	TOTAL
425-2-41	MANHOLE, P-7, <10	EA	1	$4,000.00	$4,000
110-1-1	CLEARING & GRUBBING	AC	1.50	$9,500.00	$14,250
430-175-124	PIPE CULV, OPT MATL, ROUND, 24"S/CD	LF	110	$80.00	$8,800
430-94-1	DESILTING PIPE, 0-24"	LF	420	$7.00	$2,940
520-1-10	CONCRETE CURB & GUTTER, TYPE F	LF	2100	$25.00	$52,500
	PERVIOUS PAVEMENT				
160-4	12" STABILIZATION	SY	1800	$5.00	$9,000
	8" BASE MATERIAL (LIMEROCK)	SY	1800	$20.00	$36,000
	2" ASPHALT	TN	200	$200.00	$40,000

COST	$167,490
15% CONTINGENCY	$25,124
TOTAL COST	$192,614

NOTE: THE CONSULTANT HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, EQUIPMENT, OR OVER THE CONTRACTOR'S METHODS OF DETERMINING PRICES OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. OPINIONS OF PROBABLE COSTS PROVIDED HEREIN ARE BASED ON THE INFORMATION KNOWN TO CONSULTANT AT THIS TIME AND REPRESENT ONLY THE CONSULTANT'S JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. THE CONSULTANT CANNOT AND DOES NOT GUARANTEE THAT PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM ITS OPINIONS OF PROBABLE COSTS.

PREPARED BY:

Kimley»Horn

OPINION OF PROBABLE CONSTRUCTION COSTS
Town of Windermere - First and Forst Additional Considerations
ACTUAL CONSTRUCTION COSTS WILL VARY

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST*	TOTAL
425-1-551	INLETS, DITCH BOTTOM, TYPE E <10	EA	2	$4,000	$8,000
430-982-125	MITERED END SECTION, OPTIONAL RD, 18" CD	AC	2.00	$9,500	$19,000
430-175-118	PIPE CULV, OPT MATL, ROUND, 18"S/CD	LF	407	$80	$32,560

COST	$59,560
15% CONTINGENCY	$8,934
TOTAL COST	$68,494

NOTE: THE CONSULTANT HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, EQUIPMENT, OR OVER THE CONTRACTOR'S METHODS OF DETERMINING PRICES OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. OPINIONS OF PROBABLE COSTS PROVIDED HEREIN ARE BASED ON THE INFORMATION KNOWN TO CONSULTANT AT THIS TIME AND REPRESENT ONLY THE CONSULTANT'S JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. THE CONSULTANT CANNOT AND DOES NOT GUARANTEE THAT PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM ITS OPINIONS OF PROBABLE COSTS.