CALCULATION COVER SHEET

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TITLE: **Stormwater Management Report for Cross Florida Greenway Recreational Improvement Area**

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Record of Revisions

Rev	Date	Revision Description[1]
A	See EDMS	Original issue

Note (1) Significant changes are briefly described in this table. In the rest of the calc note, each row that has changed is marked using a revision bar in the margin of the page. This approach satisfies the change identification requirements in WP 4.5 Section 7.4. The Record of Revisions for older revisions should be deleted as necessary to limit this table to one page.

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1.0 Background and Purpose

The purpose of this report is to present calculations performed for storm water engineering on the Cross Florida Greenway Recreational Improvements Area Project. The project consists of constructing a boat slip along the Cross Florida Barge Canal, a gravel access road from County Road (CR) 40 to the boat slip, a concrete bridge over the Bypass Barge Canal, and a paved recreation trail from US 19 to the boat slip.

The report reflects conservative assumptions in the calculations. In addition to the calculations required for the ERP, conveyance and erosion protection calculations are include.

Water Quality (Treatment): Water quality treatment of the 1 inch rain event as per ERP Basis of Review is applicable to the access road and concrete boat slip. Water quality treatment for the recreation path was not considered as it is not subjected to vehicular traffic that would generate pollutants. For the access road/bridge and boat slip, the treatment is achieved by infiltration in dry swales. The volume retained was determined using the Schueler Method. The Schuler Method was selected because when compared to SCS and Rational runoff methods a larger volume was determined. Calculations for water quality treatment are included in Section 5 of this report. As shown in Section 5.1.9 Recovery Time Summary, the requirement for maximum 36 hours recovery time is met for infiltration into the native soils as described in the Natural Resource Conservation Commission Soil Survey information.

Water Quantity (Attenuation): As the site discharges directly to the tidal waters of the Cross Florida Barge Canal and the Bypass Barge Canal, attenuation is not required for this site. In addition to the tidal feature of the Cross Florida Barge Canal, the area at the concrete platform for the boat slip as shown on drawings will flood in the 25 year 24 hour event as in the existing condition. Any proposed storm water facilities will be inundated from the canal. Furthermore, with detention storage for higher storms than the 1 inch rain event, the flow from detention facility would delay the peak flows could cause the peak flow from the detention facility to converge closer to peak flows from the river. Thus, combining hydrographs from the detention facility and the canal could be no less than total flows without detention. For these reasons, water quantity attenuation of 25 year 24 hour storm is not required. The point of the swale is to drain the runoff from the storms larger than 1 inch rain event to the river before the flows from the river increase significantly.

Flood Protection: Although the Cross Florida Barge Canal and the Bypass Canals are within the Federal Emergency Management Agency (FEMA) mapped floodplain, this project does not propose any fill within the floodplain. Excavation within the floodplain will be required to create the boat slip; however, this will not adversely impact storage volume of the floodplain or conveyance capabilities of the canal.

Conveyance Calculations: Swale and pipe conveyance for the site were checked for the 25 year capacity. A Hydrologic Soil Group D was assumed to be conservative in the calculations for conveyance. Design information is included in Section 5.1 and 5.2 for the following items:

1. Dry swales #1, #2 and #3 drain water from the ramp to the boat slip and meet 25 year conveyance capacity requirements. Discharges from dry swales #1, #2, and #3 are via slab type drop inlets through pipe to the canal. Pipe #1 is designed for 25 year capacity; however, Pipe #2 will be inundated in the 25 year storm; therefore, designing this pipe for 25 year capacity would not be applicable.
2. Dry swales #5 and #6 convey runoff directly to adjacent natural low points that lead to Bypass Canal. There are no adjacent properties affected by allowing the water to overspill through weir outlets to adjacent low points. The road is the highest ground and will be the last to flood. Therefore, the 25 year 24 hour storm will just overflow the weirs and flow to the canal before flooding the roads.
3. Dry swale #7 conveys runoff to the Cross Florida Barge Canal. Discharge is conveyed through weir outlets to adjacent low points leading to Cross Florida Barge Canal.

2.0 Summary of Results and Conclusions

2.1 Results

Refer to Drawings #14 through #17 as per References List.

2.2 Conclusions/Recommendations

Refer to Drawings #14 through #17 as per References List.

2.3 Open Items

There are no open items at this time.

3.0 References

1. Drainage Area Map #1 - DA 1, 2, 3, 4
2. Drainage Area Map #2 - DA 5, 6, 7
3. FHWA: HEC-22 Manual
4. Florida ERP Part B - Basis of Review
5. Overvall FIRM Map
6. FIRM Map Panel # 120145 0640 D (Appendix A.3)
7. FIRM Map Panel # 120145 0625 D (Appendix A.4)
8. FEMA Flood Map - GIS
9. LNG-G1P1-X3-001, Land Use Plan Impervious Areas
10. LNG-G1P1-X3-002, Impact of Developed Areas on Wetland
11. LNG-G1P1-X3-003, SCS Soil Types
12. LNG-G1P1-X3-004, Existing and Proposed Land Use
13. LNG-G1P1-X3-005, Natural Communities
14. LNG-G1P1-X3-006, FEMA Floodway Sections
15. LNG-G1P1-X3-009, Existing Topography Outside Project Area
16. LNG-G1P1-X3-007, Flood Insurance Rate Map
17. LNG-G1P1-X3-008, Pedestrian and Bicycle Path
18. LNG-G1-XS-044, Storm Water and Erosion Control Plan Title Sheet
19. LNG-G1-XS-045, Proposed Access Road Overall Site Grading Plan & Profile
20. LNG-G1-XS-046, Storm Water/Grading & Erosion Control Plan
21. LNG-G1-XS-047, Storm Water/Grading & Erosion Control Plan
22. LNG-G1-XS-048, Storm Water/Grading & Erosion Control Plan
23. LNG-G1-XS-049, Storm Water & Erosion Control Details
24. LNG-G1-XS-050, Proposed Access Road Cross Sections STA. 0+00-8+50
25. LNG-G1-XS-051, Proposed Access Road Cross Sections STA. 9+00-16+50
26. LNG-G1-XS-052, Proposed Access Road Cross Sections STA. 17+00-18+00
27. LNG-G1-XS-053, Proposed Access Road Cross Sections STA. 18+50-25+00
28. LNG-G1-XS-054, Proposed Access Road Cross Sections STA. 25+50-30+50
29. LNG-G1-XS-055, Proposed Access Road Storm Drainage Area Map
30. LNG-G1-XS-056, Sediment & Erosion Control Notes and Details
31. LNG-G1-XM-00000, Boat Slip Existing Conditions
32. LNG-G1-XM-000002, Boat Slip General Arrangement Plan
33. LNG-G1-XM-000003, Boat Slip Sections
34. LNG-XQ01-C2-001, Bridge Plan and Elevation
35. LNG-XQ01-C2-003, Typical Bridge Cross Section
36. Curve Number Table (Appendix B)

4.0 Calculation Methods and Inputs

4.1 Limits of Applicability

Limits of applicability are south of County Road 40 to provide access to recreational areas along the Cross Florida Barge Canal for general public.

Items designed to accomplish the above.

1. Provide Access Road from County Road 40 to Boat Slip.
2. Provide Access Road Bridge across Bypass Canal.
3. Provide boat slip along Cross Florida Barge Canal
4. Provide a 12 ft wide, 2.5 mile, biking & hiking trail from Access Road west to Highway 19

4.2 Method Discussion

4.2.1	Water Quality Volume Calculation by Schueler Method for all dry swales and compared in DA #1 with other methods for use
4.2.2	Recovery Time Calculation by Filtration Utilizing Darcy Equatior
4.2.3	Dry Swales #1 through 3 also convey 25 yr 24 hr storm
4.2.4	Dry Swales #4 through #7 provide water quality treatment only.
4.2.5	Rip Rap Energy Dissaption by USDA, SCS Method
4.2.6	SCS Method for Hydrologic Calculations of 25 yr 24 hr storm
4.2.7	Standard Hydraulic Calculations for Uniform Flows

4.3 Discussion of Significant Assumptions

N/A

4.4 Acceptance Criteria

1 inch Rain Event for Water Quality Treatment
Conveyence Storm = 25 yr 24 hr storm for Swales #1, 2, 3

4.5 Input

USGS Soils Types & Geotechnical Information
Curve Number
Time of Concentration
Wetlands Delineations by CH2M HILL- LNG-G1P1-X3-002
Impervious Areas
Drainage Areas
Topographic Maps

USGS Soil Types & Geotechnical Information

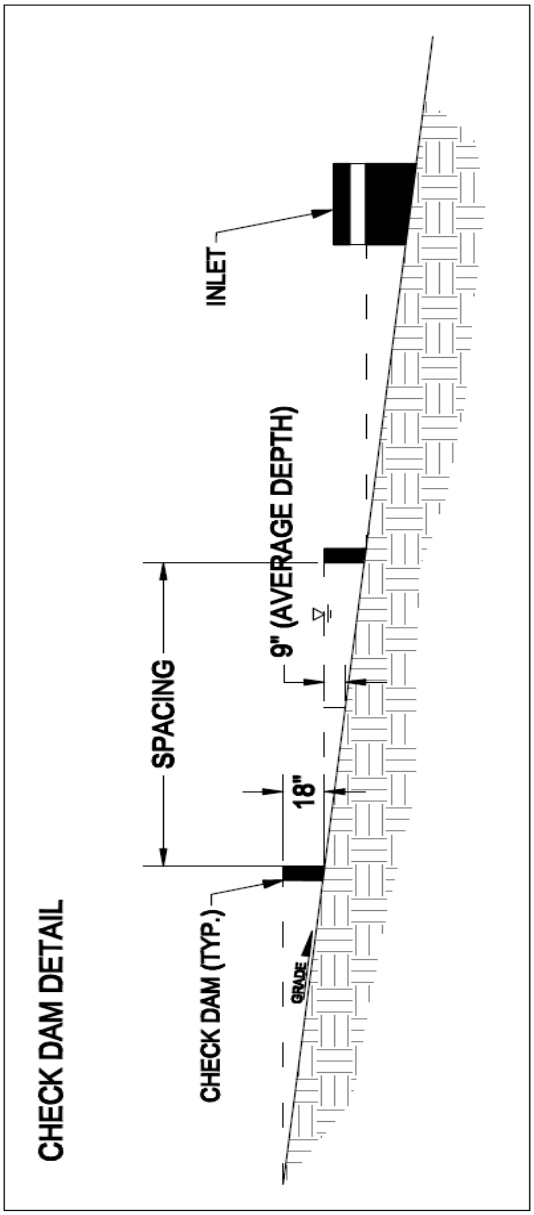
Basin	Swale/Pond				NRCS Soil Survey Information			Site Information		
	Identification	Station to	Station	Side	Soil Type Survey)	Minimum Depth to Seasonal High Groundwater	SCS Soil Group	Average Ground Elevation (ft NAVD 88)	Estimated Depth to Seasonal High Groundwater	Seasonal High Groundwater Elevation Used
1	Hwy 40	0+00	8+00	LT	Cassia	3.5 - 6 ft	C	30	3.5	26.5
2		8+00	9+00		Arents	3.5 - 6 ft	B	30	3.5	26.5
3		9+00	11+00		Water					
4	DI1	11+00	20+00		Arents	3.5 - 6 ft	B	30	3.5	26.5
5	DI2	20+00	30+82		Arents	3.5 - 6 ft	B	30	3.5	26.5

Because the estimated depth to seasonal high groundwater (3.5 ft) is greater than the required minimum of 2ft, dry wales are applicable.

5.0 Detailed Analysis / Calculations and Results

5.1 Dry Swale Calculations (6 Swales and numbered)

5.1.1 Illustration of WQv Storage



5.1.2 Dry Swale DA1

Total Drainage Area = 5 acres *Reference 1

	Road Width (ft)	Road Length (ft)	Road Imp Area (sf)
Gravel Road	50	1253	62650.00
Intake Str Bldgs & Pad			12600

Total 75250.00 sf
1.73 acres

Composite CN

*See Appendix B for CN Table

Cover	HSG	Area, A (ac)	CN	CN*A (sf)
Gravel Road & Intake Str	D (Conservative)	1.73	91	157.20
Pasture (Grassland, Fair)	D (Conservative)	3.27	84	274.89
	Total =	5.00	Composite CN =	86

Water Quality Protection Volume - Three Methods

Schueler Method:

Percent Impervious, I = 35 %
Volumetric Runoff Coefficient, Rv = 0.361
first flush rainfall, P = 1 inches
WQv = 0.150 acre-ft
= 0.361 inches

Modified CN (CNm) = 91

SCS Method:

CN	S (in)	Ia (in)
86.42	1.57	0.31

Rainfall, P = 1 inches
Accumulated Effective Rainfall, Q (in) = 0.21 inches
WQv = 0.087 acre-ft

Rational Method (Triangular Hydrograph):

C Coefficient	Intensity (in/hr)	Area (acres)
0.73	1.00	5.00

Tp =Tc = 15.8 minutes
Peak Flow, qp = 3.64 cfs

Time (min)	q (cfs)	
0	0	
16	3.64	
32	0	

WQv = 0.079 acre-ft

Maximum WQv from Three Methods = 0.150 acre-ft

Because the Schueler Method is determined to be the most conservative method, this method will be used for the WQv calculation for rest of dry swales.

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 18 inches — Meets Req'ts — *Reference 23*

Proposed Long Slope = 0.75%

Avg. Height of WQv for slope = 9 inches

Left Side Slope = 4 :1 — Right Side Slope = 3 :1

Storage for Dry Swale

Depth	Ditch Length (ft)	Width (ft)	Surface Area (sf)	SA (ac-ft)	Inc. Volume (cf)	Acc. Volume	Acc. Volume (ac-ft),	
0.00	1253.00	4.00	5,012	0.115	0.00	0.00	0.00	
0.75	1253.00	9.50	11,904	0.273	6343.31	6343.31	0.15	Meets WQv Reqts
1.00	1253.00	11.25	14,096	0.324	3249.97	9593.28	0.22	
2.00	1253.00	18.25	22,867	0.525	21731.72	28075.03	0.64	

Rounded

Check Dam Spacing = 200.00 — 200 ft

Number of check dams needed = 6.3 — 7

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.28 ft/day — Minimum k value

d_f = 2.5 ft

Surface Area, A = 11,904 sq ft

Avg height of water above filter bed, h_f = 0.75 ft

t_f = 36 hours — Maximum 36 hours

25 yr Storm Check

Peak Q25 = 40.95 cfs (see HydroCAD Results)

Peak Elev. = 1.59 ft (see HydroCAD Results) < 2ft O.K.

Check Inlet Capacity

Total Length of Opening = 16 ft - 4 sides of 4 ft width

Height of Opening = 8 inches

0.90 ft	Wier	
0.64 ft	Orifice	A = 10.67 sq ft

Hydraulic Head on Inlet = 0.90 ft

Hydraulic Head Elevation from ground = 1.65 ft < 2ft O.K.

5.1.3 Dry Swale DA2

Total Drainage Area = 4.5 acres *Reference 1*

	Road Width (ft)	Road Length (ft)	Road Imp Area (sf)
Gravel Road	50	1082	54100.00

Total 54100.00 sf
1.24 acres

Composite CN

** See Appendix B for CN Table*

Cover	HSG	Area, A (ac)	CN	CN*A (sf)
Gravel Road		1.24	91	113.02
Pasture (Grassland, Fair)	D (Conservative)	3.26	84	273.67
	Total =	4.50	Composite CN =	86

Water Quality Protection Volume - WQv (Schueler Method)

Percent Impervious, I = 28 %
Volumetric Runoff Coefficient, Rv = 0.298
first flush rainfall, P = 1 inches
WQv = 0.1119 acre-ft
= 0.298 inches

Modified CN (CNm) = 89

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 18 inches Meets Req'ts *Reference 23*
Proposed Long Slope = 3.00%
Avg. Height of WQv for slope = 9 inches
Left Side Slope = 4 :1 Right Side Slope = 3 :1

Storage for Dry Swale

Depth (ft)	Ditch Length (ft)	Width (ft)	Surface Area (sf)	SA (ac-ft)	Inc. Volume (cf)	Acc. Volume (cf)	Acc. Volume (ac-ft),	
0.00	1082.00	4.00	4,328	0.099	0.00	0.00	0.000	
0.75	1082.00	9.25	10,009	0.230	5376.19	5376.19	0.123	Meets WQv Reqts
1.50	1082.00	14.50	15,689	0.360	9636.56	15012.75	0.345	
2.00	1082.00	18.00	19,476	0.447	18427.81	23804.00	0.546	
3.00	1082.00	25.00	27,050	0.621	32054.25	47067.00	1.081	

Rounded
Check Dam Spacing = 50.0 50 ft
Number of check dams needed = 21.6 22

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.25 ft/day Minimum k value
d_f = 2.5 ft
Surface Area, A = 10,009 sq ft
Avg height of water above filter bed, h_f = 0.75 ft
t_f = 36 hours Maximum 36 hours

25 yr Storm Check

Peak Q25 = 51.64 cfs (see HydroCAD Results - DA 3)

If slope > 0%, Compute Normal Depth:

Normal Depth above WQv depth = 1.03 ft (see FlowMaster Results)
Peak Elevation = 1.78 ft < 2 ft OK

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5.1.4 Dry Swale DA3

Total Drainage Area = 1 acres *Reference 1

			Road Imp Area (sf)
Concrete Platform			20000.00

Total 20,000.00 sf
0.46 acres

Composite CN

** See Appendix B for CN Table*

Cover	HSG	Area, A (acre)	CN	CN*A (sf)
Concrete Platform	D (Conservative)	0.46	98	45.00
Pasture (Grassland, Fair)	D (Conservative)	0.54	84	45.43
	Total =	1.00	Composite CN =	90

Water Quality Protection Volume - WQv (Schueler Method)

Percent Impervious, I = 46 %

Volumetric Runoff Coefficient, Rv = 0.463
first flush rainfall, P = 1 inches
WQv = 0.0386 acre-ft
= 0.463 inches

Modified CN (CNm) = 93

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 18 inches Meets Req'ts *Reference 23
Proposed Long Slope = 1.00%
Avg. Height of WQv for slope = 9 inches
Left Side Slope = 4 :1 Right Side Slope = 3 :1

Storage for Dry Swale

Depth (ft)	Ditch Length (ft)	Width (ft)	Surface Area (sf)	Inc. Volume (cf)	Acc. Volume (cf)	Acc. Volume (ac ft),	
0.00	340.00	4.00	1,360	0.00	0.00	0.000	
0.75	340.00	9.25	3,145	1689.38	1689.38	0.039	Meets WQv Reqts
1.50	340.00	14.50	4,930	3028.13	4717.50	0.108	
1.80	340.00	16.60	5,644	4614.23	6303.60	0.145	

Rounded
Check Dam Spacing = 150.0 150 ft
Number of check dams needed = 2.3 3

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.275 ft/day Minimum k value
d_f = 2.5 ft
Surface Area, A = 3,145 sq ft
Avg height of water above filter bed, h_f = 0.75 ft
t_f = 36 hours Maximum 36 hours

25 yr Storm Check

Peak Q25 = 12.03 cfs (see HydroCAD Results - DA 3)

If slope > 0%, Compute Normal Depth:

Normal Depth =	0.7	ft (see FlowMaster Results)
Depth with 6" freeboard =	1.2	ft
Total Required Channel Depth =	1.45	ft < 2 ft O.K.

Check Inlet # 2 - 25 yr Capacity

Combined Hydrographs - DA 2 and DA 3	63.57	cfs (see HydroCAD Results)
Total Length of Opening =	16	ft
Height of Opening =	8	inches
Peak Elevation =	1.93	ft (See HydroCAD results - DI #2) < 2ft O.K.

5.1.5 Dry Swale DA 5

Total Drainage Area = 1.4 acres *Reference 1*

	Road Width (ft)	Road Length (ft)	Road Imp Area (sf)
Gravel Road	25	953.00	23825.00
Intake Str Bldgs & Pad			0
		Total	23825.00 sf
			0.55 acres

Composite CN

** See Appendix B for CN Table*

Cover	HSG	Area, A (acre)	CN	CN*A (sf)
Gravel Road & Intake Str	D (Conservative)	0.55	91	49.77
Pasture (Grassland, Fair)	D (Conservative)	0.85	84	71.66
	Total =	1.40	Composite CN =	87

Water Quality Protection Volume - WQv (Schueler Method)

Percent Impervious, I = 39 %

Volumetric Runoff Coefficient, Rv = 0.402

first flush rainfall, P = 1 inches

WQv = 0.0469 acre-ft

= 0.402 inches

Modified CN (CNm) = 92

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 10 inches Meets Req'ts *Reference 23*

Proposed Long Slope = 0.00%

Avg. Height of WQv for slope = 10 inches

Left Side Slope = 4 :1 Right Side Slope = 3 :1

Storage for Dry Swale

Depth	Ditch Length (ft)	Width (ft)	Surface Area (sf)	SA (ac-ft)	Inc. Volume (cf)	Acc. Volume (cf)	Acc. Volume (ac-ft),	
0.00	953.00	4.00	3,812	0.088	0.00	0.00	0.000	
0.83	953.00	9.83	9,371	0.215	5492.99	5492.99	0.126	Meets WQv Reqts
1.00	953.00	11.00	10,483	0.241	1654.51	7147.50	0.164	
2.00	953.00	18.00	17,154	0.394	15473.01	20966.00	0.481	
3.00	953.00	25.00	23,825	0.547	34308.00	41455.50	0.952	

Check Dam Spacing = NA No check dams required on flat slope

Number of check dams needed = NA No check dams required on flat slope

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.11 ft/day Minimum k value

d_f = 2.5 ft

Surface Area, A = 9,371 sq ft

Avg height of water above filter bed, h_f = 0.83 ft

t_f = 36 hours Maximum 36 hours

5.1.6 Dry Swale DA6

Total Drainage Area = 1.4 acres *Reference 1*

	Road Width (ft)	Road Length (ft)	Road Imp Area (sf)
Gravel Road	25	953.00	23825.00
Intake Str Bldgs & Pad			0
		Total	23825.00 sf
			0.55 acres

Composite CN

** See Appendix B for CN Table*

Cover	HSG	Area, A (ac)	CN	CN*A (sf)
Gravel Road & Intake Str	D (Conservative)	0.55	91	49.77
Pasture (Grassland, Fair)	D (Conservative)	0.85	84	71.66
	Total =	1.40	Composite CN =	87

Water Quality Protection Volume - WQv (Schueler Method)

Percent Impervious, I = 39 %
Volumetric Runoff Coefficient, Rv = 0.402
first flush rainfall, P = 1 inches
WQv = 0.0469 acre-ft
= 0.402 inches

Modified CN (CNm) = 92

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 10 inches Meets Req'ts *Reference 23*
Proposed Long Slope = 0.00%
Avg. Height of WQv for slope = 10 inches
Left Side Slope = 4 :1 Right Side Slope = 3 :1

Storage for Dry Swale

Depth	Ditch Length (ft)	Width (ft)	Surface Area (sf)	SA (ac-ft)	Inc. Volume (cf)	Acc. Volume (cf)	Acc. Volume (ac-ft),	
0.00	953.00	4.00	3,812	0.088	0.00	0.00	0.000	
0.83	953.00	9.83	9,371	0.215	5492.99	5492.99	0.126	Meets WQv Reqts
1.00	953.00	11.00	10,483	0.241	1654.51	7147.50	0.164	
2.00	953.00	18.00	17,154	0.394	15473.01	20966.00	0.481	
3.00	953.00	25.00	23,825	0.547	34308.00	41455.50	0.952	

Check Dam Spacing = NA No check dams required on flat slope
Number of check dams needed = NA No check dams required on flat slope

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.11 ft/day Minimum k value
d_f = 2.5 ft
Surface Area, A = 9,371 sq ft
Avg height of water above filter bed, h_f = 0.83 ft
t_f = 36 hours Maximum 36 hours

5.1.7 Dry Swale DA7

Total Drainage Area = 0.3 acres *Reference 1*

	Road Width (ft)	Road Length (ft)	Road Imp Area (sf)
Gravel Road	25	370.00	9250.00
Intake Str Bldgs & Pad			0
		Total	9250.00 sf
			0.21 acres

Composite CN

** See Appendix B for CN Table*

Cover	HSG	Area, A (ac)	CN	CN*A (sf)
Gravel Road & Intake Str	D (Conservative)	0.21	91	19.32
Pasture (Grassland, Fair)	D (Conservative)	0.09	84	7.36
	Total =	0.30	Composite CN =	89

Water Quality Protection Volume - WQv (Schueler Method)

Percent Impervious, I = 71 %
Volumetric Runoff Coefficient, Rv = 0.687
First flush rainfall, P = 1 inches
0.0172 acre-ft
= 0.687 inches

Modified CN (CNm) = 97

Swale Design for WQv

Height of Check Dams and/or Outlet Structure = 10 inches Meets Req'ts *Reference 23*
Proposed Long Slope = 0.00%
Avg. Height of WQv for slope = 10 inches
Left Side Slope = 4 :1 Right Side Slope = 3 :1

Storage for Dry Swale

Depth	Ditch Length (ft)	Width (ft)	Surface Area (sf)	SA (ac-ft)	Inc. Volume (cf)	Acc. Volume (cf)	Acc. Volume (ac-ft),	
0.00	370.00	4.00	1,480	0.034	0.00	0.00	0.000	
0.83	370.00	9.83	3,638	0.084	2132.64	2132.64	0.049	Meets WQv Reqts
1.00	370.00	11.00	4,070	0.093	642.36	2775.00	0.064	
2.00	370.00	18.00	6,660	0.153	6007.36	8140.00	0.187	
3.00	370.00	25.00	9,250	0.212	13320.00	16095.00	0.369	

Check Dam Spacing = NA No check dams required on flat slope
Number of check dams needed = NA No check dams required on flat slope

Recovery Time - Darcy Equation

Soil Hydraulic Conductivy, k = 0.104 ft/day Minimum k value
d_f = 2.5 ft
Surface Area, A = 3,638 sq ft
Avg height of water above filter bed, h_1 = 0.83 ft
t_f = 36 hours Maximum 36 hours

5.1.8 Final Dry Swale Design

Bottom Width = 4 ft
Depth = 2 ft

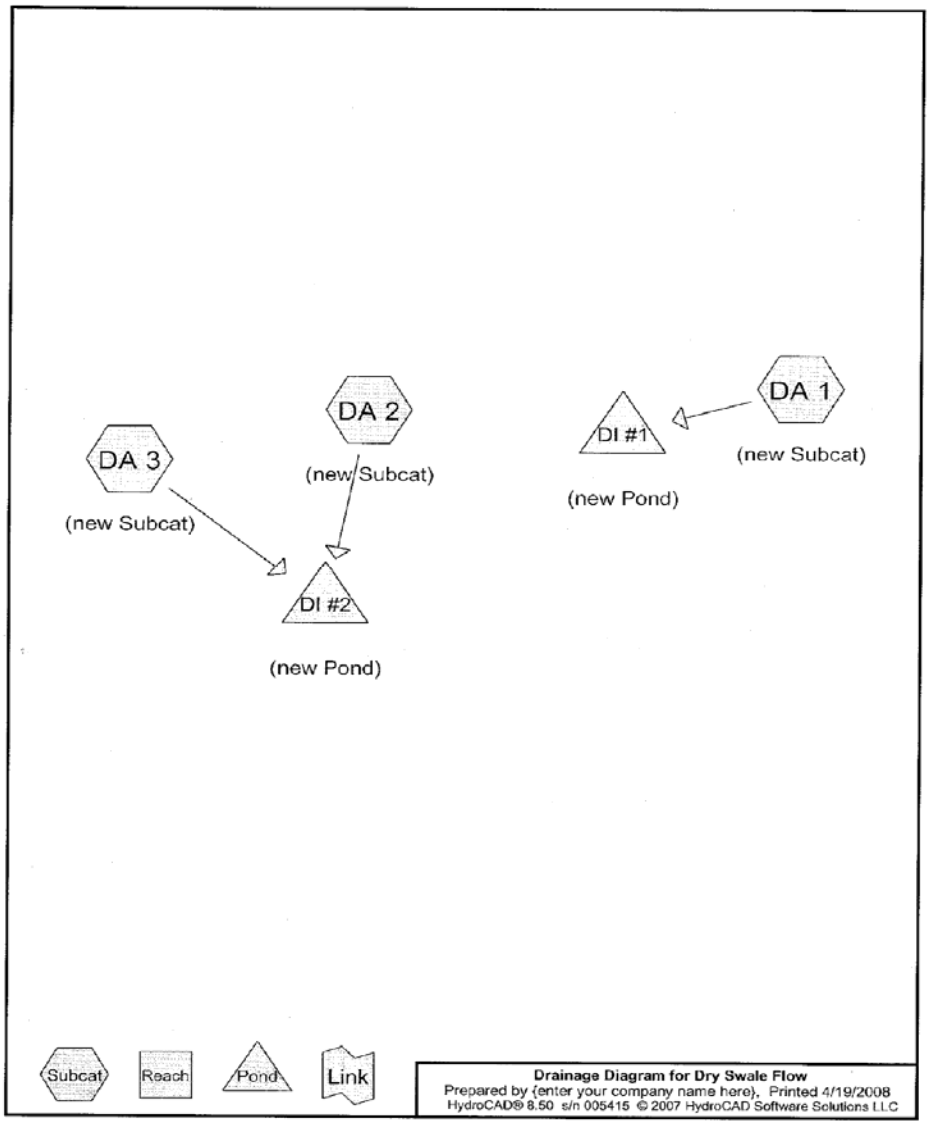
Ditch #	Height of Check Dams (inches)	Check Dam Spacing (ft)	Number of Check Dams	
1	18	200	7	0.75% channel slope
2	18	50	22	3% channel slope
3	18	150	3	1% channel slope
5	No Check Dams - Flat			
6	No Check Dams - Flat			
7	No Check Dams - Flat			

5.1.9 Recovery Time Summary: Hydraulic Conductivities

Ditch/DA #	Minimum K Value to Achieve Maximum 36 hour Recovery Time (ft/day)
1	0.280
2	0.250
3	0.275
5	0.110
6	0.110
7	0.104

Soil boring tests indicate values of hydraulic conductivities ranging from 0.9 ft/day to 28.6 ft/day, which are higher than all of the minimum hydraulic conductivities stated in table above. Therefore, the soils meet the requirement of maximum recovery time of 36 hours.

5.1.10 **Dry Swale 25 yr Flow Calculations (HydroCAD results)**



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.000	86	(DA 1)
4.500	88	(DA 2)
1.000	90	(DA 3)
10.500		**TOTAL AREA**

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA 1: (new Subcat) Runoff Area=5.000 ac 0.00% Impervious Runoff Depth=6.82"
Flow Length=550' Tc=15.8 min CN=86 Runoff=40.95 cfs 2.840 af

SubcatchmentDA 2: (new Subcat) Runoff Area=4.500 ac 0.00% Impervious Runoff Depth=7.06"
Flow Length=770' Tc=5.9 min CN=88 Runoff=51.64 cfs 2.647 af

SubcatchmentDA 3: (new Subcat) Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=7.30"
Tc=5.0 min CN=90 Runoff=12.03 cfs 0.608 af

Pond DI #1: (new Pond) Peak Elev=1.59' Storage=0.253 af Inflow=40.95 cfs 2.840 af
Outflow=35.84 cfs 2.840 af

Pond DI #2: (new Pond) Peak Elev=1.93' Storage=0.393 af Inflow=63.57 cfs 3.255 af
Outflow=47.20 cfs 3.255 af

Total Runoff Area = 10.500 ac Runoff Volume = 6.095 af Average Runoff Depth = 6.97"
100.00% Pervious = 10.500 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment DA 1: (new Subcat)

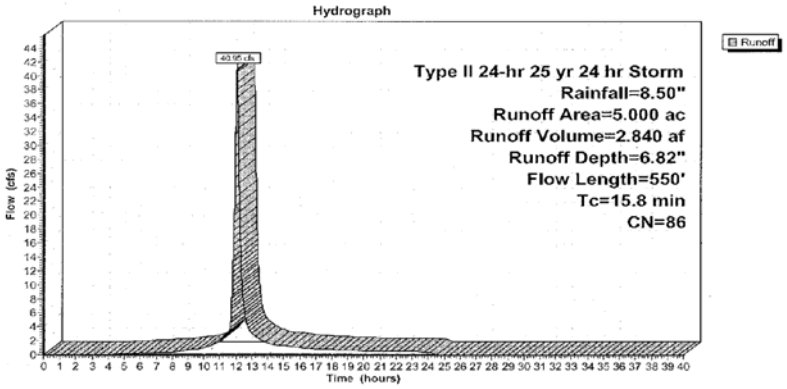
Runoff = 40.95 cfs @ 12.07 hrs, Volume= 2.840 af, Depth= 6.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 yr 24 hr Storm Rainfall=8.50"

	Area (ac)	CN	Description
*	5.000	86	
	5.000		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	200	0.0500	0.23		**Sheet Flow,** Grass: Dense n= 0.240 P2= 4.50"
0.9	150	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	200	0.0300	7.69	107.65	**Channel Flow,** Area= 14.0 sf Perim= 16.5' r= 0.85' n= 0.030
15.8	550	Total			

Subcatchment DA 1: (new Subcat)



Summary for Subcatchment DA 2: (new Subcat)

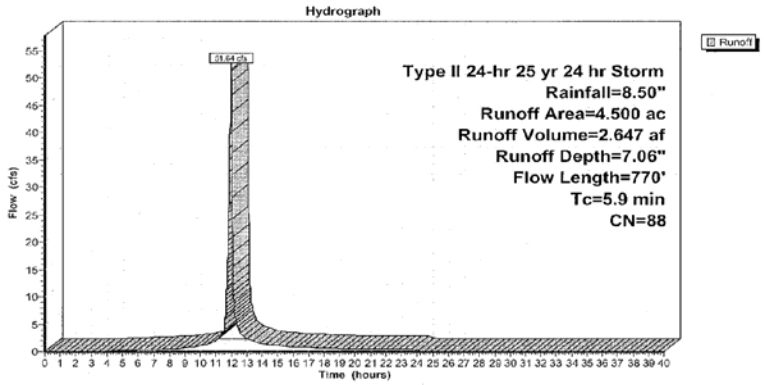
Runoff = 51.64 cfs @ 11.97 hrs, Volume= 2.647 af, Depth= 7.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 yr 24 hr Storm Rainfall=8.50"

Area (ac)	CN	Description
* 4.500	88	
4.500		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.2500	0.38		**Sheet Flow,** Grass: Dense n= 0.240 P2= 4.50"
1.5	670	0.0300	7.69	107.65	**Channel Flow,** Area= 14.0 sf Perim= 16.5' r= 0.85' n= 0.030
5.9	770	Total			

Subcatchment DA 2: (new Subcat)



Summary for Subcatchment DA 3: (new Subcat)

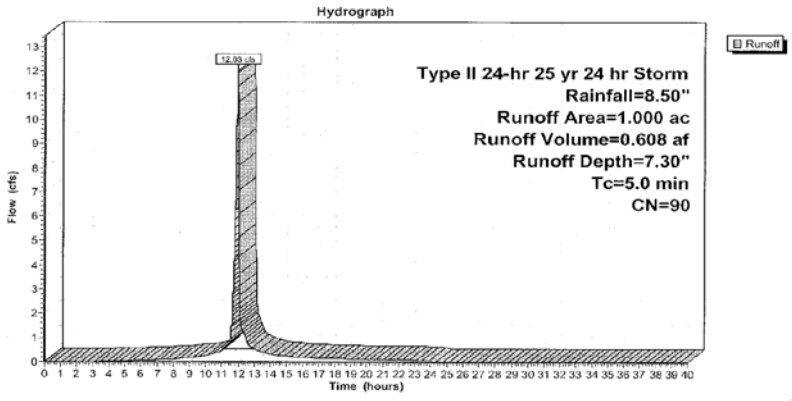
Runoff = 12.03 cfs @ 11.96 hrs, Volume= 0.608 af, Depth= 7.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 yr 24 hr Storm Rainfall=8.50"

	Area (ac)	CN	Description
*	1.000	90	
	1.000		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment DA 3: (new Subcat)



Summary for Pond DI #1: (new Pond)

Inflow Area = 5.000 ac, 0.00% Impervious, Inflow Depth = 6.82" for 25 yr 24 hr Storm event
Inflow = 40.95 cfs @ 12.07 hrs, Volume= 2.840 af
Outflow = 35.84 cfs @ 12.14 hrs, Volume= 2.840 af, Atten= 12%, Lag= 4.0 min
Primary = 35.84 cfs @ 12.14 hrs, Volume= 2.840 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.59' @ 12.14 hrs Surf.Area= 0.375 ac Storage= 0.253 af

Plug-Flow detention time= 8.7 min calculated for 2.840 af (100% of inflow)
Center-of-Mass det. time= 8.8 min (800.3 - 791.6)

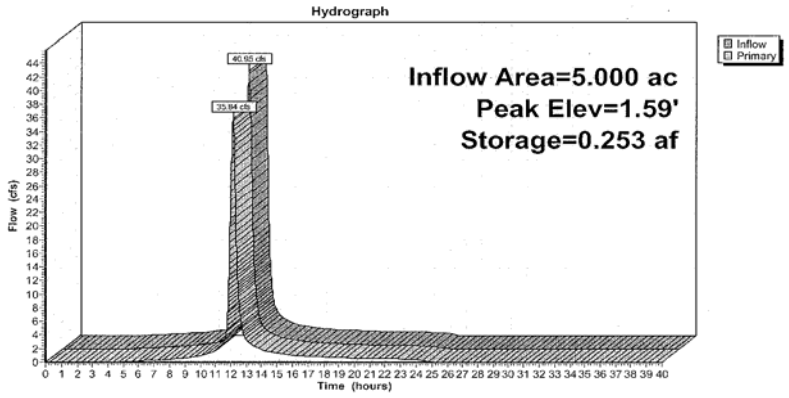
Volume	Invert	Avail.Storage	Storage Description
#1	0.75'	0.957 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.75	0.230	0.000	0.000
1.50	0.360	0.221	0.221
2.00	0.447	0.202	0.423
3.00	0.621	0.534	0.957

Device	Routing	Invert	Outlet Devices
#1	Primary	0.75'	**16.00' W x 0.67' H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=35.84 cfs @ 12.14 hrs HW=1.59' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 35.84 cfs @ 3.34 fps)

Pond DI #1: (new Pond)



Summary for Pond DI #2: (new Pond)

Inflow Area = 5.500 ac, 0.00% Impervious, Inflow Depth = 7.10" for 25 yr 24 hr Storm event
Inflow = 63.57 cfs @ 11.96 hrs, Volume= 3.255 af
Outflow = 47.20 cfs @ 12.02 hrs, Volume= 3.255 af, Atten= 26%, Lag= 3.5 min
Primary = 47.20 cfs @ 12.02 hrs, Volume= 3.255 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 1.93' @ 12.02 hrs Surf.Area= 0.435 ac Storage= 0.393 af

Plug-Flow detention time= 8.7 min calculated for 3.254 af (100% of inflow)
Center-of-Mass det. time= 8.7 min (784.1 - 775.4)

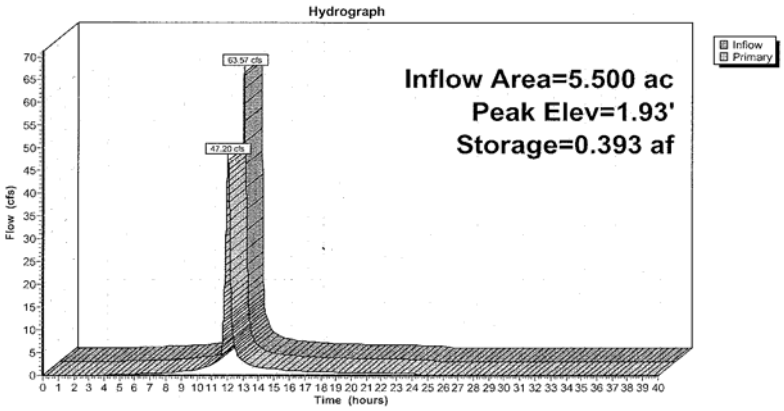
Volume	Invert	Avail.Storage	Storage Description
#1	0.75'	0.957 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.75	0.230	0.000	0.000
1.50	0.360	0.221	0.221
2.00	0.447	0.202	0.423
3.00	0.621	0.534	0.957

Device	Routing	Invert	Outlet Devices
#1	Primary	0.75'	**16.00' W x 0.67' H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=47.18 cfs @ 12.02 hrs HW=1.93' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 47.18 cfs @ 4.40 fps)

Pond DI #2: (new Pond)



5.1.11 **Normal Depth calculations (FlowMaster results)**

Worksheet for Swale #2

Project Description			
Friction Method	Manning Formula		
Solve For	Normal Depth		
Input Data			
Roughness Coefficient		0.030	
Channel Slope		0.03000	ft/ft
Left Side Slope		4.00	ft/ft (H:V)
Right Side Slope		3.00	ft/ft (H:V)
Bottom Width		4.00	ft
Discharge		51.64	ft³/s
Results			
Normal Depth		1.03	ft
Flow Area		7.79	ft²
Wetted Perimeter		11.48	ft
Top Width		11.18	ft
Critical Depth		1.22	ft
Critical Slope		0.01461	ft/ft
Velocity		6.63	ft/s
Velocity Head		0.68	ft
Specific Energy		1.71	ft
Froude Number		1.40	
Flow Type	Supercritical		
GVF Input Data			
Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	
GVF Output Data			
Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		1.03	ft
Critical Depth		1.22	ft
Channel Slope		0.03000	ft/ft
Critical Slope		0.01461	ft/ft

Cross Section for Swale #2

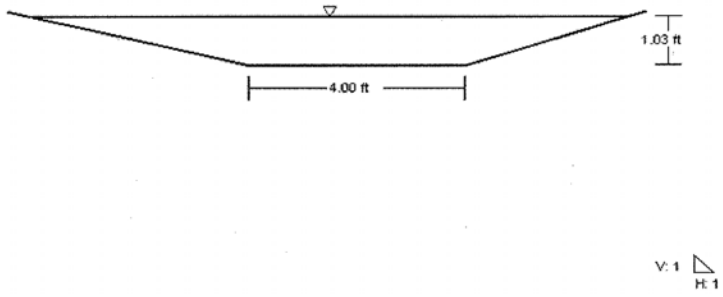
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.03000	ft/ft
Normal Depth	1.03	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	51.64	ft³/s

Cross Section Image



Worksheet for Swale #3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	14.19	ft^3/s

Results

Normal Depth	0.70	ft
Flow Area	4.55	ft^2
Wetted Perimeter	9.13	ft
Top Width	8.93	ft
Critical Depth	0.61	ft
Critical Slope	0.01758	ft/ft
Velocity	3.12	ft/s
Velocity Head	0.15	ft
Specific Energy	0.86	ft
Froude Number	0.77	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.61	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01758	ft/ft

Cross Section for Swale #3

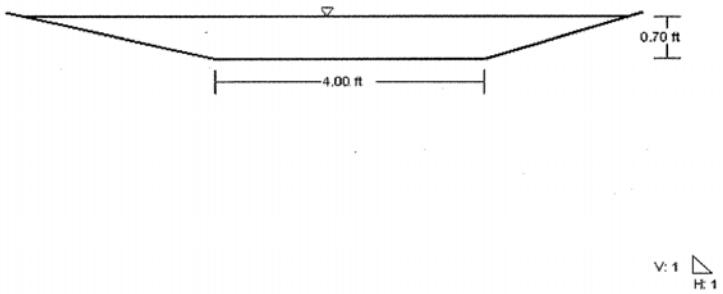
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Normal Depth	0.70	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	14.19	ft^3/s

Cross Section Image



5.1.12 **Calculations for Specifications of Matting**

Due to the slope and flow, swale #2 is the most severe condition for erosion. Therefore, parameters for swale #2 for this computation will be used for specification of matting for entire site. Refer to normal depth calculation for swale #2 for these parameters. This is a conservative assumption.

Shear Strength = (Unit Weight of Water)* (Depth) * Slope

Normal Depth =	1.03	ft
Unit Weight of water =	62.4	lb/sq ft
Slope =	0.03	ft/ft
Shear Strength =	1.93	lb/sq ft

Minimum shear strength of matting or Sod to be specified in the drawings to be 1.93 lb/sq ft.

5.2 Pipe Crossing design

5.2.1 FlowMaster Result

Worksheet for Circular Pipe - 1

Project Description			
Friction Method	Manning Formula		
Solve For	Full Flow Diameter		
Input Data			
Roughness Coefficient		0.012	
Channel Slope		0.01500	ft/ft
Normal Depth		2.25	ft
Diameter		2.25	ft
Discharge		40.95	ft³/s
Results			
Diameter		2.25	ft
Normal Depth		2.25	ft
Flow Area		3.97	ft²
Wetted Perimeter		7.06	ft
Top Width		0.00	ft
Critical Depth		2.10	ft
Percent Full		100.0	%
Critical Slope		0.01296	ft/ft
Velocity		10.33	ft/s
Velocity Head		1.66	ft
Specific Energy		3.90	ft
Froude Number		0.00	
Maximum Discharge		44.05	ft³/s
Discharge Full		40.95	ft³/s
Slope Full		0.01500	ft/ft
Flow Type	SubCritical		
GVF Input Data			
Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	
GVF Output Data			
Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Average End Depth Over Rise		0.00	%
Normal Depth Over Rise		100.00	%

Worksheet for Circular Pipe - 1

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.25	ft
Critical Depth	2.10	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.01296	ft/ft

Cross Section for Circular Pipe - 1

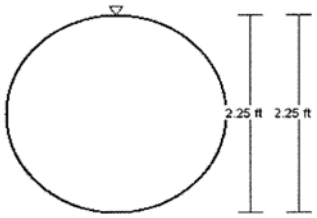
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data

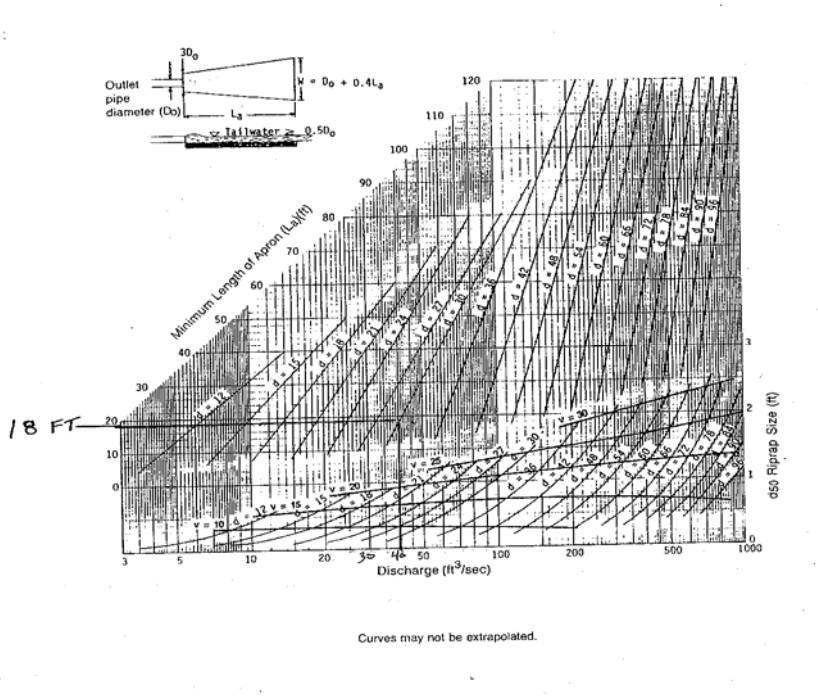
Roughness Coefficient	0.012	
Channel Slope	0.01500	ft/ft
Normal Depth	2.25	ft
Diameter	2.25	ft
Discharge	40.95	ft³/s

Cross Section Image



V: 1
H: 1

5.2.2 Rip Rap Apron Calculation

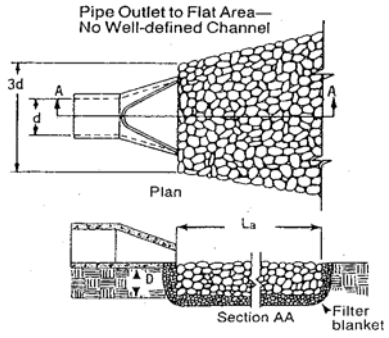


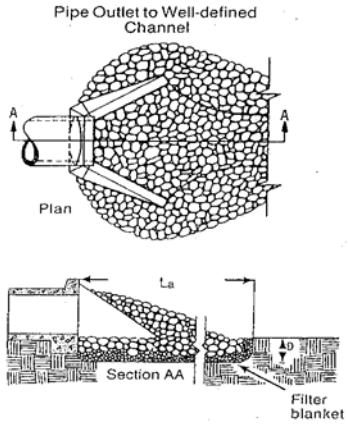
Curves may not be extrapolated.

Rip Rap Apron Dimenions

Number	3*Do (ft)	(ft)	W (ft)
FES 1	0	18	7
FES 2	8	10	12

Note: Tailditch to daylight apron
Note: Refer to USDA Graph for sizing calculation





Notes

1. L_a is the length of the riprap apron.
2. D = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

5.3 Drainage Summary

Cross Pipes & Drainage Structures

Structure					Swale	Storm Pipe						C/L of Road
Number	Type	Std. #	Type	Open Throat Invert Elev (ft)	Bottom Elev (ft)	Pipe Invert In Elev (ft)	Outlet Elev (ft)	Length (ft)	Slope (%)	Size (in)	Material	Elev (ft)
1	DI	TAIL SHEET	Slab Type	28.30	27.50	24.00	23.00	65	1.5	30	HDPE	30.00
2	DI	TAIL SHEET	Slab Type	3.00	1.50	0.00	0.00	65	0.0	12	HDPE	4.00

Note: Number 2 is a watertight joint

6.0 FEMA Maps and Description (Reference Appendix A.6 and A.7)

Flood Insurance Rate Maps (FIRM's) are created and utilized by Federal Emergency Management Agency (FEMA) to designate flood zones and are available on FEMA website. FIRM Community Panel Number 120145 0640 D, effective date 1984 and Panel Number 120145 0625 D, effective date 1984 are the associated maps for reference to the proposed construction.

From collecting the FIRM's and creating FIRMETTES, the following was determined:

- The proposed "New South Access Bridge" is located within FEMA Flood Zone A1 determined from the FIRM and the proposed plans with the FEMA flood lines. The FIRM indicates an approximate flood (100 year) elevation of 28 NGVD29 (EL 27 NAVD88). The low member of the bridge that spans this floodplain will be above elevation 27 NAVD88; therefore, no impact to storage volume from the bridge span.
- A portion of the proposed "South Access Road" grading contours (Station 11+00 to Station 30+82 is located within FEMA Flood Zone A12 determined from the FIRM and the proposed plans with the FEMA flood lines. The FIRM indicates an approximate flood (100-YR) elevation of 13 NGVD29 (EL 12 NAVD88). The Storm Water/Erosion Control Plans depict the FEMA flood line for elevation 28 NGVD29 (27 NAVD88) to be conservative. As indicated in the plans, only excavation and no fill is proposed in the FEMA floodplain, thus the project is not impacting the floodplain storage volume for the Cross Florida Barge Canal.
- All other proposed construction is located within FEMA Flood Zone C – Areas of minimal flooding (Not Shaded), which means these areas are not regulated by FEMA.
- There are appears to be no mapped floodways (indicated by the FIRM maps) within the project area; therefore, a "No Rise" or "No Impact" submittal to FEMA is not required.

Since there is construction within a FEMA Flood Zone, in accordance with federal regulations, the authorized Floodplain Administrator and/or a FEMA designated reviewer should review the project to determine if a floodplain development permit application is needed as well as a hydraulic analysis of the effective hydraulic model for development/construction within the FEMA flood zone to assure the proposed construction including the bridge addition does not raise the base flood more than one (1) foot (minimum FEMA regulations if there is no regulated floodway) or less if the local flood hazard ordinance (provided by the Floodplain Administrator) is stated otherwise. Minimum federal regulations established by FEMA in accordance with "44 Code of Federal Regulations Section 60.3" and the "Local Official's Guide to Implementing the National Flood Insurance Program in Florida states that a floodplain development permit should be obtained with any construction within a FEMA Flood Zone.

7.0 Listing of Computer Codes Used and Runs Made in Calculation

Table 6-1
Summary of Computer Codes Used in Calculation

Code No.	Code Name	Code Ver.	Configuration Control Reference	Basis (or reference) that supports use of code in current calculation
1	MS Excel (2,3)	2002 SP3	Commercial Software (1)	
2	Bentley FlowMaster	3/6/2007		
3	HydroCAD	V 6.0		
4				
5				

Notes:

(1) The approach to using Excel in this calc note does not require that Excel or the Custom Add-In Functions attached to Excel be verified as long as the calc note can be verified by inspection of the paper output of the file. This verification approach is consistent with WP 4.19-5, revision 6, paragraph 7.2, which indicates that computer code validation does not apply to general utility programs that provide sufficient output to allow for independent verification without reference to the generating program. Check List B documents the verification method used for this calc note.

(2) PC operating system is Microsoft Windows XP.

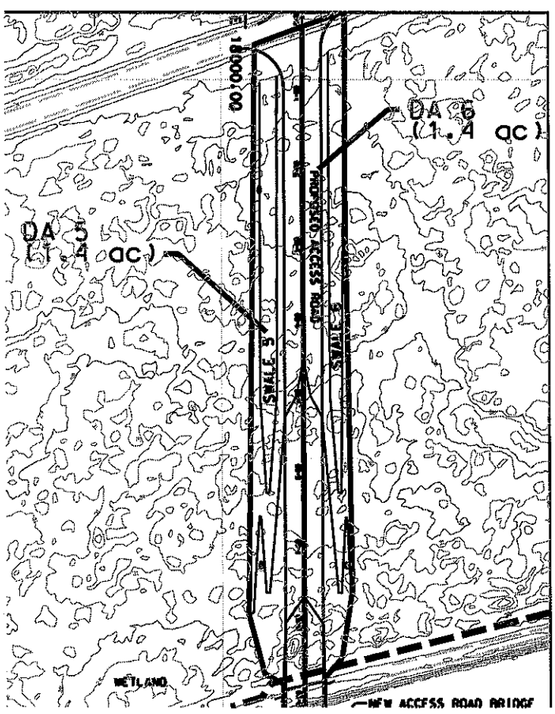
Appendix A.1

Drainage Area map # 1

DRAINAGE AREA MAP # 1

Appendix A.2

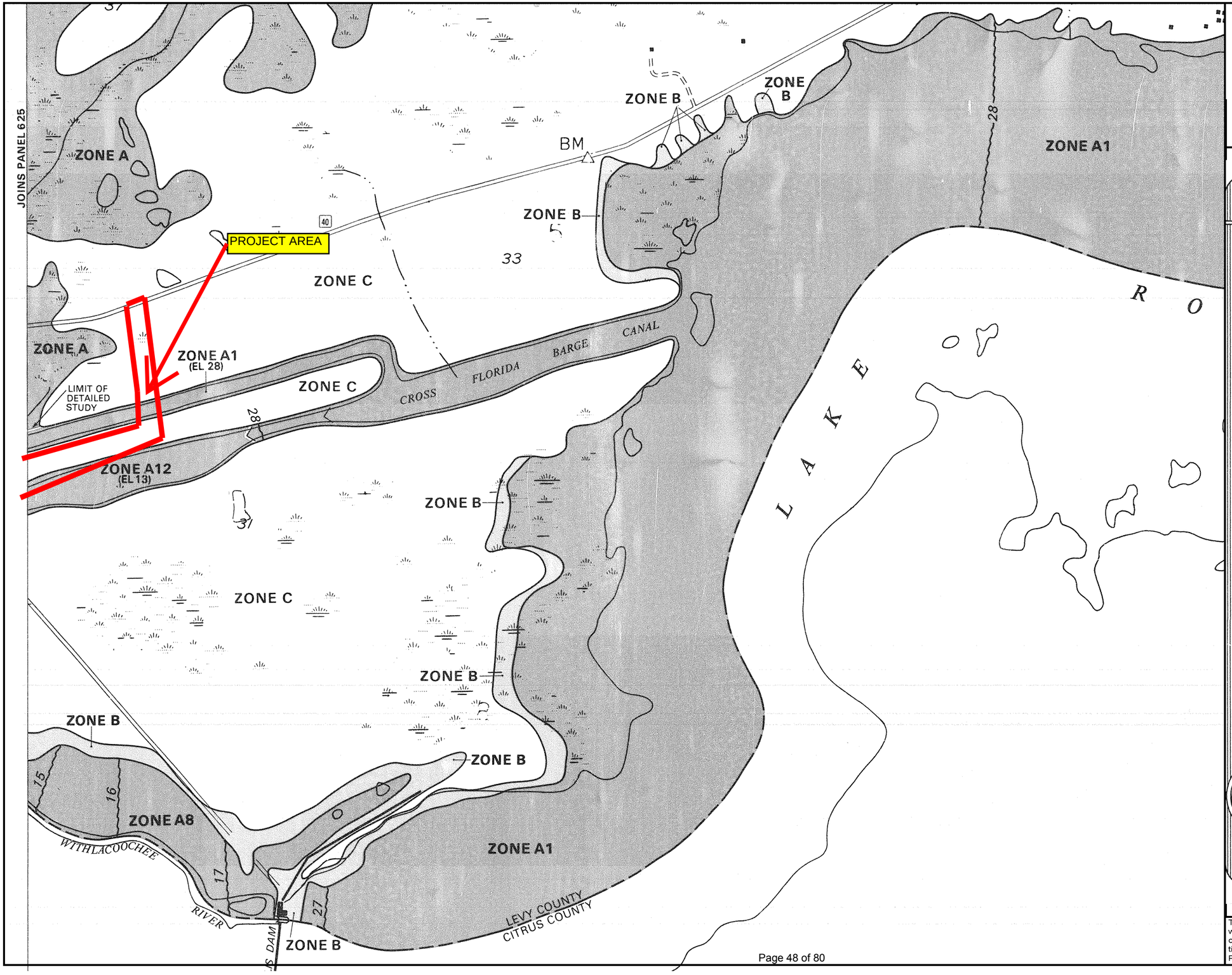
Drainage Area map # 2



DRAINAGE AREA MAP #2

Appendix A.3

FIRM Map Panel # 120145 0640 D



APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

LEVY COUNTY, FLORIDA

(UNINCORPORATED AREAS)

PANEL 640 OF 650

COMMUNITY-PANEL NUMBER
120145 0640 D

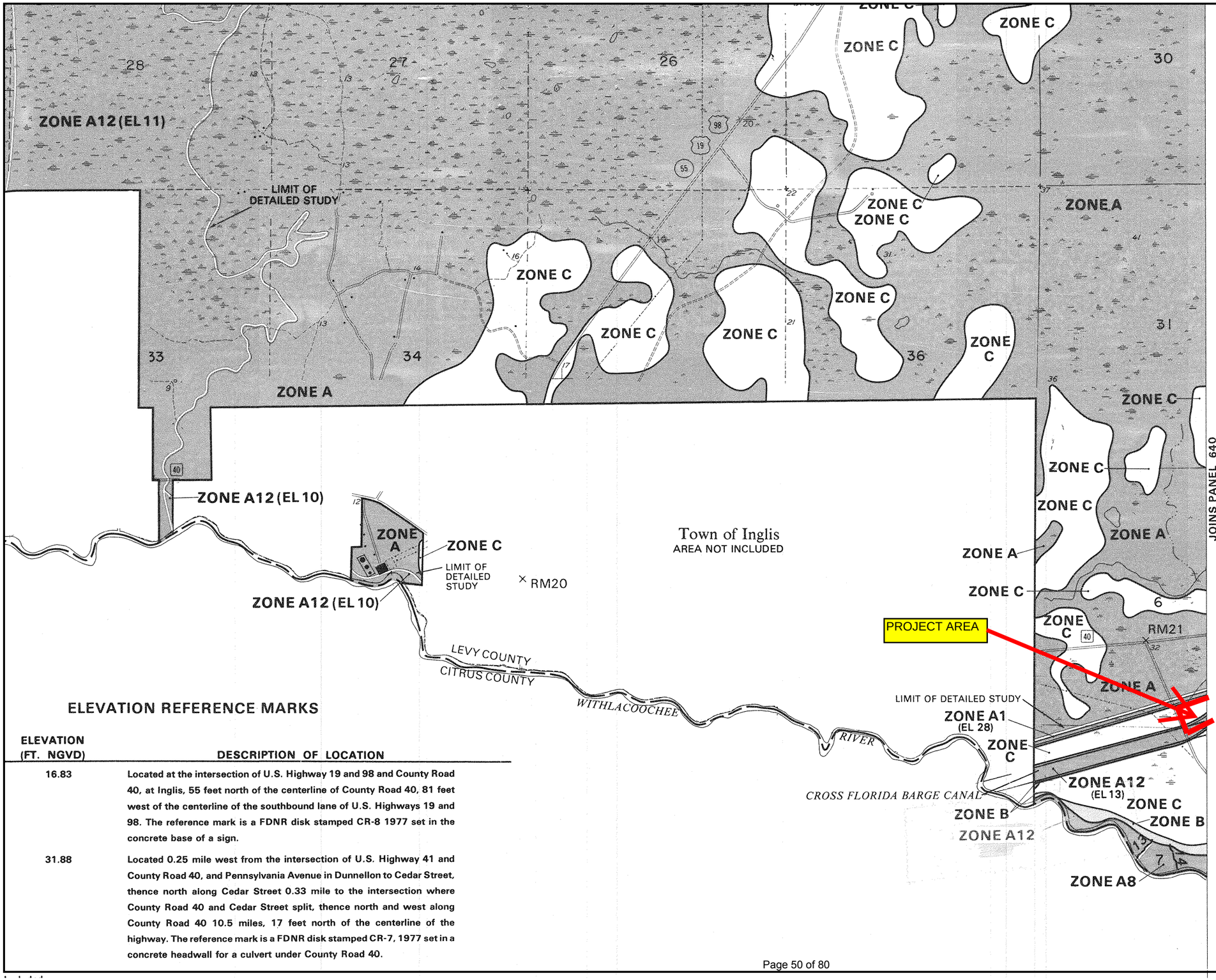
EFFECTIVE DATE:
MARCH 1, 1984

Federal Emergency Management Agency

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

Appendix A.4

FIRM Map Panel # 120145 0625 D



ELEVATION REFERENCE MARKS

ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
16.83	Located at the intersection of U.S. Highway 19 and 98 and County Road 40, at Inglis, 55 feet north of the centerline of County Road 40, 81 feet west of the centerline of the southbound lane of U.S. Highways 19 and 98. The reference mark is a FDNR disk stamped CR-8 1977 set in the concrete base of a sign.
31.88	Located 0.25 mile west from the intersection of U.S. Highway 41 and County Road 40, and Pennsylvania Avenue in Dunnellon to Cedar Street, thence north along Cedar Street 0.33 mile to the intersection where County Road 40 and Cedar Street split, thence north and west along County Road 40 10.5 miles, 17 feet north of the centerline of the highway. The reference mark is a FDNR disk stamped CR-7, 1977 set in a concrete headwall for a culvert under County Road 40.

APPROXIMATE SCALE
2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

LEVY COUNTY, FLORIDA
(UNINCORPORATED AREAS)

PANEL 625 OF 650

COMMUNITY-PANEL NUMBER
120145 0625 D

EFFECTIVE DATE:
MARCH 1, 1984

Federal Emergency Management Agency

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

Appendix B:

Curve Number Table

Cover Description		Curve Numbers for Hydrologic Soil Groups			
Cover Type and Hydrologic Condition	Average Percent Impervious Area	A	B	C	D
Fully Developed Urban Areas (vegetation established)					
Open space (lawns, parks, cemetaries, etc.)					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious Areas:					
Paved parking lots, roofs, driveways, ect.		98	98	98	98
Paved streets and roads		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	91	88	91	93
Residential district by average lost size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Agricultural Lands					
Pasture, grassland, or range (continuous forage for grazing)					
Poor hydrologic condition		68	79	86	89
Fair hydrologic condition		49	69	79	84
Good hydrologic condition		39	61	74	80
Meadow (continuous grass, protected from grazing and generally mowed for hay)		30	58	71	78
Woods					
Poor hydrologic condition		45	66	77	83
Fair hydrologic condition		36	60	73	79
Good hydrologic condition		30	55	70	77
Developing Urban Areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94

Appendix C:

Elevations on Station Datum (NOAA)

Dec 17 2007 09:35 ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 8727520 T.M.: 0 W
Name: CEDAR KEY, GULF OF MEXICO, FL Units: Feet
Status: Accepted Epoch: 1983-2001

Datum	Value	Description
MHHW	5.60	Mean Higher-High Water
MHW	5.27	Mean High Water
DTL	3.70	Mean Diurnal Tide Level
MTL	3.85	Mean Tide Level
MSL	3.84	Mean Sea Level
MLW	2.44	Mean Low Water
MLLW	1.80	Mean Lower-Low Water
GT	3.80	Great Diurnal Range
MN	2.83	Mean Range of Tide
DHQ	0.34	Mean Diurnal High Water Inequality
DLQ	0.63	Mean Diurnal Low Water Inequality
HWI	6.49	Greenwich High Water Interval (in Hours)
LWI	0.34	Greenwich Low Water Interval (in Hours)
NAVD	4.06	North American Vertical Datum
Maximum	10.75	Highest Water Level on Station Datum
Max Date	19961007	Date Of Highest Water Level
Max Time	22:48	Time Of Highest Water Level
Minimum	-2.40	Lowest Water Level on Station Datum
Min Date	19470918	Date Of Lowest Water Level
Min Time	11:30	Time Of Lowest Water Level

To refer Water Level Heights to a Tidal Datum, apply the desired Datum Value.

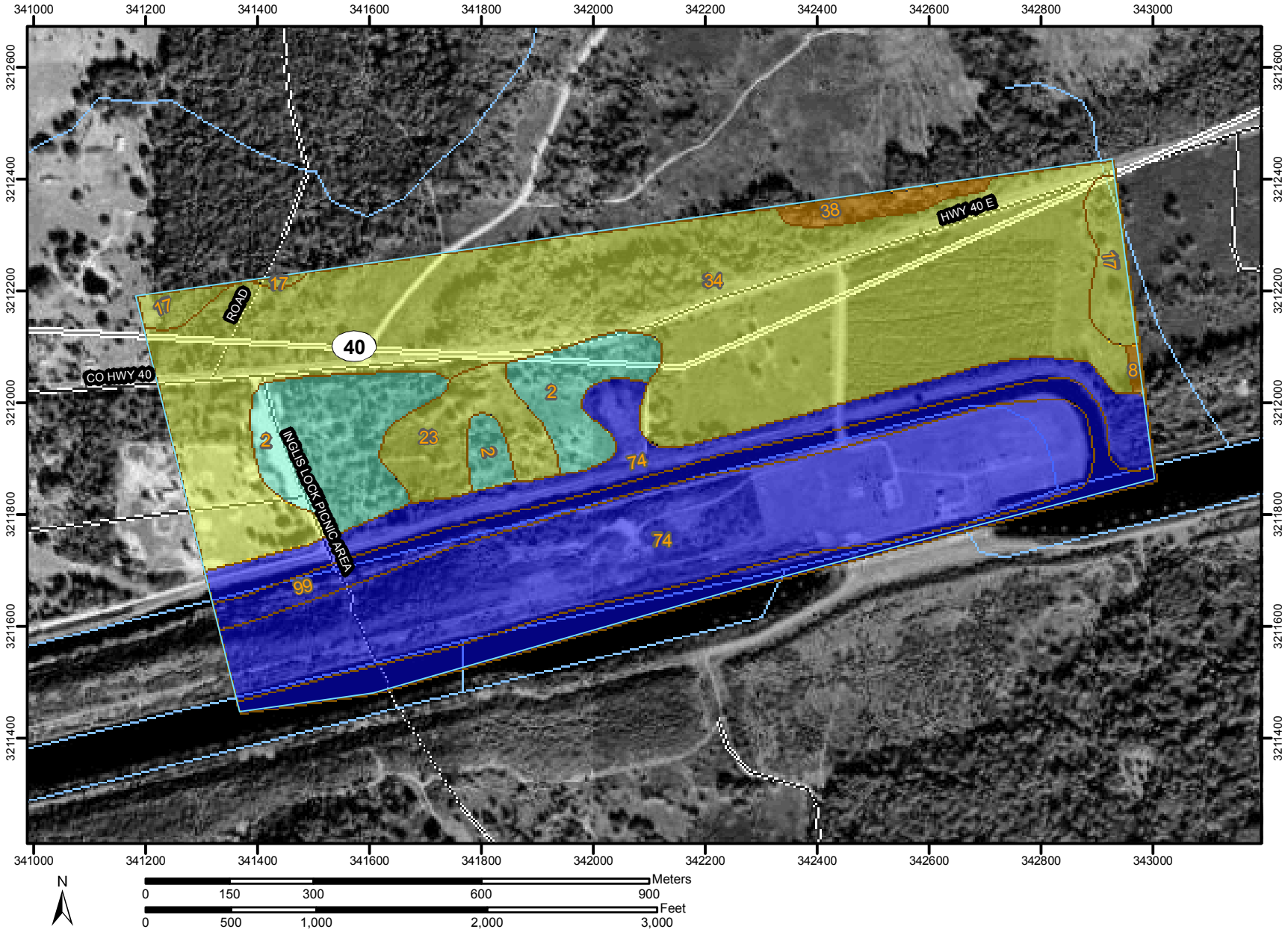
Click HERE for further station information including New Epoch products.

To refer Water Level Heights to either
NGVD (National Geodetic Vertical Datum of 1929) or
NAVD (North American Vertical Datum of 1988), apply the values located at:
National Geodetic Survey

Appendix D

NRCS Soil Data

Depth to Water Table–Levy County, Florida
(Levy-Depth_to_Water_Table)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Levy County, Florida
Survey Area Data: Version 5, Nov 30, 2006

Date(s) aerial images were photographed: 12/30/1998; 1/5/1999

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Depth to Water Table

Depth to Water Table— Summary by Map Unit — Levy County, Florida				
Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
2	Tavares fine sand, 1 to 5 percent slopes	145	27.1	9.4%
8	Smyrna fine sand	31	0.5	0.2%
17	Adamsville fine sand, 0 to 5 percent slopes	84	6.8	2.4%
23	Zolfo sand	84	10.2	3.5%
34	Cassia-Pomello complex	77	121.9	42.2%
38	Myakka sand	30	3.4	1.2%
74	Arents, 0 to 5 percent slopes	>200	90.6	31.3%
99	Water	>200	28.5	9.9%
Totals for Area of Interest (AOI)			289.2	100.0%

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

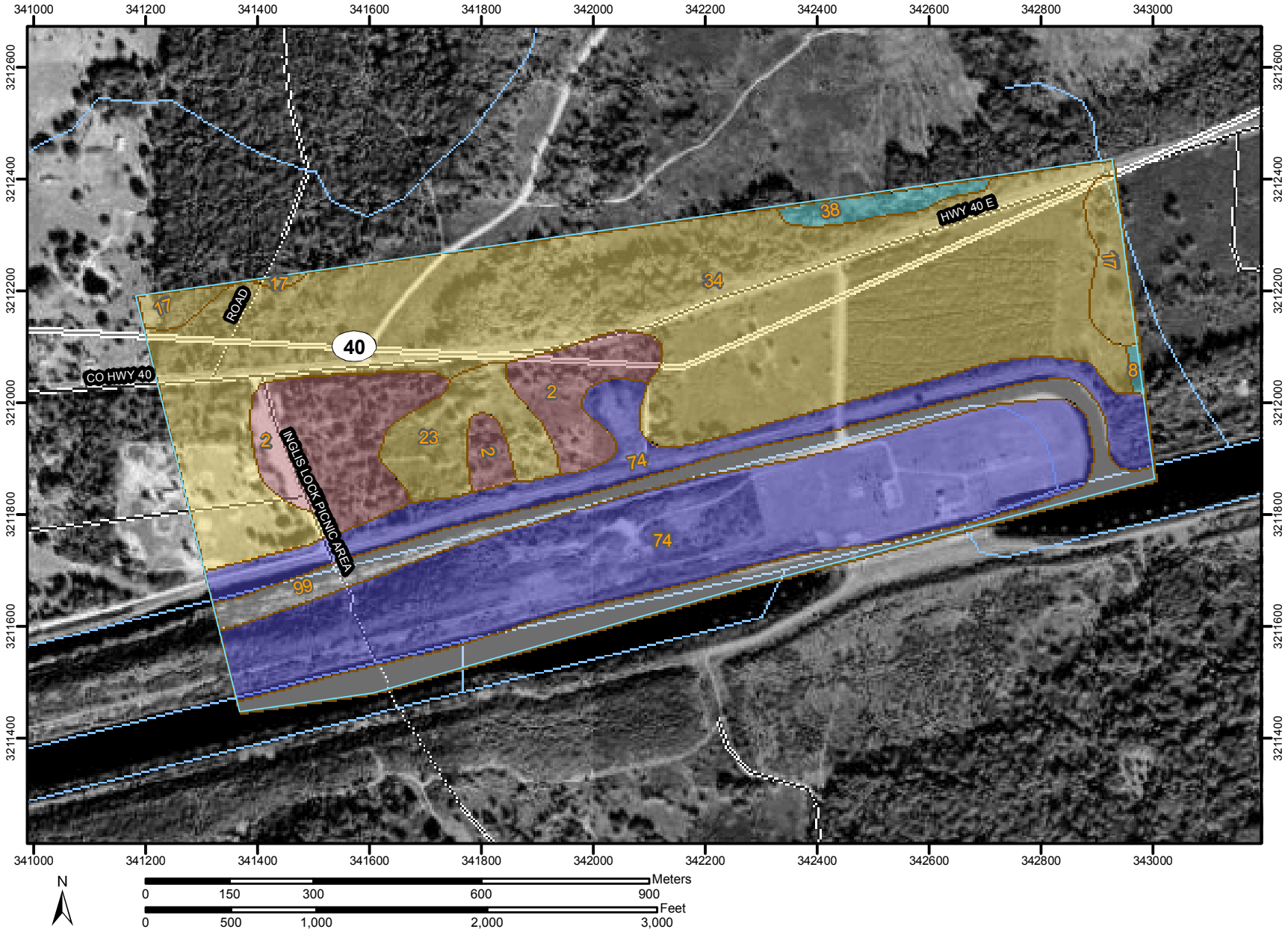
Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Beginning Month: January

Ending Month: December

Hydrologic Soil Group–Levy County, Florida
(Levy-HydrologicGroup)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Levy County, Florida
Survey Area Data: Version 5, Nov 30, 2006

Date(s) aerial images were photographed: 12/30/1998; 1/5/1999

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Levy County, Florida				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
2	Tavares fine sand, 1 to 5 percent slopes	A	27.1	9.4%
8	Smyrna fine sand	B/D	0.5	0.2%
17	Adamsville fine sand, 0 to 5 percent slopes	C	6.8	2.4%
23	Zolfo sand	C	10.2	3.5%
34	Cassia-Pomello complex	C	121.9	42.2%
38	Myakka sand	B/D	3.4	1.2%
74	Arents, 0 to 5 percent slopes	B	90.6	31.3%
99	Water		28.5	9.9%
Totals for Area of Interest (AOI)			289.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

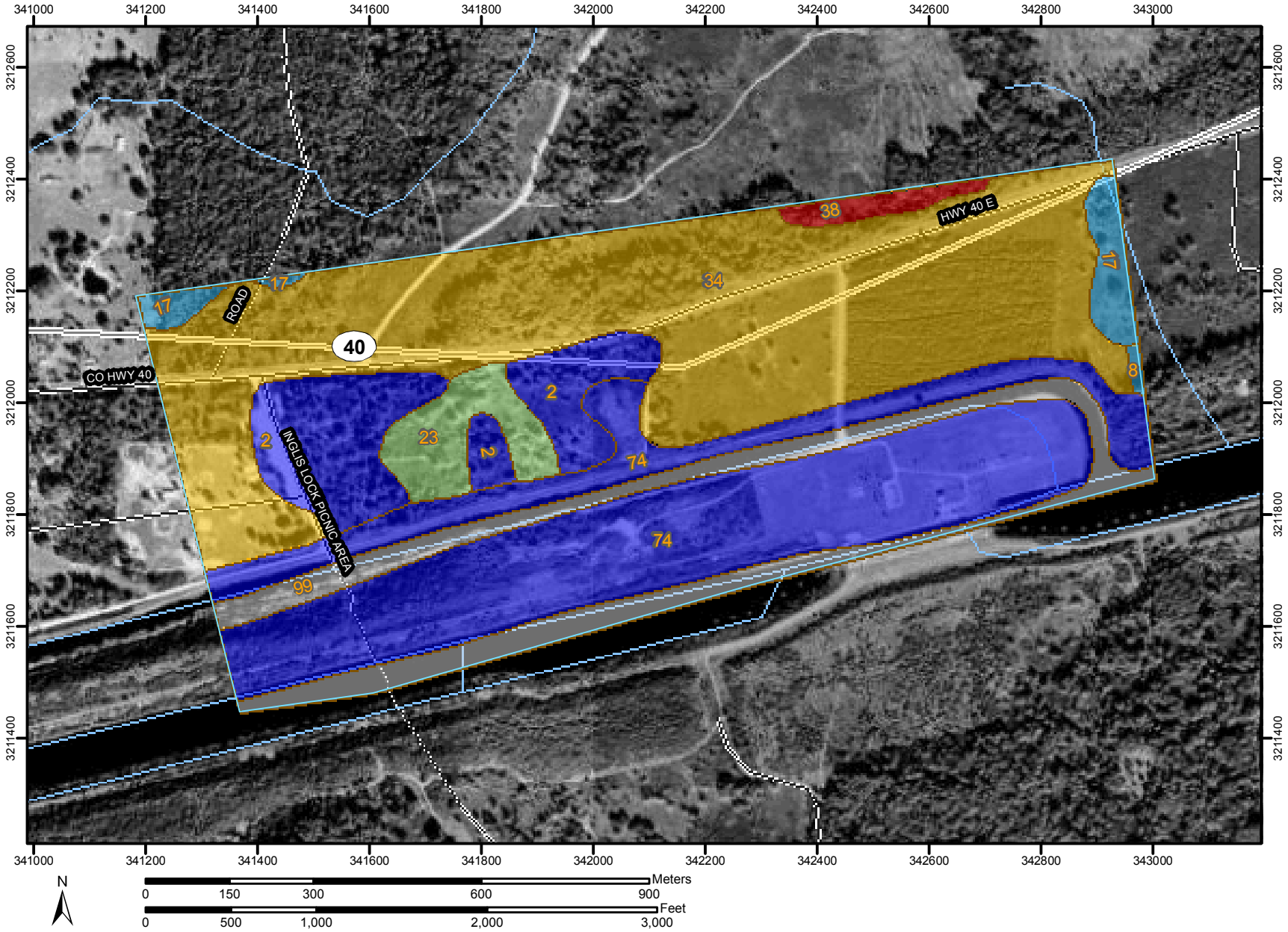
Physical Soil Properties– Levy County, Florida														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
2—Tavares fine sand, 1 to 5 percent slopes														
Tavares	0-7	—	0-15	0-4	1.25-1.65	42.00-353.00	0.05-0.10	0.0-2.9	0.5-2.0	.10	.10	5	1	220
	7-80	—	0-15	0-4	1.40-1.70	42.00-353.00	0.02-0.05	0.0-2.9	0.0-0.5	.10	.10			
8—Smyrna fine sand														
Smyrna	0-5	—	0-15	1-6	1.35-1.50	42.00-141.00	0.03-0.07	0.0-2.9	1.0-5.0	.10	.10	5	1	220
	5-19	—	0-15	1-6	1.35-1.50	42.00-141.00	0.03-0.07	0.0-2.9	0.0-0.5	.10	.10			
	19-23	—	0-15	3-8	1.30-1.45	4.00-42.00	0.10-0.20	0.0-2.9	1.5-6.0	.15	.15			
	23-80	—	0-15	1-6	1.45-1.70	42.00-141.00	0.03-0.07	0.0-2.9	0.0-0.5	.10	.10			
17—Adamsville fine sand, 0 to 5 percent slopes														
Adamsville	0-14	—	0-15	1-8	1.35-1.65	42.00-141.00	0.05-0.10	0.0-2.9	0.5-2.0	.10	.10	5	1	220
	14-80	—	0-15	1-7	1.35-1.65	42.00-141.00	0.03-0.08	0.0-2.9	0.0-0.5	.10	.10			
23—Zolfo sand														
Zolfo	0-4	—	0-15	1-5	1.35-1.55	42.00-141.00	0.10-0.15	0.0-2.9	0.5-1.0	.10	.10	5	1	180
	4-71	—	0-15	1-5	1.30-1.60	42.00-141.00	0.03-0.10	0.0-2.9	0.0-0.5	.10	.10			
	71-80	—	0-15	1-5	1.50-1.70	4.00-14.00	0.10-0.25	0.0-2.9	0.3-1.0	.15	.15			

Physical Soil Properties– Levy County, Florida														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
34—Cassia-Pomello complex														
Cassia	0-6	—	0-15	1-4	1.30-1.55	42.00-141.00	0.03-0.07	0.0-2.9	0.5-1.0	.10	.10	5	1	220
	6-24	—	0-15	1-4	1.30-1.55	42.00-141.00	0.03-0.07	0.0-2.9	0.0-1.0	.10	.10			
	24-55	—	0-15	2-10	1.30-1.55	4.00-42.00	0.10-0.15	0.0-2.9	1.0-5.0	.15	.15			
	55-70	—	0-15	1-5	1.40-1.60	42.00-141.00	0.03-0.07	0.0-2.9	0.0-0.8	.10	.10			
	70-80	—	0-15	1-5	1.40-1.60	42.00-141.00	0.03-0.07	0.0-2.9	1.0-5.0	.10	.10			
Pomello	0-4	—	0-15	0-2	1.35-1.65	141.00-353.00	0.02-0.05	0.0-2.9	0.5-1.0	.10	.10	5	1	220
	4-40	—	0-15	0-2	1.35-1.65	141.00-353.00	0.02-0.05	0.0-2.9	0.0-1.0	.10	.10			
	40-46	—	0-15	0-2	1.45-1.60	14.00-42.00	0.10-0.30	0.0-2.9	1.0-4.0	.15	.15			
	46-60	—	0-15	0-2	1.35-1.65	141.00-353.00	0.02-0.05	0.0-2.9	0.0-1.0	.10	.10			
	60-80	—	0-15	0-2	1.45-1.60	14.00-42.00	0.10-0.30	0.0-2.9	1.0-4.0	.15	.15			
38—Myakka sand														
Myakka	0-5	—	0-15	1-3	1.25-1.45	42.00-141.00	0.05-0.15	0.0-2.9	2.0-5.0	.10	.10	5	1	180
	5-26	—	0-15	0-2	1.45-1.60	42.00-141.00	0.02-0.05	0.0-2.9	0.0-0.5	.10	.10			
	26-58	—	0-15	1-8	1.45-1.60	4.00-42.00	0.10-0.20	0.0-2.9	1.5-4.5	.15	.15			
	58-80	—	0-15	0-2	1.48-1.70	42.00-141.00	0.02-0.10	0.0-2.9	0.0-0.5	.10	.10			
74—Arents, 0 to 5 percent slopes														
Arents	0-80	—	0-15	1-5	1.30-1.70	141.00-353.00	0.02-0.05	0.0-2.9	0.5-1.0	.10	.10	5	1	180
99—Water														
Water	—	—	—	—	—	—	—	—	—					

Data Source Information

Soil Survey Area: Levy County, Florida
Survey Area Data: Version 5, Nov 30, 2006

Saturated Hydraulic Conductivity (Ksat)–Levy County, Florida
(Levy-HydrologicConductivity)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 64.468
- > 64.468 AND <= 65.1478
- > 65.1478 AND <= 82.5961
- > 82.5961 AND <= 92
- > 92 AND <= 247
- Not rated or not available

Political Features

Municipalities

- Cities
- Urban Areas

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails

Roads

- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

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Date(s) aerial images were photographed: 12/30/1998; 1/5/1999

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — Levy County, Florida				
Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
2	Tavares fine sand, 1 to 5 percent slopes	197.5000	27.1	9.4%
8	Smyrna fine sand	88.6010	0.5	0.2%
17	Adamsville fine sand, 0 to 5 percent slopes	92.0000	6.8	2.4%
23	Zolfo sand	82.5961	10.2	3.5%
34	Cassia-Pomello complex	65.1478	121.9	42.2%
38	Myakka sand	64.4680	3.4	1.2%
74	Arents, 0 to 5 percent slopes	247.0000	90.6	31.3%
99	Water		28.5	9.9%
Totals for Area of Interest (AOI)			289.2	100.0%

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Fastest

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Layer Options: All Layers

For an attribute of a soil horizon, a depth qualification must be specified. In most cases it is probably most appropriate to specify a fixed depth range, either in centimeters or inches. The Bottom Depth must be greater than the Top Depth, and the Top Depth can be greater than zero. The choice of "inches" or "centimeters" only applies to the depth of soil to be evaluated. It has no influence on the units of measure the data are presented in.

When "Surface Layer" is specified as the depth qualifier, only the surface layer or horizon is considered when deriving a value for a component, but keep in mind that the thickness of the surface layer varies from component to component.

When "All Layers" is specified as the depth qualifier, all layers recorded for a component are considered when deriving the value for that component.

Whenever more than one layer or horizon is considered when deriving a value for a component, and the attribute being aggregated is a numeric attribute, a weighted average value is returned, where the weighting factor is the layer or horizon thickness.

Soil Features

This table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage, or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (Ksat), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Report—Soil Features

Soil Features– Levy County, Florida									
Map symbol and soil name	Restrictive Layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	*In*		*In*	*In*			
2—Tavares fine sand, 1 to 5 percent slopes									
Tavares		—	—		—	—	None	Low	High
8—Smyrna fine sand									
Smyrna		—	—		—	—	None	High	High
17—Adamsville fine sand, 0 to 5 percent slopes									
Adamsville		—	—		—	—	None	Low	Moderate
23—Zolfo sand									
Zolfo		—	—		—	—	None	Low	Moderate
34—Cassia-Pomello complex									
Cassia		—	—		—	—	None	Moderate	High
Pomello		—	—		—	—	None	Low	High
38—Myakka sand									
Myakka		—	—		—	—	None	High	High
74—Arents, 0 to 5 percent slopes									
Arents		—	—		—	—	None		
99—Water									
Water		—	—		—	—			

Data Source Information

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Water Features

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Report—Water Features

Water Features– Levy County, Florida										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
2—Tavares fine sand, 1 to 5 percent slopes										
Tavares			June	3.5-6.0	>6.0	—	—	None	—	None
			July	3.5-6.0	>6.0	—	—	None	—	None
			August	3.5-6.0	>6.0	—	—	None	—	None
			September	3.5-6.0	>6.0	—	—	None	—	None
8—Smyrna fine sand										
Smyrna			June	0.5-1.5	>6.0	—	—	None	—	None
			July	0.5-1.5	>6.0	—	—	None	—	None
			August	0.5-1.5	>6.0	—	—	None	—	None
			September	0.5-1.5	>6.0	—	—	None	—	None
17—Adamsville fine sand, 0 to 5 percent slopes										
Adamsville			June	2.0-3.5	>6.0	—	—	None	—	None
			July	2.0-3.5	>6.0	—	—	None	—	None
			August	2.0-3.5	>6.0	—	—	None	—	None
			September	2.0-3.5	>6.0	—	—	None	—	None
			October	2.0-3.5	>6.0	—	—	None	—	None
			November	2.0-3.5	>6.0	—	—	None	—	None

Water Features– Levy County, Florida										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
23—Zolfo sand										
Zolfo			June	2.0-3.5	>6.0	—	—	None	—	None
			July	2.0-3.5	>6.0	—	—	None	—	None
			August	2.0-3.5	>6.0	—	—	None	—	None
			September	2.0-3.5	>6.0	—	—	None	—	None
			October	2.0-3.5	>6.0	—	—	None	—	None
			November	2.0-3.5	>6.0	—	—	None	—	None
34—Cassia-Pomello complex										
Cassia			June	1.5-3.5	>6.0	—	—	None	—	None
			July	1.5-3.5	>6.0	—	—	None	—	None
			August	1.5-3.5	>6.0	—	—	None	—	None
			September	1.5-3.5	>6.0	—	—	None	—	None
			October	1.5-3.5	>6.0	—	—	None	—	None
			November	1.5-3.5	>6.0	—	—	None	—	None
Pomello			June	1.5-3.5	>6.0	—	—	None	—	None
			July	1.5-3.5	>6.0	—	—	None	—	None
			August	1.5-3.5	>6.0	—	—	None	—	None
			September	1.5-3.5	>6.0	—	—	None	—	None
			October	1.5-3.5	>6.0	—	—	None	—	None
			November	1.5-3.5	>6.0	—	—	None	—	None

Water Features– Levy County, Florida										
Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
38—Myakka sand										
Myakka			June	0.5-1.5	>6.0	—	—	None	—	None
			July	0.5-1.5	>6.0	—	—	None	—	None
			August	0.5-1.5	>6.0	—	—	None	—	None
			September	0.5-1.5	>6.0	—	—	None	—	None
74—Arents, 0 to 5 percent slopes										
Arents	B	Negligible	Jan-Dec	—	—	—	—	None	—	—
99—Water										
Water	—	—	Jan-Dec	—	—	—	—	None	—	—

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