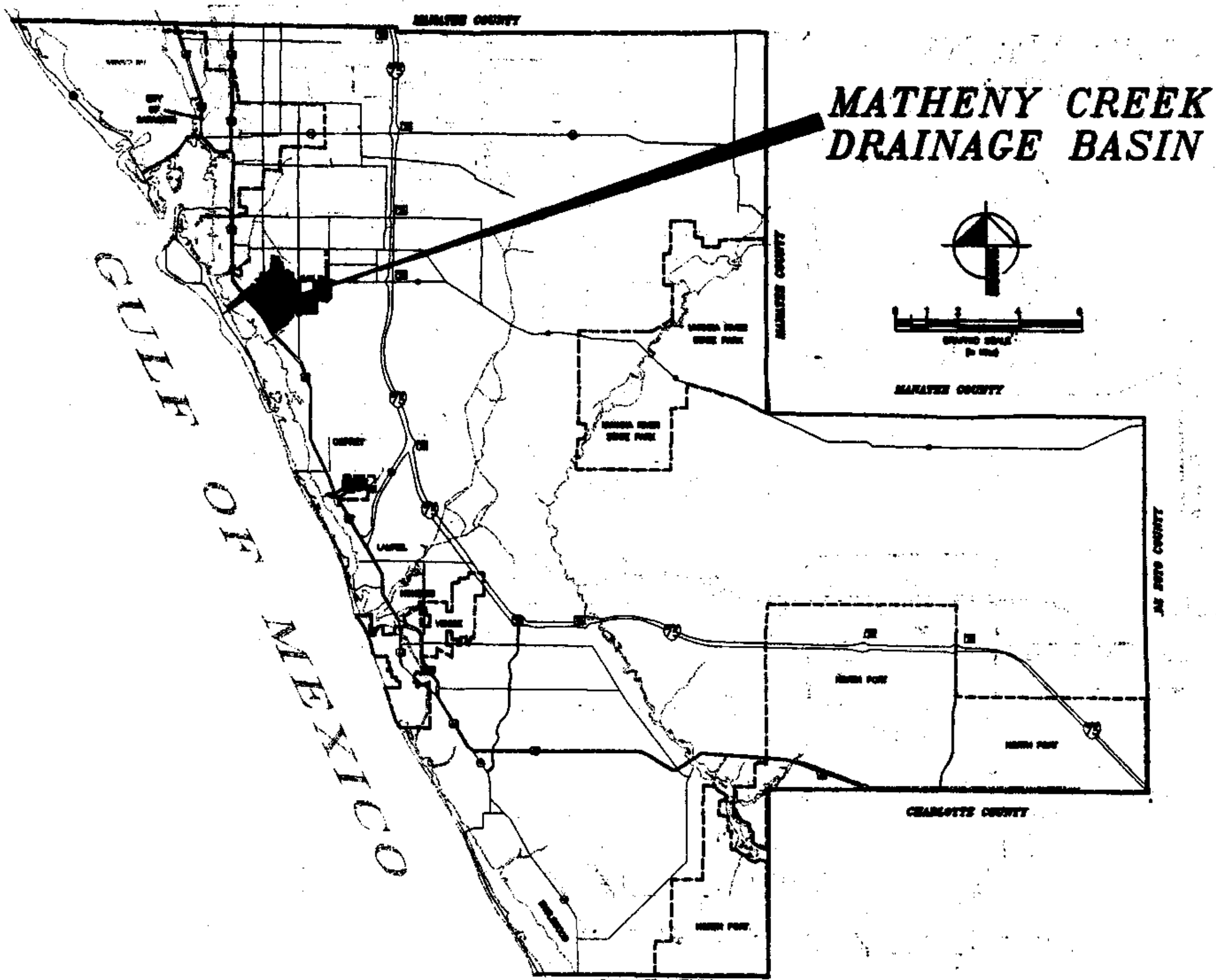
MATHENY CREEK - BASIN MASTER PLAN

FINAL REPORT



Kimley-Horn
Engineers ◇ Planners ◇ Surveyors
Kimley-Horn and Associates, Inc.
7202 BENEVA ROAD SOUTH
SARASOTA, FLORIDA 34238
PHONE (813) 922-8187
FAX (813) 922-2153

Prepared For:

Sarasota County
Stormwater Environmental Utility

September, 1994

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MATHENY CREEK - BASIN MASTER PLAN
1-22-99

NODAL MAXIMUM CONDITIONS REPORT

NODE ID	STAGE (ft)	VOLUME (af)	INFLOW RUNOFF (cfs)	INFLOW OFFSITE (cfs)	INFLOW OTHER (cfs)	OUTFLOW (cfs)
100	2.00	1132.75	.00	.00	1682.23	.00
101	2.00	15.89	.00	.00	65.52	.00
102	21.00	2.34	.00	.00	15.77	.00
103	14.60	.00	.00	.00	.00	.00
109	6.58	4.36	.00	.00	1707.98	1682.23
110	7.84	.74	.00	.00	1696.57	1707.98
111	10.56	1.91	116.99	.00	1980.17	1696.57
112	10.57	1.27	.00	.00	931.94	1156.78
113	10.91	2.24	73.60	.00	667.31	931.94
114	11.19	4.08	61.74	.00	629.81	663.58
115	11.44	1.95	.00	.00	591.90	591.48
116	11.77	1.36	35.55	.00	574.25	591.90
117	11.89	2.48	29.24	.00	568.02	574.25
118	12.52	2.28	44.61	.00	531.74	568.02
119	13.02	1.05	48.63	.00	477.58	504.80
120	14.46	1.50	26.79	.00	473.51	477.58
121	14.66	4.20	74.53	.00	450.85	427.82
122	14.90	2.94	.00	.00	439.58	450.85
123	15.31	2.29	32.88	.00	432.43	392.97
124	15.77	1.24	41.79	.00	356.44	432.43
125	16.00	1.66	.00	.00	353.30	356.44
126	16.22	1.50	75.74	.00	327.05	353.30
127	16.48	2.39	104.17	.00	300.14	327.05
128	16.61	4.03	44.61	.00	281.21	291.31
129	16.82	4.74	58.53	.00	261.89	274.45
130	17.03	5.95	.00	.00	322.13	261.89
131	17.09	7.84	.00	.00	212.82	197.92
132	17.22	9.72	43.44	.00	191.59	236.74
133	17.47	1.85	.00	.00	170.94	154.66
134	17.65	1.03	20.45	.00	92.31	170.94
137	18.85	2.53	4.32	.00	100.60	72.91
138	18.87	.93	20.53	.00	74.87	93.18
139	17.61	7.43	71.85	.00	.00	25.63
140	14.12	3.11	42.18	.00	38.41	52.83
141	14.15	.30	9.98	.00	31.36	38.41
142	14.17	.24	10.90	.00	30.84	31.36
143	16.20	2.87	40.85	.00	27.95	30.84
144	16.22	26.89	145.55	.00	17.64	27.95
145	17.49	1.72	26.97	.00	3.78	11.78
146	17.80	3.08	41.49	.00	.00	20.88
147	16.22	.53	9.44	.00	.00	7.79
150	14.80	.53	25.15	.00	53.39	73.40
151	14.91	.45	53.25	.00	.92	53.39
160	15.13	.39	60.26	.00	13.63	78.42

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NODAL MAXIMUM CONDITIONS REPORT

NODE ID	STAGE (ft)	VOLUME (af)	RUNOFF (cfs)	INFLOW OFFSITE (cfs)	OTHER (cfs)	OUTFLOW (cfs)
161	15.35	.04	.00	.00	13.24	13.63
162	17.03	4.18	36.02	.00	6.89	13.24
163	18.07	5.71	53.47	.00	.00	6.89
170	18.50	3.08	24.75	.00	11.67	10.91
171	18.62	3.76	21.70	.00	18.54	11.67
172A	18.65	.02	.00	.00	4.40	4.40
172B	18.84	.02	.00	.00	4.40	4.40
172C	18.98	4.34	24.17	.00	16.64	18.55
173	17.09	1.13	57.04	.00	51.61	142.14
174	17.89	.02	.00	.00	51.13	51.61
175	18.62	6.73	.00	.00	75.41	51.13
176	18.63	1.37	33.22	.00	51.89	75.41
177	18.65	7.92	102.33	.00	12.11	51.89
178A	18.69	.09	.00	.00	12.16	12.11
178B	18.77	.06	.00	.00	12.19	12.16
178C	19.07	.02	.00	.00	12.20	12.19
178D	19.19	3.41	52.91	.00	.00	24.13
180	16.61	2.86	27.13	.00	14.93	32.58
181	20.33	.94	19.51	.00	.00	14.93
182	17.09	11.67	88.74	.00	.00	107.72
190	18.28	.36	28.97	.00	31.95	43.72
191	19.21	11.18	57.37	.00	36.15	31.95
192	20.06	1.63	39.79	.00	.00	28.10
194	19.32	.32	6.90	.00	10.92	15.47
195	21.42	.16	.00	.00	6.92	10.92
196	25.91	4.65	.00	.00	42.83	6.92
197	25.91	5.16	91.61	.00	.00	42.83
198	18.91	20.81	157.29	.00	44.21	74.87
199	19.39	3.22	83.78	.00	.00	44.21
200	11.61	2.71	.00	.00	852.94	825.23
202	12.14	2.82	50.65	.00	818.16	852.94
203	12.41	1.25	66.56	.00	766.92	818.16
204	12.61	5.48	104.59	.00	689.80	766.92
205	12.78	5.48	46.92	.00	658.01	689.80
206	13.66	2.37	12.85	.00	469.74	472.19
207	13.81	2.63	72.15	.00	428.65	469.74
208	14.49	2.50	.00	.00	426.61	428.65
209	14.66	2.40	41.91	.00	344.73	380.98
210	15.47	5.90	57.35	.00	329.87	344.73
211	15.70	1.18	60.43	.00	130.29	147.84
300	14.57	1.13	.00	.00	88.41	92.22
301	14.64	2.56	42.81	.00	117.89	88.41
302	14.65	3.57	17.71	.00	88.89	114.68
303	14.83	.87	105.69	.00	.00	123.41

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NODAL MAXIMUM CONDITIONS REPORT

NODE ID	STAGE (ft)	VOLUME (af)	RUNOFF (cfs)	INFLOW OFFSITE (cfs)	OTHER (cfs)	OUTFLOW (cfs)
310	14.87	1.52	.00	.00	21.03	14.81
311	15.05	4.59	78.06	.00	.00	57.23
320	14.39	16.40	54.91	.00	14.30	50.85
321	14.69	.07	.00	.00	14.20	14.30
322	15.20	5.04	53.08	.00	.00	14.20
400	13.03	3.64	28.90	.00	166.86	187.61
400A	16.54	1.63	37.87	.00	.00	35.82
401	14.41	.72	.00	.00	137.23	138.95
402	14.55	2.01	37.15	.00	151.07	171.67
403	15.12	.76	25.46	.00	134.68	151.07
404	15.78	1.14	31.11	.00	114.92	134.68
405	16.05	1.36	49.36	.00	83.51	114.92
406	16.26	.69	26.88	.00	35.30	45.56
407	16.41	.44	60.53	.00	.00	69.66
408	16.39	.19	34.73	.00	34.35	73.46
410	18.16	.44	.00	.00	66.74	63.73
411	18.23	.35	12.69	.00	59.49	66.74
412	18.34	1.98	.00	.00	58.62	57.60
413	18.46	3.22	43.97	.00	40.45	63.32
414	18.61	8.07	90.04	.00	4.09	40.08
415	18.60	20.31	94.42	.00	.38	10.11
416	18.66	12.08	44.17	.00	113.57	5.01
500	15.74	2.10	52.50	.00	161.06	193.21
501	16.30	3.42	13.39	.00	188.45	161.06
502	16.59	.48	28.85	.00	72.66	96.18
503	16.89	.25	.00	.00	73.31	72.66
504	17.25	.24	53.93	.00	27.99	73.31
505	18.63	.01	48.59	.00	24.05	27.99
505A	18.67	11.71	40.47	.00	112.74	97.88
506	19.74	3.57	43.12	.00	89.72	113.56
507	19.83	.85	.00	.00	90.54	89.72
508	20.23	.42	.00	.00	86.48	87.48
509	21.64	7.08	55.79	.00	60.24	86.48
510	21.85	5.63	69.25	.00	.00	40.78
511	22.41	3.37	39.20	.00	.00	19.61
512	19.95	.12	6.60	.00	.00	6.02
520	16.42	.01	18.02	.00	9.07	60.03
521	16.85	.01	13.27	.00	7.86	9.07
522	17.01	9.76	50.62	.00	9.39	7.86
600	16.94	.03	1.69	.00	12.17	12.88
601	17.05	.04	1.81	.00	11.20	12.17
602	17.31	.05	3.20	.00	9.28	11.20
603	17.57	.02	3.64	.00	6.65	9.28
604	17.68	.02	3.04	.00	4.59	6.65

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NODE ID	STAGE (ft)	VOLUME (af)	INFLOW RUNOFF (cfs)	INFLOW OFFSITE (cfs)	INFLOW OTHER (cfs)	OUTFLOW (cfs)
605	17.70	.02	.92	.00	3.94	4.59
606	17.70	.05	1.78	.00	8.16	9.86
607	19.05	.06	1.37	.00	7.81	8.82
608	19.60	.03	1.45	.00	6.82	7.81
609	20.24	.07	8.61	.00	.00	6.82
610A	18.50	.14	.00	.00	37.53	37.55
610B	18.55	.41	32.20	.00	45.34	74.18
611	18.98	.34	23.84	.00	56.24	79.09
612	19.85	.09	32.52	.00	35.32	63.85
613	20.34	.13	21.22	.00	54.96	72.82
614	21.15	.30	38.47	.00	36.16	58.07
615	21.91	2.84	27.15	.00	28.70	36.16
616	22.03	.13	8.16	.00	21.45	28.70
617	22.52	.25	10.84	.00	25.75	35.11
618	22.71	.24	7.54	.00	22.32	25.75
619	22.93	.11	7.46	.00	22.22	24.60
620	16.34	.03	.00	.00	91.32	91.12
621	16.35	.02	.00	.00	21.20	21.22
622	16.35	1.19	10.80	.00	20.19	21.20
630	16.76	.05	.00	.00	78.65	78.42
631	17.14	.10	49.01	.00	68.09	67.82
632	17.74	.10	.00	.00	65.45	65.49
633	17.88	2.90	42.59	.00	.00	10.88
634	17.91	.04	.00	.00	56.53	56.54
635	18.13	.49	4.92	.00	7.90	11.45
636	18.16	.83	8.17	.00	.00	7.90
639	18.12	.39	3.41	.00	48.31	48.74
640	17.10	.01	.00	.00	6.10	6.10
641	17.10	.01	.00	.00	6.10	6.10
642	17.03	.01	.00	.00	6.09	6.10
643	16.81	4.26	46.27	.00	43.85	57.68
645	18.12	15.58	57.53	.00	70.60	80.66
650	18.16	.12	.00	.00	58.91	58.91
651	18.48	5.94	40.23	.00	20.37	29.22
652	18.62	3.17	39.90	.00	.00	20.37
661	18.65	14.59	35.96	.00	36.30	16.54
662	18.50	1.80	7.66	.00	.00	2.86
663	18.66	1.71	12.96	.00	35.02	38.88
664	20.41	.22	10.23	.00	27.94	35.02
665	23.37	.73	16.80	.00	5.00	15.18
666	24.08	.61	5.66	.00	.00	5.00
667	23.28	.29	.00	.00	12.71	13.52
668	25.23	1.20	7.29	.00	8.10	12.71
672	25.67	9.55	52.41	.00	.00	6.06

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NODAL MAXIMUM CONDITIONS REPORT

NODE ID	STAGE (ft)	VOLUME (af)	INFLOW RUNOFF (cfs)	INFLOW OFFSITE (cfs)	INFLOW OTHER (cfs)	OUTFLOW (cfs)
690	23.77	4.59	58.94	.00	.00	22.22
710	25.72	2.24	32.53	.00	5.28	22.64
720	26.02	1.71	18.06	.00	1.20	5.28
730	25.89	7.33	17.46	.00	.00	1.20
800	21.64	.13	.00	.00	22.46	22.48
801	21.00	.00	.00	.00	.00	.00
802	20.28	.02	.00	.00	5.40	5.38
803	20.00	.00	.00	.00	.00	.00
804	18.48	.36	.00	.00	111.10	109.88
805	18.47	.36	.00	.00	69.60	38.00
806	18.14	.23	.00	.00	44.31	18.53
807	18.14	.23	.00	.00	6.94	6.87
809	18.12	.07	.00	.00	1.26	1.40
811	17.75	.08	.00	.00	.67	.67

MATHENY CREEK

COMPREHENSIVE BASIN MASTER PLAN

FINAL REPORT

Prepared for:

SARASOTA COUNTY
STORMWATER ENVIRONMENTAL UTILITY

Prepared by:

KIMLEY-HORN AND ASSOCIATES, INC.
7202 Beneva Road South
Sarasota, Florida 34238

With:

CCI Environmental Services, Inc.
5010 U.S. Highway 19 North
P. O. Box 35
Palmetto, Florida 34220

September, 1994

Project No. 6739.05

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1.0 EXECUTIVE SUMMARY

1.1 OVERVIEW

The Matheny Creek basin contains 1,724 acres which ultimately empty into Little Sarasota Bay. The study area generally extends from the tidal confluence of the Matheny Creek Main at U.S. 41, east to McIntosh Road and north to Ashton Road. The Matheny Creek basin is bordered by the Phillippi Creek basin to the north, the Catfish Creek basin to the east, and the Elligraw Bayou basin to the south.

Drainage from the basin is serviced by two major man-made canals referenced herein as the Matheny Creek Main, which extends easterly from U.S. 41 to the headwaters of the basin and the Denham Acres Lateral which extends north from U.S. 41 to Clark Road. Two water level control structures (MC-1 and MC-2) are located in the Matheny Creek Main and one water level control structure (DL-1) is located in the Denham Acres Lateral. A network of other laterals, branches and feeder ditches in the basin conduct stormwater into these two primary drainage systems. These other man-made ditches are referenced herein as the Breakwater Lateral, the Coral Lakes Branch, the Gulf Gate Branch, the Williamsburg Branch and the Shadow Lakes Feeder.

At present, the Matheny Creek drainage basin is approximately 94% developed. Existing land uses within the basin include 966.20 acres of medium density residential (56%) 205.75 acres of high density residential (12%), 171.00 acres of open spaces (10%), 143.23 acres of commercial (8%), 129.49 acres of office (8%), 69.64 acres of low density residential (4%), and 37.91 acres of major public roads with closed drainage (2%). Of the total basin area, approximately 759.28 acres (44%) are impervious and 457.15 acres (27%) are directly connected impervious.

The surface waters within the Matheny Creek basin are classified as Class III waters (i.e. recreation and the propagation and management of fish and wildlife). An estimated 34% of the Matheny Creek drainage basin is presently serviced by stormwater treatment best management practices, BMP's.

1.2 BACKGROUND

Historically, the basin was serviced by a small coastal creek extending from Little Sarasota Bay to just downstream (west) of U.S. 41. The remainder of the basin was frequented by numerous isolated wetlands. The extent of these wetlands contracted and expanded throughout the year in response to rainfall. During periods of heavy rainfall, many of these wetlands extended well into upland areas where they may have become hydraulically connected to similarly extended wetlands. Most notably, three (3) large isolated wetlands of more than 40 acres each were situated within the basin area. These three wetland systems were flanked by large bands of mesic hammock areas which provided a typical transition from large wetland habitat to pine flatwood habitat. Over the years, dredge and fill activities drained and altered most of the wetlands within the basin. It is speculated that the basin may have been named after the Matheny brothers, who operated the first commercial dredge in the area in the early 1900's. Initial drainage ditches were likely dug either during or shortly after that period in response to agricultural and/or mosquito control needs.

It was not until the mid 1960's that development pressures in the area mandated the need for greater drainage measures. In response to these pressures, the Sarasota Board of County Commissioners authorized a flood control plan for the basin. This study was completed in 1967 and established right-of-way and cross-sectional area requirements for the Matheny Creek Main and the Denham Acres Lateral. Subsequent improvements were based upon this 1967 study. The construction plans for most of these improvements are available in the public records of Sarasota County and serve to document the original design section for maintenance and restoration purposes. Those improvements not constructed by Sarasota County were implemented by subsequent developments located along these drainage courses with public drainage right-of-ways and/or easements being dedicated upon completion.

1.3 ASSESSMENT

As an initial activity of this study, extensive research was conducted relative to flood protection and water quality in the Matheny Creek basin. This research included: (1) the review of development drainage plans and correspondence available from the Sarasota County Transportation Department; (2) the review of previous authoritative studies relative to the Matheny Creek drainage basin; (3) review of FDOT plans for improvements to Clark Road currently underway; (4) the review of information from the June, 1992 flood; (5) review of field survey data and field reconnaissances; (6) review of citizen's complaints; (7) interviews with residents in the Matheny Creek drainage basin; (8) interviews with Sarasota County Stormwater Maintenance personnel; and (9) coordination with other agencies.

One-foot contours aerials, field surveying, and development plan information were used to define the hydrologic and hydraulic characteristics of the Matheny Creek basin. In all, 154 subbasin areas were delineated for the analyses. A listing of the hydrologic characteristics for all 154 subbasin areas is provided within APPENDIX A. However, for the sake of simplicity and evaluation, these subbasin areas were aggregated into one of six (6) subbasins as summarized in TABLE 1.3.

EXISTING SUBBASIN SUMMARY

SUBBASIN NAME	AREA (acres)	Directly Connected Impervious Area (acres/%)	Total Impervious Area (acres/%)
U. S. 41	72.64	0.00/ 0%	35.60/49%
LOWER MATHENY CREEK	332.60	62.53/19%	118.96/36%
UPPER MATHENY CREEK	456.46	140.40/31%	190.31/42%
DENHAM ACRES LATERAL	511.44	137.69/27%	224.87/44%
CORAL LAKES	93.65	49.45/53%	63.32/64%
CLARK ROAD	257.02	81.99/32%	119.48/46%
TOTAL	1,723.81	471.54/27%	749.54/43%

TABLE 1.3

An overview of these six primary subbasins is provided below:

U.S. 41 Basin

This basin contains 72.64 acres which drain directly or ultimately to U.S. 41. Existing land uses in this basin consist of 32.38 acres of commercial (45%), 28.59 acres of medium density residential (39%), 8.33 acres of open space (11%), and 3.34 acres of office (5%). This basin has an estimated 35.60 acres of total impervious coverage (49%) with only an estimated 3.50 acres (5%) serviced by stormwater best management practices (BMP's).

The proposed widening and closed drainage system currently being planned and designed for U.S. 41 will significantly increase the directly connected impervious coverage within the basin. As a result, corresponding increases in pollutant loads will especially need to be mitigated.

Lower Matheny Creek Basin

The lower Matheny Creek basin encompasses 332.60 acres and is defined by the area which drains directly to that portion of the Matheny Creek Main located upstream of Water Level Control Structure No. 1 (WLCS MC-1) and downstream of Water Level Control Structure No. 2 (WLCS MC-2). This basin contains approximately 62.53 acres of directly connected impervious areas (19%) and 118.96 acres of total impervious coverage (36%). This basin is essentially built-out and consists of an estimated 266.93 acres of medium density residential (80%), 54.94 acres of open spaces (17%), 7.26 acres of major public roadways with closed drainage systems (2%) and 3.47 acres of high density residential (1%). Approximately 120.31 acres (36%) are presently serviced by stormwater best management practices (BMP's).

Drainage facilities lying within this basin include the Lower Matheny Creek Main and the Breakwater Lateral. When combined with the upper Matheny Creek basin, the total basin area serviced by the Matheny Creek Main is 789.06 acres or 46% of the total study area.

Upper Matheny Creek Basin

The upper Matheny Creek basin is defined by the area which drains directly to that portion of the Matheny Creek Main located upstream of WLCS MC-2 and contains 456.46 acres. Directly connected and total impervious coverage within this basin are 140.40 acres (31%) and 190.31 acres (42%), respectively. Existing land uses within the basin include 182.87 acres of medium density residential (40%), 107.05 acres of office/light industrial (23%), 69.64 acres of low density residential (15%), 17.08 acres of major public roadways with closed drainage systems (4%), 5.86 acres of commercial (1%), 2.30 acres of high density residential (1%), and 71.66 acres of open spaces (16%). An estimated 217.60 acres (48%) are presently serviced by stormwater best management practices (BMP's).

Denham Acres Lateral Basin

The Denham Acres Lateral Basin is defined by that area which drains either directly to the Denham Acres Lateral or via the Williamsburg Branch, the Gulf Gate Branch, or the Shadow Lakes Feeder. This area constitutes 511.44 acres and excludes the area serviced by the Coral Lakes Branch and the Clark Road drainage system. When these drainage conveyance systems are considered, the total area serviced by the Denham Acres Lateral is 862.11 acres or 50% of the entire study area.

The directly connected and total impervious coverages for the Denham Acres Lateral basin total 224.87 acres (44%) and 137.69 acres (27%), respectively. This basin area is essentially built-out and is made up of 348.19 acres of medium density residential (68%), 88.63 acres of high density residential (17%), 14.42 acres of office/light industrial (3%), 34.36 acres of commercial (7%), 20.32 acres of open space (4%), and 7.02 acres of major public roadways with closed drainage systems (1%). Approximately 139.85 acres (27%) are presently serviced by stormwater best management practices (BMP's).

Coral Lakes Basin

This basin is serviced by the Coral Lakes Branch which ultimately discharges to the Denham Acres Lateral. The basin contains 93.65 acres of which 49.45 acres (53%) and 63.32 acres (64%) are directly connected and total impervious surfaces, respectively. Existing land uses in this basin consist of 45.58 acres of commercial (49%), 26.94 acres of high density residential (29%), 17.68 acres of medium density residential (19%), and 3.45 acres of major public roadways with closed drainage systems (4%). Approximately 44.23 acres (47%) are presently serviced by stormwater best management practices (BMP's).

Clark Road Subbasin

This basin contains 257.02 acres and ultimately discharges to the Denham Acres Lateral via the Clark Road drainage conveyance system and cross drains. Within this basin, it is estimated that directly connected and total impervious surfaces are 81.99 acres (32%) and 119.48 acres (46%), respectively. Existing land uses within the basin consist of 25.05 acres of commercial (10%), 84.41 acres of high density residential (33%), 121.94 acres of medium density residential (48%), 4.68 acres of office/light industrial (2%), 3.10 acres of designated major public roadways with closed drainage systems (1%), and 15.75 acres of open spaces (6%). Approximately 65.29 acres (26%) are presently serviced by stormwater best management practices (BMP's).

The Florida Department of Transportation is currently modifying Clark Road from a two-lane rural section to a six lane urban section (i.e. closed drainage). These Clark Road improvements include the segment contained within the Matheny Creek watershed. Since this work is currently underway, the proposed Clark Road was considered in the existing conditions analysis.

Existing Structures

The general condition of existing major structures located in the Matheny Creek were visually assessed. Major structures include water level control structures and bridges (i.e. area > 20 square feet). Many of these structures are pictured in APPENDIX D. An inventory of structures located within the study reaches of the Matheny Creek watershed is presented in APPENDIX A.

Concrete structures in good condition include: (1) double box culverts at U.S. 41; (2) double box culverts at Beneva Road; (3) 78" x 48" elliptical culvert at St Thomas Moore Catholic Church entrance; and (4) span bridge at Bispham Road. Concrete structures in fair condition include: (1) water level control structure MC-1. Concrete structures in poor condition include: (1) water level control structure DL-1 which is in need of immediate repair or replacement.

In addition, numerous corrugated metal bridge structures were installed in association with the development of Gulf Gate. These structures were constructed in the early to mid nineteen seventies. Corrugated metal structures typically have a life of twenty years. Corrugated metal structures in fair condition include: (1) arch culverts at Gulf Gate Drive; (2) arch culvert at Mall Drive; and (3) sheet metal water level control structure MC-2.

Existing Water Quality

Surface water and sediment samples were taken on 10/07/93 and 10/13/93, respectively to obtain a snapshot indication of existing water quality conditions following a 1 inch rainfall event. These samples were taken at the three existing water level control structures located in the drainage basin. Two of these water level control structures are located in the Matheny Creek Main (MC-1 and MC-2) and one is located at the southern end of the Denham Acres Lateral (DL-1). A sediment sample was also taken east of U.S. 41, downstream of MC-1 and DL-1. The lab results from these samples are contained within APPENDIX C. The samples collected in Matheny Creek suggest a substantial input of pollution originating from human sources along with the expected nonhuman sources. A major source of input may be due to a leachate from failed septic tank systems. Zinc concentrations and specific conductivity levels were found to exceed the limits specified in Sarasota County Ordinance No. 7237. Cd levels measured in Matheny Creek sediments are estimated to be approximately 12 to 65 times higher than average crustal material indicating a potential pollution problem in the watershed with respect to Cd. The observed enriched Cd concentrations measured at the two monitoring stations may have resulted from roadside runoff or from areas containing pesticides, insecticides, and fertilizers. In addition, the enriched Cd levels at DL-1 may have been contributed by runoff originating from commercial and light industrial land use in this portion of the watershed. Higher Cu concentrations in the surface layer of the sediment column at each of the monitoring sites may have resulted from runoff containing Cu from fertilizers, pesticides, or from the use copper-based algicides. The relatively enriched sediment Cu at this site is probably a result of pesticide, fertilizer, and algicide use upstream of the monitoring site. All sediment samples collected in the Matheny Creek watershed were enriched with Pb. The accumulated sediment Pb is a result of Pb-rich runoff entering the watershed from automobile emission. The linear relationship determined for Matheny Creek sediment Cu and Zn concentrations indicates a common source for these two metals. Both metals are present in pesticides, algicides, and fertilizers. Surficial sediment composition suggests that poor soil conservation techniques may have contributed to the sediment accumulation in Matheny Creek.

1.3.1 FLOOD PROTECTION DEFICIENCIES

The existing conditions assessment identified numerous floodprone areas within the Matheny Creek drainage basin. In order to evaluate and prioritize these problem areas, proposed Flood Protection Level of Service (FPLOS) objective criteria was established. This FPLOS objective criteria is consistent with the FPLOS adopted by Sarasota County as part of Comprehensive Plan Amendment RU-24. This criteria is also consistent with that conceptually developed by the five Florida Water Management Districts and the Florida Department of Environmental Protection in 1993 for possible Statewide application. Specifically, this FPLOS objective criteria considers both structural and roadway flood protection up to and including the 100-year flood.

With respect to structural flooding, the existing conditions assessment indicated that all emergency shelters/essential services located within the Matheny Creek drainage basin are at or above the 100-year flood. However, an estimated 2, 6, 9, 25, and 47 habitable structures are susceptible to flooding from the 2, 5, 10, 25, and 100 year floods, respectively. An estimated 1, 4, and 14 employment/service center structures are flood prone during the 10, 25, and 100 year floods, respectively. Based upon the analysis, areas indicated to be most susceptible to flooding from the 100 year storm include portions of Woodside South Condominium and Gulf Gate Subdivision, Unit No. 10 in the Lower Matheny Creek subbasin; Trinity Village Condominium and Colonial Terrace Subdivision in the Denham Acres Lateral Subbasin; Coral Lake Condominium and Gulf Gate Manor in the Coral Lakes Branch Subbasin; and Los Lagos Condominium, Summerside Condominium, and unplatted lots adjacent to Blount Avenue in the Clark Road Subbasin. The estimated number of habitual structures susceptible to flooding by subbasin are inventoried in TABLE 1.3.1.a.

ESTIMATED HABITABLE STRUCTURES SUBJECT TO FLOODING BY SUBBASIN

BASIN NAME	2-YR	5-YR	10-YR	25-YR	100-YR
U.S. 41	0	0	0	0	0
LOWER MATHENY CREEK	0	0	0	7	15
UPPER MATHENY CREEK	0	0	0	0	0
DENHAM ACRES LATERAL	1	2	2	4	9
CORAL LAKES BRANCH	0	0	0	4	11
CLARK ROAD	1	4	7	10	12
TOTAL	2	6	9	25	47

TABLE 1.3.1.a.

Since the susceptibility of structure flooding was estimated from interpretation of 1" = 200', 1 foot contour aerials, the final determination of flood susceptibility for suspected structures should be based on field survey measurements of finished floor elevations.

With respect to roadways, Clark Road and Lockwood Ridge Road (from Clark Road south to Gulf Gate Elementary School) are designated evacuation routes. Designated arterials within the basin include U.S. 41 and Beneva Road. Segments of Gulf Gate Drive, Lockwood Ridge Road, Sawyer Road, and Gateway Avenue located within the Matheny Creek drainage basin are designated collector roads.

Under existing conditions, portions of Gulf Gate Drive, Lockwood Ridge Road, Gateway Avenue and Clark Road were determined to be susceptible to flooding to the extent that they do not meet the adopted FPLOS. The frequency and depth of flooding for these roads are identified in TABLE 1.3.1.b.

EVACUATION/ARTERIAL/COLLECTOR ROAD FPLOS DEFICIENCIES

ROAD	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR
Gulf Gate Drive	East of Markridge Road	-	-	-	0.4'	0.9'
	West of Markridge Road	-	0.6'	0.9'	1.3'	1.7'
Lockwood Ridge Road	South of Gulf Gate Elementary School	-	-	-	0.7'	1.0'
	North of Gulf Gate Elementary School	-	-	-	-	0.6'
Gateway Avenue		-	-	0.4'	1.1'	2.0'
Clark Road	West of Swift Road	-	0.6'	0.7'	0.7'	0.8'
	West of Colonial Dr.	-	0.3'	0.5'	0.7'	0.8'
	*Entrance to Ashton Lakes	0.2'	0.7'	0.9'	1.2'	1.3'
	*Between Nutmeg Ave. and Murdock Ave.	0.7'	1.1'	1.2'	1.3'	1.4'
	Between Lockwood Ridge Rd. & Blount Ave.	-	-	-	0.1'	0.4'
	Between Blount Ave. and Westwind Lane	-	0.2'	0.4'	0.5'	0.7'

* Road over topped (i.e. entire width flooded)

TABLE 1.3.1.b

1.3.2 WATER QUALITY DEFICIENCIES

The Sarasota Bay National Estuary Program (SBNEP) has indicated that baywide, the contributions of nutrients and toxins from existing stormwater discharges should be reduced 7% and 27%, respectively.

Since the Matheny Creek drainage basin lies within the SBNEP watershed, these baywide pollutant load reduction goals (PLRG's) were utilized as a benchmark in determining the effectiveness of water quality improvement projects and/or in quantifying level of service deficiencies (WQLOS). For the parameters of interest to the SBNEP, TABLE 1.3.2 identifies the existing pollutant loads and the PLRG's for the Matheny Creek drainage basin. Existing pollutant loads were determined by application of the Sarasota County Pollutant Loading Model to the Matheny Creek drainage basin.

PARAMETER	POLLUTANT LOAD (in lbs/yr)	
	Existing	PLRG
TKN	11,220	10,435
$NO_2 + NO_3$	2,081	1,935
TSS	982,659	717,341
Lead	744	543
Copper	315	230
Zinc	562	410
Cadmium	16	12

TABLE 1.3.2

1.4 ALTERNATIVE ANALYSES

Various capital improvements were considered in alternative analyses, to address existing level of service deficiencies. The major projects anticipated to be effective are discussed in this section.

1.4.1 FLOOD PROTECTION ALTERNATIVES

Capital improvement projects developed to address FPLOS deficiencies were prioritized into one of three levels. The first priority level projects were selected as those believed to result in the most dramatic reductions in flood levels in areas where habitable structure flooding has been identified. The second priority level projects were categorized as those anticipated to provide additional reductions in flood elevations, extending the intended relief to arterial and collector roads access. Third priority level projects were intended to further extend flood level reductions to include neighborhood road access. The three (3) alternative analyses correspond to the three priority levels and build upon one another.

To address FPLOs deficiencies, the capital improvement projects considered generally either improve the movement (conveyance) of water or, where acceptable, enhance the ability of the basin to temporarily detain water. The cumulative effectiveness of these improvements with respect to habitable structure FPLOS deficiencies would be to remove an estimated 30 of 47 structures from the 100-year floodplain as reflected in TABLE 1.4.1.a. In addition, with the exception of segments of Breakwater Circle, Concord Street, Valley, Forge Street, Nelson Avenue, Gateway Avenue, Terry Lane, Mall Drive, Clark Road, Nutmeg Avenue and Mohawk Street, all roads within the basin are anticipated to meet the FPLOS access standards for the 100-year design storm.

ESTIMATED EXISTING AND PROPOSED HABITABLE STRUCTURE FPLOS DEFICIENCIES

Matheny Creek Subbasin	2-Year		5-Year		10-Year		25-Year		100-Year	
	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
Lower Matheny Creek	0	0	0	0	0	0	7	0	15	0
Upper Matheny Creek	0	0	0	0	0	0	0	0	0	0
Denham Acres Lateral	1	0	2	1	2	1	4	2	9	6
Coral Lakes Branch	0	0	0	0	0	0	4	0	11	3
Clark Road	1	0	4	1	7	3	10	4	12	8
Total	2	0	6	2	9	4	25	6	47	17

TABLE 1.4.1.a

Not considering additional property acquisition costs, the estimated construction cost for the Matheny Creek FPCIP is $2,650,000. TABLE 1.4.1.b provides a breakdown of the estimated construction cost by subbasin.

FPCIP CONSTRUCTION COST ESTIMATE

Matheny Creek Subbasin	Estimated Construction Cost
Lower Matheny Creek	$ 800,000
Upper Matheny Creek	$ 400,000
Denham Acres Lateral	$ 750,000
Coral Lakes Branch	$ 200,000
Clark Road	$ 500,000
Total	$2,650,000

TABLE 1.4.1.b

An overview of these improvement projects is presented herein for each major subbasin.

1.4.1.1 <u>LOWER MATHENY CREEK SUBBASIN</u>

Of first priority in the subbasin, the existing 36" RCP outfall culvert for the Breakwater Branch should be enlarged. A 4' x 7' RCBC was considered in the alternative analyses. This improvement is expected to provide the largest contribution to resolving habitable structure FPLOS deficiencies in the subbasin as well as addressing existing cross-basin flows from the Matheny Creek basin to the Elligraw Bayou basin.

Other recommended improvements considered effective in addressing road access FPLOS deficiencies in the lower Matheny Creek subbasin include:

- Replace and enlarge the existing corrugated metal culverts within the Breakwater Branch drainage system. Reinforced concrete culverts should be used.

- Replace and enlarge the existing bridge structure and Gulf Gate Drive and Matheny Creek.

- Modify water level control structure MC-1 to provide more efficient flood conveyance while enhancing normal ground water levels.

- Enhance storage in Gulf Gate Golf Course lakes.

1.4.1.2 <u>UPPER MATHENY CREEK SUBBASIN</u>

Although no habitable structure flooding is suspected within the Upper Matheny Creek subbasin, cross basin flows from the Catfish Creek drainage basin are anticipated during major storm events. It is recommended that this historic drainage divide be established when McIntosh Road is designed and constructed. This recommendation is consistent with that contained in the *Clark Road Corridor - Drainage Study* prepared by Kimley-Horn and Associates, Inc. in 1992.

Other recommended improvements considered effective in addressing road access FPLOS deficiencies in the Upper Matheny Creek subbasin include:

- Remove excess sediment build-up in the Upper Matheny Creek Main.

- Modify water level control structure MC-2 to enhance storage within the historical Upper Matheny Creek floodplain and reduce downstream discharges.

- Enhance floodplain storage capacity within the open space of the historical Upper Matheny Creek floodplain along the south side of the Main.

- Redirect storm-sewer outfall for Roxbury Drive to the downstream side of water level control structure MC-2.

- Replace and enlarge, as appropriate, the existing corrugated metal equalizer culverts within the Gulf Gate East subdivision.

1.4.1.3 <u>DENHAM ACRES LATERAL SUBBASIN</u>

The Denham Acres Lateral actually services the entire Denham Acres Lateral subbasin as well as the Coral Lakes and Clark Road subbasin. Therefore, the improvements in this subbasin may assist in addressing FPLOS deficiencies in these dependent upstream subbasins.

A major component of the capital improvement program for the subbasin includes the construction of overflow by-pass canal along the east side of St. Thomas Moore Catholic Church. This canal would be by hydraulically connected to the Lower Matheny Creek Main to provide additional relief to areas draining to the Gulf Gate Branch. Another major component intended to ultimately address upstream FPLOS deficiencies is the modification of water level control structure DL-1. The modifications to DL-1 are intended to both improve flood conveyance and enhance normal groundwater levels similar to the modifications proposed for water level control structure MC-1. It is envisioned that the design and construction of these two weir modification projects could be completed concurrently.

Other recommended improvements considered effective in address FPLOS deficiencies in the Denham Acres Lateral subbasin include:

- Replace and enlarge crossings within the Denham Acres Lateral at Gulf Gate Drive and Mall Drive.

- Replace and enlarge culverts within Williamsburg Branch.

- Replace and enlarge culverts within the Gulf Gate Branch.

- Improve upper stage conveyance in the lower segments of the Denham Acres Lateral, the Williamsburg Branch and the Gulf Gate Branch.

- Create a flood storage enhancement area along the east side of the Gulf Gate Branch within the western portion of Gulf Gate Elementary School.

- Replace and enlarge outfall culvert for the Shadow Lakes Feeder along the north side of the Gulf Gate Elementary School.

1.4.1.4 <u>CORAL LAKES BRANCH SUBBASIN</u>

Improvements considered in this subbasin are expected to remove 8 of 11 habitable structures from the 100-year floodplain. In addition to the improvements proposed downstream of the Coral Lakes Branch within the Denham Acres Lateral, three (3) general improvements are recommended for consideration to address FPLOS deficiencies in the subbasin:

- Modify outfall for Coral Lakes to prevent backwater from the Coral Lakes Branch.

- Replace and enlarge the equalizer culvert between Coral Lakes. Direct all runoff from Gateway Avenue north of Mall Drive to Coral Lakes.

- Increase flood storage for the Gulf Gate Mall by expanding the existing lake, and/or allowing flooding in the lower portions of the parking lot. The berm along the east side of the existing lake/property line should also be elevated to prevent over topping of the lake and flooding of adjacent properties.

1.4.1.5 <u>CLARK ROAD SUBBASIN</u>

This entire subbasin drains to the upstream end of the Denham Acres Lateral via Clark Road. Based upon the Matheny Creek analyses, the drainage improvements currently underway by the Florida Department of Transportation (FDOT) in association with the widening of Clark Road are expected to result in the more efficient transfer of water from east to west. Runoff from Clark Road itself will be conveyed by a storm sewer collection system to a retention/detention pond proposed in the northwest quadrant of the intersection of Clark Road and Swift

Road. Runoff from other areas in the subbasin which drain to Clark Road will be conveyed directly to the upper end of the Denham Acres Lateral by a separate storm sewer collection system. However, during major storm events such as those considered in Matheny Creek Basin Master Plan, it is anticipated that the by-pass storm sewer system will become overloaded resulting in the sheet flow of the excess runoff onto Clark Road and into its associated storm sewer collection system. This in term will overload the storm sewer collection system for Clark Road and is expected to cause two significant FPLOS deficiencies. First, Clark Road, a designated evacuation route, will be subjected to estimated flooding depths between 0.4 and 1.4 feet for the 100-year design storm. The second consequence of the introduction of additional water to the Clark Road storm sewer collection system is the additional volume which will be ultimately conveyed to the proposed retention/detention pond for Clark Road. Based upon the analyses, this additional volume will result in significantly higher flood stages in the pond than anticipated by FDOT. In fact, the analyses indicate the proposed pond top-of-bank will be exceeded during the 100-year design storm resulting in the flooding of adjacent lands.

To address these anticipated FPLOS deficiencies, the expansion of the proposed FDOT pond to the extent that the additional volume can be accommodate at a pond elevation which will alleviate or minimize the flooding of Clark Road (and adjacent lands) was considered. Since the FDOT pond discharges to the upstream end of the Denham Acres Lateral, it is also important that any solution for the Clark Road area not result in adverse flood stages downstream. Specifically, it is recommended that the proposed FDOT pond be hydraulically connected to existing ponds such as Bernice Lake and Sunnyside Lake, and that other floodprone properties south of the intersection of Clark Road and Swift Road be converted to part of this expanded regional stormwater system

Other recommended improvements considered effective in addressing FPLOS deficiencies in the Clark Road subbasin include:

- Provide definitive outfalls to the Phillippi Creek drainage basin for the portion of Phillippi Shores and area south of Gypsy Street. Although these areas are currently hydraulically connected to the Matheny Creek drainage basin, they are both indicated as being within the Phillippi Creek drainage basin in the Phillippi Creek Basin Master Plan and were in fact historically contained within that basin. Based upon the alternative analyses, it is expected that FPLOS deficiencies in these areas could be addressed in this manner.

- Enhance the storage capacity of Lily Pond and Sunnyside Lake by expanding these facilities into adjacent open spaces.

- Create a storage facility north of Ashton Road and east of McCallum Terrace in an existing open space area. Equalize this facility with the existing lake south of Gypsy Street and increase conveyance to the south, under Ashton Road.

- Increase conveyance from Mohawk Lake.

- Direct upper portion of Nutmeg Avenue to Sunnyside Lake.

1.4.2 WATER QUALITY ALTERNATIVES

Opportunities to improve water quality by stormwater retrofit were quantified and assessed through application of the Sarasota County Pollutant Loading Model to the Matheny Creek drainage basin. Together these proposed water quality improvements constitute a water quality capital improvement program (WQCIP) for the Matheny Creek drainage basin. The effectiveness of the WQCIP was evaluated by comparison to the previously identified PLRG's in TABLE 1.3.2. TABLE 1.4.2 compares the pollutant loads resulting from the alternative analyses to the PLRG's for the parameters of interest.

PARAMETER	POLLUTANT LOAD (in lbs/yr)	
	PLRG	Proposed WQCIP
TKN	10,435	10,163
$NO_2 + NO_3$	1,935	1,526
TSS	717,341	756,996
Lead	543	677
Copper	230	235
Zinc	410	466
Cadmium	12	13

TABLE 1.4.2

As indicated in TABLE 1.4.2, the proposed WQCIP can be expected to be effective in meeting the SBNEP baywide PLRGs for nitrogen (i.e. TKN, and NO_2 + NO_3). However additional reductions for TSS, Lead, Copper and Zinc loads are believed to be within the objective reduction goal and could presumably be obtained by implementation of several of the non-quantifiable water quality improvement projects identified in Section 6.1 and through routine removal of sediments from the Matheny Creek Main and the Denham Acres Lateral.

1.5 CONCLUSIONS AND RECOMMENDATIONS

Since the Matheny Creek drainage basin is essentially developed, the effectiveness of watershed management strategies other than capital improvements may be somewhat limited. However, the following alternative watershed management strategies are recommended:

- Require that all new public and private development within the Matheny Creek drainage basin be consistent with the Level of Service objectives of the Matheny Creek Basin Master Plan. Specifically, new development should be required to provide the Sarasota County Stormwater Environmental Utility with all required input data needed to update both the basin flood protection and water quality models. This will enable the Stormwater Environmental Utility to update the basin models to ensure that development proposals will not result in reductions to the adopted level of service standards, both on-site and off-site.

- Encourage regional common-use stormwater management facilities over small single-use facilities wherever feasible.

- Develop a basin-wide maintenance program. To this end, schedules for sediment removal and vegetation harvesting should be established for stormwater management facilities.

- Contingent upon documentation confirming its effectiveness, Sarasota County should pro-actively participate in the Florida Yards and Neighborhoods programs.

- Prohibit the perpetuation of open swale enclosures without both adequate conveyance provisions and water quality mitigation.

- Confirm finished floor elevations in areas identified as being susceptible to flooding. Negotiate the purchase of either the real property or a flood easement with owners of structures which do not meet the adopted level of service.

With respect to flood protection, the existing level of service deficiencies were fully realized in lake June of 1992 when over 18 inches of rainfall fell on the Matheny creek drainage basin in a three day per period. As such, an immediate need exists to implement a Flood Protection Capital Improvement Program (FPCIP) to resolve the FPLOS deficiencies.

State Water Policy requires that the Southwest Florida Water Management District establish pollution load reduction goals for Matheny Creek. In addition, the National Estuary Program for Sarasota Bay is expected to reveal specific stormwater pollutant load reduction goals (PLRG's) by the end of the 1994. Based upon preliminary discussions with the SBNEP, it is anticipated that baywide PLRG's for nitrogen and toxins of 7% and 27%, respectively, are to be proposed for stormwater. It is expected that these PLRG's will establish a baseline WQLOS standard for the entire SBNEP watershed, which contains the Matheny Creek drainage basin. It may be prudent to wait for implementation of a WQCIP until such PLRG's are formally proposed by SBNEP, adopted by SWFWMD, and assessed within the context of the entire SBNEP Watershed by the Sarasota County Pollutant Loading Model.

Therefore, it is recommended that Sarasota County proceed with the implementation of the FCIP identified in TABLE 1.5 but wait for final option of the PLRG's before proceeding with the implementation of the proposed WQCIP. Implementation of the proposed FPCIP and its storage enhancement components are expected to compliment the subsequent WQCIP. In fact, some of the projects proposed in the FPCIP are also projects considered in the WQCIP.

MATHENY CREEK BASIN MASTER PLAN - PRELIMINARY FPCIP

SUBBASIN LOCATION	PROJECT DESCRIPTION	PRIORITY
Lower Matheny Creek	1. Replace existing 36" RCP outfall for Breakwater Branch with a 4' x 7' RCBC±.	1
	*2. Modify water level control structure MC-1.	1
	3. Replace and enlarge the existing CMP culverts within the Breakwater Branch drainage system with RCP culverts.	2
	4. Replace and enlarge existing bridge structure at Gulf Gate Drive and Matheny Creek.	2
	*5. Enhance storage in Gulf Gate Golf Course Lakes.	3
	*6. Increase conveyance between and from Mirror Lakes and provide overflow storage area.	3

* Denotes flood protection project included in Water Quality Capital Improvement Program and potentially beneficial from a water supply perspective.

NOTE: Projects 1, 4, and 6 will require additional public drainage right-of-way or easements.

TABLE 1.5.a

MATHENY CREEK BASIN MASTER PLAN - PRELIMINARY FPCIP

SUBBASIN LOCATION	PROJECT DESCRIPTION	PRIORITY
Upper Matheny Creek	1. Provide basin divide at McIntosh Road between Matheny Creek and Catfish Creek	1
	*2. Remove excess sediment build-up in the Upper Matheny Creek Main upstream of water level control structure MC-2.	2
	*3. Modify water level control structure MC-2 to enhance upstream storage.	2
	*4. Enhance floodplain storage capacity within the open space of the historical Upper Matheny Creek floodplain along the south side of the Main.	2
	5. Replace and enlarge, as appropriate, the existing CMP culvert equalizes within Gulf Gate East subdivision.	3
	6. Re-direct storm sewer outfall for Roxbury Drive to downstream side of water level control structure MC-2.	3

* Denotes flood protection project included in Water Quality Capital Improvement Program and potentially beneficial from a water supply perspective.

NOTE: Projects 4, 5, and 6 may require additional public right-of-way or easements.

TABLE 1.5.b

MATHENY CREEK BASIN MASTER PLAN - PRELIMINARY FPCIP

SUBBASIN LOCATION	PROJECT DESCRIPTION	PRIORITY
Denham Acres Lateral	*1. Modify water level control structure MC-2.	1
	2. Construct a secondary outfall from the Gulf Gate Branch to the lower Matheny Creek Main along the east side of St. Thomas Moore Church.	1
	3. Replace and enlarge Denham Acres Lateral crossings at Gulf Gate Drive and Mall Drive.	1
	4. Improve flood conveyance in the lower segment of Denham Acres Lateral.	1
	5. Replace and enlarge culverts in the Gulf Gate Branch, regrade the upper ditch segment to drain south, and improve flood conveyance in the lower segment.	1
	*6. Replace and enlarge the existing 24" CMP outfall culvert for the Shadow Lakes Feeder along the north side of Gulf Gate Elementary School. Create a flood storage area in the eastern portion of Gulf Gate Elementary School.	1
	7. Replace and enlarge culverts within Williamsburg Branch, improve flood conveyance in downstream segments.	1

* Denotes flood protection project included in Water Quality Capital Improvement Program and potentially beneficial from a water supply perspective.

NOTE: Projects 2 and 6 may require additional public right-of-way or easements.

TABLE 1.5.c

MATHENY CREEK BASIN MASTER PLAN - PRELIMINARY FPCIP

SUBBASIN LOCATION	PROJECT DESCRIPTION	PRIORITY
Coral Lakes Branch	1. Modify outfall for Coral Lakes to prevent backwater from the Coral Lakes Branch.	1
	2. Replace and enlarge the equalizer culvert between Coral Lakes. Direct runoff from Gateway Avenue north of Mall Drive to Coral Lakes.	1
	3. Elevate berm along the east side of Gulf Gate Mall.	1
	*4. Increase flood storage for the Gulf Gate Mall by expanding the existing lake and/or allowing flooding in the lower portions of the parking lot.	1

* Denotes flood protection project included in Water Quality Capital Improvement Program and potentially beneficial from a water supply perspective.

NOTE: Projects 3 and 4 may require additional public right-of-way or easements.

TABLE 1.5.d

MATHENY CREEK BASIN MASTER PLAN - PRELIMINARY FPCIP

SUBBASIN LOCATION	PROJECT DESCRIPTION	PRIORITY
Clark Road	*1. Create a regional stormwater system to include the proposed FDOT pond, Sunnyside Lake, Bernice Lake and Floodprone areas south of Clark Road and east and west of the Denham Acres Lateral.	1
	2. Increase Mohawk Lake outfall and improve downstream conveyance.	1
	3. Provide outfall from lake south of Gypsy Street to Phillippi Creek.	1
	*4. Create a regional stormwater facility north of Ashton Road and east of McCullum Terrace and connect to Lake south of Gypsy Street.	1
	5. Provide outfall from Britannia Road to Phillippi Creek	1
	6. Replace and enlarge Ashton Road outfall culverts.	2
	*7. Expand Sunnyside Lake into adjacent open space areas and direct runoff from northern portion of Nutmeg Avenue to Sunnyside Lake.	2
	*8. Expand Lily Pond to the south into existing open space areas and modify outfall weir to take advantage of additional storage created.	3

* Denotes flood protection project included in Water Quality Capital Improvement Program and potentially beneficial from a water supply perspective.

NOTE: Projects 1, 4, 3 and 7 may require additional public right-of-way or easements.

TABLE 1.5.e

2.0 INTRODUCTION

2.1 PURPOSE

The purpose of the Matheny Creek Basin Master Plan is to identify Level of Service Deficiencies with respect to flood protection and water quality for the purpose of establishing a Capital Improvement Program and/or basin specific design criteria.

2.2 AUTHORIZATION

This basin Master Plan for Matheny Creek was authorized by the Sarasota Board of County Commissioners on July 27, 1993 pursuant to purchase order no. 307672. This Basin Master Plan is specifically required pursuant to the Stormwater Component of the Sarasota County Comprehensive Plan.

2.3 COORDINATION WITH FEDERAL, STATE AND LOCAL AGENCIES

This study has been coordinated with the Soil Conservation Service, the Southwest Florida Water Management District (SWFWMD), the Florida Department of Transportation (FDOT), the Florida Department of Environmental Protection (FDEP), the National Estuary Program for Sarasota Bay, the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Federal Stormwater Permitting Program, the Sarasota County Planning Department, and the Sarasota County Stormwater Environmental Utility.

3.0 BACKGROUND

3.1 HISTORIC FLOODING

EXHIBIT 4 identifies those areas which have historically been susceptible to flooding. Identification of these areas is based upon Depressional and Frequently Flooded SCS soils. Once inundated for significant durations throughout the year (i.e. wet season), these areas have to varying degrees been dredged and filled over the years. However, many of these areas are relatively low and are still susceptible to flooding following heavy rainfall. In all, some thirty (30) historic flood prone areas are identified on EXHIBIT 4. A brief description and location of these thirty (30) sites are provided below and a summary of these areas are provided on TABLE 3.1.

1. Small developed area located at northwest corner of Gulf Gate Mall.
2. Developed area extending southeast from Stickney Pointe Road, through Coral Lake and Gulf Gate Manor, Gateway and Superior Drives (Gulf Gate, Units 1, 2 and 3), to intersection of Gulf Gate Drive and Denham Acres Lateral.
3. Developed area at the headwaters of Denham Acres Lateral, extending north of the intersection of Swift Road and Stickney Point Road.
4. Excavated pond and surrounding area located in Sun Haven and Mohawk Garden Subdivisions.
5. Excavated Pond (Lake Bernice) located south of Clark Road and west of Nutmeg Avenue.
6. Excavated Sun Haven and Beneva Village Shoppe pond(s) and area extending north to Clark Road.
7. Developed area in southeast portion of Beneva Village Shoppes and northeast portion of Village in the Pines.
8. Large developed area east of Denham Acres Lateral and west of Lockwood Ridge Road, centered on Williamsburg Canal and Concord Street within Colonial Terrace Unit 2, Palm Lakes, and Golden Acres Subdivisions.
9. Shadow Lakes Subdivision including Shadow Lake, Lake Irene, Wright Lake and areas between and along Mayflower Drive.
10. Northwest portion of Gulf Gate School (primarily undeveloped), extending north to include southwest portion of Palm Lakes and west to include the easterly portion of Gulf Gate Unit 5 Subdivision.
11. Small developed area north of Gulf Gate Drive including Anchor Way and adjacent area of Gulf Gate Unit 6 to the east.
12. Small area located east of Lockwood Ridge Road, south of Shadow Lakes Subdivision, within western portion of Gulf Gate Subdivision, Unit 14.
13. Portion of Gulf Gate Subdivision, Unit 15 including small pond located northeast of Mirrow Lake.

14. Large developed area severed from east to west by the Matheny Creek Main and from north to south by Gulf Gate Drive. Includes portions of Gulf Gate Subdivision, Units 7, 8, and 9.
15. Developed area severed by the Matheny Creek Main and located west of Beneva Road and east of Gulf Gate Drive. Encompasses portions of Gulf Gate Units 12 and 15.
16. Large area between, and upstream of confluence of Denham Acres Lateral with the Matheny Creek Main. Includes a large portion of Woodside Village, East and area in the vicinity of the Matheny Creek Main and Bispham Road Crossing.
17. Small golf course lake and surrounding area located east of Breakwater Circle and north of Post Road.
18. Small area in the vicinity of the intersections of Bounty Drive with Post and Antigua Roads.
19. Developed area including both dredged golf course lakes and Gulf Gate Woods Unit 1.
20. Area just east of Beneva Road including two small lakes (Tracts 'E' and 'F') and surrounding area in Gulf Gate East, Units 1 and 2.
21. Small excavated lake area (Tract 'D') located east of Beneva Road and south of Kingston Loop in Gulf Gate East, Unit 2.
22. Excavated area (Tract B) located in Gulf Gate East, Unit 4 extending east to include Kingston Boulevard.
23. Small developed area including portions of Beneva Road and Beneva Oaks 2, south of entrance to Beneva Oaks.
24. Large floodplain area extending from Beneva Road to Seminole Gulf railroad spur line (east of Publix). This area has been served by the Matheny Creek Main and includes two small excavated ponds within the Beneva Oaks Subdivision. Although platting has occurred within the historical floodplain, encroachment has been conscientiously limited along the southern portion of this area.
25. Present headwaters of the Matheny Creek Main. Includes area south of Winn Dixie building site.
26. Area west of, and including McIntosh Road just north of railroad spur. Also includes eastern portion of Winn Dixie pond.
27. Undeveloped area east of, and including existing Sawyer Road and north of Publix Warehouse.
28. Impacted wetland located north of Publix development and west of Seminole Gulf railroad spur line.
29. Small area which has subsequently been filled for Winn Dixie building.
30. Parking lot area for Winn Dixie (west of McIntosh Road)

SUMMARY OF HISTORICAL FLOOD PRONE AREAS

Historical Flood Prone Area	Area (in acres)	Dredged	Filled (i.e. developed)	Maintained	Existing Flood Prone Area
1	1.84		X		
2	46.85	X	X		X
3	19.26		X		X
4	6.01	X	X		X
5	3.02	X	X		X
6	5.60	X	X		X
7	4.88		X		
8	22.68	X	X		X
9	9.04	X	X		X
10	12.13	X	X	X	X
11	3.69		X		X
12	2.20		X		X
13	5.77	X	X		X
14	42.77	X	X		X
15	9.31	X	X		X
16	16.73	X	X		
17	2.90	X			X
18	2.07		X		X
19	17.57	X	X		X
20	4.41	X	X		X
21	0.71	X			X
22	7.18	X	X		X
23	1.59		X		
24	48.66	X	X	X	X
25	8.10	X	X	X	X
26	1.74	X	X		X
27	8.40		X	X	X
28	5.47		X	X	X
29	3.37		X		
30	2.41		X		

TABLE 3.1

3.2 PRIOR STUDIES

The Matheny Creek drainage basin has been the subject of several authoritative studies. While most of these studies have dealt primarily with water quantity issues such as drainage and flood control, the most recent emphasis has been on water quality.

With respect to water quantity, the most authoritative studies include the 1967 Flood Control Study prepared by Smally, Wellford and Nalven, Inc. and the 1992 Flood Insurance Study performed by Gee & Jenson, Inc., which was adopted by reference pursuant to Sarasota County Ordinance No. 92-055.

Recent water quality studies which considered the Matheny Creek basin include those provided as part of the 1992 Sarasota Bay - *Framework for Action* prepared by the National Estuary Program and Sarasota County's National Pollution Discharge Elimination System (NPDES) permit application.

A list of the prior studies which were obtained and reviewed for the Matheny Creek Basin Master Plan are provided below:

1. May 1959 - State of Florida, State Road Department Drainage Map

    Matheny Creek drained 1,341 acres (upstream of 41)

    (3) 48" Concrete Pipes at U.S. 41

    Denham Canal 12' bottom, 20' top

    Main Channel of Matheny Creek was ditched but consisted mainly of a large depressional area called 'FLAG POND'

2. September 1961 - Engineering Report

    Matheny Creek drained 1,640 acres (2.56 SM)

    1/3 was developed

    1/3 was in planning stage

    Structures at U.S. 41 and Bispham Road were reportedly undersized

    Main drainage ways were reportedly undersized

    Warned of serious flooding occurring if improvements not made

    Development pressures had been recently diverted to this area when subdivision was prohibited in the Phillippi Creek basin in the early 1960's.

3. July 1967 - Matheny Creek Basin Flood Control Study

    Matheny Creek drained 1,640 acres (2.56 SM) at U.S. 41

    Design Discharge = 1,150 cfs

Denham Acres Lateral drained 770 acres

Design Discharge = 780 cfs

4. June 1973 - Flood Plain Report

Matheny Creek drained 1,728 acres (2.70 SM)

IRF Discharge = 300 cfs

SPF Discharge = 400 cfs

IRF Elevation @ U.S. 41 = 2.4/2.5

SPF Elevation @ U.S. 41 = 3.0/3.1

Low Chord = 7.3

Low Bridge Approach = 14.5

5. March 1987 Sarasota County - Stormwater Master Plan

Matheny Creek drained 1,500 acres (2.36 SM)

Flooding reported in upper most reaches

Recommended flow control devices at:

Matheny Creek and Gulf Gate Drive

Denham Branch and Gulf Gate Drive

Lake Wright

Design Discharge = 607 cfs

2 - 12' x 10' Boxes

48" CMP

Beneva 2 - 6' x 3' CMP

84% developed (60% residential, 24% commercial/ industrial, and 16% undeveloped)

6. August 1988 - Florida Non-point Source Assessment

Matheny Creek given a SEVERE water quality rating by FDEP. Poor water quality indicators include urbanization and septic tanks. Associated pollutants suspected include sediments, nutrients, bacteria, debris, and habitat alteration.

7. September 1992 - Flood Insurance Study

Matheny Creek Drained 1,670 acres (2.61 SM)

Design Flow: Q_{10} = 380 cfs

Q_{50} = 540 cfs

Q_{100} = 650 cfs

8. 1992 - Framework for Action - Sarasota Bay National Estuary Program

*Matheny Creek Drainage Area = 3,800 acres

Existing Loadings

Total Runoff = 36.96 inches

Total Phosphorus = 11,390 lb

Total Nitrogen = 57,290 lb

Lead = 2,040 lb

Zinc = 2,100 lb

Future Loadings

Total Runoff = 44.41 inches

Total Phosphorus = 15,560 lb

Total Nitrogen = 74,830 lb

Lead = 3,290 lb

Zinc = 3,010 lb

* Study delineation of Matheny Creek basin encompasses Elligraw Bayou drainage basin, Holiday Bayou drainage basin, Clower Creek drainage basin, and headwaters of Catfish Creek drainage basin.

9. 1993 - National Pollution Discharge Elimination System (NPDES) Permit Application for Sarasota County

Matheny Creek Drainage Area = 1,732 acres

Existing Statistics

1990 Population - 8,448

Dwelling Units - 4,661

EXISTING LAND USE ALLOCATIONS		
Land Use Category	Area (in acres)	BMP Coverage (%)
Forest/Open	245	0%
LDSF Residential	84	0%
MDSF Residential/Instit.	913	2%
HDSF/MF Residential	164	0%
Commercial CBD	200	16%
Office/Light Industrial	95	40%
Water	31	0%

FUTURE LAND USE ALLOCATIONS		
Land Use Category	Area (in acres)	BMP Coverage (%)
LDSF Residential	98	0%
MDSF Residential/Instit.	1,067	16%
HDSF/MF Residential	192	14%
Commercial/CBD	234	28%
Office/Light Industrial	111	48%
Water	31	0%

Pollutant Loading Parameter	Loading From Wastewater Treatment Plant (lb/yr)	Loading For Stormwater/BF (lb/yr)	Annual Yield Rate (lbs/acre/yr)	Annual EMC's (Runoff = 25") (mg/L)
BOD	4,691	100,100	60	10.0
COD	255,880	699,000	400	70
TSS	2,985	1,198,300	690	120
TDS	2,132,330	1,523,800	880	100
TP	2,132	3,200	1.9	0.3
DP	4,265	1,500	0.9	0.1
TKN	6,397	13,800	8.0	1.3
NO2 & NO3	426	3,100	1.8	0.3
PB	128	910	0.5	0.09
CU	149	380	0.2	0.04
ZN	0	730	0.4	0.07
CD	30	20	0.010	0.002

3.3 PREVIOUS IMPROVEMENTS

Two primary conveyance facilities are located within the Matheny Creek basin. These facilities are the Matheny Creek main drainage ditch and the Denham Acres Lateral.

The Matheny Creek ditch is a man-made canal which extends from U.S. 41 to the Publix Warehouse located at the northeasterly headwaters of the basin. The original coastal creek was filled and relocated when the initial downstream canal work was completed by Sarasota County in 1968. Two water level control weirs are located in the Matheny Creek Main. The first weir is located approximately 250 feet upstream of U.S. 41 and the second weir is located approximately 860 feet downstream of Beneva Road. The latter weir was installed in 1981 as part of the of Beneva Road widening project.

The Denham Acres Lateral is a man-made ditch which extends from its confluence with Matheny Creek, just upstream of U.S. 41, to Clark Road. This lateral has one water level control weir located just upstream of it's confluence with the Matheny Creek Main. This weir is in disrepair and in need of restoration/replacement.

A chronology of previous improvements to the Matheny Creek Main and Denham Acres Lateral is provided below:

Date

5/59 At this time FDOT identified the following on drainage maps prepared in association with U.S. 41:

- 3 - 48" RCP at Matheny Creek Main and U.S. 41 (HW = 7.2)
- 48" CMP at Matheny Creek Main and Bispham Road (HW 11.1)
- Matheny Creek Main and Beneva Road (HW = 15.9)
- 42" CMP at Denham Acres Branch and Bispham Road (HW - 11.4)
- 24" RCP at Denham Acres Branch and Clark Road (HW - 14.0)
- Concrete Pipe cross drain at Clark Road outfalling to Bernice Lake (HW = 15.2)

08/10/60 Bottle-neck in the drainage structures under Bispham Road (42" CMP) at the junction of Section 16, 17, 20, 21. Drainage problem involving the ditch along the north-south section line of Sections 16 and 17 (Denham Acres Lateral). (Letter from County Health Department to Planning Commission.)

01/08/63 Developers of Gulf Gate Subdivision committed to dedicate a 70' drainage right-of-way for the Matheny Creek Main as units of the subdivision were platted through Section 21 approximately along the line of the "Comprehensive Drainage Plan for Matheny Creek". Developer also committed to provide a continuation of this right-of-way south-westerly to Bispham Road through private properties owned by Mrs. Karlene Darling and Mr. L.C. Smith. The latter commitment to negotiate, purchase, and dedicate drainage right-of-way through off-site lands was conditioned on the County installing equal to, or larger structures at Bispham Road as the twin 54" culverts which existed at the time under Beneva Road. (Letter from James E. Saunders, Secretary and Treasurer for R. L. King Co. to Sarasota Board of County Commissioners.)

01/09/63 1 - 24" RCP at Stickney Pointe crossing location to Denham Acres Branch. Invert of upper 900 feet of Denham Acres Lateral ranged between 11.0 NGVD and 11.7 NGVD. Inverts of 24" RCP cross drain at 12.6 NGVD and 13.2 NGVD. (Sarasota County Public Works Department - Drainage Study of Old Unrecorded Drainage Ditch South from Stickney Pointe Road.)

01/27/65 Developers of Gulf Gate Subdivision committed to keep water courses and lakes within golf course free of impediments which would obstruct the flow. The developer further granted Sarasota County the right of ingress and egress as required to maintain said water courses and in order to permit the flow of such drainage waters as may deemed necessary for the protection of County roads. (Letter from Rolland L. King, President of First Development Corporation of America to Sarasota Board of County Commissioners.)

08/23/66 In response to numerous complaints and a reported fish kill, Wright Lake located within Shadow Lake Subdivision is documented to have low dissolved oxygen. The lake is reported to be over-fertilized and have very little circulation. In addition, surrounding homes are serviced by septic tanks. Associated drainfield effluent and modified sand filter systems are reported to drain nutrient chemicals into the lake at times. Colonial Terrace subdivision is reported as having an excessive number of septic tank failures due to exceedingly poor drainage in the area. Central sewerage facilities recommended as the only long range solution. (Memorandum from Jeff D. Rangan, R.S., Assistant Director, Sarasota County Health Department to Charles O. Morgan.)

01/67 Matheny Creek Main Improvements.

Ditch excavated from 4.61 NGVD to 6.28 NGVD from Bispham Road to ±500 feet upstream of Gulf Gate Drive. A 70' drainage easement identified on the plans. (Sarasota County Public Works Department - Construction Plans)

4/67 By April of 1967, SWN study identified the following in their Flood Control Study for Matheny Creek:

- 17' x 5' - 2½ CMPA at the Matheny Creek Main and Gulf Gate Drive
- 2 - 8' x 8' Box Culverts at the Matheny Creek Main and Beneva Road
- 16' x 7' - 1" CMPA at Denham Acres Lateral and Gulf Gate Drive
- 18' x 5' - 9" CMPA at Denham Acres Lateral and Mall Drive
- 48" RCP at Denham Acres Lateral and Clark Road

06/68 Matheny Creek Main Improvements.
Existing creek upstream of U.S. 41 filled, Matheny Creek Main constructed just upstream of Bispham Road to the east line of the NW¼ of NW¼ of Section 21, Township 37S, Range 18E. Water level control structure MC-1 (just upstream of U.S. 41), Bridge at Bispham Road, and 580'-36" RCP at the outfall to the Breakwater Branch installed by Sarasota County Public Works Department. Public drainage right-of-way or easements identified for all improvements. (Sarasota County Department of Public Works - Construction Plans)

07/69 Matheny Creek dredged ±1,300 feet downstream of bulk head and along Upper Cove Terrace Subdivision to elevation -3.0 NGVD.

11/69 Existing bulkhead for Matheny Creek constructed ±300 downstream of U.S. 41 (Sarasota County Public Works Department - Construction Plans)

05/19/71 Conditional approval of County Engineering to construct an orifice in the Coral Lake outlet. (Letter from Franklin H. Hunt, P.E., Sarasota County Engineer to G.H. Underhill.)

07/71 Denham Acres Lateral Phase II Improvements.
Ditch deepened 3-4 feet just upstream of Bispham Road to Gulf Gate Drive. Water level controlled at approximate elevation of original ditch invert (7.0 NGVD) by downstream water level control structure. (Sarasota County Department of Engineering - Construction Plans)

02/09/72	Drainage complaint regarding poor drainage along the entire block of Seaspray Street from Colonial Drive west to the circle ending said street (Denham Acres Lateral just upstream of confluence with Coral Lakes Branch). Problems reported to have coincided with the clearing and development of Colonial Terrace Unit No. 2. (Letter from Barry Binz of 2704 Seaspray Street to Sarasota County Engineering Department.)
03/03/72	County had initiated plans to deepen the Denham Acres Lateral approximately two (2) feet. First phase of work, downstream Bispham Road had already been completed. (Response letter from Franklin W. Hunt, P.E., Sarasota County Engineer to Barry Binz.)
10/72	Denham Acres Lateral Water Level Control Structure Repair (Sarasota County Department of Engineering - Construction Plans)
02/74	Denham Acres Lateral, Phase III and IV Improvements. Ditch deepened ±2 feet from Gulf Gate Drive to Clark Road. Water Level Control Structure originally proposed between Gulf Gate Drive and Mall Drive, not constructed. (Sarasota County Department of Engineering - Construction Plans)
01/79	Matheny Creek Main improved by Beneva Oaks Subdivision Developer from Beneva Road to southwestern property line of Publix property in accordance with Sheet #E-1090-11 of Matheny Creek Flood Control Study. (Beneva Oaks Subdivision Plans prepared by Mosby Engineering, Inc.)
05/21/79	Commitment from engineer for Gulf Gate East Subdivision that all the lots along the north boundary of the development would have a building setback line and that the area to the north of this setback line would remain in grass and may be used for additional storage of stormwater. (Letter from William B. Houghton, P.E. of Bennett & Bishop to Charles L. Goode, P.E., Sarasota County Engineer.)
09/28/81	Drainage culverts proposed by Seaboard Coast Line Railroad Company in association with railroad spur authorized by Sarasota County.
11/81	Beneva Road 8' x 8' Box Culverts extended. Water level control structure constructed 860' downstream of Beneva Road in Matheny Creek Main (Control Water Elevation = 12.4 NGVD). (Beneva Road Construction Plans prepared by

Glace & Radcliffe, Inc. for the Sarasota Board of County Commissioners.)

07/26/83 Request for ditch maintenance of the Matheny Creek Main upstream of Beneva Road on behalf of Gulf Gate, East. Assistance in providing adequate ditch bank access and haul routes through Gulf Gate East offered. (Letter from Connor J. Chambers, Division Vice President of U.S. Homes Corporation to Charles L. Goode, P.E., Sarasota County Engineer.)

03/27/85 Coral Lakes Branch reported to be inadequate in accommodating surface waters during rainy seasons prior to the expansion of Gulf Gate Mall. Flooding problems associated with this ditch and the Gulf Gate Garden Homes community reported to be well documented. Gulf Gate Garden Homes Association advised Sarasota County that they were in the process of installing an orifice in the outfall culvert from the Garden Homes Lake (Coral Lake) to Mall Drive Ditch (Coral Lakes Branch), to prevent water from backing up from the ditch to the lake, pursuant to, and in accordance with 05/19/71 conditional approval letter from County Engineer. (Letter from Ray Graham of Gulf Gate Homes Association, Inc. to Sarasota Board of County Commissioners.)

05/94 Clark Road widened from two (2) lane rural section to six (6) lane urban section by the Florida Department of Transportation.

4.0 INVESTIGATION METHODS

4.1 DATA SOURCES

4.1.1 FLOOD PROTECTION

In addition to the prior studies previously inventoried, numerous data sources were reviewed in the initial phases of the Matheny Creek Basin Master Plan. These other data sources included a review of Sarasota County's files for developments located within the study area. A complete list of the development plans and correspondence which were reviewed is provided in the bibliography. Other data sources include pictures of flooded areas (refer to APPENDIX D), SWFWMD 1-foot contour aerials, drainage and construction plans and calculations for the proposed State Road 72 improvements, interviews with residents and County maintenance personnel, and review of the Sarasota County Initial Response Team (IRT) data base of citizen reported drainage complaints. Most significantly, an extensive field survey of each study reach was conducted by Tom Synder Surveying, Inc. under the direction of KHA.

4.1.2 WATER QUALITY

In addition to the prior studies previously inventoried in Section 3.2, a detailed pollutant loading analysis for the Matheny Creek drainage basin was conducted using the Watershed Management Model developed for the Sarasota County NPDES permit application by Camp, Dresser and McKee. The land use maps developed in association with the NPDES permit application were reviewed along with 1990 aerials, plat maps and zoning maps.

Actual field samples of surface water and sediment were taken following a 1 inch rain to obtain a snapshot of existing water quality conditions within the Matheny Creek drainage basin. The results of these field samples are discussed below:

4.1.2.1 SURFACE WATER SAMPLING

Surface water samples were collected on October 7, 1993, at the three water level control structure locations within the Matheny Creek watershed. Station MC-1 corresponds to water level control structure MC-1 and is located just upstream of the confluence of the Matheny Creek Main with the Denham Acres Lateral. Station MC-2 corresponds to water level control structure MC-2 located in the Matheny Creek Main 860 feet west of Beneva Road. Station DL-1 is located at the southern end of the Denham Acres Lateral, just upstream of its confluence with the Matheny Creek Main. Water samples were collected following a 1.00 inch rainfall event to assure surface water flow through the system and to characterize water quality associated with the "first flush" of stormwater runoff. In addition, since the 4-day antecedent rainfall was only 0.10 inches, it is expected that wash-off was effectuated. Grab samples and *in situ* measurements were collected at mid-depth and mid-stream of the creek. Each sample collected at the three monitoring sites was analyzed for the following parameters:

- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Total Coliform Bacteria
- Fecal Coliform Bacteria
- Fecal Streptococcus Bacteria
- Ammonia Nitrogen
- Nitrate + Nitrite Nitrogen
- Total Kjeldahl Nitrogen
- Total Nitrogen
- Orthophosphate (field filtered)
- Total Phosphorus
- Oil and Grease
- Turbidity
- Total Dissolved Solids
- Total Suspended Solids
- Total Hardness
- Total Cadmium
- Total Copper
- Total Iron
- Total Lead
- Total Zinc

In addition to the collection of water samples for laboratory analyses, *in situ* measurements were made at each monitoring station for the following parameters:

- Specific Conductance
- Dissolved Oxygen
- Water pH
- Water Temperature

All collection and analyses were made in compliance with Comprehensive Quality Assurance Plan (CompQAP No. 87201G) on file with the Florida Department of Environmental Protection. In addition, all analyses were performed in adherence to the 16th edition of *Standard Methods for the Analysis of Water and Wastewater* (American Public Health Association, 1985), and *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983). Methods used for the collection, handling, and analyses of water quality samples are presented in Table 4.1.2.a. The results of this monitoring event for the parameters of interest are summarized in Table 4.1.2.b and are discussed below:

Biochemical oxygen demand (BOD_5) ranged from 0.6 to 2.4 mg/L and averaged 1.4 mg/L. The highest BOD_5 concentration was observed at MC-2 which is the upstream most station. The relatively higher BOD_5 measured for this site may be a result of organic-rich runoff from residential and industrial land use within the drainage area of the creek. Biochemical oxygen demand can be defined as the amount of oxygen required by bacteria to stabilize decomposable organic matter under aerobic conditions (Sawyer and McCarthy, 1978). The major source of organic matter upstream of the control structure at MC-2 is believed to be the dense vegetation lining the banks of the creek. Organic matter from the vegetation enters the creek in the form of plant detritus. This conclusion is supported by the relatively high organic nitrogen content which comprises approximately 86% of the total nitrogen for this site. In addition, a portion of the organic matter entering the creek system can also be attributed to hydrocarbon input (*i.e.*, automobile emission, oil leakage, *etc.*).

At MC-1, the BOD_5 concentration measured at 1.2 mg/L or approximately half of that measured upstream at MC-2. The lower BOD_5 concentration at this site may be a result of removal of organics from the water column through deposition. This evidenced by total suspended solids (TSS) levels which decrease from 3 mg/L at MC-2 to <1 mg/L at MC-1.

Biochemical oxygen demand at Station DL-1 was 0.6 mg/L and the lowest measured at the three monitoring sites. The lower BOD_5 content reported for this site is probably a consequence of lower organic matter input as well as greater flow through the system. Higher stream flows were observed at DL-1 as a result of the poor condition of the control structure which had water seeping around the sides and under the structure, as well as from the flow-through pipe in the control structure.

A screening level for BOD_5 concentrations of greater than 3.3 mg/L has been established to indicate potential water quality problems (FDER, 1992). The General Criteria for BOD_5 in all surface waters as designated by FAC Chapter 17-302, as well as Sarasota County Ordinance No. 72-37, specifies that BOD_5 levels shall not increase which result in violations of the ≥5.0 mg/L dissolved oxygen standard. The BOD_5 concentrations measured at the three monitoring sites were all below the specified screen level. The reported BOD_5 levels for Matheny Creek generally suggest "fairly clean" water. Also, BOD_5 levels measured in the Matheny Creek watershed, except at MC-2, were below the median value of 1.5 mg/L typically found in Florida streams (FDER, 1989).

Chemical oxygen demand (COD) levels measured for the three monitoring sites in the Matheny Creek watershed ranged from 31.3 to 39.5 mg/L with an average of 34.3 mg/L. In general, COD concentrations followed a similar trend as those reported for BOD_5. Additionally, COD levels measured in Matheny Creek were much lower than the 102 mg/L screening level determined by FDER (1992) representing water quality problems.

Total Coliform bacteria levels reported for the three monitoring sites within the Matheny Creek watershed ranged from 2,900 to 9,150 Col./100 mL averaging 4,395 Col./100 mL. Both MC-1 and MC-2 had comparable total coliform bacteria levels. The highest level of total coliform bacteria in the basin was measured for DL-1. All three stations had total coliform bacteria levels which exceeded the allowable limit of 2,400 Col./100 mL for Class III freshwaters as specified in FAC Subsection 17-302.560(6). Also, total coliform bacteria levels measured in the Matheny Creek watershed were greater than found in 80% of Florida streams (FDER, 1989). A source of total coliform bacteria in the Matheny Creek watershed is believed to be the naturally occurring coliform bacteria of the soils and vegetation along the creek. This is believed to be exacerbated during periods of significant runoff. However, the primary source of coliform bacteria may be represented by birds and other warm-blooded animals inhabiting the watershed. Further, due to the relatively high number of septic tanks within this drainage basin, leachate from failed septic tanks cannot be ruled out as a possible source.

Fecal coliform bacteria levels measured in Matheny Creek ranged from 1,750 to 2,750 Col./100 mL with a mean of 2,351 Col./100 mL. The lowest concentration of fecal coliform bacteria was measured at MC-2 with the highest reported for MC-1. Fecal coliform bacteria levels reported for the Matheny Creek watershed exceeded the allowable limit of 800 Col./100 mL as specified in FAC Subsection 17-302.560(6) for Class III freshwaters. In addition, fecal coliform bacteria levels were greater than typically found in 90% of Florida streams (FDER, 1989). The high fecal coliform bacteria levels observed in Matheny Creek indicate significant sources of fecal coliform bacteria originating within the Matheny Creek watershed. The primary source of fecal coliform is believed to be birds and other warm-blooded wild animals. Another possible source of fecal coliform bacteria is leachate from failed septic tanks.

In addition, fecal streptococcus bacteria was also measured in samples collected from the three monitoring sites with levels ranging from 500 to 1,400 col/100 mL with an average of 873 Col./100 mL. The ratio of concentrations of fecal coliform bacteria to fecal streptococcus bacteria can often be used to provide information on possible pollution sources (American Public Health Association, 1985). Ratios greater than 4.4 are considered indicative of contamination from human wastes, while ratios of 0.7 or below suggest nonhuman pollution sources. Ratios between 0.7 and 4.4 generally indicate a mixture of animal and human sources. Therefore, the fecal coliform to fecal streptococcus bacteria ratios of 1.9 to 3.5 determined from the samples collected in Matheny Creek suggest a substantial input of pollution originating from human sources along with the expected nonhuman sources. A major source of anthropogenic input may be due to leachate from failed septic tank systems. Figure 4.1.2.a shows the distribution of coliform species in Matheny Creek.

Total nitrogen concentrations measured in the Matheny Creek watershed ranged from 0.78 to 0.94 mg/L with an average concentration for the three sites of 0.87 mg/L. The highest total nitrogen concentrations were measured at MC-2 with the lowest concentration reported for DL-1. Total nitrogen concentrations were observed to decrease in a downstream direction from MC-2 to MC-1 as indicated in Figure 4.1.2.b. The observed decrease is believed to be a function of removal of organic-rich particles through deposition as evidenced by the decrease in TSS levels for these two sites.

As specified in FAC Chapter 17-302, nutrients, including total nitrogen, shall not be elevated to levels causing an imbalance in the natural flora and fauna which would be characteristic of eutrophic or nutrient-rich streams. Results from the three stations monitored in Matheny Creek indicated that total nitrogen levels never exceeded the screening level of 2.0 mg/L considered by the FDER (1992) characteristic of eutrophic conditions. Further, total nitrogen levels for the three monitoring sites were lower than the median level of 1.2 mg/L typical found in Florida streams (FDER, 1989).

Ammonia nitrogen measured within the Matheny Creek watershed averaged 0.06 mg/L with a range from 0.03 to 0.08 mg/L. Ammonia nitrogen levels reported for stations MC-1 and MC-2 were 0.08 and 0.07 mg/L, respectively. Station DL-1 had the lowest ammonia nitrogen concentration of the three monitoring sites (*i.e.*, 0.03 mg/L). Ammonia nitrogen is a potentially important nutrient to the primary producers (*i.e.*, plants) in Matheny Creek and naturally occurs from the decomposition of organic matter and groundwater input. Ammonia nitrogen in Matheny Creek comprised 4 to 9% of the total nitrogen measured.

Nitrate + nitrite levels measured in Matheny Creek ranged from 0.06 to 0.21 mg/L with a mean concentration of 0.15 mg/L. The lowest nitrate + nitrite concentration was measured at MC-2. Higher concentrations of nitrate + nitrite measured at MC-1 and DL-1 are believed to reflect inputs from runoff, as well as, decomposition of organic matter and groundwater inflow. Another possible source of nitrate + nitrite into the Matheny Creek watershed is the oxidation of ammonia nitrogen. Overall, nitrate + nitrite comprise 7 to 27% of the total nitrogen within the Matheny Creek watershed. Therefore, due to higher concentration of nitrate + nitrite, especially downstream in the watershed, this fraction of total nitrogen may be an important nutrient for primary producers within the Matheny Creek watershed and Sarasota Bay.

Total Kjeldahl nitrogen (TKN) is a measure of ammoniacal and organic nitrogen. In Matheny Creek, TKN levels ranged from 0.57 to 0.88 mg/L and averaged 0.71 mg/L. The highest TKN level was measured at upstream station MC-2 and corresponds to the high BOD_5 level measured at this site and is believed to have resulted from input of organic matter in the form of plant detritus. Overall, organic nitrogen comprised 69 to 86% of the total nitrogen in Matheny Creek.

Total phosphorus concentrations were measured for the three monitoring sites in the Matheny Creek watershed and averaged 0.21 mg/L with a range from 0.19 to 0.23 mg/L. Phosphorus is a required nutrient by algae and other plants for in the production of organic matter. Therefore, as plant material decomposes, phosphorus is a by-product of this decomposition. Other sources of phosphorus to surface waters of Matheny Creek include: groundwater inflow, phosphate-rich soils, and atmospheric fallout. Although atmospheric fallout of phosphorus is measurable, it is minimal as compared to other sources. None of the total phosphorus concentrations measured in Matheny Creek exceeded the FDER screening level of 0.46 mg/L (FDER, 1992). Exceedances of the screening level are indicative of water quality problems. Therefore, water quality in Matheny Creek can be assumed to be "fairly good" with respect to total phosphorus. Compared with typical Florida streams, total phosphorus levels in Matheny Creek were greater than the median value of 0.11 mg/L (FDER, 1989). A total phosphorus distribution is shown in Figure 4.1.2.c.

Orthophosphate levels measured in Matheny Creek ranged from 0.13 to 0.15 mg/L for the three monitoring stations and had a mean of 0.14 mg/L. Approximately 57 to 74% of the total phosphorus in Matheny Creek was present as orthophosphate. As observed with total phosphorus, concentrations of orthophosphate were similar across the monitoring sites.

Oil and grease concentrations measured at the three monitoring stations were all below detection limits. Therefore, samples collected from the three monitoring sites were in compliance with both State and County Standards.

Turbidity levels in Matheny Creek ranged from 2.0 to 3.9 NTU with a mean turbidity of 3.2 NTU. The highest turbidity levels were reported for samples collected at sites MC-2 and DL-1. Higher turbidity levels measured for these two sites are believed to be associated with organic matter decay and the import of particulate matter through stormwater runoff. The lower turbidity levels measured at MC-1 probably reflect deposition of suspended material within the creek from MC-2 to MC-1. All turbidity measurements made in Matheny Creek were below the 29 NTU level above natural background as specified in the General Water Quality Criteria for all surface waters of FAC Chapter 17-302. Sarasota County Ordinance No. 72-37 allows a maximum increase of 25 Jackson units (JTU) above background. As the turbidity analysis water samples was performed in accordance with FAC Chapter 17-302 criteria that is based on Nephelometric units, a comparison with Sarasota County criteria cannot be made.

Total dissolved solids (TDS) consist of mainly inorganic salts, small amounts of organic matter, and dissolved gases (Sawyer and McCarthy, 1978). In Matheny Creek, TDS averaged 449 mg/L and ranged from 389 to 545 mg/L. The highest TDS level was measured at MC-1 which may reflect an input from terrestrial runoff, groundwater seepage, and tidal activity. A similar distribution was observed for total hardness which ranged from 260 to 291 mg/L.

Total suspended solids ranged from <1 to 4 mg/L at the three monitoring sites in Matheny Creek and had a mean concentration of 2.5 mg/L. Overall, TSS followed the same distribution as turbidity as expected. As explained above, TSS levels decreased from MC-2 to MC-1 through the deposition of material. None of the three samples collected in Matheny Creek exceeded the screening level of 18 mg/L indicative of water quality problems (FDER, 1992).

Trace metal concentrations were also determined for samples collected at the three monitoring sites. Total cadmium concentrations were all below the analytical detection limit of 0.1 μg/L, and therefore, in compliance with both FAC Chapter 17-302 and Sarasota County Ordinance No. 72-37.

Total copper concentrations in the Matheny Creek watershed ranged from 2 to 6 μg/L and averaged 3.7 μg/L and had a similar distribution as TSS. All copper concentrations measured in Matheny Creek were below both State and County criteria as specified in FAC Chapter 17-302 and Sarasota County Ordinance No.72-37, respectively.

Total iron levels in Matheny Creek averaged 307 mg/L and ranged from 200 to 450 μg/L. An increase in iron concentration was observed from MC-2 to MC-1 which corresponds to an increase in TDS, total hardness, and specific conductance. These observations suggest groundwater infiltration near MC-1 resulting in a higher iron concentration. All three concentrations measured in Matheny Creek were less than the 1,000 μg/L limit specified in FAC Subsection 17-302.560(21) for Class III freshwaters. However, the iron concentration at station DL-1 exceeded the allowable limit of 300 μg/L specified for Sarasota County Ordinance No. 72-37. The high iron concentration reported for station DL-1 may reflect groundwater inflow at this site.

Concentrations of total lead measured for the three stations in Matheny Creek had an average of 1 μg/L and ranged from <1 to 2 μg/L. Total lead levels reported for Matheny Creek were incompliance with both State and County criteria as specified in FAC Subsection 17-302.560(26) and Sarasota County Ordinance No. 72-37, respectively. Possible sources of lead in Matheny Creek include: (1) naturally occurring levels in soils and (2) anthropogenic input from automobile emissions.

Total zinc levels measured in Matheny Creek averaged 20 μg/L with a range from 17 to 23 μg/L. In addition, total zinc levels were found to have a similar distribution as copper levels. This observation suggests an association of zinc with TSS. All zinc concentrations measured in Matheny Creek were less than the allowable level of 238 μg/L which was calculated using total hardness levels determined for each sample collected as specified in FAC Subsection 17-302.560(45). However, all of the zinc concentrations were found to exceed the more stringent 10 μg/L limit specified in Sarasota County Ordinance No. 72-37. The high zinc levels measured in Matheny Creek are believed to reflect naturally occurring levels typically found in soils and associated with TSS.

In addition to these parameters, *in situ* measurements for specific conductance, dissolved oxygen, pH and temperature were collected for the three monitoring stations in Matheny Creek. Specific conductance levels in the creek ranged from 650 to 840 μmhos/cm and averaged 727 μmhos/cm. Similar distributions were observed for TDS and total hardness. The relatively high specific conductivity levels at the downstream locations suggest groundwater inflow as additionally evidenced by iron concentrations for these sites. None of the specific conductivity levels measured at the three monitoring sites exceeded the 1,275 μmhos/cm limit specified in FAC Paragraph 17-302.510(5)(o) for Class III freshwaters. However, all three specific conductivity levels were found to exceed the more stringent 500 μmhos/cm limit specified by Sarasota County Ordinance No. 72-37.

Dissolved oxygen concentrations measured at the three monitoring sites averaged 6.8 mg/L with a range from 4.8 to 8.6 mg/L. The lowest dissolved oxygen level was measured at MC-2 which had the highest BOD_5 levels. The remaining sites had relatively high dissolved oxygen concentrations. All three dissolved oxygen concentrations were in compliance with the ≥4.0 mg/L limit specified by Sarasota County Ordinance No 72-37. However, only Station MC-2 was found to be below the ≥5.0 mg/L criteria for Class III freshwaters as specified in FAC Subsection 17-302.560(21). The non-compliance with the State Standard is believed to be a result of organic-matter decomposition.

In situ water pH measured in Matheny Creek ranged from 7.0 to 7.6 pH units. The highest pH levels were associated with sites having higher dissolved oxygen concentrations. Overall, pH levels measured in Matheny Creek were in compliance with both State and County Standards.

Water temperatures measured at the three monitoring sites ranged from 24.8 to 25.5°C. In general, water temperatures were similar across the monitoring sites and averaged 25.1°C.

4.1.2.2 <u>SEDIMENT SAMPLING</u>

Sediment samples were collected on October 13, 1993, at four (4) locations within the Matheny Creek watershed. Three of the sites are situated immediately upstream of existing control structures. The fourth monitoring site is located downstream of the confluence of Matheny Creek and Denham Acres Lateral Ditch and immediately upstream of the U.S. Highway 41 bridge. A brief description of each monitoring site is provided below.

Station MC-2 is located at the most upstream control structure. The segment of the creek upstream of Station MC-2 receives drainage from approximately 456 acres. The major land use upstream of MC-2 is residential which makes up approximately 56% of this drainage area. In addition, 23% of the drainage area upstream of the control structure is comprised of office/light industrial land use. Station MC-1 is located downstream of MC-2 and just upstream of the confluence of the Matheny Creek Main with the Denham Acres Lateral. Approximately 333 acres drain into this portion of Matheny Creek with 81% of the land use as residential. Station DL-1 is located within the Denham Acres Lateral just upstream of the control structure located at its confluence with the Matheny Creek Main. Approximately 862 acres are drained by the Denham Acres Lateral at this monitoring site. Residential land use makes up approximately 80% of this portion of the watershed. In addition, 14% of the area draining into the Denham Acres Lateral Ditch is comprised of commercial and light industrial land use. The final monitoring site (US-41) is located immediately upstream of the U.S. Highway 41 bridge and downstream of the confluence of the Matheny Creek and the Denham Acres Lateral Ditch.

Sediment samples were collected at each site using a hand-held coring device with a 5.3-cm (inner diameter) cellulose-acetate-butyrate liner. Cores were transported back to the laboratory where the heights of the sediment samples were recorded and the sediments were carefully extruded from each linear. Once the sediment was extruded, the upper and lower layer of each core were placed in separate clean, plastic containers. The sediment samples were homogenized using a clean, plastic spatula in each of the containers. In addition, a description of each core was recorded. Sediment samples collected at the four monitoring stations were analyzed for the following parameters:

- Aluminum (Al)
- Iron (Fe)
- Cadmium (Cd)
- Copper (Cu)
- Lead (Pb)
- Zinc (Zn)
- Total Organic Carbon (TOC)
- Total Nitrogen
- Total Phosphorus

All collection and analyses were made in compliance with Comprehensive Quality Assurance Plan (CompQAP No. 87201G) on file with the Florida Department of Environmental Protection. In addition, all analyses were performed in adherence to the 16th edition of *Standard Methods for the Analysis of Water and Wastewater* (American Public Health Association, 1985), and *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983). Analyses of Al, Fe, Cd, Cu, Pb, and Zn in sediment samples were made by atomic absorption spectrophotometry following complete sediment digestion performed using a HNO_3-HF-$HClO_4$ mixture as described by FDER (1984) and Trefry and Metz (1984). As an accuracy check, National Institute of Standards and Technology Buffalo River Sediment SRM 2704 was analyzed along with the samples collected from the Matheny Creek Main. All values obtained were within 5% of the certified values.

The results of the sediment cores collected on October 13, 1993 for the parameters of interest are summarized in Tables 4.1.2.c and 4.1.2.d.

Figure 4.1.2.d gives a cross-section view of the sediment cores collected within the Matheny Creek watershed. Under a normal depositional environment, fine-grained materials are deposited over coarse-grained materials. Most of the cores (*i.e.*, MC-2, MC-1, and DL-1) had a "muck" layer mixed with fine-grained sands within the top 6 cm. The muck layer in sediments is composed of fine-grained biogenic detritus (*e.g.*, plant remains) and aluminosilicate material (*e.g.*, soil minerals) (Trefry *et. al.*, 1987). The biogenic fraction of the muck contributes to the black coloration of the sediment and is an indicator of high plant productivity (Trefry *et. al.*, 1987). In contrast, the aluminosilicate portion gives a measure of the poor soil retention control within the watershed.

At the station located upstream of the U.S. Highway 41 Bridge, coarser-grained sands were observed within the top 7 cm of the core with a fine-grained sand and muck transition zone between 7 to 11 cm. Below 11 cm, a mixture of fine-grained sand, muck, and clay was observed. Evidence of sediment scouring was observed immediately downstream of MC-1. As a result of this scouring, coarser-grained materials accumulated over the finer-grained sediments at the Station US-41 resulting in the observed lithological change in the core.

Sediments cores collected from the Matheny Creek watershed were analyzed for Al, Cd, Cu, Pb and Zn. These trace metal analyses were performed utilizing homogenized portions from the surficial and bottom half of each sediment core collected. The results of these analyses are presented in TABLE 4.1.2.c.

Total sediment Al at the four monitoring stations ranged from 4,600 to 15,200 μg/g with an overall average of 10,300 μg/g. The lowest Al concentrations were generally found in the deeper portion of the sediment core. At Station US-41, the highest Al content was observed in the deeper portion of the core suggesting a higher aluminosilicate fraction. The relatively low sediment Al content (*i.e.*, <20,000 μg/g) in the Matheny Creek basin is an indicator that a large portion of the sediment layer is composed of quartz sand. Aluminum levels in Matheny Creek sediments were approximately 5 to 18 times lower than average crustal abundance (Taylor, 1964). In addition, Al levels measured in the Matheny Creek sediments compared well with those measured in 1991 for the Sarasota Bay National Estuarine Program (SBNEP) which ranged from 1,660 to 13,600 μg/g (Mote Marine Laboratory, 1992).

Sediment Fe concentration in the Matheny Creek watershed ranged from 3,500 to 11,400 μg/g with an average Fe concentration for the four monitoring stations of 5,740 μg/g. Higher sediment Fe content was usually associated with finer-grained and organic-rich portions of the sediment column. The highest sediment Fe concentration was measured in the surface layer (*i.e.*, 0 to 11 cm) of Station DL-1. Overall, sediment Fe levels were approximately 5 to 16 times lower than in average crustal abundance (Taylor, 1964).

One of the most efficient methods in determining whether a sample has an anthropogenic contribution of trace metals is to normalize the metal concentration to Al (Klinkhammer and Bender, 1981; Windom *et. al.*, 1984; Trefry *et. al.*, 1985; Schropp *et. al.*, 1990). Because Al has a high natural abundance and a relatively small input from anthropogenic sources, it has been used to normalize metal data as an aid to interpretation. During the study Fe/Al ratios ranged from 0.32 to 0.81 compared with 0.68 in average crust. Sediments having a Fe/Al ratio lower than 0.68 indicate lower Fe concentrations in the sediment than supported by normal weathering and may also indicate a higher quartz portion in the sediment column. Ratios of Fe/Al which exceed 0.68 indicate possible enrichment of Fe relative to Al. This enrichment is believed to be a result Fe-rich groundwater infiltrating into the sediment column and not a result of anthropogenic input.

Cadmium concentrations in sediment samples collected from four monitoring sites in the Matheny Creek watershed ranged from 0.19 to 0.85 μg/g and averaged 0.45 μg/g. Higher Cd concentrations were generally associated with sediments containing a relatively greater aluminosilicate and organic fraction. During the 1991 SBNEP study, sediment Cd levels in Matheny Creek ranged from <0.005 to 0.31 μg/g (Mote Marine Laboratory, 1992). Based on the Cd/Al ratios, Cd levels measured in Matheny Creek sediments are estimated to be approximately 12 to 65 times higher than average crustal material indicating a potential pollution problem in the watershed with respect to Cd.

Because of regional variations in the metal/Al ratios, the FDER determined this relationship in Florida sediments (Schropp *et. al.*, 1989; Windom *et. al.*, 1989; Schropp *et. al.*, 1990;). Metal/Al ratios were determined for arsenic, cadmium, chromium, copper, lead, and zinc from 103 sites in Florida. Linear relationships were determined for each of the seven metals and aluminum. In addition, the linear regression data was used to establish 95% confidence limits which can be used to determine whether a sample is enriched with a particular metal relative to Al.

The Cd and Al concentrations measured in Matheny Creek sediments were plotted on the Cd/Al graph established for Florida sediments (FIGURE 4.1.2.e). All sediment Cd concentrations (except for Station MC-1 and DL-1) were within the 95% confidence limit suggesting no enrichment of Cd relative to Al. At MC-1, sediment Cd was outside the 95% confidence limit (in the positive direction) in the bottom layer (*i.e.*, 6 to 15 cm from the surface) of the sediment column. However, at Station DL-1, Cd levels were enriched in the surface layer (*i.e.*, 0 to 11 cm) of the sediment column. The observed enriched Cd concentrations measured at the two monitoring stations may have resulted from roadside runoff or from areas containing pesticides, insecticides, and fertilizers. In addition, the enriched Cd levels at DL-1 may have been contributed by runoff originating from commercial and light industrial land use in this portion of the watershed.

Copper concentrations in Matheny Creek sediments averaged 14.1 μg/g with a range from 3.3 to 39.2 μg/g. These levels compared well with those measured in 1991 for the SBNEP which ranged from 3.7 to 29.5 μg/g (Mote Marine Laboratory, 1992). The highest Cu levels were measured in the surface sediment layer at all four monitoring stations. Higher Cu concentrations in the surface layer of the sediment column at each of the monitoring sites may have resulted from runoff containing Cu from fertilizers, pesticides, or from the use copper-based algicides.

Copper/Al ratios for these four sites ranged from 2.3×10^{-4} to 25.8×10^{-4} or approximately 0.3 to 4 times that of average crustal abundance. FIGURE 4.1.2.f shows the Matheny Creek data relative to Cu and Al plotted against the average concentrations of the two metals in Florida sediments. All sediment Cu concentrations measured in Matheny Creek were within the 95% confidence boundary suggesting no enrichment except for the surface sediment layer at MC-2. The relatively enriched sediment Cu at this site is probably a result of pesticide, fertilizer, and algicide use upstream of the monitoring site.

The average Pb content of Matheny Creek sediments was calculated to be 85 μg/g with a range from 45 to 141 μg/g. These levels were more elevated than those sediment concentrations in Matheny Creek reported by Mote Marine Laboratory (1992) whose range was 1.5 to 30.6 μg/g. These observed differences in sediment Pb concentrations may be a result of different sampling locations used in both studies, whether the sediment sample was sectioned, and the amount of sediment homogenized prior to analysis.

Ratios of Pb/Al at the four monitoring stations ranged from 40 × 10-4 to 115 × 10-4. Overall, these ratios were 20 to 60 times greater than average crustal abundance. In addition, sediment Pb and Al concentrations from Matheny Creek were plotted using the FDER method for determining enrichment of metals in sediments (FIGURE 4.1.2.g). All sediment samples collected in the Matheny Creek watershed were enriched with Pb (FIGURE 4.1.2.g). The accumulated sediment Pb is a result of Pb-rich runoff entering the watershed from automobile emission. The Pb in the water column is adsorbed unto fine-grained particles and ultimately deposited to the sediments.

The concentration of Zn in Matheny Creek sediments ranged from 16 to 213 μg/g and averaged 83.3 μg/g. The highest Zn concentrations at each site were associated with fine-grained, organic-rich surface sediments. More elevated Zn concentrations were measured during this study than reported by the SBNEP (Mote Marine Laboratory, 1991) for Matheny Creek sediments. In the SBNEP study, sediment Zn concentrations ranged from 3.2 to 66.1 μg/g (Mote Marine Laboratory, 1991). As discussed previously, these changes in sediment metal concentrations can be accounted by the location of sample collection and amount of sediment homogenized prior to analysis.

A strong linear relationship was determined for sediment Cu and Zn concentrations ($r = 0.95$) in the Matheny Creek watershed (FIGURE 4.1.2.h). Of the eight data points plotted, only the Cu and Zn sediment data for MC-1 surficial sediments was outside the 95% confidence limit. The linear relationship determined for Matheny Creek sediment Cu and Zn concentrations indicates a common source for these two metals. Both metals are present in pesticides, algicides, and fertilizers. Thus, runoff containing Cu and Zn from these sources entering the creek system will result in scavenging of dissolved metal species by fine-grained, organic-rich particles and deposition to the sediment resulting in higher metal concentration in the surface sediments.

Ratios of Zn to Al in Matheny Creek sediments ranged from 11×10^{-4} to 140×10^{-4} or 1.2 to 16 times the Zn to Al ratio in average continental crust (*i.e.*, 9×10^{-4}). Using this approach, most of the sediment samples collected in Matheny Creek suggested anthropogenic input of Zn. Similarly, plotting the Zn and Al data from Matheny Creek on the Zn/Al plot used by the FDER (FIGURE 4.1.2.i) suggests unnaturally elevated Zn levels in Matheny Creek sediments. These elevated levels are believed to be a result of pesticide, fertilizer, and algicide use in the watershed.

Organic carbon, nitrogen and phosphorus content was also determined in sediment cores collected from the Matheny Creek basin. These parameters were determined in the surficial and bottom half of each core to identify digenetic stratification of these parameters in the sediment column. The results of these analyses are presented in TABLE 4.1.2.d.

Organic carbon in Matheny Creek sediments ranged from 6.0% to 12.0% and averaged 8.6%. In general, higher organic carbon concentrations were measured in the surficial half of the sediments suggesting recent deposition of these sediments. The source of the organic carbon in Matheny Creek sediments is believed to be plant detritus from existing aquatic vegetation and terrestrial plant material (*i.e.*, organic matter) washed into the creek in the form of runoff.

Sediment nitrogen and phosphorus levels are closely associated with organic carbon (Meybeck, 1982). Sediment nitrogen concentrations measured in Matheny Creek sediments ranged from 43 to 1,600 μg/g and averaged 873 μg/g. As expected, higher sediment nitrogen levels were measured in the surficial half of the sediment cores in conjunction with higher organic carbon concentrations. Higher sediment phosphorus concentrations were also measured in the surficial layer of the sediments and ranged from 253 to 2,330 μg/g. Due to the abundance of phosphatic minerals present in southwest Florida soils (Sheldon, 1982), not all the phosphorus present in Matheny Creek sediments is associated with organic carbon.

From the data collected in Matheny Creek, carbon/nitrogen ratios were determined for each station. A carbon/nitrogen ratio is an effective way of predicting the overall sediment composition and source material. Carbon/nitrogen ratios in Matheny Creek sediments were stratified with lower ratios (*i.e.*, 40 to 69) being observed in the surficial portion of the sediment column. Typical sediment carbon/nitrogen ratios range from 8 to 12 (Meybeck, 1982). Carbon/nitrogen ratios determined for Matheny Creek sediments were approximately 5 times higher and suggest terrestrial plants (carbon/nitrogen = 69) and soil humus (carbon/nitrogen = 18) as a possible source of both to the surficial portion of the sediment column (Simpson, 1977; Meybeck, 1982). In the bottom portion of the sediment cores, carbon/nitrogen ratios ranged from 137 to 1,620. The much higher ratios in the bottom portion of the sediments are probably a result of digenetic reactions which remove nitrogen in the form of nitrogen gas (*i.e.*, N_2) and dissolved inorganic species (*i.e.*, ammoniacal nitrogen and nitrate + nitrite). As the nitrogen portion of the sediment material is removed, the ratio of carbon/nitrogen increases.

In addition, nitrogen/phosphorus ratios were also determined for Matheny Creek sediments. Higher nitrogen/phosphorus ratios were observed in the surficial portion of the cores and ranged from 0.69 to 2.11. These ratios also indicate terrestrial plants (nitrogen/phosphorus = 4.5) and soil humus (nitrogen/phosphorus = 2.5) as possible sources of sediments to Matheny Creek. Ratios of nitrogen/phosphorus in the bottom portion of the sediment column ranged from 0.16 to 0.84. These much lower ratios probably resulted from digenetic transformation of nitrogen species and the presence of phosphorus-rich minerals in southwest Florida soils.

Sediment composition was determined for both halves of each of the four core collected in Matheny Creek by using Al and organic carbon data. The composition of the Matheny Creek sediments was categorized as organic matter, aluminosilicate, and quartz and calcium carbonate fractions. Organic matter was determined by multiplying the organic carbon content by 2.5, assuming the organic matter to be 40% carbon (Trefry *et. al.*, 1987). The aluminosilicate fraction was calculated by multiplying Al (as percent Al)[1] content by 12.2, assuming average aluminosilicate material contains 82,000 μg/g Al. This could vary as a function of different mineralogy. The remaining material is assumed to be the quartz and calcium carbonate fraction.

A sample calculation is given below for MC-2 (0 - 5.5 cm). All values are expressed as percent of the sediment dry weight:

Organic Matter	=	6.3% organic carbon × 2.5	=	15.8%
Aluminosilicates	=	1.52% Al × 12.2	=	18.5%
Quartz and Calcium Carbonate			=	<u>65.7%</u>
		Total	=	100.0%

Composite diagrams for the sediment samples collected in Matheny Creek show that organic matter ranged from 15.0% to 30.0% (Figures 4.1.2.j through 4.1.2.m). The dominant components in the Matheny Creek sediments are the quartz and calcium carbonate fractions ranging from 53% to 77.1%, of which quartz is believed to be the dominant fraction. Aluminosilicates in Matheny Creek sediments ranged from 5.6% to 18.5% (FIGURES 4.1.2.j through 4.1.2.m).

Compositional change was observed from the surficial half to the bottom half of each sediment core. In general, the aluminosilicate and organic matter fractions were observed to decrease down the core with the quartz and calcium carbonate fraction increasing (FIGURES 4.1.2.j through 4.1.2.l). These observed changes in sediment composition are probably a result of a change in the depositional material through the years. Based on these observations, the surficial sediment composition suggests that poor soil conservation techniques may have contributed to the sediment accumulation in Matheny Creek.

However, the sediments at Station US-41 show a reverse trend. The bottom half of the sediment core exhibited a greater organic matter and aluminosilicate composition than the surficial portion of the sediments (FIGURE 4.1.2.m). As previously discussed, this compositional change is believed to result from the

[1] % = μg/g ÷ 10,000

scouring activity occurring upstream of Station US-41 which resulted in the deposition coarse-grained materials (*i.e.*, quartz sand) at the sampling site.

TABLE 4.1.2.a COLLECTION AND ANALYTICAL METHODS USED DURING THE MATHENY CREEK WATER QUALITY SAMPLING.

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
Fecal Coliform Bacteria	Grab	Stored on Ice	6 Hours	Immediate Analysis	Membrane Filtration	APHA 909 C
Total Coliform Bacteria A	Grab	Stored on Ice	6 Hours	Immediate Analysis	Membrane Filtration	APHA 909
Fecal Streptococcus Bacteria	Grab	Stored on Ice	6 Hours	Immediate Analysis	Membrane Filtration	APHA 910 B
Biochemical Oxygen Demand (BOD_5)	Grab	Stored on Ice	48 Hours	Immediate Analysis	Membrane Electrode	APHA 507
Chemical Oxygen A Demand (COD)	Grab	Stored on Ice	48 Hours	Immediate Analysis	Open Reflux Method	APHA 508
Ammonia Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4°C	Automated Phenate	EPA 350.1
Nitrate + Nitrite Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4°C	Automated Cadmium Reduction	EPA 353.2
Total Kjeldahl Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4°C	Automated Block Digestion, Autoanalyzer	EPA 351.2
Total Nitrogen	Grab	----	----	----	Calculation	EPA 351.2
Orthophosphate	Grab	Field Filtered Stored on Ice	48 Hours	Immediate Analysis	Automated, Ascorbic Acid	EPA 365.1
Total Phosphorus	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4°C	Automated Block Digestion, Autoanalyzer	EPA 365.4
Total Dissolved Solids (TDS)	Grab	Stored on Ice	7 Days	Stored at 4°C	Glass Fiber Filtration, Dried at 180°C	APHA 209 C
Total Suspended Solids (TSS)	Grab	Stored on Ice	7 Days	Stored at 4°C	Glass Fiber Filtration, Dried at 105°C	APHA 209 B

TABLE 4.1.2.a COLLECTION AND ANALYTICAL METHODS USED DURING THE MATHENY CREEK WATER QUALITY SAMPLING (Continued).

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
Turbidity (NTU) A	Grab	Stored on Ice	48 Hours	Stored at 4°C	Nephelometric	APHA 214
Total Hardness	Grab	Stored on Ice	7 Days	Stored at 4°C	Titration with EDTA	APHA 314 B
Oil and Grease	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4°C	Gravimetric	EPA 413.1
Dissolved Oxygen	*In situ*	----	----	----	Hydrolab - Membrane Electrode	APHA 421 B
pH	*In situ*	----	----	----	Hydrolab - Electrometric	APHA 423
Specific Conductance	*In situ*	----	----	----	Hydrolab - Wheatstone Bridge	APHA 205
Temperature	*In situ*	----	----	----	Hydrolab - Thermistor	APHA 212
Total Cadmium	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption, Furnace	EPA 213.1
Total Copper	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption, Furnace	EPA 220.1
Total Lead	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption, Furnace	EPA 236.1
Total Iron	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption, Flame	EPA 239.1
Total Zinc	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption,	EPA 289.1

APHA - American Public Health Association, American Water Works Association and Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th Edition. American Public Health Association.

EPA - U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes, EPA - 600/4-79-020, National Environmental Research Center, Cincinnati, Ohio.

TABLE 4.1.2.b RESULTS OF WATER QUALITY MONITORING PERFORMED AT THREE STATIONS IN THE MATHENY CREEK WATERSHED ON OCTOBER 7, 1993.

Parameters	MC-1	MC-2	DL-1	State/County Standards[a]
Biochemical Oxygen Demand (mg/L)	1.2	2.4	0.6	------
Chemical Oxygen Demand (mg/L)	32.1	39.5	31.3	------
*Fecal Coliform Bacteria (Col./100 mL)	2,750	1,750	2,700	≤800
*Total Coliform Bacteria (Col./100 mL)	2,900	3,200	9,150	≤2,400
Fecal Streptococcus Bacteria (Col./100 mL)	950	500	1,400	------
Ammonia Nitrogen (mg/L)	0.08	0.07	0.03	------
Nitrate + Nitrite Nitrogen (mg/L)	0.19	0.06	0.21	------
Total Kjeldahl Nitrogen (mg/L)	0.69	0.88	0.57	------
Total Nitrogen (mg/L)	0.88	0.94	0.78	------
Orthophosphate (mg/L)	0.15	0.14	0.13	------
Total Phosphorus (mg/L)	0.19	0.22	0.23	------
Oil and Grease (mg/L)	<1	<1	<1	≤5/≤15
Turbidity (NTU)	2.0	3.7	3.9	+29 NTU/ +25 JTU
Total Dissolved Solids (mg/L)	545	389	412	------
Total Suspended Solids (mg/L)	<1	3	4	------
Total Hardness (mg/L)	391	282	260	------
Total Cadmium (μg/L)	<0.1	<0.1	<0.1	≤2[b]/≤10
Total Copper (μg/L)	2	6	3	≤27[c]/≤10
**Total Iron (μg/L)	200	270	450	≤1,000/≤300
Total Lead (μg/L)	<1	<1	2	≤11[d]/≤10
Total Zinc (μg/L)	17	23	21	≤238[e]/≤10
**Specific Conductance (μmhos/cm)	840	650	690	≤1,275/≤500
**Dissolved Oxygen (mg/L)	6.9	4.8	8.6	≥5/≥4
Water pH (-log[H^+])	7.5	7	7.6	6.0 - 8.5
Water Temperature (°C)	25	24.8	25.5	------

a Standards specified in FAC Chapter 17-302 and Sarasota County Ordinance No. 72-37

b,c,d,e Metal standards calculated using total hardness values as specified in FAC Chapter 17-302.

* Does not meet State Standards

** Does not meet County Standards

TABLE 4.1.2.c SEDIMENT TRACE METAL CONCENTRATIONS AND METAL TO ALUMINUM RATIOS FOR FOUR MONITORING LOCATIONS IN THE MATHENY CREEK WATERSHED, SARASOTA COUNTY, FLORIDA. ALL CONCENTRATIONS EXPRESSED AS DRY WEIGHT.

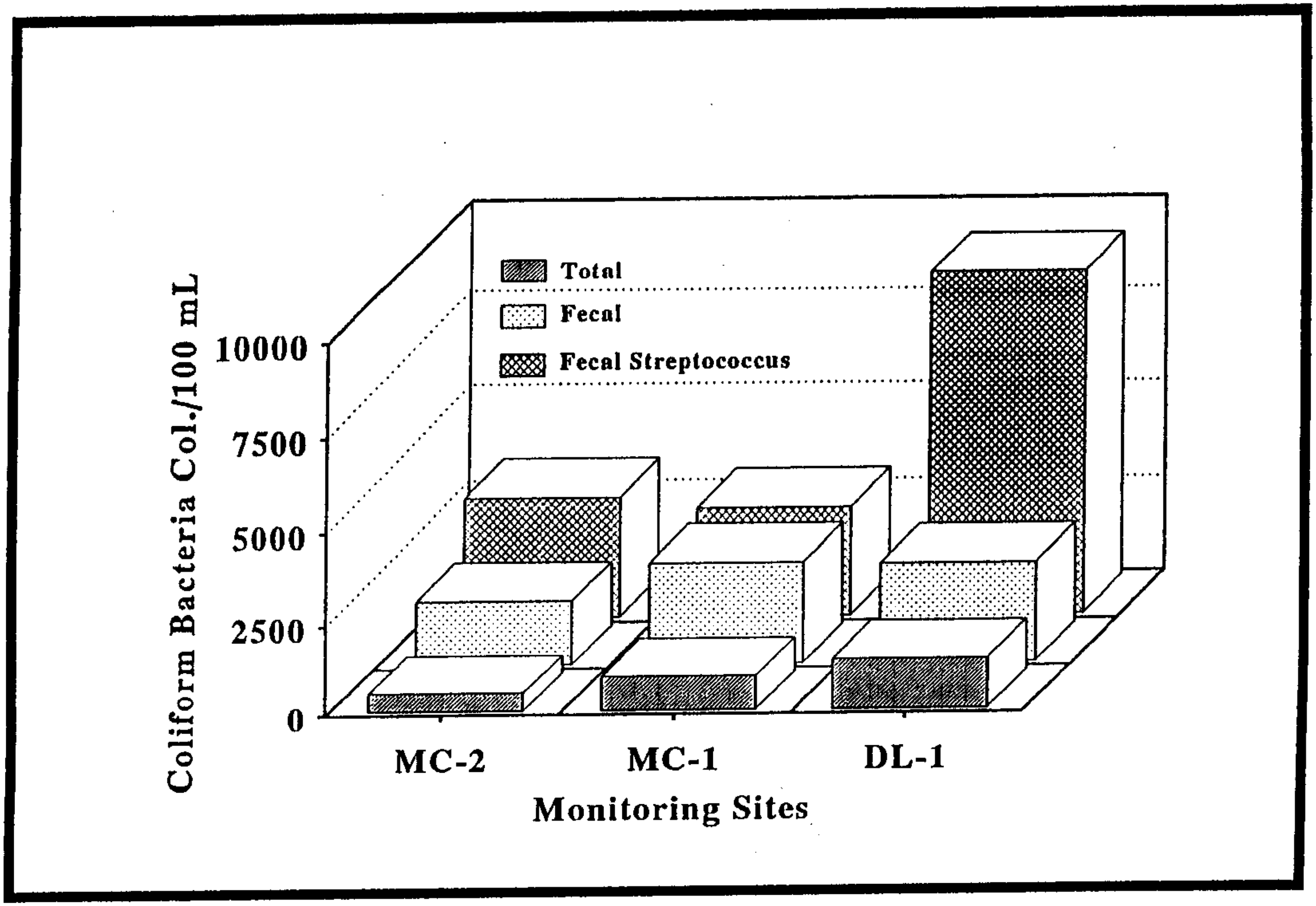
Station	Sediment Depth (cm)	Sediment Interval (cm)	Al (μg/g)	Fe (μg/g)	Cd (μg/g)	Cu (μg/g)	Pb (μg/g)	Zn (μg/g)
MC-2	15.5	0 - 5.5	15,200	7,810	0.43	39.2	141	213
		5.5 - 15.5	8,400	3,890	0.19	7.3	97	38
MC-1	15	0 - 6	7,970	5,300	0.39	15.8	59	64
		6 - 15	4,600	3,740	0.60	4.2	45	25
DL-1	17	0 - 11	14,200	11,400	0.85	22.8	139	175
		11 - 17	11,100	3,490	0.36	7.0	83	63
US41	21	0 - 11	6,910	3,940	0.34	13.1	57	97
		11 - 21	13,900	6,320	0.41	3.3	55	16
Average Crustal Abundance[a]			82,300	56,300	0.20	55.0	13	70

Station	Sediment Depth (cm)	Sediment Interval (cm)	Fe/Al	Cd/Al ($\times 10^{-4}$)	Cu/Al ($\times 10^{-4}$)	Pb/Al ($\times 10^{-4}$)	Zn/Al ($\times 10^{-4}$)
MC-2	15.5	0 - 5.5	0.51	0.28	25.8	93	140
		5.5 - 15.5	0.46	0.23	8.7	115	45
MC-1	15	0 - 6	0.66	0.49	19.8	74	81
		6 - 15	0.81	1.31	9.0	99	54
DL-1	17	0 - 11	0.80	0.60	16.0	98	123
		11 - 17	0.32	0.33	6.4	75	57
US41	21	0 - 11	0.57	0.49	19.0	82	140
		11 - 21	0.45	0.29	2.3	40	11
Average Crustal Abundance[a]			0.68	0.02	6.7	2	9

[a] Taylor (1964).

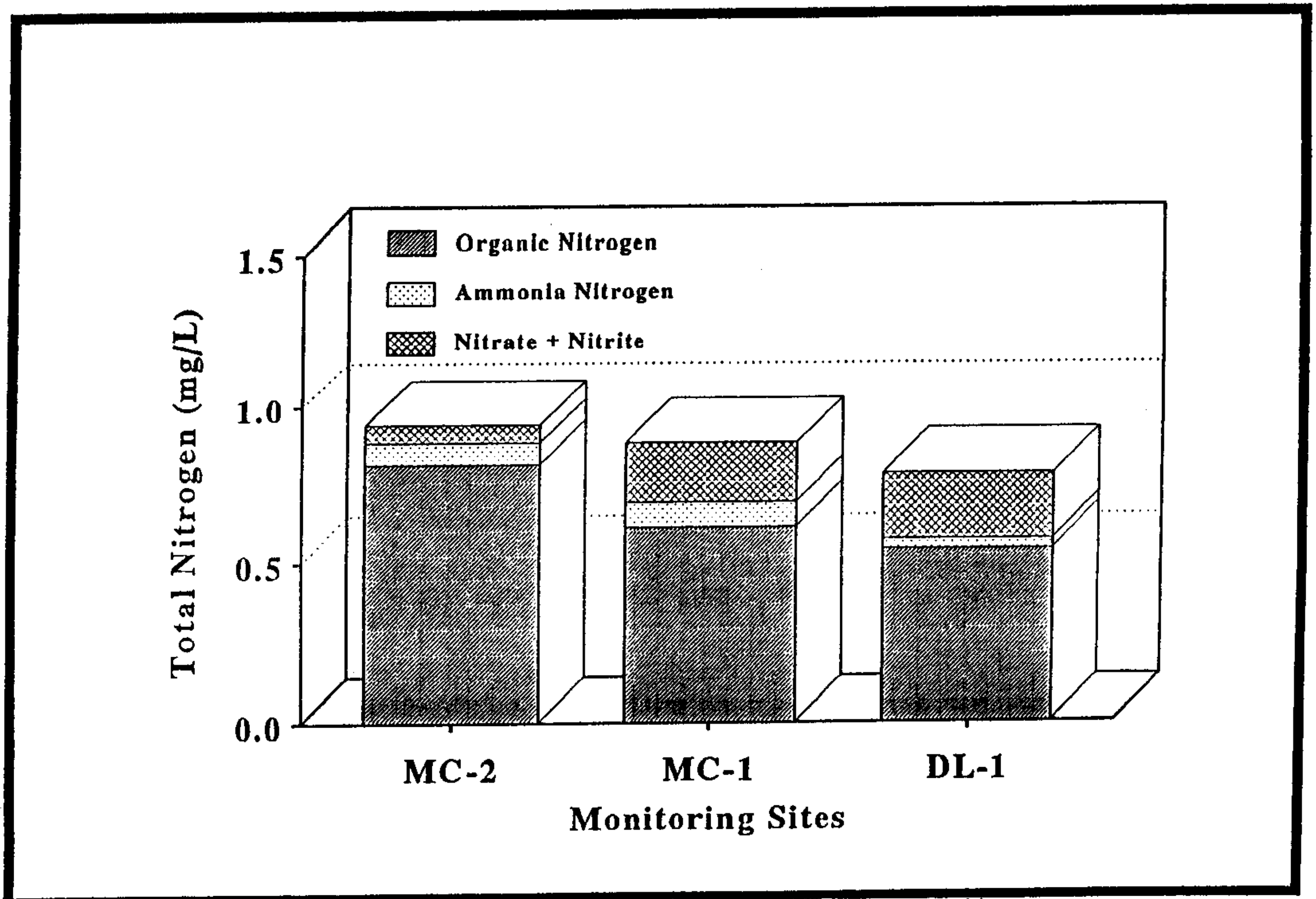
TABLE 4.1.2.d SEDIMENT ORGANIC CARBON, NITROGEN, AND PHOSPHORUS CONCENTRATIONS MEASURED AT FOUR MONITORING LOCATIONS IN THE MATHENY CREEK WATERSHED, SARASOTA COUNTY, FLORIDA. ALL CONCENTRATIONS EXPRESSED AS DRY WEIGHT.

Station	MC-2		MC-1		DL-1		US41	
Sediment Depth (cm)	15.5		15		17		21	
Sediment Interval (cm)	0 - 5.5	5.5 - 15.5	0 - 6	6 - 15	0 - 11	11 - 17	0 - 11	11 - 21
Total Organic Carbon (%)	6.3	9.1	8.4	6.9	11.0	6.0	9.0	12.0
Total Nitrogen (g/g)	1,590	364	1,500	43	1,600	438	1,320	129
Total Phosphorus (g/g)	814	484	713	253	2,330	520	982	831
Carbon/Nitrogen	40	250	56	1,620	69	137	68	930
Nitrogen/Phosphorus	1.96	0.75	2.11	0.17	0.69	0.84	1.34	0.16



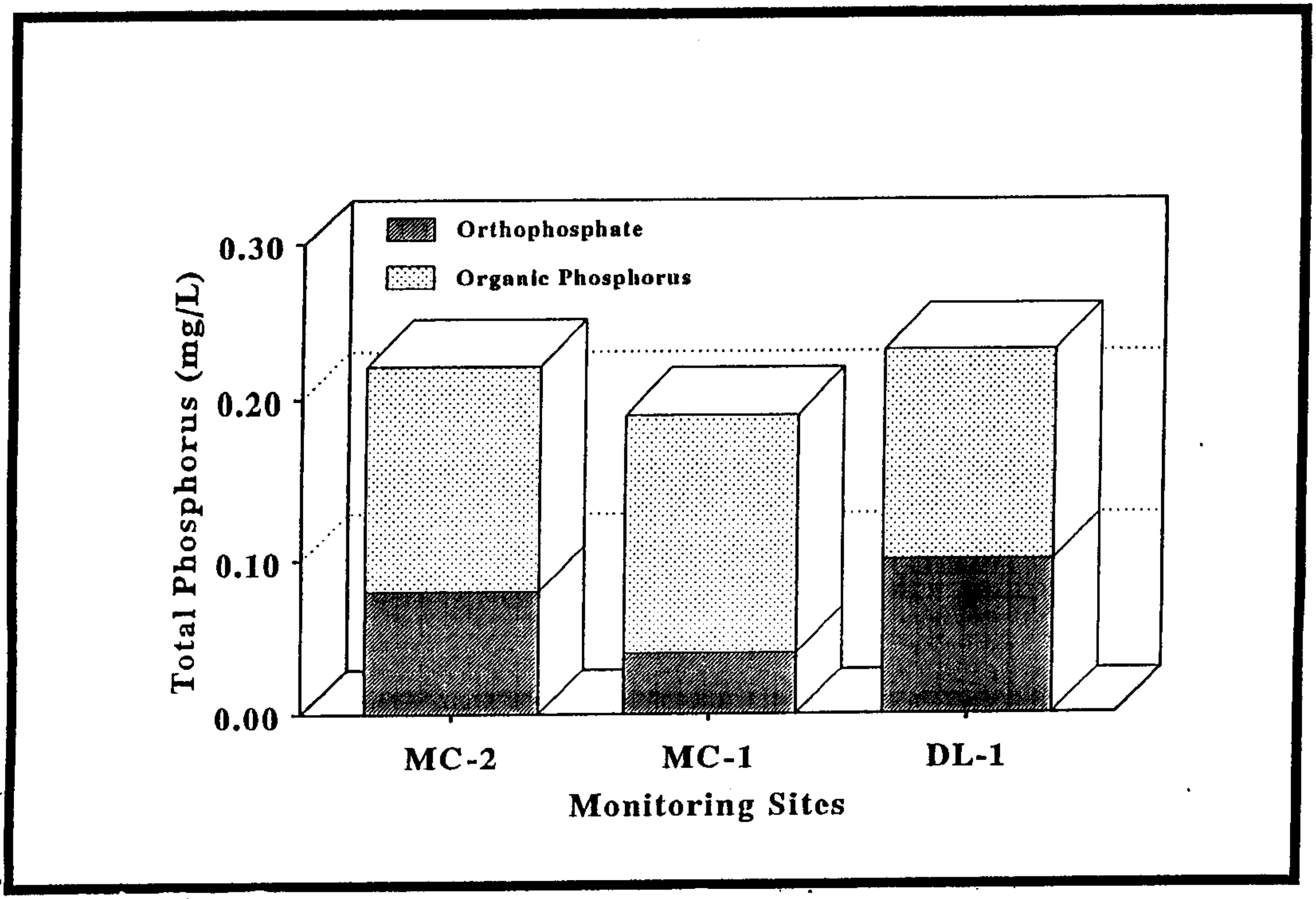
Coliform Bacteria Levels Measured at Three Stations in the Matheny Creek Watershed on October 7, 1993.

FIGURE 4.1.2.A



Total Nitrogen Concentrations Measured at Three Stations in the Matheny Creek Watershed on October 7, 1993

FIGURE 4.1.2.B



Total Phosphorus Concentrations Measured at Three Stations in the Matheny Creek Watershed on October 7, 1993

FIGURE 4.1.2.c

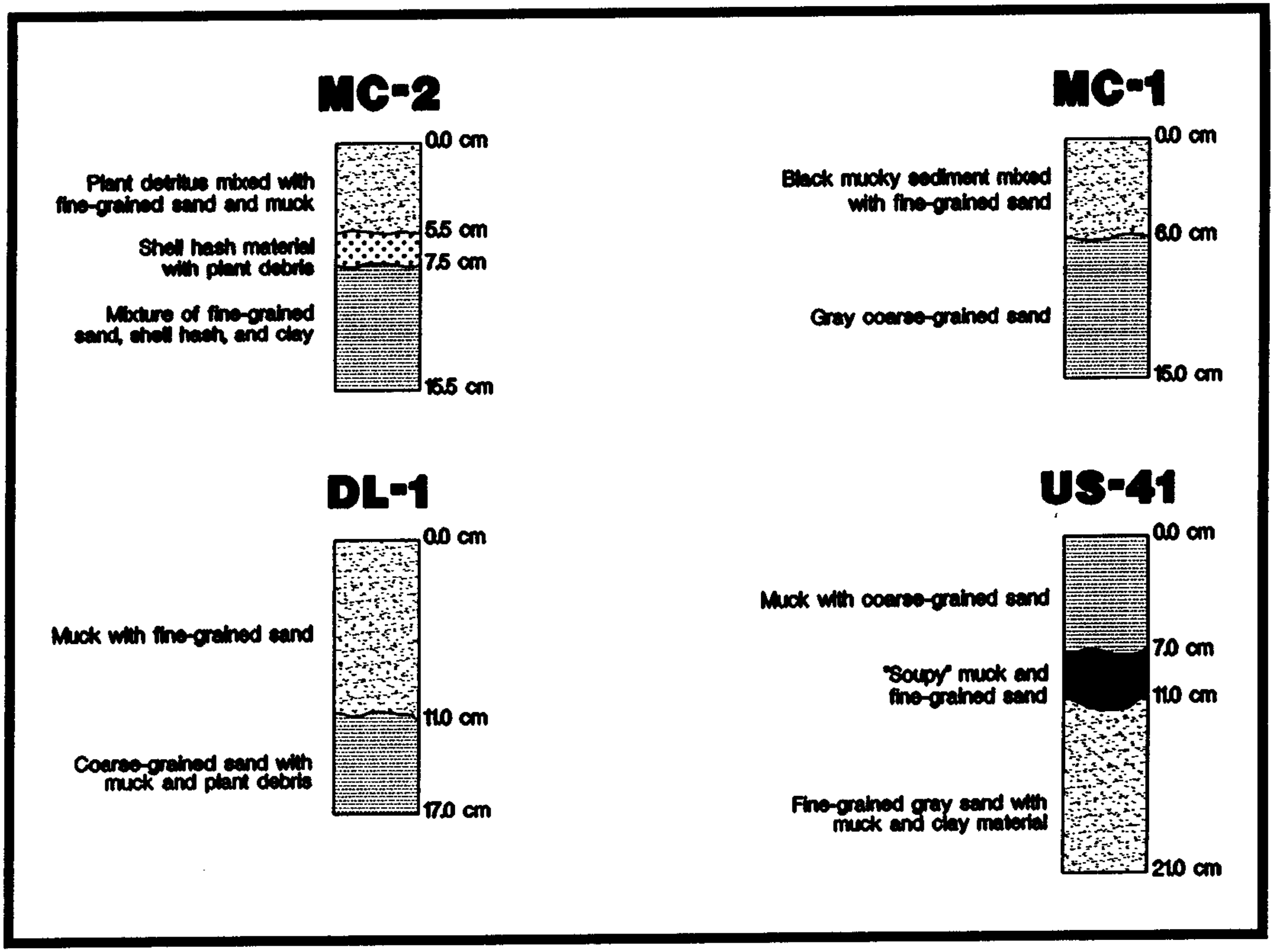


Figure 4.1.2.d Description of cores collected from the Matheny Creek watershed on October 13, 1993.

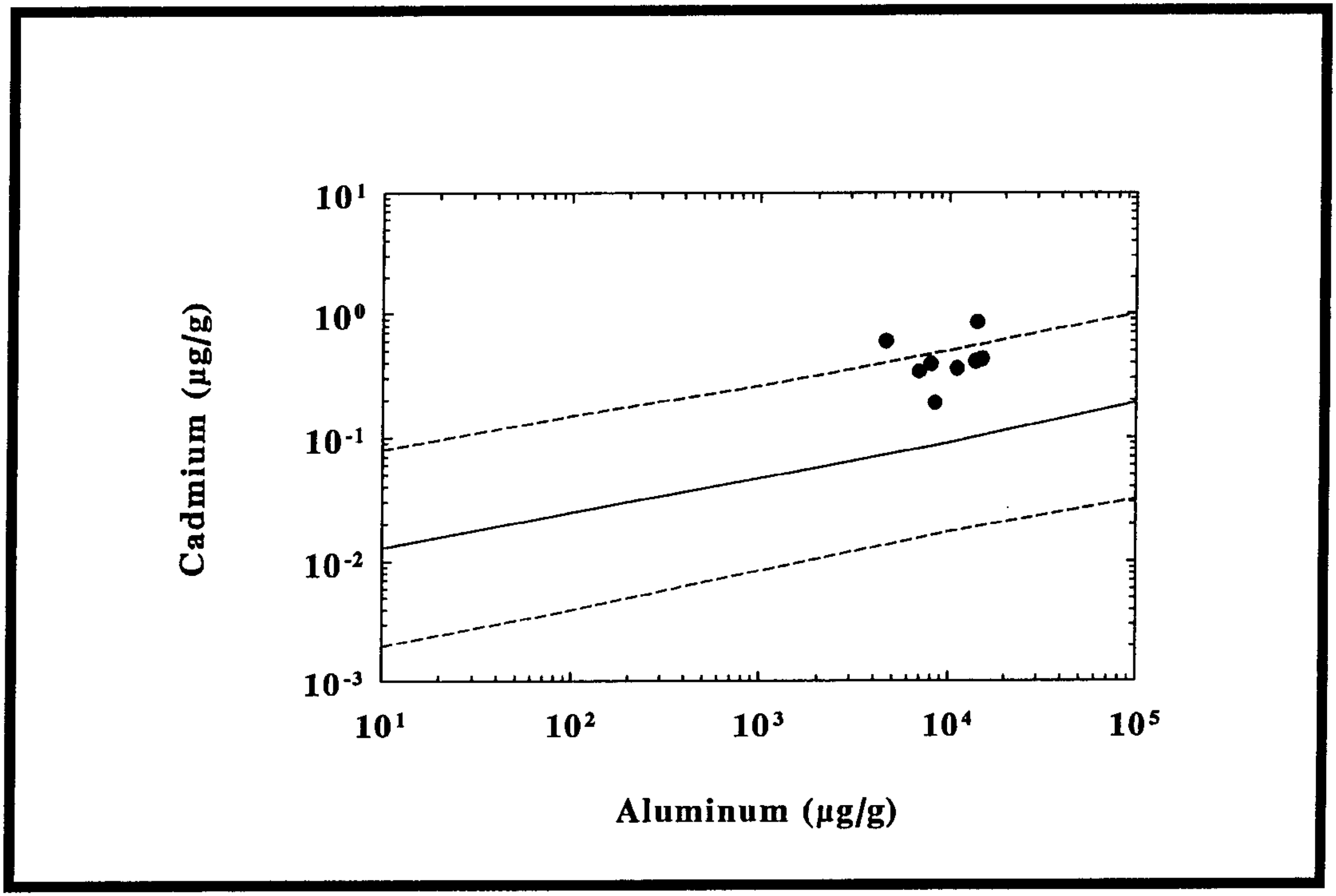


Figure 4.1.2.e Scatter plot of sediment Cd versus Al concentrations for Matheny Creek samples. Lines on the figure indicate mean Cd and Al sediment concentrations in Florida (solid line) with 95% confidence limits (dashed lines) based on Schropp *et.al.* (1989)

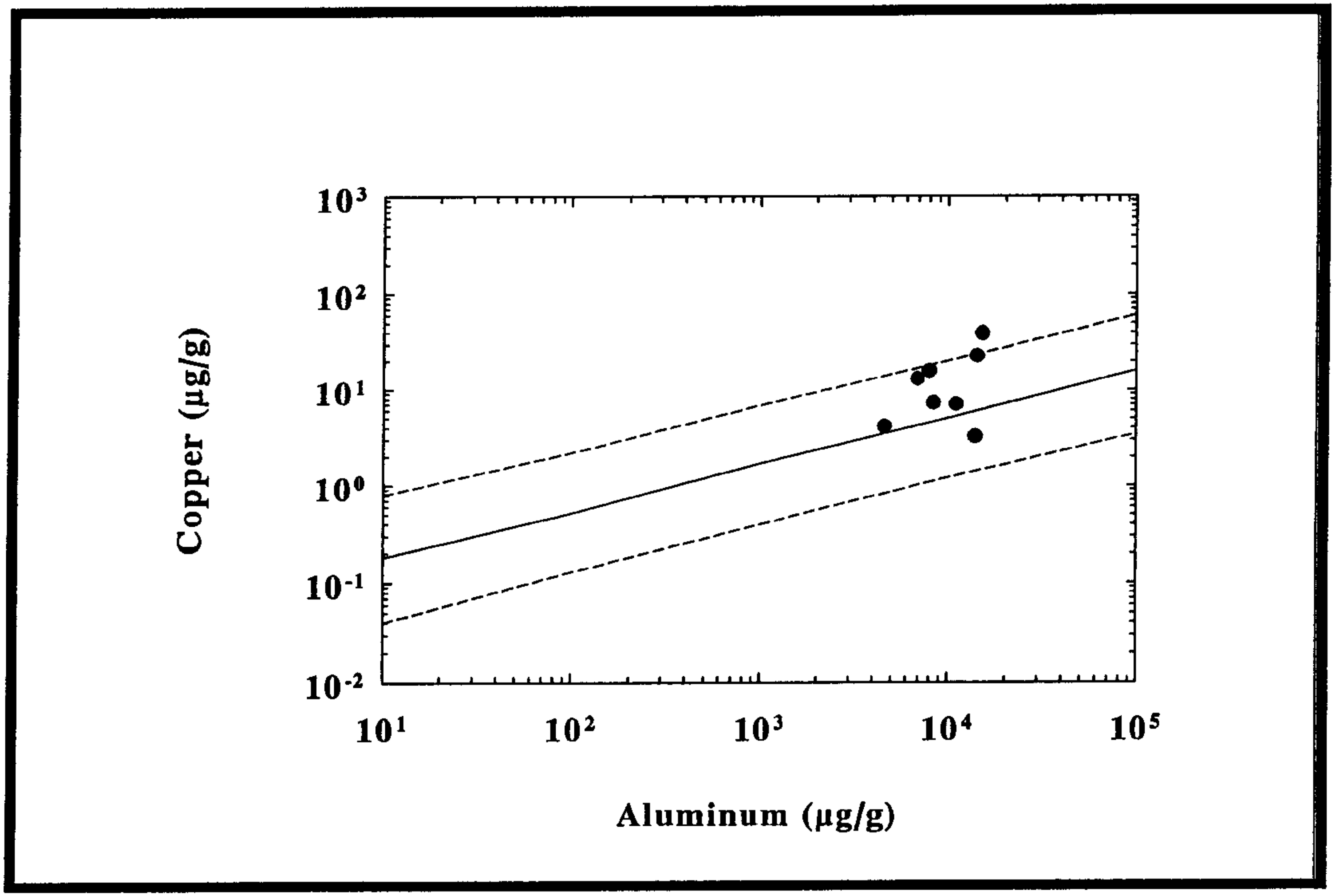


Figure 4.1.2.f Scatter plot of sediment Cu versus Al concentrations for Matheny Creek samples. Lines on the figure indicate mean Cu and Al sediment concentrations in Florida (solid line) with 95% confidence limits (dashed lines) based on Schropp *et.al.* (1989)

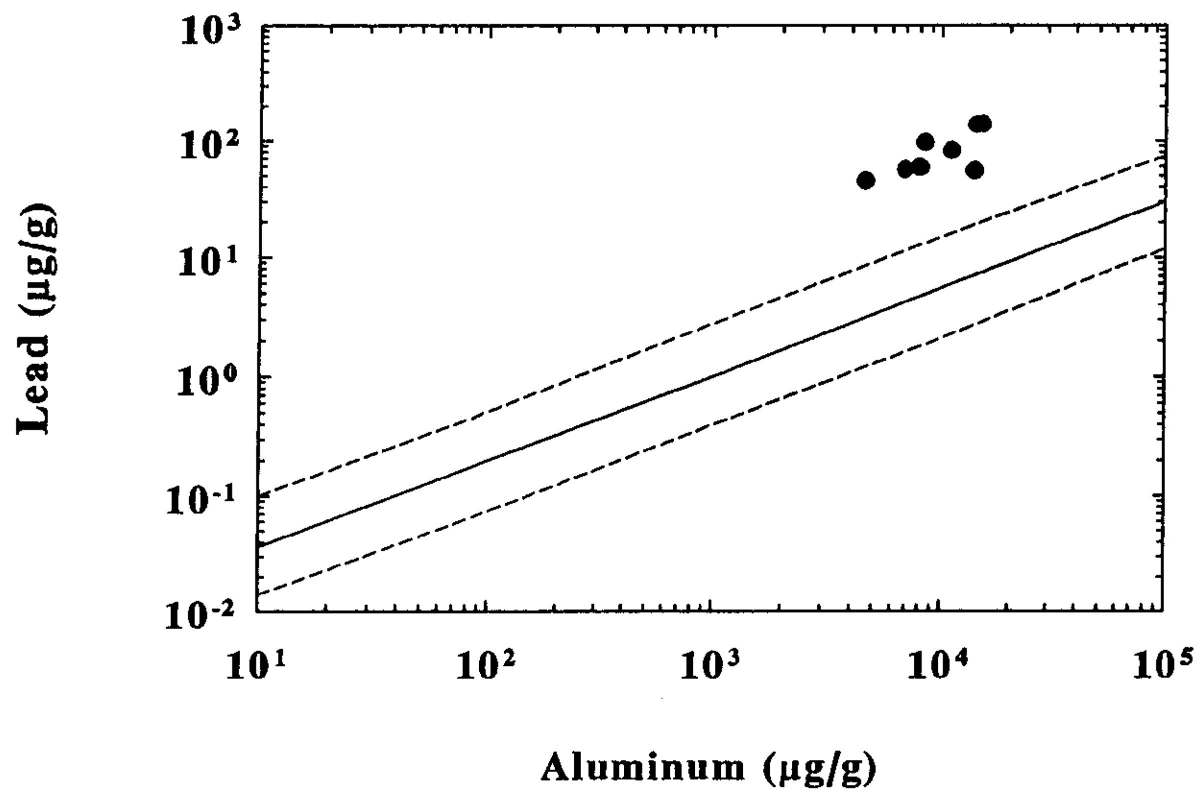


Figure 4.1.2.g Scatter plot of sediment Pb versus Al concentrations for Matheny Creek samples. Lines on the figure indicate mean Pb and Al sediment concentrations in Florida (solid line) with 95% confidence limits (dashed lines) based on Schropp *et.al.* (1989)

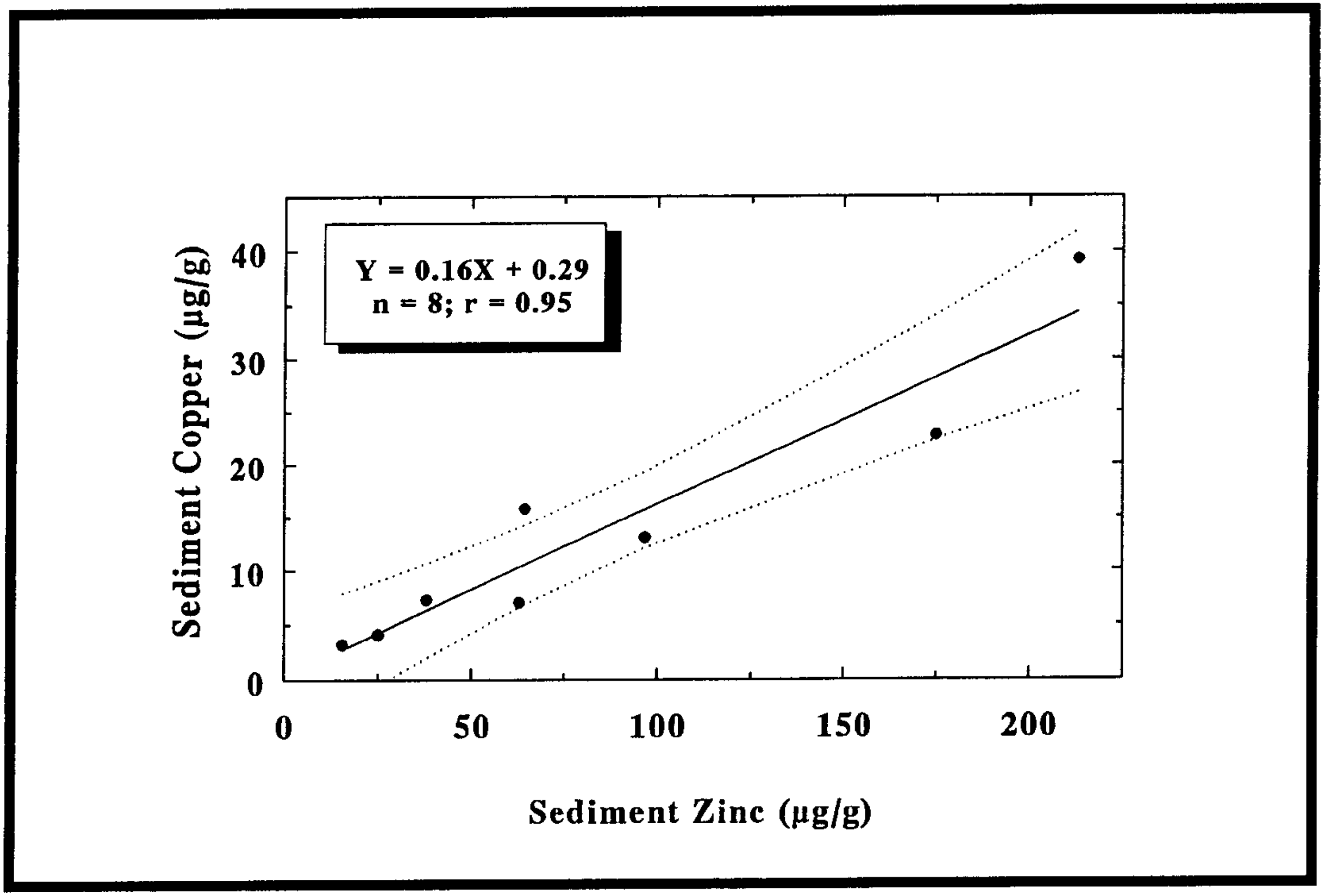


Figure 4.1.2.h Scatter plot of sediment Cu versus Zn for Matheny Creek samples. Solid line indicates regression line with dashed line defining the 95% confidence limits.

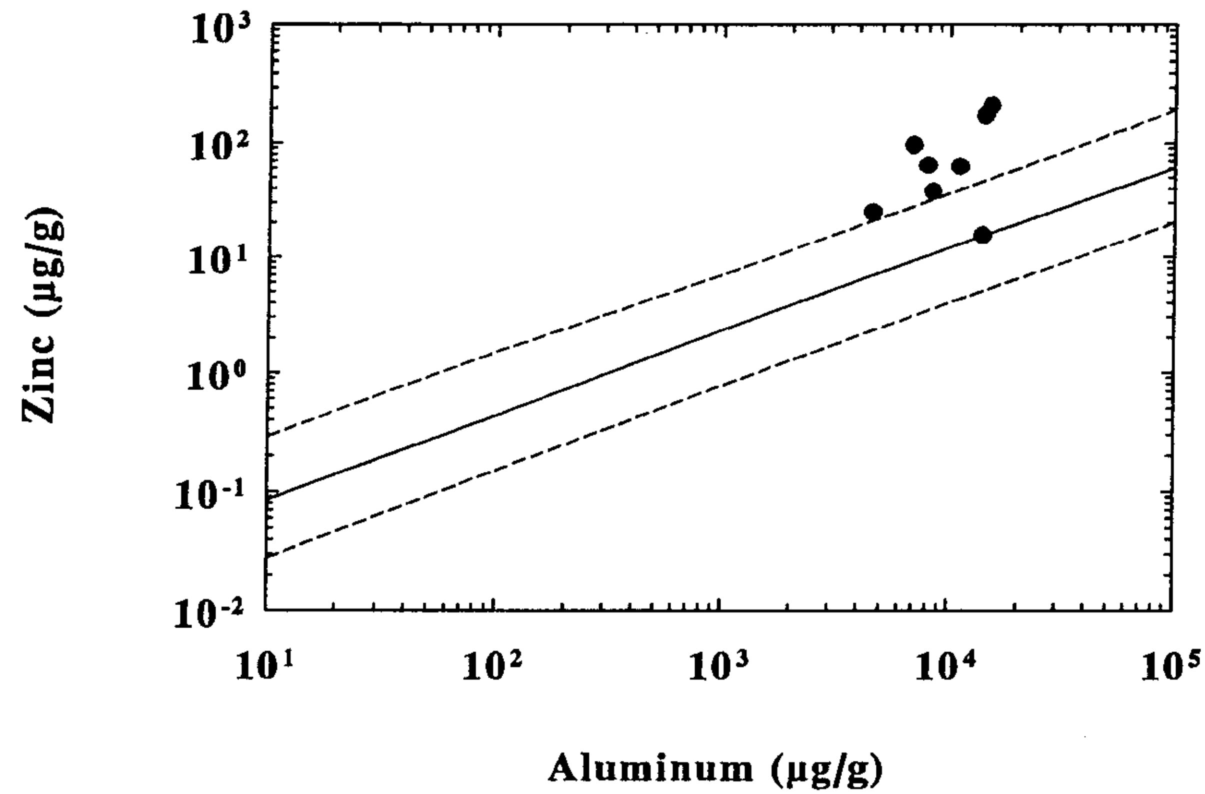


Figure 4.1.2.i Scatter plot of sediment Zn versus Al concentrations for Matheny Creek samples. Lines on the figure indicate mean Zn and Al sediment concentrations in Florida (solid line) with 95% confidence limits (dashed lines) based on Schropp *et.al.* (1989)

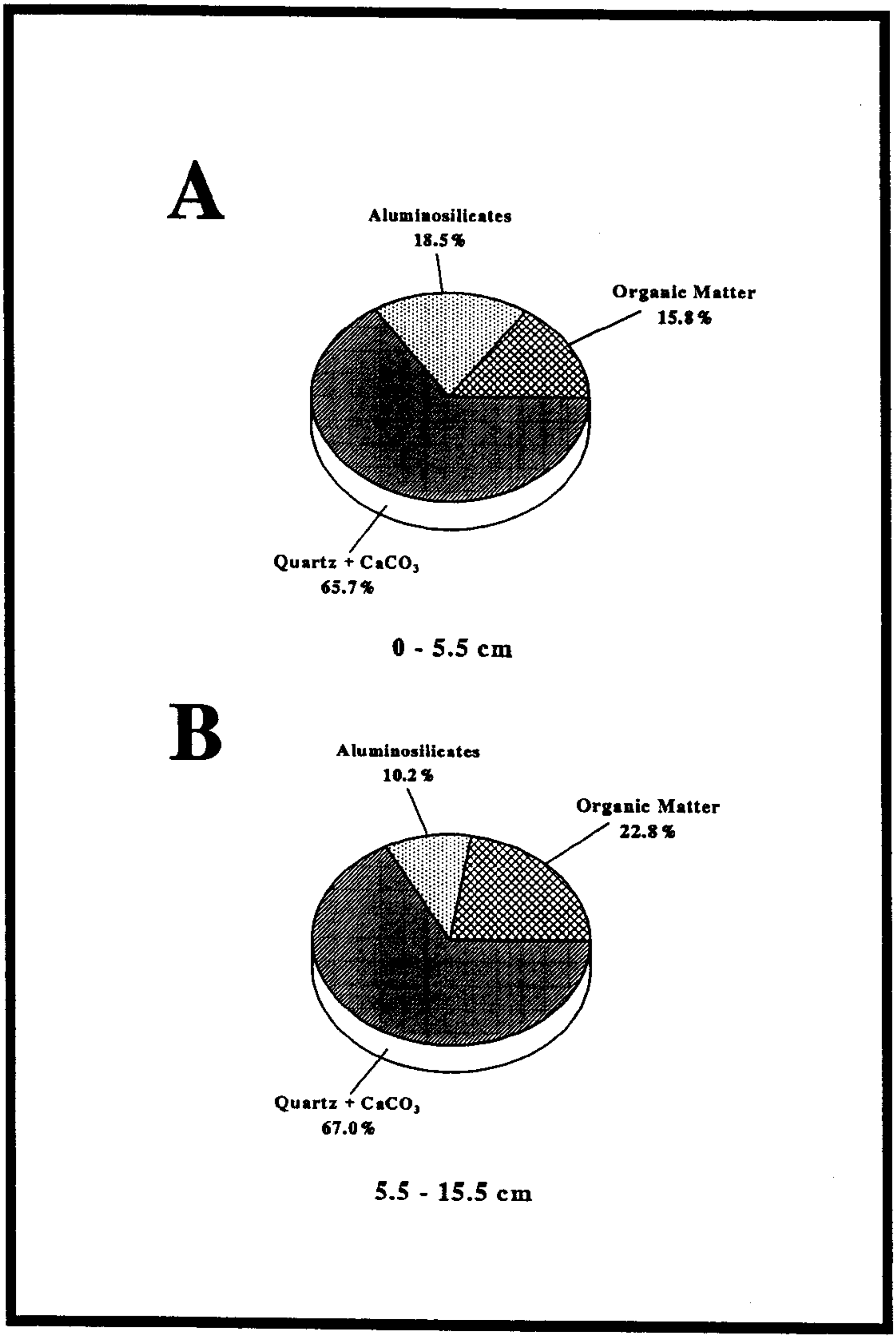


Figure 4.1.2.j Composite diagrams showing sediment composition for the surficial sediment layer (a) and bottom sediment layer (b) at Station MC-2 in Matheny Creek.

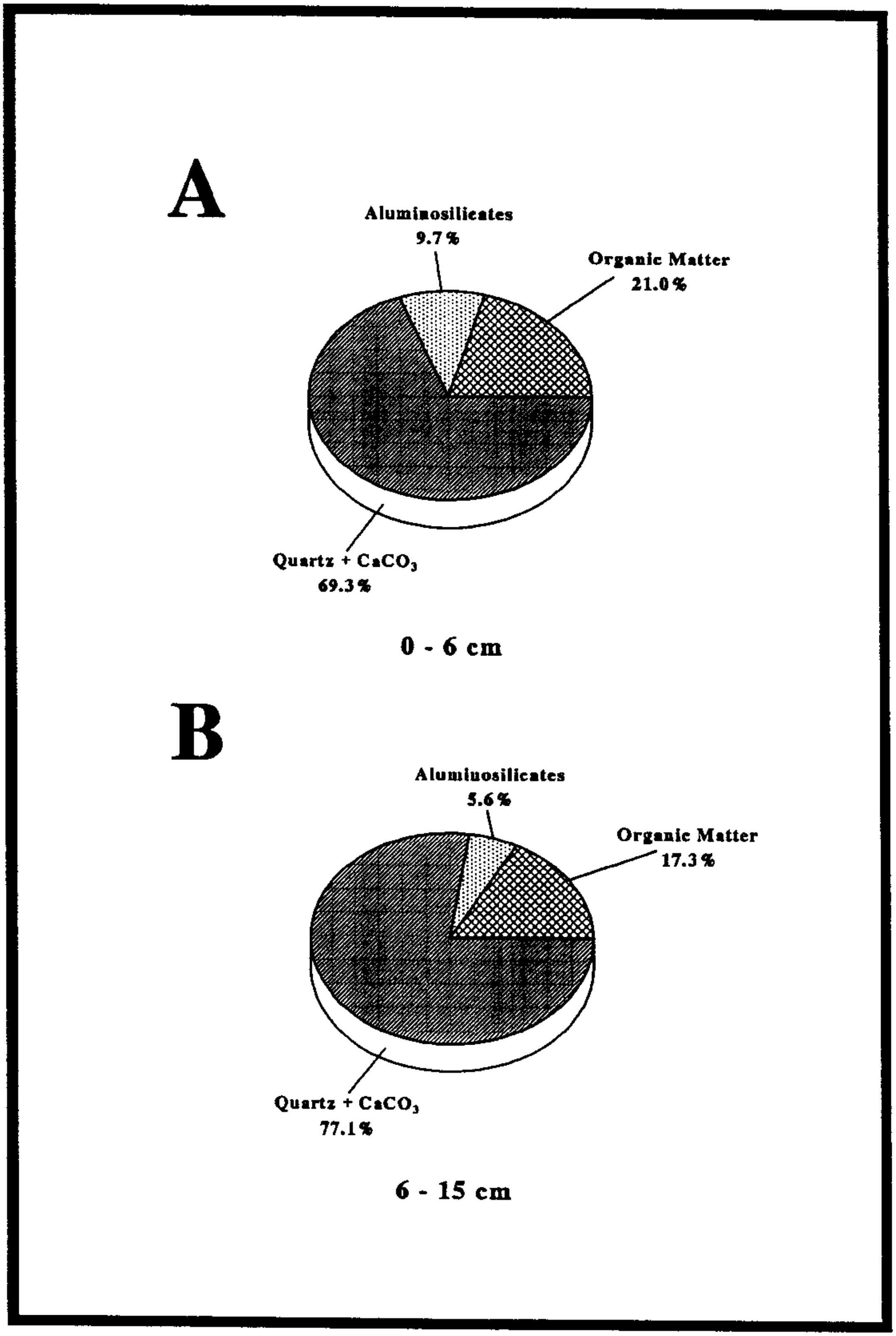


Figure 4.1.2.k Composite diagrams showing sediment composition for the surficial sediment layer (a) and bottom sediment layer (b) at Station MC-1 in Matheny Creek.

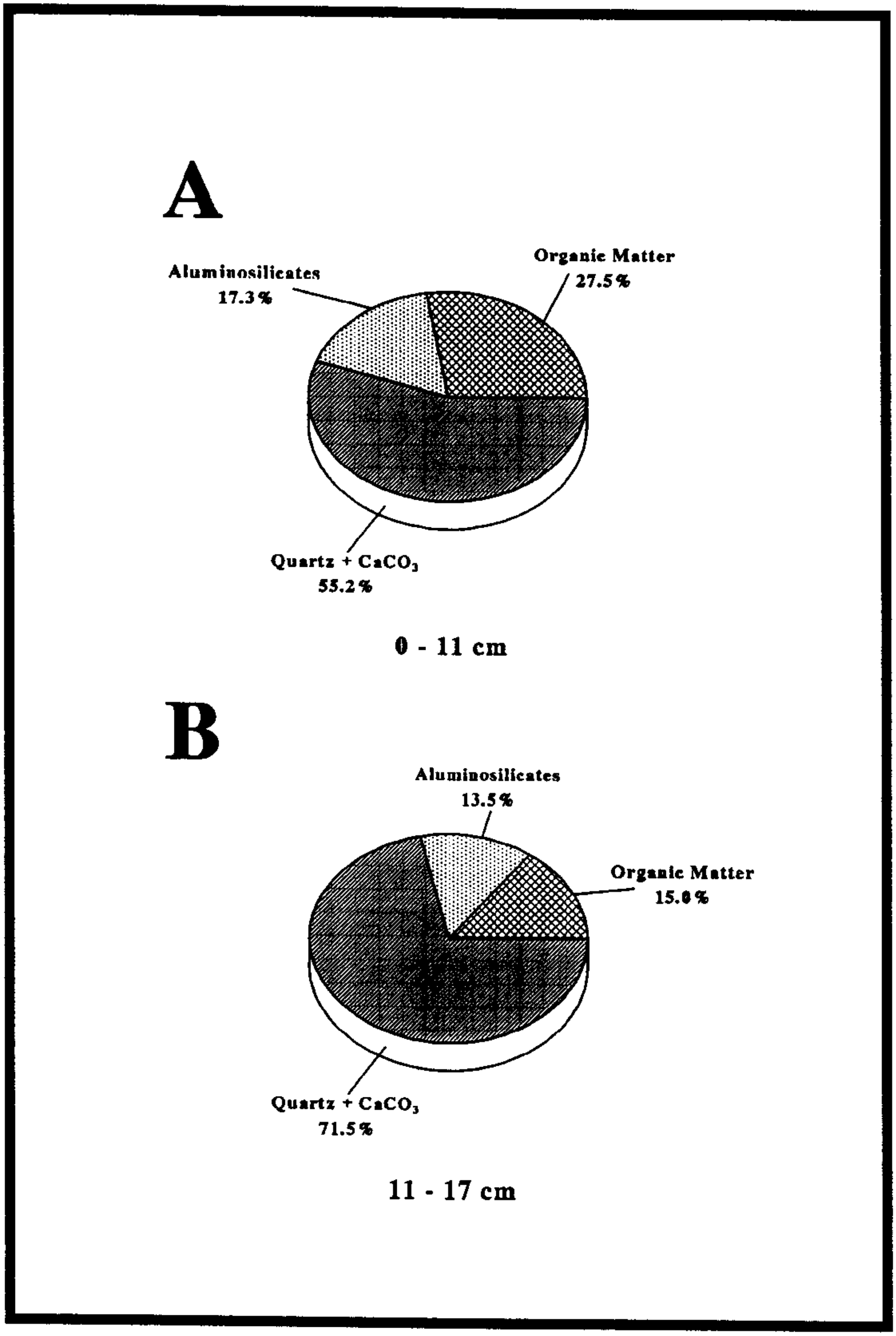


Figure 4.1.2.1 Composite diagrams showing sediment composition for the surficial sediment layer (a) and bottom sediment layer (b) at Station DL-1 in Matheny Creek.

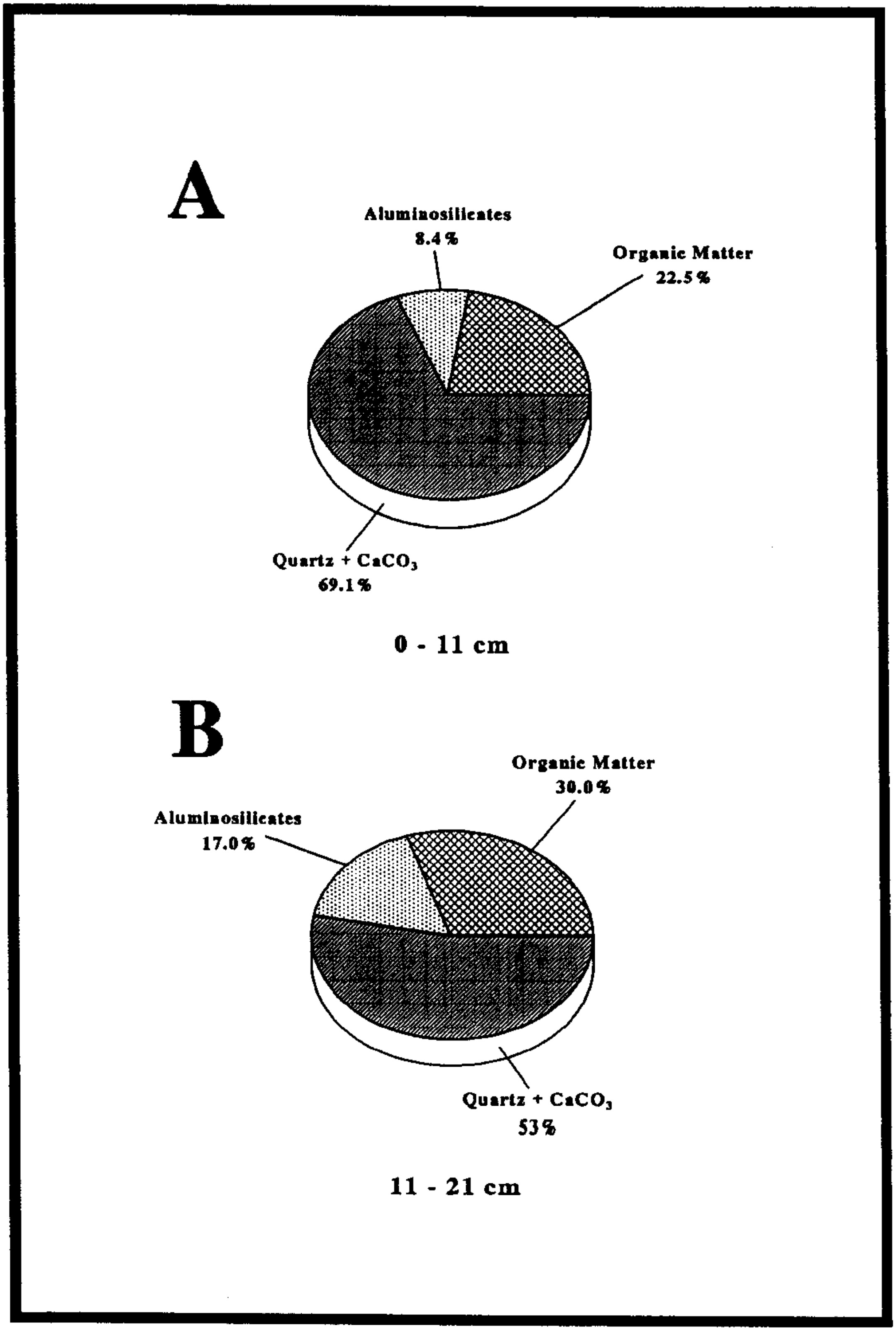


Figure 4.1.2.m Composite diagrams showing sediment composition for the surficial sediment layer (a) and bottom sediment layer (b) at Station US41 in Matheny Creek.

4.2 COMPUTER MODELING

4.2.1 FLOOD ANALYSIS

In order to accurately and economically assess the implications of basin modifications or improvements, it is first necessary to develop a computer model which can predict the effects of actual or observed flood events with a reasonable degree of accuracy.

Although the Matheny Creek drainage basin is relatively small, it's interior hydraulics are extremely complex. This is due to the fact the basin is essentially developed and therefore has been subjected to numerous and often uncoordinated drainage modifications which are piece-mealed throughout. It is this existing hydraulic network which dictated both the field survey needs and the hydrologic network (i.e. subbasins). Although general guidelines for the delineation of urban subbasin areas provided by Sarasota County recommends a minimum area between 200 and 300 acres, it was determined that the complexity of the hydraulic network required a more detailed subbasin delineation. In all, the Matheny Creek flood protection computer model considered 164 subbasins, 190 nodes, 101 weirs, 90 culverts, 27 drop structures, and 61 ditch reaches. This level of detail is advantageous since it is expected to increase the accuracy of results and allows a more site specific assessment with respect to both existing conditions and basin modifications. Disadvantages of the detailed model would include longer computer simulation times. The advantages were determined to outweigh the disadvantages.

With respect to hydrologic modeling, the SCS unit hydrography method was selected over the RUNOFF block of SWMM. It was determined that the SCS unit hydrography method was more appropriate since it is the most widely used hydrologic methodology in Sarasota County, is the method of preference of the Southwest Florida Water Management District, and is currently being calibrated by the U.S.G.S. to observed data in Sarasota County. The Sarasota County Stormwater Environmental Utility considered the use of this hydrologic methodology appropriate.

The SCS unit hydrograph program does not interface with the EXTRAN block of SWMM. However, KHA is aware that Hillsborough County has developed a program which interfaces the SCS unit hydrograph module of HEC-1 (with a peak rate factor of 256) with EXTRAN. Unfortunately, Hillsborough County would only release these programs to KHA through Sarasota County and it was not available in time to meet the required time schedule for the project's hydrologic/hydraulic analyses. The Advanced Interconnected Pond Routing (AdICPR) interfaces with a SCS unit hydrography package and is well suited to perform hydrodynamic modeling. It also has been proven to be capable of considering extremely complex networks such as that of the Matheny Creek drainage basin. Although this program is not under public domain, it is one of, if not the most commonly used computer model in Sarasota County and the Southwest Florida Water Management District. In addition, since the Matheny Creek drainage basin is essentially developed, few updates to the existing conditions model are anticipated. In order to meet the time constraints of the hydrologic/hydraulic analyses, the AdICPR computer program was employed.

In July of 1994, the Federal Emergency Management Agency (FEMA) indicated that the were in the process of registering the AdICPR program. Although the AdICPR had been accepted by FEMA in the past, they advised Sarasota County that they were currently not accepting it as an approved model. Further discussions with both Pete Singhoffen, author of the AdICPR and consultants to FEMA as well as more recent correspondence from FEMA indicate FEMA and Mr. Singhoffen are in the process of resolving this matter. However, as an alternative, it is anticipated that the peak discharges determined as part of the Matheny Creek Basin Master Plan using the SCS methodology (presented in TABLE 4.2.1.2) can be used with the HEC-2 computer model to determine water surface elevations for the study reaches. This approach would satisfy present FEMA requirements and could be implemented upon authorization as Phase C of the Matheny Creek Basin Master Plan contract.

4.2.1.1 METHODOLOGY

As previously discussed, computer simulations where performed using the Advanced Interconnected Pond Routing (AdICPR) program. This program utilizes the SCS unit hydrography methodology and a hydrodynamic routing method for the hydrologic and hydraulic components of the analyses, respectively. The AdICPR program is well suited to complex coastal watersheds such as Matheny Creek and was used to conduct a detailed assessment of the basin. An overview of the modeling methodology is provided below.

Depression Storage: The effects of depression storage and the relationship of contributing area to time were accounted for by routing hydrography flows through existing stormwater lakes and major depressions (wetlands). As such, a unit hydrography peak rate factor of 256 was used.

Watershed Retention: Rainfall losses were determined by computing a weighted CN for the pervious and non-directly connected impervious areas. The portion of the basin area which is directly connected impervious was specified and is considered independently by the model. The retention storage, S was computed by the following relationship:

$$S = \frac{1000}{CN} - 10 \qquad \text{Eq. 1}$$

Initial abstraction, Ia were computed as 20% of the watershed retention storage, S:

$$Ia = 0.2S \qquad \text{Eq. 2}$$

Employing Eq. 1 and Eq. 2, rainfall volumes (P) were converted to runoff volumes (R) by the following standard SCS equation:

$$R = \frac{(P-0.2S)^2}{P + 0.8S} \qquad \text{Eq. 3}$$

Time of Concentration: The time of concentration was computed using the Kinematic Wave Formula, consistent with the guidelines prescribed by the SCS in Technical Release No. 55.

Design Storm Event(s): Consistent with the Rules of the Southwest Florida Water Management District, the following design 24-hour duration rainfall volumes were used:

Frequency	Volume
2-year	4.25"
5-year	6.00"
10-year	7.00"
25-year	8.00"
100-year	10.00"

The SCS - TYPE II MODIFIED 24-hour, dimensionless rainfall distribution was used.

Initial simulations were conducted utilizing only the largest design storm (i.e. 100-year, 24-hour) to assure that the model input adequately accounted for both watershed storage and their attenuation effects on discharge rates. Numerous trial and error simulations were required to accomplish this objective. Simulations were then completed for the 2-year, 5-year, 10-years, and 25-year design storms.

4.2.1.2 RESULTS

The subbasin hydrologic inventory is provided in APPENDIX A along with the node (or junction)/reach (or link) schematic developed for the AdICPR model. The computer modeling input/output results are contained in APPENDIX B. A Summary of Existing Discharges for the study reaches is provided herein as TABLE 4.2.1.2. A Summary of Existing Surface Water Elevations for the study reaches are provided in TABLES 4.2.1.2.a through 4.2.1.2.h. These surface water profiles are also presented graphically on EXHIBITS 4.2.1.2.a through 4.2.1.2.h.

The results of the Flood Insurance Study (FIS) for Matheny Creek are compared with those of the Basin Master Plan (BMP) in TABLE 4.2.1.2.g. This comparison reveals that significant discrepancies exist with respect to discharge rates and water surface elevations at U.S. 41 and water level control structure (WLCS) MC-1. Both the discharge rates and base flood elevations generated by the BMP analyses are higher than those established by the FIS in the lower portions of the Matheny Creek watershed. However, base flood elevations for the FIS are higher than those determined by the BMP in the upper portion of the Matheny Creek Main.

Although the hydrologic analysis for the FIS indicated a total basin area of 1,670 acres which is relatively consistent with the 1,723 acres determined for the BMP, the FIS hydraulic analysis only considered the Matheny Creek Main which has an actual service area of 789 acres at WLCS MC-1. The FIS hydraulic analysis did not consider the Denham Acres Lateral and its service area of 872 acres which enters the Matheny Creek Main between U.S. 41 and WLCS MC-1. In general, the preliminary base flood elevations (BFEs) determined by the BMP are based upon more accurate information and more scientifically and technically correct hydrologic and hydraulic methodologies.

It is anticipated that the final base flood elevations determined by the BMP would provide the basis of the supporting data report for revisions to effective base flood elevations for the Matheny Creek Main, in addition to providing base flood elevations for un-numbered 'A' Zones and previously unstudied areas in the Matheny Creek watershed. However, with respect to the Matheny Creek Main, revisions to the effective base flood elevations would not significantly affect the current flood insurance requirements in the lower portion of the basin since such are based upon the tidal surge base flood elevation of 10.8 NGVD.

SUMMARY OF EXISTING DISCHARGES (in cfs)

Structure I.D.	LOCATION	2-YR Q	5-YR Q	10-YR Q	25-YR Q	100-YR Q
LOWER MATHENY CREEK MAIN		742	1,113	1,289	1,389	1,697
111	U.S. 41	742	1,113	1,289	1,389	1,697
113	WLCS MC-1	332	529	662	642	932
116	Bispham Road	249	389	459	525	592
120	Gulf Gate Drive	220	333	390	438	478
UPPER MATHENY CREEK MAIN		144	211	247	277	356
125	WLCS MC-2	145	211	247	277	356
127	Beneva Road	136	190	222	253	327
137	SCL RR Spur	32	40	45	57	73
BREAKWATER LATERAL		30	38	43	46	53
140	Outlet Culvert	30	38	43	46	53
141	West Breakwater Circle	20	27	28	32	38
143	East Breakwater Circle	18	22	25	29	31
DENHAM ACRES LATERAL		381	562	631	764	825
200	WLCS DL-1	381	562	631	764	825
203	Bispham Road	369	542	612	700	818
206	Gulf Gate Drive	234	322	363	402	472
208	Mall Drive	220	299	338	359	429
211	Clark Road	101	120	124	135	148
CORAL LAKES BRANCH		59	81	115	118	92
301	Gateway Avenue	56	76	92	114	88
GULF GATE BRANCH		75	128	148	162	188
401	St. Thomas Moore Entrance	68	100	113	126	139
403	Gulf Gate Drive	59	86	97	112	151
406	Savage Road	23	35	39	35	46
SHADOW LAKES FEEDER		8	12	15	21	64
410	Gulf Gate School	8	12	15	21	64
412	Lockwood Ridge Road	9	10	13	17	58
WILLIAMSBURG BRANCH		65	102	125	151	193
503	Murdock Avenue	24	38	48	57	73
505A	Lockwood Ridge Road	12	21	35	45	98

TABLE 4.2.1.2

LOWER MATHENY CREEK MAIN (CANAL 10-198)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
110	U.S. 41 (D.S.)	5.40	6.43	6.87	7.19	7.84	
111	U.S. 41 (U.S.)	5.93	7.62	8.41	9.04	10.56	10.56
112	WLCS MC-1 (D.S.)	6.23	7.63	8.41	9.58	10.57	
113	WLCS MC-1 (U.S.)	7.13	8.29	8.98	9.72	10.91	
114	628 Ft. Downstream of Bispham Road	8.49	9.56	9.78	10.13	11.19	
115	Bispham Road (D.S.)	8.88	9.89	10.23	10.51	11.44	
116	Bispham Road (U.S.)	9.22	10.23	10.61	10.93	11.77	8.67
117	450 Ft. Upstream of Bispham Road	9.48	10.47	10.81	11.18	11.89	
118	600 Ft. Downstream of Gulf Gate Drive	10.20	11.17	11.56	11.86	12.52	
119	Gulf Gate Drive (D.S.)	10.93	11.78	12.27	12.57	13.02	Photo
120	Gulf Gate Drive (U.S.)	11.31	12.56	13.34	13.88	14.46	Photo
121	525 Ft. Upstream of Gulf Gate Drive	11.57	12.72	13.40	14.00	14.66	15.1
122	1200 Ft. Upstream of Gulf Gate Drive	12.11	13.05	13.65	14.32	14.90	
123	1675 Ft. Upstream of Gulf Gate Drive	12.28	13.24	13.81	14.48	15.31	
124	WLCS MC-2 (D.S.)	12.48	13.41	13.94	14.51	15.77	

TABLE 4.2.1.2.a

UPPER MATHENY CREEK MAIN (CANAL 10-199)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
124	WLCS MC-2 (D.S.)	12.48	13.41	13.94	14.51	15.77	
125	WLCS MC-2 (U.S.)	13.70	14.10	14.42	14.83	16.00	17.18
126	Beneva Road (D.S.)	14.12	14.57	14.81	15.26	16.22	
127	Beneva Road (U.S.)	14.19	14.71	15.01	15.51	16.48	16.52
128	631 Ft. Upstream of Beneva Road	14.51	15.12	15.45	15.74	16.61	
129	1181 Ft. Upstream of Beneva Road	14.69	15.35	15.70	16.04	16.82	
130	1739 Ft. Upstream of Beneva Road	14.84	15.55	15.91	16.25	17.03	
131	2289 Ft. Upstream of Beneva Road	14.94	15.61	16.01	16.33	17.09	
132	3229 Ft. Upstream of Beneva Road	15.01	15.75	16.09	16.44	17.22	
133	3709 Ft. Upstream of Beneva Road	15.12	15.80	16.20	16.56	17.47	
134	SCL RR Spur (D.S.)	15.29	16.04	16.43	16.82	17.65	
137	SCL RR Spur (U.S.)	15.46	16.25	16.77	17.42	18.85	
138	480 Ft. Upstream of SCL RR Spur	15.61	16.47	16.90	17.60	18.87	

TABLE 4.2.1.2.b

BREAKWATER LATERAL (CANAL 11-209)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
114	Confluence with Matheny Creek Main	8.49	9.56	9.78	10.13	11.19	
140	West Breakwater Circle (D.S.)	10.33	12.33	13.20	13.62	14.12	
141	West Breakwater Circle (U.S.)	12.00	13.60	13.81	13.89	14.15	
142	East Breakwater Circle (D.S)	12.29	13.64	13.86	13.92	14.17	
143	East Breakwater Circle (U.S.)	13.30	14.60	15.01	15.76	16.20	
144	West Post Road (U.S.)	14.27	15.23	15.54	15.79	16.22	
145	Bounty Drive (U.S.)	15.69	16.76	17.04	17.18	17.49	Photo
146	East Post Road U.S.)	17.09	17.48	17.63	17.70	17.80	

TABLE 4.2.1.2.c

DENHAM ACRES LATERAL (CANAL 10-190)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
111	WLCS DL-1 (D.S.)	5.93	7.62	8.41	9.04	10.56	
200	WLCS DL-1 (U.S.)	9.89	10.43	10.66	11.01	11.61	
202	Bispham Road (D.S.)	10.33	11.04	11.28	11.51	12.14	
203	Bispham Road (U.S.)	10.43	11.21	11.47	11.75	12.41	11.80
204	325 Ft. Upstream of Bispham Road	10.55	11.34	11.67	11.97	12.61	
205	Gulf Gate Drive (D.S.)	10.74	11.63	11.96	12.38	12.78	
206	Gulf Gate Drive (U.S.)	10.98	12.04	12.49	13.03	13.66	13.50
207	Mall Drive (D.S.)	11.17	12.14	12.71	13.28	13.81	
208	Mall Drive (U.S.)	11.37	12.48	13.13	13.76	14.49	
209	600 Ft. Upstream of Mall Drive	11.67	12.71	13.25	13.86	14.66	
210	1500 Ft. Upstream of Mall Drive	13.04	13.99	14.47	14.93	15.47	16.05 16.04
211	Clark Road (D.S.)	13.76	14.48	14.86	15.19	15.70	16.93

TABLE 4.2.1.2.d

CORAL LAKES BRANCH (CANAL 11-191)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
208	Confluence with Denham Acres Lateral	11.37	12.48	13.13	13.76	14.49	
300	Gateway Avenue (D.S.)	11.46	12.54	13.16	13.85	14.57	
301	Gateway Avenue (U.S.)	11.46	12.58	13.20	13.93	14.64	Photo
302	325 Ft. Upstream of Gateway Avenue	11.49	12.66	13.23	14.00	14.65	
303	1000 Ft. Upstream of Gateway Avenue	11.66	12.69	13.42	14.07	14.83	

TABLE 4.2.1.2.e

GULF GATE BRANCH (CANAL 10-192)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
205	Confluence With Denham Acres Lateral	10.74	11.63	11.96	12.38	12.78	
400	St.Thomas Moore Entrance (D.S.)	10.95	11.93	12.20	12.57	13.03	
401	St.Thomas Moore Entrance (U.S.)	11.54	12.67	13.15	13.75	14.41	
402	Gulf Gate Drive (D.S.)	12.14	12.97	13.38	13.93	14.55	
403	Gulf Gate Drive (U.S.)	12.91	14.02	14.34	14.66	15.12	
404	500 Ft. Upstream of Gulf Gate Drive	13.99	14.78	15.03	15.32	15.78	
405	Savage Road (D.S.)	14.36	15.10	15.32	15.61	16.05	
406	Savage Road (U.S.)	14.48	15.38	15.52	15.84	16.26	
[1]407	Valley Forge Street (D.S.)	14.51	15.41	15.66	15.98	16.41	
408	Valley Forge Street (U.S.)	14.42	15.14	15.62	15.95	16.39	
[2]501	Williamsburg Street (D.S.)	14.26	15.03	15.51	15.86	16.30	16.43
520	Williamsburg Street (U.S.) New England Street (D.S.)	15.07	15.80	16.00	16.00	16.42	
521	New England Street (U.S.) Yorktown Street (D.S.)	15.08	15.74	16.07	16.33	16.85	
522	Yorktown Street (U.S.) Bernice Lake	15.11	15.76	16.14	16.42	17.01	

[1] High Point
[2] Low Point

TABLE 4.2.1.2.f

WILLIAMSBURG BRANCH (CANAL 10-194)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
210	Confluence with Denham Acres Lateral	13.04	13.99	14.47	14.93	15.47	16.05 16.04
500	630 Ft. Upstream of Confluence	13.30	14.30	14.82	15.21	15.74	
501	1310 Ft. Upstream of Confluence	14.26	15.03	15.51	15.86	16.30	16.43 Photo
502	Murdock Avenue (D.S.)	14.68	15.37	15.79	16.17	16.59	
503	Murdock Avenue (U.S.)	15.20	16.40	16.59	16.72	16.89	
504	Lockwood Ridge Road (D.S.)	15.62	16.56	16.83	16.99	17.25	
505	Lockwood Ridge Road (U.S.)	16.07	17.02	17.55	17.91	18.63	
505A	Nelson Avenue (D.S.)	16.55	17.45	17.93	18.23	18.67	
506	Nelson Avenue (U.S.)	17.08	18.84	19.17	19.33	19.74	
507	600 Ft. Upstream of Nelson Avenue	17.15	18.95	19.28	19.39	19.83	
508	1100 Ft. Upstream of Nelson Avenue	17.88	19.00	19.33	19.57	20.23	
509	Sun Haven Lake	19.94	20.70	21.16	21.50	21.64	

TABLE 4.2.1.2.g

SHADOW LAKES FEEDER (CANAL 10-196)
SUMMARY OF EXISTING WATER SURFACE ELEVATIONS (NGVD)

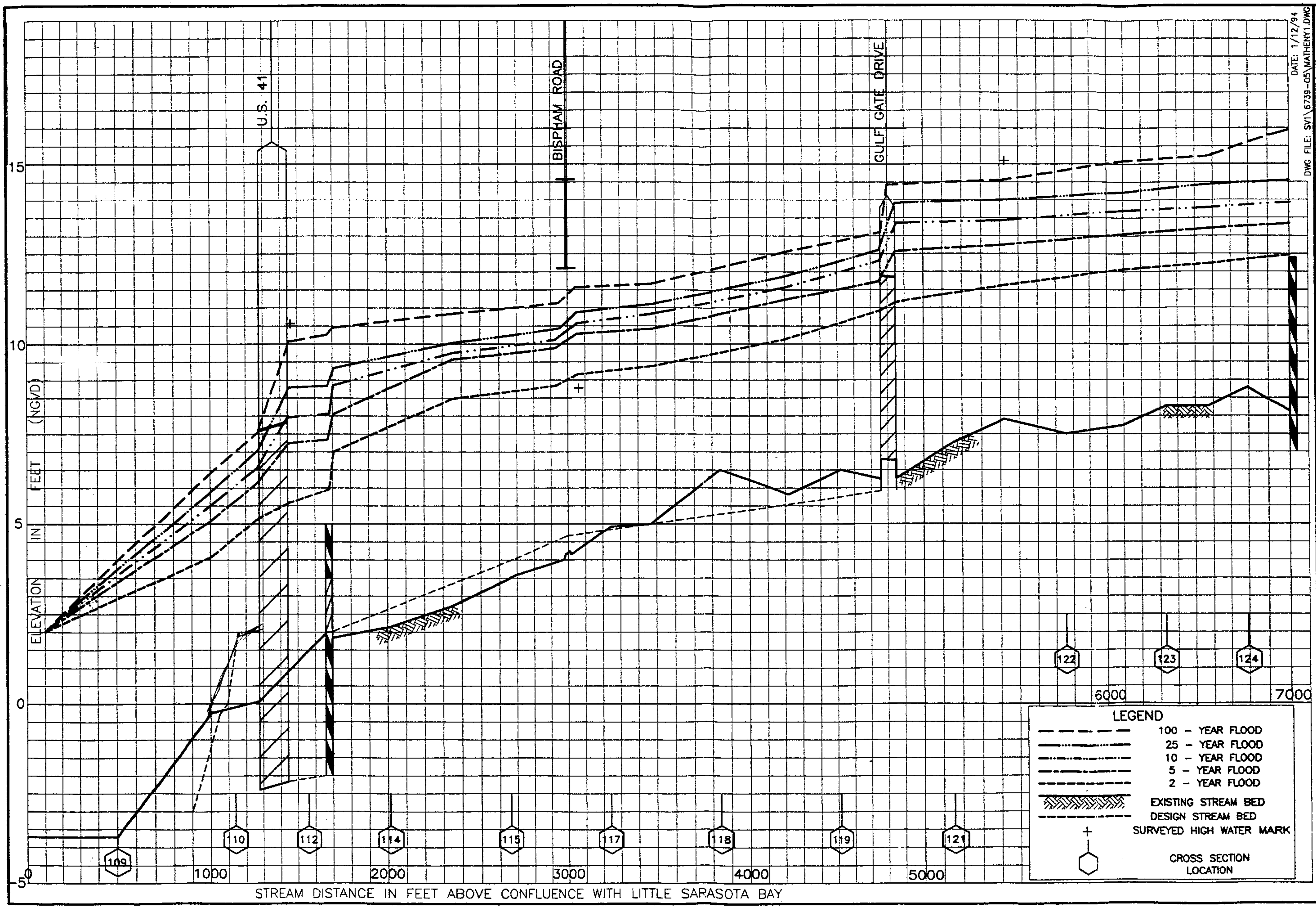
NODE	LOCATION	2-YR	5-YR	10-YR	25-YR	100-YR	JUNE 1992
405	Confluence with Gulf Gate Branch	14.36	15.10	15.32	15.61	16.05	
410	Gulf Gate Elem. School Culvert (U.S.)	16.11	16.80	16.95	17.17	18.16	
411	Lockwood Ridge Road (D.S.)	16.20	16.84	17.10	17.31	18.23	
412	Lockwood Ridge Road (U.S.)	16.34	17.10	17.49	17.87	18.34	
413	1000 Ft. Upstream of Lockwood Ridge Road	16.40	17.20	17.62	17.98	18.46	
414	1940 Ft. Upstream of Lockwood Ridge Road	16.46	17.23	17.63	18.06	18.61	18.76
415	Lake Wright	16.37	17.13	17.51	18.08	18.60	

TABLE 4.2.1.2.h

COMPARISON OF MATHENY CREEK BASIN MASTER PLAN WITH FLOOD INSURANCE STUDY

LOCATION	AREA (in acres)		DISCHARGE (in cfs)				BASE FLOOD ELEVATION (NGVD)			
			Q_{10}		Q_{100}		$W.S._{10}$		$W.S._{100}$	
	FIS	BMP	FIS	BMP	FIS	BMP	FIS	BMP	FIS	BMP
U.S. 41	1,724	1,670	380	1,289	650	1,697	3.75	8.41	4.96	10.56
WLCS - MC-1	789	not avail.	380	662	650	932	7.51	8.98	8.54	10.81
BISPHAM RD.	641	not avail.	380	459	650	592	10.67	10.61	12.15	11.77
GULF GATE DR.	592	902	230	390	410	478	13.35	13.34	14.92	14.46
WLCS - MC-2	456	461	150	247	250	356	14.89	14.42	16.27	16.00

TABLE 4.2.1.2.i

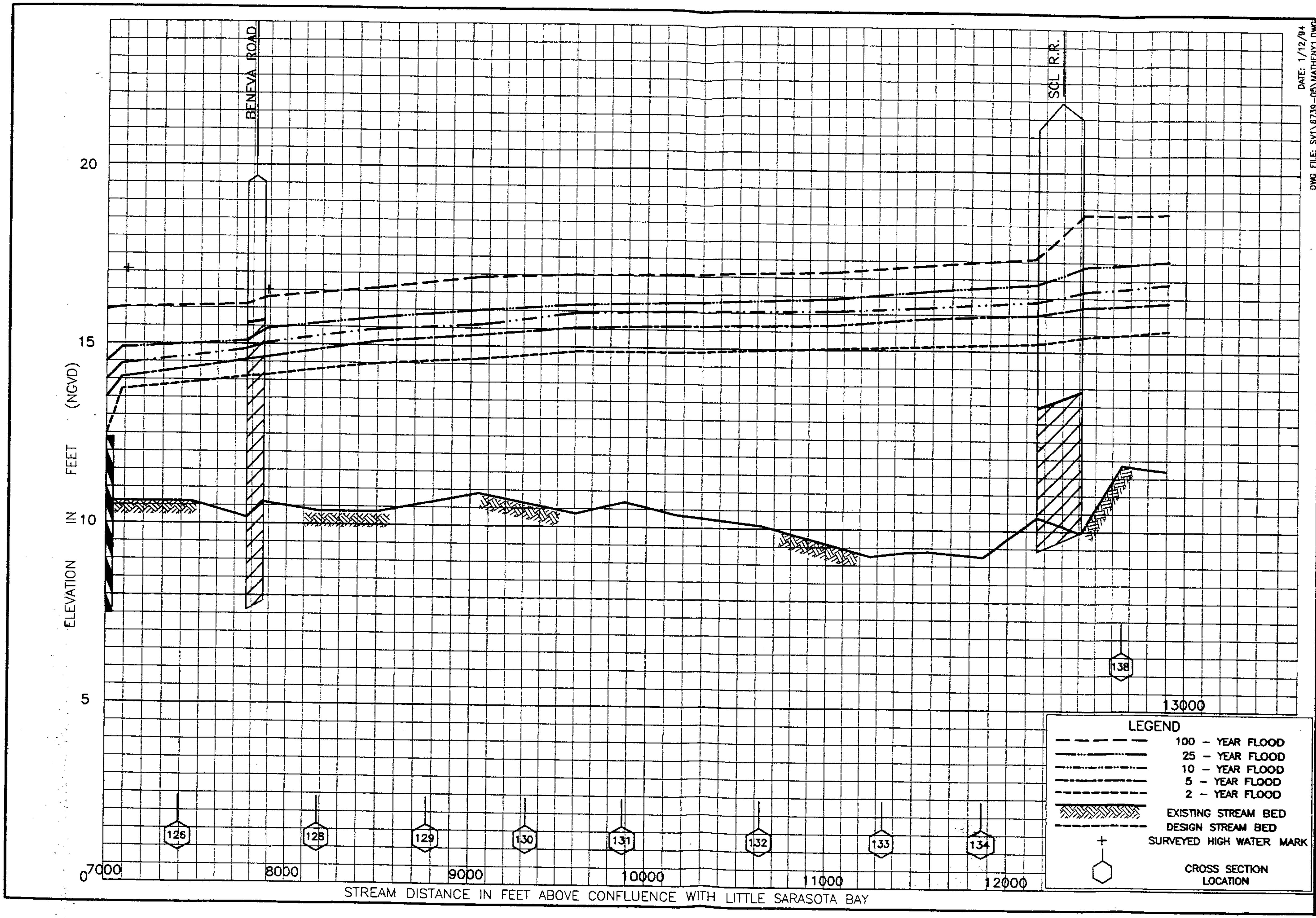


PREPARED FOR: SARASOTA BOARD OF COUNTY COMMISIONERS

PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN
LOWER MATHENY CREEK MAIN
(CANAL 10-198)

EXHIBIT 4.2.1.2.a

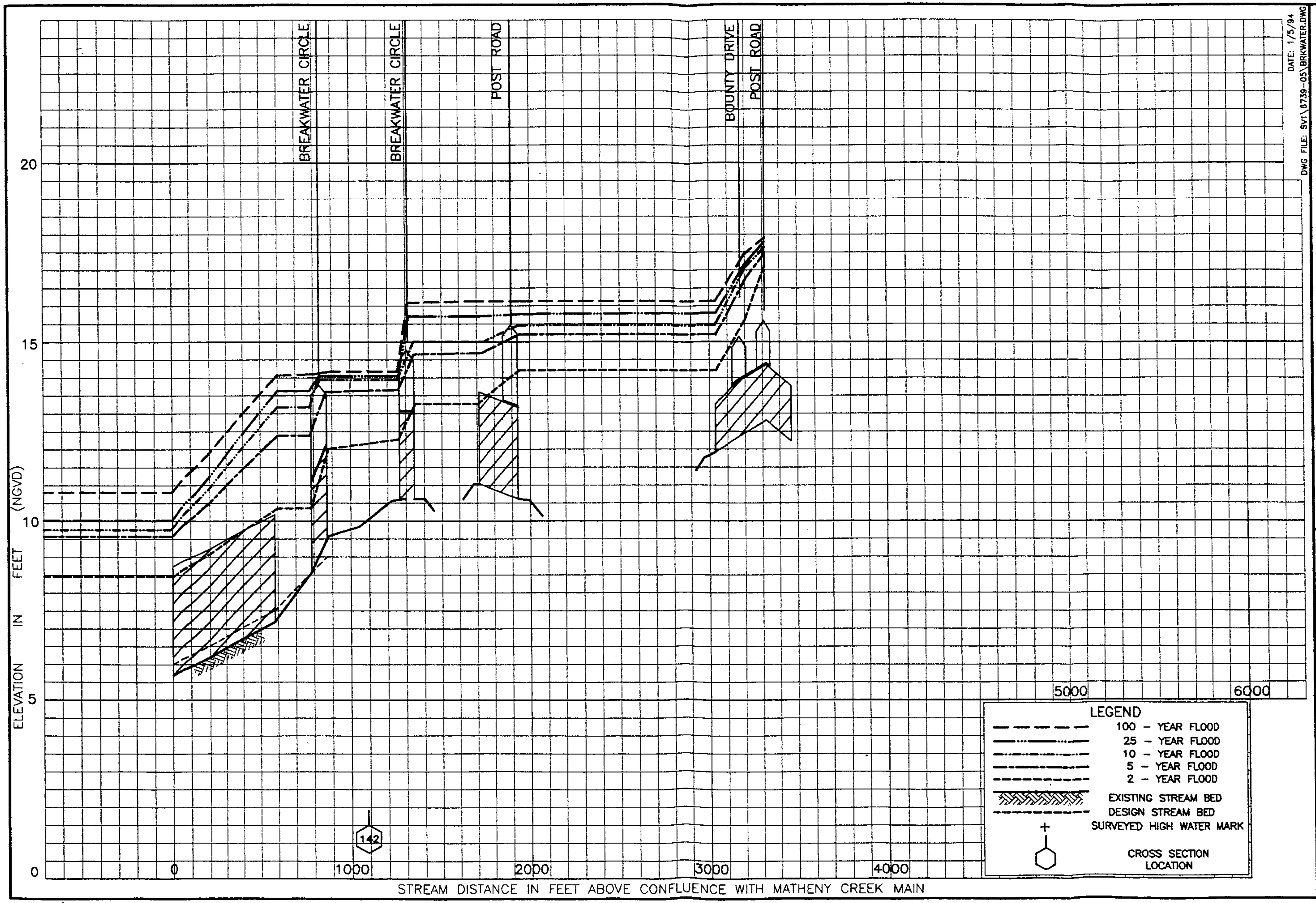


PREPARED FOR: SARASOTA BOARD OF COUNTY COMMISIONERS

PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN
UPPER MATHENY CREEK MAIN
(CANAL 10-199)

EXHIBIT 4.2.1.2.b



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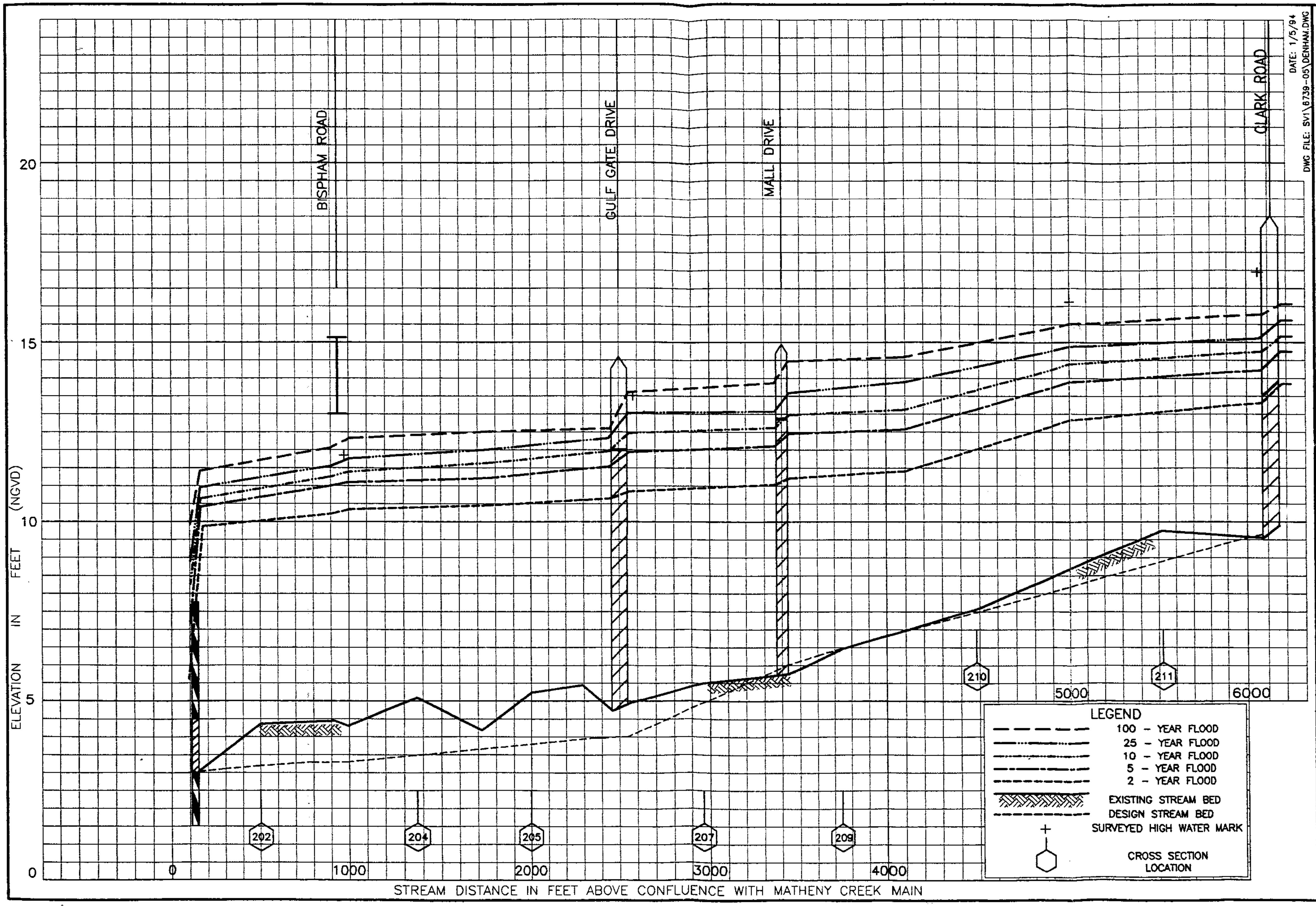
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN

BREAKWATER LATERAL

(CANAL 11-209)

EXHIBIT 4.2.1.2.c



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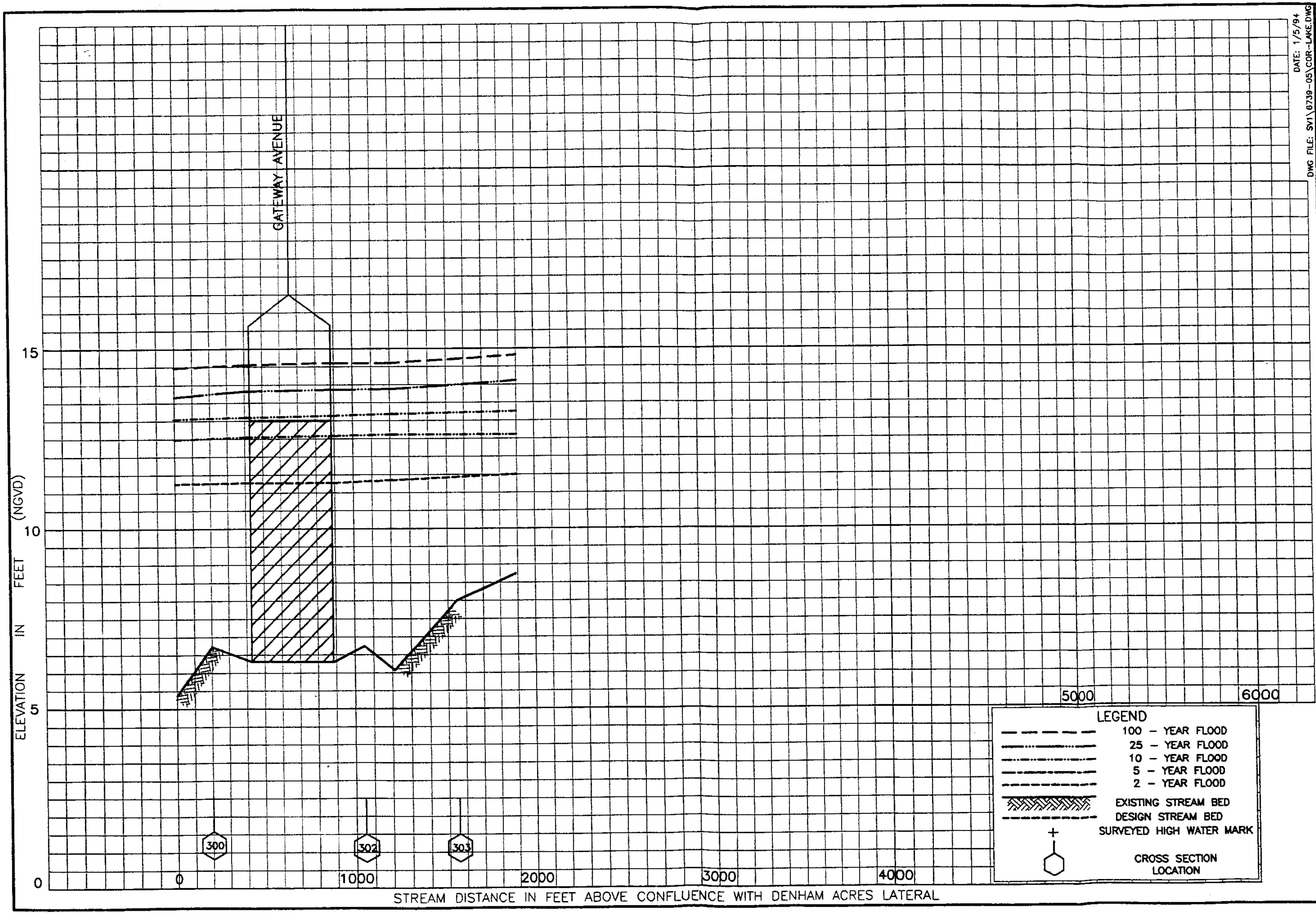
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN
DENHAM ACRES LATERAL
(CANAL 10-190)

EXHIBIT 4.2.1.2.d



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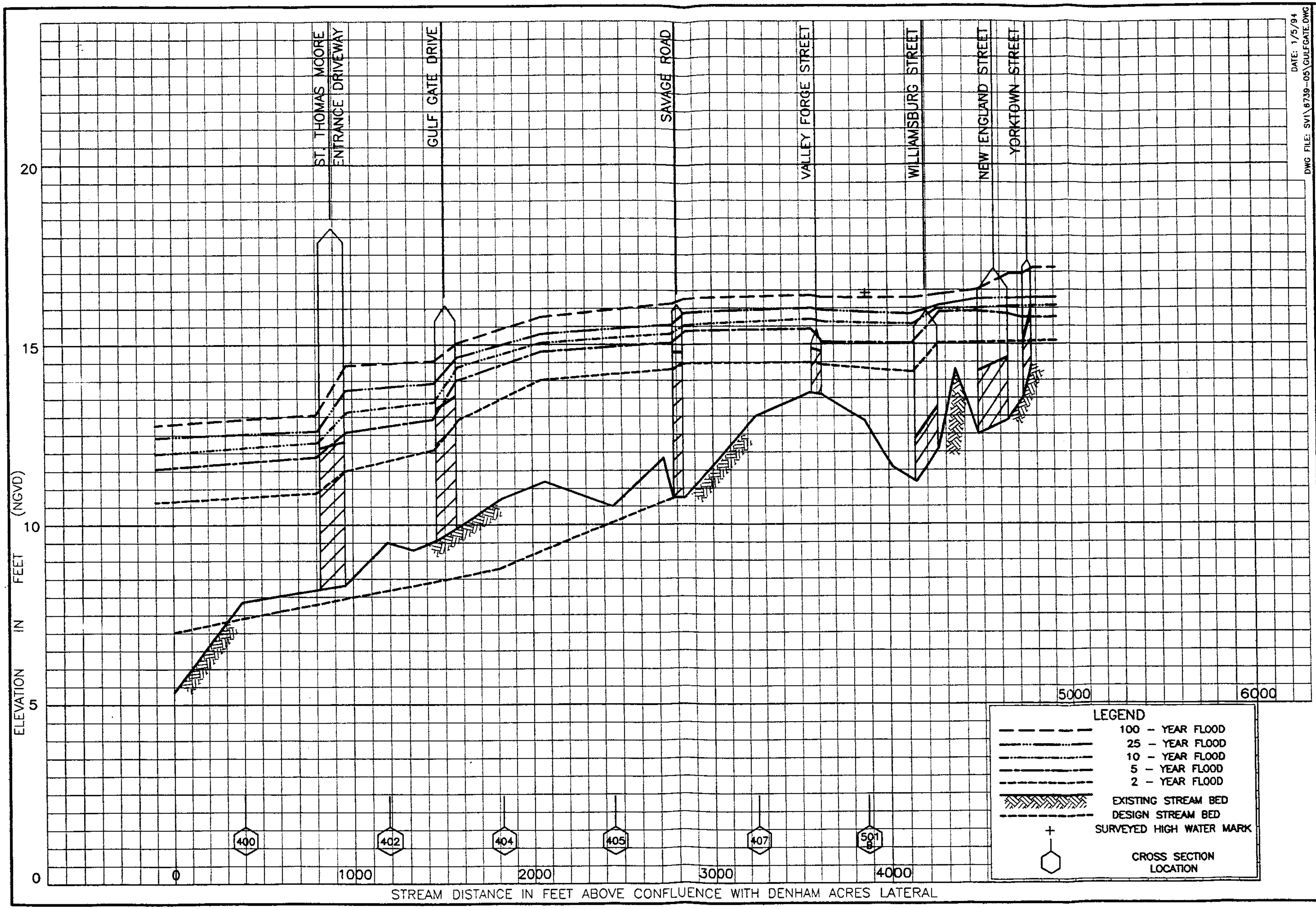
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN
CORAL LAKES BRANCH
(CANAL 11-191)

EXHIBIT 4.2.1.2.e

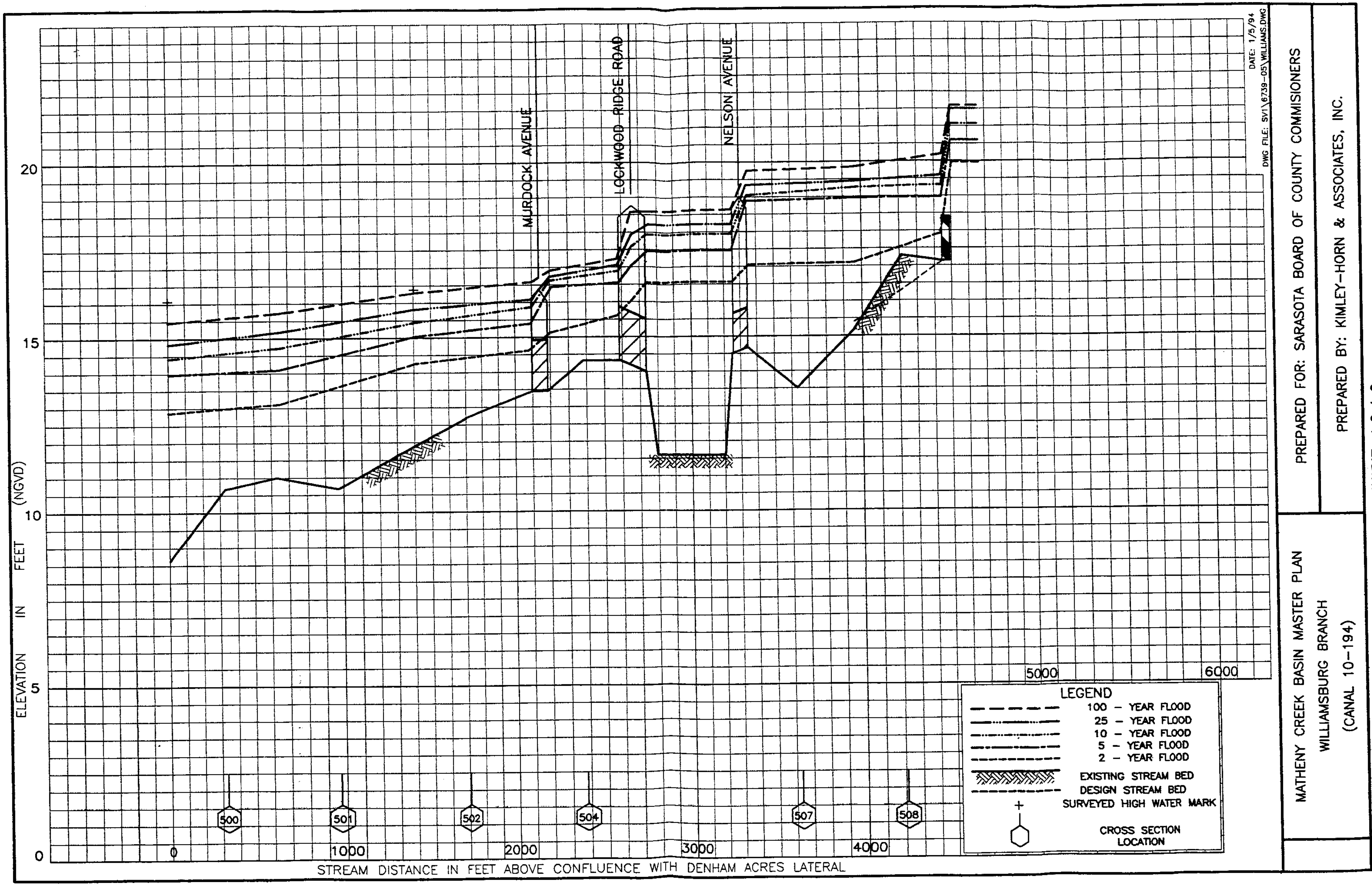


PREPARED FOR: SARASOTA BOARD OF COUNTY COMMISIONERS

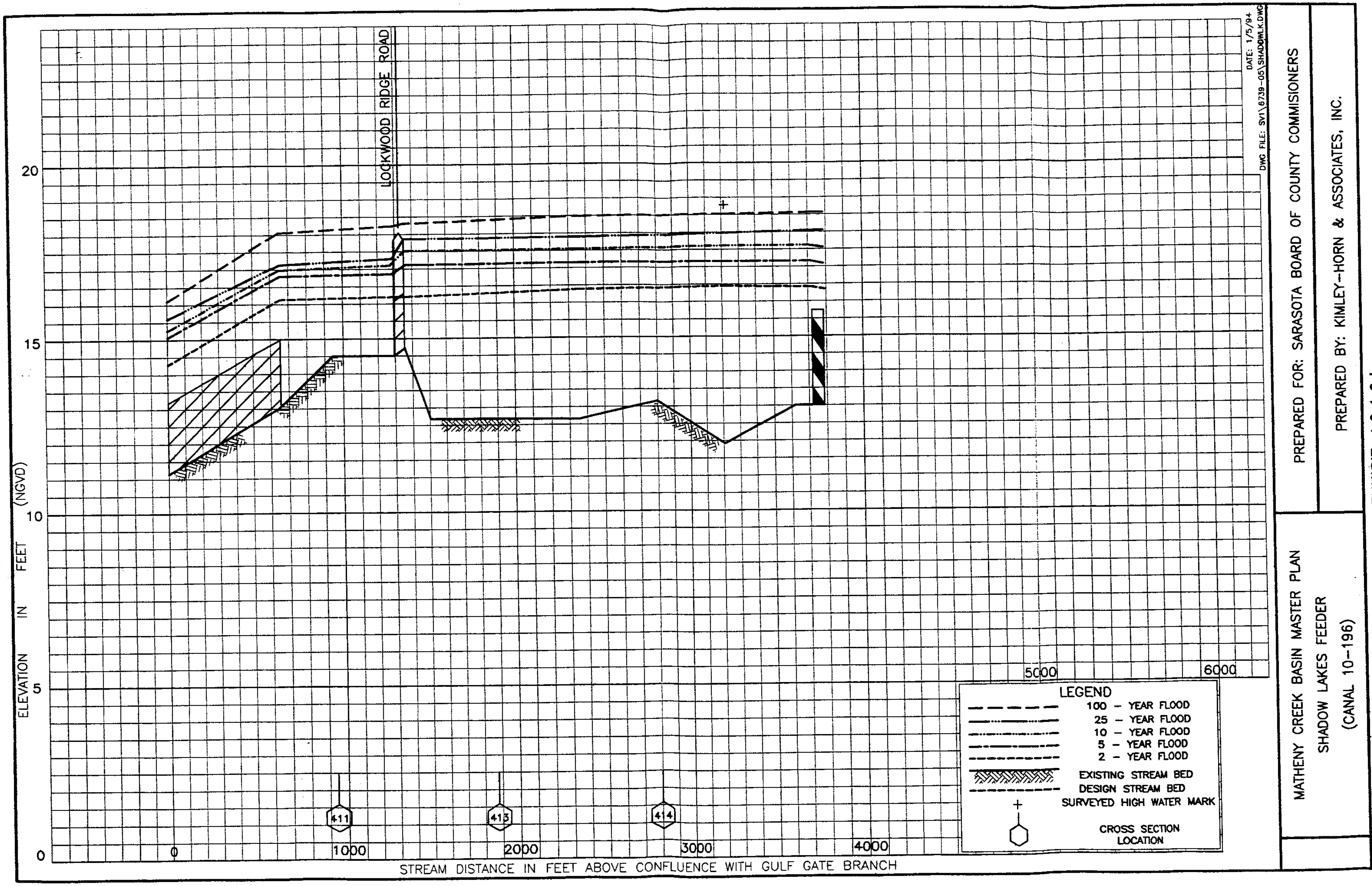
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.

MATHENY CREEK BASIN MASTER PLAN
GULF GATE BRANCH
(CANAL 10-192)

EXHIBIT 4.2.1.2.f



MURDOCK AVENUE
LOCKWOOD RIDGE ROAD
NELSON AVENUE
ELEVATION IN FEET (NGVD)
0
5
10
15
20
0
1000
2000
3000
4000
5000
6000
500
501
502
504
507
508
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH DENHAM ACRES LATERAL
LEGEND
100 – YEAR FLOOD
25 – YEAR FLOOD
10 – YEAR FLOOD
5 – YEAR FLOOD
2 – YEAR FLOOD
EXISTING STREAM BED
DESIGN STREAM BED
SURVEYED HIGH WATER MARK
CROSS SECTION LOCATION
DATE: 1/5/94
DWG FILE: SV1\6739-05\WILLIAMS.DWG
PREPARED FOR: SARASOTA BOARD OF COUNTY COMMISIONERS
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.
MATHENY CREEK BASIN MASTER PLAN
WILLIAMSBURG BRANCH
(CANAL 10-194)
EXHIBIT 4.2.1.2.g



LOCKWOOD RIDGE ROAD
ELEVATION IN FEET (NGVD)
0
5
10
15
20
0
1000
2000
3000
4000
5000
6000
411
413
414
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH GULF GATE BRANCH
LEGEND
100 - YEAR FLOOD
25 - YEAR FLOOD
10 - YEAR FLOOD
5 - YEAR FLOOD
2 - YEAR FLOOD
EXISTING STREAM BED
DESIGN STREAM BED
SURVEYED HIGH WATER MARK
CROSS SECTION LOCATION
DATE: 1/5/94
DWG FILE: SV1\6739-05\SHADOWLK.DWG
PREPARED FOR: SARASOTA BOARD OF COUNTY COMMISIONERS
PREPARED BY: KIMLEY-HORN & ASSOCIATES, INC.
MATHENY CREEK BASIN MASTER PLAN
SHADOW LAKES FEEDER
(CANAL 10-196)
EXHIBIT 4.2.1.2.h

4.2.2 POLLUTANT LOADING ANALYSIS

4.2.2.1 METHODOLOGY

For consistency, the Watershed Management Model Version 3.10 developed by Camp, Dresser & McKee (CDM) for the Sarasota County NPDES permit was used for the pollutant loading analysis. Nonpoint pollutant loading estimates were determined using the Watershed Management Model Version 3.10 (WMM) developed by Camp, Dresser, and McKee for Sarasota County. The WMM is a spreadsheet model which estimates seasonal and annual nonpoint source loads using direct runoff based upon event mean concentrations (EMC's) and runoff volumes (CDM, 1992). The model requires the identification and input of land use, septic tank, and best management practices coverages for each subbasin to be analyzed. This information is inventoried in APPENDIX C for all 154 existing subbasins.

The features of the WMM spreadsheet model are:

- Uses of the Lotus 1-2-3 spreadsheet program.
- Estimates annual runoff pollutant load for nutrients, heavy metals, oxygen demand, and solids based upon EMC's, land use, percent impervious surface, and annual rainfall.
- Estimates of stormwater treatment or load reduction through partial or full scale implementation of on site or regional Best Management Practices (BMP's).

While the WMM projects the average annual pollutant loads in a watershed, it is limited in its ability to estimate these loads. It is not appropriate to use the model for analysis of short-term water quality impacts (CDM, 1992). In addition, pollutant loads resulting from incremental development of a watershed will not be appropriately determined by the model (CDM, 1992).

4.2.2.2 RESULTS

Using the WMM spreadsheet model existing pollutant loads were determined for the Matheny Creek watershed. The model estimates pollutant loads in a watershed as the product of runoff and mean concentration in that runoff. For a given pollutant, both mean concentration and runoff will vary by land use.

A total of fifteen (15) land use categories can be used in the model (12 listed and 3 optional categories). The twelve listed categories are:

- Forest/Open
- Agricultural/Pasture
- Cropland
- Low Density Single Family (LDSF) Residential
- Medium Density Single Family (MDSF) Residential
- High Density Single Family/Multi-Family (HDSF/MF) Residential
- Commercial/Central Business District (CBD)
- Office/Light Industrial
- Heavy Industrial
- Water
- Wetlands
- Roads

The Matheny Creek watershed covers an area of approximately 1,723 acres with six (6) major subbasins, as depicted on EXHIBIT 1. Table 4.2.2.2.a summarizes the total acreages for each land use type by basin in Matheny Creek. The modeling results for the six major subbasins are provided in APPENDIX C.

The most predominant land use in the Matheny Creek watershed is MDSF Residential which comprises approximately 56% of the total acreage as shown in Figure 4.2.2.2.a. All together, residential areas comprise approximately 72% of the land use in the Matheny Creek watershed. In contrast, wetlands in the Matheny Creek watershed comprise less than 1% of the total area.

Based on the existing land uses, which include failed septic tanks, pollutant loads were estimated using the CDM model for the following twelve constituents;

- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Total Suspended Solids
- Total Dissolved Solids
- Total Phosphorus
- Dissolved Phosphorus
- Total Kjeldahl Nitrogen
- Nitrate + Nitrite
- Total Lead
- Total Copper
- Total Zinc
- Total Cadmium

Gross pollutant loads for the Matheny Creek watershed are summarized by parameter in Figure 4.2.2.2.b.

Subbasins 1 and 5 had the highest pollutant unit loading rates of the six basins in the Matheny Creek watershed (Table 4.2.2.2.b). Greater than 40% of both basins are comprised of commercial/central business district land use with both basins having a greater than 50% impervious area. In addition, less than 40% of the land use in both basins is residential. However, residential land use for the remaining basins comprises greater than 50% of the basin area. Thus, it can be concluded that the highest unit loading rate in the Matheny Creek watershed is associated with the commercial land use, and consequently, with areas with a high percentage of impervious surface. In contrast, the lowest unit loading rates were observed for Subbasin 2 which has mainly residential land use (approximately 81%) (Table 4.2.2.1.b). Therefore, based on these observations, residential land uses are believed to contribute the lowest loading per area of any developed land use within the watershed. However, because residential land use makes up 72% of the entire Matheny Creek watershed, it contributes the greatest total pollutant load to the surface waters within the watershed (Table 4.2.2.2.b).

Interestingly, the highest unit loading rates for nitrate + nitrite and total phosphorus are associated with those basins which have greater than 80% residential land use (Table 4.2.2.2.b). Sources for the nutrient-rich runoff originating from these land uses are fertilization and decaying vegetation. Unit loading rates for the remaining pollutants appear to be associated with TSS. Those basins having high TSS unit loading rates also have higher unit-loading rates of BOD, COD, TDS, TKN, and metals.

Overall, the highest gross pollutant loads were associated with the largest basins (Table 4.2.2.2.b). Subbasins 3 and 4 contributed to greater than 50% of the total pollutant load in the Matheny Creek watershed. Interestingly, residential land use for these two basins makes up greater than 55% of the area in the entire watershed.

As a result of existing mitigative features in the Matheny Creek watershed, gross pollutant loadings are reduced prior to their introduction into the surface waters. Approximately 34% of the Matheny Creek watershed is treated through Best Management Practices (BMP's). The two BMP's utilized in the Matheny Creek watershed are retention and wet detention (Table 4.2.2.2.c). Subbasin 1 utilized only retention as a means of treating stormwater. In the remaining basins, stormwater was treated using both retention and wet detention.

Table 4.2.2.2.c shows the removal of pollutants through the use of BMP's under existing conditions. In general, approximately 22% of the pollutant load is removed by the treatment systems presently in place in the Matheny Creek watershed. As expected, removal of the TDS load was the lowest for the watershed at approximately 8%.

Subbasin 1 had the lowest pollutant removal efficiency of the six basins. Overall, pollutant efficiencies for this basin were less than 9%. As stated earlier, the mitigative system in Subbasin 1 is based only on retention. Of the two treatment methods, retention is more efficient in removing pollutant loads from stormwater than wet detention. However, a very small percentage of subbasin no. 1 (i.e.5%) is serviced by retention. Because of its low percentage of BMP coverage and its close proximity to the tidal area of Matheny Creek and Little Sarasota Bay, additional stormwater treatment is expected to result in significant reductions in pollutant loads from this subbasin.

The highest removal efficiencies were estimated for Subbasin 5 with pollutant removal ranging from 24 to 41%. Both retention and wet detention treatment was utilized in treating runoff from both commercial and residential land uses.

Net pollutant loads for the Matheny Creek watershed are summarized in Table 4.2.2.2.d. In addition, net removal loading rates are graphically depicted by parameter for the Matheny Creek watershed in Figure 4.2.2.2.b.

The pollutant loadings estimated for the Matheny Creek Basin Master Plan were compared with those previously determined for the Matheny Creek watershed by CDM as part of a NPDES permit application for Sarasota County. The results of the two analyses are compared in Table 4.2.2.2.e.

In general, gross pollutant loads estimated by CDM for Matheny Creek as part of the NPDES permit application were lower than estimated by the Basin Master Plan analysis. Because the NPDES analysis used a macro approach (i.e. Matheny Creek as a basin of the Sarasota County watershed), less precise determinations of actual land use types in the Matheny Creek watershed may have resulted in these lower loading rates.

A comparison of the total acreage in the Matheny Creek watershed also indicates a discrepancy of 9 acres between the two analyses (Table 4.2.2.2.e). The total acreage used in the previous analysis is higher than for this Matheny Creek Basin Master Plan study. For the Basin Master Plan study, a "micro" approach was used to more precisely determine the area of the Matheny Creek watershed (*i.e.*, the watershed was subdivided into basins and sub-basins). In addition, by examining the watershed using a micro approach, actual land uses in the Matheny Creek watershed were more easily delineated. Although the total area determined for the Matheny Creek was slightly smaller than the previous study, the gross pollutant loads were higher than the previous estimates.

The higher pollutant loads determined for Matheny Creek for the Basin Master Plan study resulted from a greater estimate of developed regions under existing conditions. Residential (MDSF/HDSF), industrial, and road land use coverages for the Basin Master Plan were estimated to be 167 acres higher than in the previous study. The previous study estimated 71 acres more for LDSF residential and commercial land uses than were estimated by the Basin Master Plan. Estimated coverage of developed land use for the Basin Master Plan was 96 acres greater than in the previous study resulting in higher gross loading estimates.

In addition, the previous study estimated fewer BMP's throughout the Matheny Creek watershed. Overall, the previous study estimated that approximately 4.4% of the pollutant load is removed from the stormwater through the existing treatment systems. Under the present study, the removal of pollutants by existing stormwater systems is estimated to be 21.6%. Review of development plans revealed that many developments dating back to the mid 1970's, provided stormwater management systems. These systems, though approved by Sarasota County, pre-dated the subsequent regulatory requirements of the Florida Department of Environmental Protection and the Southwest Florida Water Management District. Also, because the Basin Master Plan used a "micro" approach to delineate land use types and BMP's, a more precise representation of the watershed is possible.

TABLE 4.2.2.2.a LAND USES IN MATHENY CREEK UNDER EXISTING CONDITIONS

	Basin No.						
	1	2	3	4	5	6	Total
Number of Sub-basins:	7	23	33	45	7	46	161
<u>Land Use Type (Acres):</u>							
Forest/Open	8	55	63	20	0	16	163
Agricultural/Pasture	0	0	0	0	0	0	0
Cropland	0	0	0	0	0	0	0
LDSF Residential	0	0	70	0	0	0	70
MDSF Residential	29	267	183	348	18	122	966
HDSF/MF Residential	0	3	2	89	27	84	206
Commercial/CBD	32	0	6	34	46	25	143
Office/Light Industrial	3	0	107	14	0	5	129
Heavy Industrial	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0
Wetlands	0	0	8	0	0	0	8
Roads	0	7	17	7	3	3	38
Total	73	333	456	513	94	255	1,723

TABLE 4.2.2.2.b GROSS POLLUTANT LOADS AND UNIT LOADING RATES PER BASIN IN THE MATHENY CREEK WATERSHED.

	Basins						
	1	2	3	4	5	6	Total
Drainage Area (acres)	73	333	456	513	94	255	1,723
Runoff (acre-ft/yr)	201	583	979	1,089	292	563	3,707
Gross Pollutant Loads (lbs/yr)							
Biochemical Oxygen Demand	5,460	16,723	26,741	31,255	7,995	16,068	104,242
Chemical Oxygen Demand	36,573	130,003	195,294	235,676	55,851	120,112	773,509
Total Suspended Solids	59,014	230,837	328,617	392,870	86,559	201,155	1,299,052
Total Dissolved Solids	54,776	158,539	266,117	296,152	79,302	153,022	1,007,908
Total Phosphorus	117	571	697	971	171	474	3,001
Dissolved Phosphorus	62	234	331	427	93	217	1,364
Total Kjeldahl Nitrogen	641	2,260	3,308	4,056	924	2,024	13,213
Nitrate + Nitrite	104	546	652	919	153	452	2,826
Total Lead	98	89	358	269	143	154	1,111
Total Copper	21	69	109	131	33	67	430
Total Zinc	53	80	219	193	79	105	729
Total Cadmium	1	3	5	6	2	3	20
Unit Loading Rates (lbs/yr-acre)							
Biochemical Oxygen Demand	75	50	59	61	85	29	60
Chemical Oxygen Demand	503	391	428	459	596	7	449
Total Suspended Solids	812	694	720	766	924	2	754
Total Dissolved Solids	754	477	583	577	847	1	585
Total Phophorus	1.62	1.72	1.53	1.89	1.82	0.00	1.74
Dissolved Phosphorus	0.85	0.70	0.72	0.83	0.99	0.46	0.79
Total Kjeldahl Nitrogen	8.82	6.80	7.25	7.91	9.86	9.33	7.67
Nitrate + Nitrite	1.43	1.64	1.43	1.79	1.63	0.22	1.64
Total Lead	1.34	0.27	0.78	0.52	1.53	0.34	0.64
Total Copper	0.29	0.21	0.24	0.26	0.35	0.44	0.25
Total Zinc	0.74	0.24	0.48	0.38	0.84	1.57	0.42
Total Cadmium	0.015	0.009	0.011	0.011	0.017	0.029	0.011

TABLE 4.2.2.2.c POLLUTANT LOADING REDUCTIONS PER BASIN UTILIZING EXISTING BMP'S IN THE MATHENY CREEK WATERSHED.

Constituents (lbs/yr)	Basin No.						
	1	2	3	4	5	6	Total
Biochemical Oxygen Demand	335	3,202	4,555	3,572	2,383	1,970	16,016
Chemical Oxygen Demand	2,103	28,774	51,179	37,315	18,681	15,200	153,253
Total Suspended Solids	3,113	61,655	111,684	79,177	33,376	27,386	316,393
Total Dissolved Solids	3,438	22,020	2,742	12,898	18,805	16,791	76,695
Total Phosphorus	5	128	182	154	55	55	582
Dissolved Phosphorus	3	63	140	98	39	31	376
Total Kjeldahl Nitrogen	36	432	559	461	268	236	1,993
Nitrate + Nitrite	4	151	256	209	64	60	745
Total Lead	8	21	181	67	59	30	367
Total Copper	1	17	44	29	13	10	115
Total Zinc	4	17	66	33	29	17	167
Total Cadmium	0.1	0.6	1.5	1.0	0.5	0.4	4
Mitigation Type	Retention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	

Removal Efficiencies (CDM, 1992):

Retention — 90% efficiency for all constituents.

Wet Detention — Biochemical Oxygen Demand = 30%; Chemical Oxygen Demand = 50%; Total Suspended Solids = 70%, Total Dissolved Solids = 0%, Total Phosphorus = 50%, Dissolved Phosphorus = 80%, Total Kjeldahl Nitrogen = 30%, Nitrate + Nitrite = 80%; Total Lead = 80%, Total Copper = 75%, Total Zinc = 50%, Total Cadmium = 50%.

TABLE 4.2.2.2.d ESTIMATED TOTAL POLLUTANT LOADING FOR SURFACE RUNOFF IN THE MATHENY CREEK WATER SHED, SARASOTA COUNTY, FLORIDA.

Parameters	Gross Load[a]	Removal[b]	Net Load[c]
Total Drainage Area (acres)	1,723	-----	1,723
Total Impervious Area (acres)	638	-----	638
Total Surface Runoff (acre-ft/yr)	3,707	-----	3,707
Biochemical Oxygen Demand (lbs/yr)	104,242	16,016	88,226
Chemical Oxygen Demand (lbs/yr)	773,509	153,253	620,256
Total Suspended Solids (lbs/yr)	1,299,052	316,393	982,659
Total Dissolved Solids (lbs/yr)	1,007,908	76,695	931,213
Total Phosphorus (lbs/yr)	3,001	582	2,419
Dissolved Phosphorus (lbs/yr)	1,364	376	988
Total Kjeldahl Nitrogen (lbs/yr)	13,213	1,993	11,220
Nitrate + Nitrite (lbs/yr)	2,826	745	2,081
Total Lead (lbs/yr)	1,111	367	744
Total Copper (lbs/yr)	430	115	315
Total Zinc (lbs/yr)	729	167	562
Total Cadmium (lbs/yr)	20	4	16

[a] Gross Load - Total pollutant load with no conveyance of runoff through a stormwater management system.

[b] Removal - Mass of pollutants removed from stormwater by BMP's.

[c] Net Load - Total pollutant load after treatment by BMP's.

TABLE 4.2.2.2.e A COMPARISON OF POLLUTANT LOADING RATES ESTIMATED FOR THE MATHENY CREEK WATERSHED AS PART OF THE NPDES APPLICATION AND FOR THIS STUDY.

	CDM NPDES (1,732 Acres)			THIS STUDY (1,723 Acres)		
Constituents (lbs/yr)	Gross Load	Net Load	Removal Efficiency	Gross Load	Net Load	Removal Efficiency
Biochemical Oxygen Demand	99,526	97,169	2.4%	104,242	88,226	15.4%
Chemical Oxygen Demand	718,425	693,022	3.5%	773,509	620,256	19.8%
Total Suspended Solids	1,244,581	1,190,848	4.3%	1,299,052	982,659	24.4%
Total Dissolved Solids	974,632	974,632	0.0%	1,007,908	931,213	7.6%
Total Phosphorus	2,856	2,785	2.5%	3,001	2,419	19.4%
Dissolved Phosphorus	1,298	1,231	5.2%	1,364	988	27.6%
Total Kjeldahl Nitrogen	12,600	12,335	2.1%	13,213	11,220	15.1%
Nitrate + Nitrite	2,729	2,633	3.5%	2,826	2,081	26.4%
Total Lead	1,050	914	13.0%	1,111	744	33.3%
Total Copper	401	378	5.7%	430	315	26.7%
Total Zinc	701	657	6.3%	729	562	22.9%
Total Cadmium	18	18	4.3%	20	16	20.0%

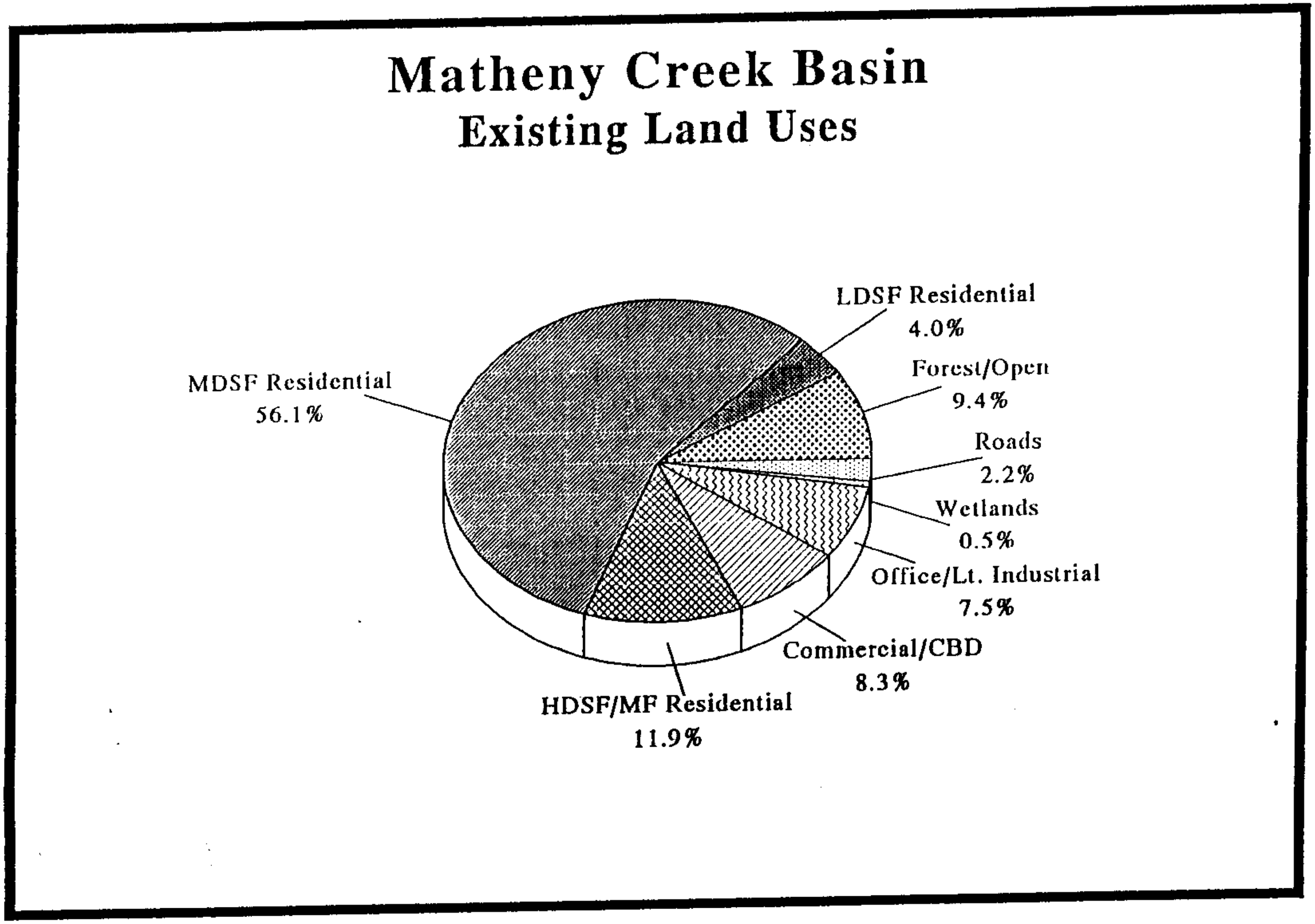
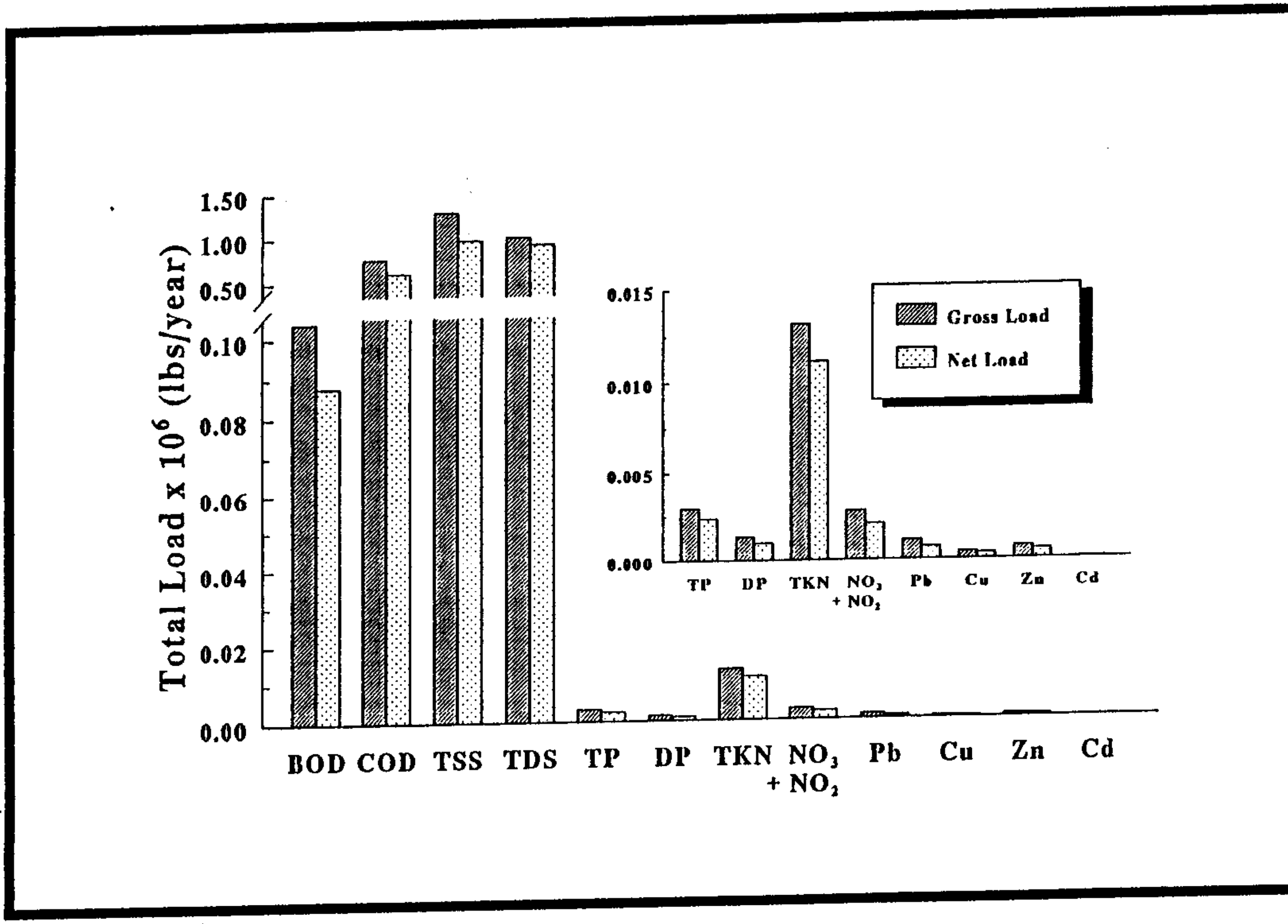


FIGURE 4.2.2.2.A



Estimated Gross Pollutant Loads and Net Pollutant Loads for the Matheny Creek Watershed

FIGURE 4.2.2.2.B

5.0 LEVEL OF SERVICE

This section presents water quantity and water quality level of service objectives and deficiencies for the Matheny Creek drainage basin.

5.1 LEVEL OF SERVICE OBJECTIVES

5.1.1 FLOOD PROTECTION LEVEL OF SERVICE OBJECTIVES

The flood protection level of service (FPLOS) objectives proposed for the Matheny Creek drainage basin are based upon those adopted by Sarasota County Comprehensive Plan Amendment RU-24 and are consistent with that recently developed by the five Florida Water Management Districts and the Florida Department of Environmental Protection (FDEP) during workshops held in 1993 for application throughout the State of Florida.

TABLE 5.1.1 presents the proposed FPLOS for the Matheny Creek drainage basin. Flood protection and floodplain management within the Matheny Creek drainage basin are also subject to applicable Federal and State regulations as briefly discussed below:

5.1.1.1 FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

In September of 1992, the Sarasota Board of County Commissioners adopted regulatory requirements for unincorporated Sarasota County pursuant to Ordinance No. 92-055 relative to floodplain management and minimum finished floor elevations. This Ordinance as adopted qualifies unincorporated Sarasota County for the Federal Flood Insurance Program. Regulatory floodplain maps for the Matheny Creek Main were also adopted by reference. The FEMA floodplain maps are based upon the 100-year storm.

5.1.1.2 STATE OF FLORIDA

The State of Florida is currently proposing amendments to Chapter 17-40, F.A.C., Water Policy requiring the State Water Management Districts to determine flood elevations for priority floodplains. At a minimum, this is to include the 100-year return flood levels.

With respect to flood protection design criteria, the Florida Department of Transportation currently requires control of the 100-year storm pursuant to Chapter 14-86, F.A.C. The Southwest Florida Water Management District currently utilizes the 25-year design storm for flood protection and control but requires compensation for encroachments and displacements of the 100-year floodplain pursuant to Chapters 40D-4 and 40D-40, F.A.C. As previously indicated, the Southwest Florida Water Management District, in cooperation with the other four

Florida Water Management Districts and the Florida Department of Environmental Protection, has developed conceptual Flood Protection Level of Service objectives based upon flooding frequency up to and including the 100-year event. This FPLOS was used as a basis for Sarasota County Comprehensive Plan Amendment RU-24 and the Matheny Creek Basin Master Plan.

PROPOSED
FLOOD PROTECTION LEVEL OF SERVICE CRITERIA

FLOODING REFERENCE (BUILDINGS, ROADS AND SITES)	LEVEL OF SERVICE (FLOOD INTERVALS ARE IN YEARS)
I. BUILDINGS: Pre-FIRM or Post-FIRM structures are at or above the flood water elevation.	
A. Emergency shelters and essential services	>100
B. Habitable	100
C. Employment/Service Centers	100
II. ROAD ACCESS: roads shall be passable during flooding. Roadway flooding ≤ 6" depth at the outside edge of pavement is considered passable.	
A. Evacuation	>100
B. Arterials	100
C. Collectors	25
D. Neighborhood	10

III. The water quantity level of service can be adjusted to allow for greater amounts of flooding of roads and sites if the flooding does not adversely impact public health and safety, natural resources or property. The level of service for improvements to existing roadways may be adjusted based on existing conditions such as adjacent topography and economic impacts.

ACCEPTABLE FLOODING CRITERIA

ROADWAYS	10-YR	25-YR	100-YR
A. Evacuation	NONE	NONE	NONE
B. Arterials	NONE	NONE	6 inches
C. Collectors	NONE	6 inches	9 inches
D. Neighborhood	6 inches	9 inches	12 inches

TABLE 5.1.1

5.1.2 WATER QUALITY LEVEL OF SERVICE OBJECTIVES

Currently, water quality is presumed to satisfy level of service standards if the runoff from the first inch of rainfall is treated through stormwater retention or detention facilities designed and constructed in accordance with accepted criteria. This level of service criteria is only applicable to new development. In the case of the Matheny Creek basin, an estimated 60% of the watershed has previously been developed without implementation of any stormwater treatment methods, and less than 10% of the basin remains undeveloped. Therefore, different level of service objectives may be appropriate in order to improve or even maintain water quality.

For guidance in establishing more appropriate and site specific water quality level of service objectives for the Matheny Creek basin, four developing programs/policies were investigated. These include the Sarasota County National Pollution Discharge Elimination System (NPDES) permit program, the National Estuary Program for Sarasota Bay, the currently evolving Florida State Water Policy, and Florida Department of Environmental Protection's Non-point Source Assessment. A brief description of each of these four water quality programs is provided below:

5.1.2.1 SARASOTA COUNTY'S NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES)

In 1987 the "Federal Water Pollution Control Act", U.S. Public Law 92-500, was amended to stipulate that the existing NPDES permit program also applies to stormwater runoff. In 1990 the Federal Environmental Protection Agency issued regulations for implementation of the amendment. These regulations generally require that the impact of urban development on water quality be reduced to the "maximum extent practical". Specifically, these regulations require the preparation of an extensive baseline inventory of water quality at certain stormwater discharge points including ditches, paved channels, and man-made canals that discharge into the Waters of the United States, as well as development of a water quality management plan that will meet federal standards.

Sarasota County is required to obtain a NPDES Permit for the discharge of stormwater into Waters of the United States. In July 1993, unincorporated Sarasota County in cooperation with the incorporated municipalities (i.e. City of Sarasota, City of Venice, City of North Port, City of Longboat Key) and the Florida Department of Transportation, submitted a comprehensive stormwater quality management program (permit application) to the U.S. Environmental Protection

Agency.

Sarasota County is scheduled to receive a NPDES permit from the Federal Environmental Protection Agency in July of 1994. This permit will stipulate what measures are to be implemented to provide reasonable assurance that impacts of existing and future urban development on water quality will be reduced to the "maximum extent possible". It is expected that the permit will stipulate specific pollutant load reduction goals.

5.1.2.2 NATIONAL ESTUARY PROGRAM FOR SARASOTA BAY

In July of 1988 Sarasota Bay was selected by the U.S. Environmental Protection Agency for inclusion in the National Estuary Program. The National Estuary Program brings together knowledge from citizen and technical advisory groups, governmental agencies and staff, and elected officials to promote bay protection and enhancement. On June 26, 1989 the Sarasota Bay Program was officially initiated with the signing of a five-year interagency agreement between local, state and federal government agencies. This agreement specified that the Program would produce three major documents: The *State of the Bay Report* in 1990, the *Framework for Action* in 1992 and the *Comprehensive Conservation and Management Plan* in 1994.

Goals identified as part of the Sarasota Bay Program which are relevant to the subject study include:

- Improve water transparency
- Reduce the quantity and improve the quality of stormwater runoff

The publication of the *Framework for Action* in 1992 identified several water quality management strategies which included:

- Continue policy of AWT, reuse, and deepwell injection in the study area.
- Develop density restrictions/cluster development strategies to limit the amount of new impervious area, and thus runoff, in the watershed.
- Implement the Sarasota County wastewater plan for consolidation of the existing package plants and small utilities into a centralized wastewater-treatment system that will achieve AWT standards.
- Connect 80% of the existing septic tanks to the centralized sewer

system.

Other management strategies noted but not investigated included.

- Restoration of channelized areas.
- Retrofitting existing development with stormwater BMP's.

To date, the Sarasota Bay Program has not established a method for evaluating the effectiveness of watershed load reductions on the achievement of Sarasota Bay Program goals. Therefore the *Framework for Action* does not provide "target" reductions or a basis for recommending one loading reduction alternative over another. However, based upon discussions with Sarasota County and the National Estuary Program technical staff, it is anticipated that the *Comprehensive Conservation and Management Plan* scheduled for publication in 1994 will recommend target watershed pollutant load reduction goals (PLRG's), as well as preventative programs.

In a letter to the Sarasota County Stormwater Environmental Utility Advisory Committee from the Sarasota Bay National Estuary Program Director dated June 6, 1994, the following baywide Pollutant Load Reduction Goals for stormwater were identified for the contributing SBNEP watershed.

BAYWIDE POLLUTANT LOAD REDUCTION GOALS FOR SBNEP WATERSHED

Nutrient (Nitrogen)	Toxins
7%	27%

TABLE 5.1.2

The Florida Yards and Neighborhoods program, currently being finalized in association with the Cooperative Extension Service, is an example of a preventative program actively being supported by the Sarasota Bay Project. The Florida Yards and Neighborhood program is aimed at educating homeowners and residents of pollution prevention measures such as xeroscaping, lawn management, water conservation, etc.

5.1.2.3 FLORIDA STATE WATER POLICY

Florida State Water Policy is contained within Chapter 17-40, Florida Administrative Code. The Florida Department of Environmental Protection is currently proposing amendments for 1994 to Chapter 17-40. As part of the proposed amendments, the Southwest Florida Water Management District must develop water body specific pollutant reduction goals for non-SWIM bodies on a priority basis according to a schedule provided in the District's Water Management Plan. Priority consideration shall be given to water bodies that are required to obtain a NPDES municipal stormwater discharge permit. Sarasota County was required to obtain a NPDES permit. The Matheny Creek basin is included within the Sarasota County NPDES permit application which was submitted in July of 1993. The receiving water body for the Matheny Creek basin is Little Sarasota Bay, a non-SWIM water body.

Pursuant to Section 403.0891, F.S. State Water Policy, the Florida Department of Environmental Protection, the Southwest Florida Water Management District, and Sarasota County are required to cooperatively implement on a watershed basis, a comprehensive stormwater management program designed to minimize the adverse effects of stormwater on land and water resources. Further, programs are to be implemented in a manner that will improve and restore the quality of waters that do not meet state water quality standards and maintain the quality of those waters which meet or exceed state water quality standards. To accomplish these objectives for the Matheny Creek drainage basin, pollutant load reduction goals (estimated numeric reductions in pollutant loadings as needed to preserve or restore designated uses of receiving waters and maintain water quality consistent with applicable state standards) are to be established by the Southwest Florida Water Management District.

In 1993, water quality level of service criteria (WQLOS) were developed during workshops for possible application throughout the State of Florida by the Florida Department of Environmental Protection and the five (5) Water Management Districts. This WQLOS is based upon a system which considers the effectiveness and extent of the BMPs within a watershed. Specifically, the adequacy of water quality treatment for each land parcel is denoted by a multiplier. The multiplier is a numerical measure between 0 and 5, with 5 corresponding to lands with native vegetation which are designated and protected as preservation areas.

A multiplier of 4 denotes areas with an advanced level of stormwater treatment (i.e. no less than 150% of the required stormwater quality treatment).

A multiplier of 3 comprises stormwater treatment systems which improves the quality of stormwater runoff to meet or exceed state water quality standards (i.e. no less than 100% of the required stormwater quality treatment).

A multiplier of 2 consists of a best management practices system which improves the quality of stormwater runoff but may not meet state water quality standards (i.e. between 50% and 100% of the required stormwater quality treatment volume).

A multiplier of 1 also consists of a limited best management practices system which improves the quality of stormwater runoff but may not meet state water quality standards (i.e. between 25% and 50% of the required stormwater quality treatment volume).

A multiplier of 0 applies to areas with few if any stormwater best management practices (i.e. less than 25% of the required stormwater quality treatment volume).

A watershed water quality index (WQI) is computed as the area average of multipliers for all lands in the watershed. The watershed WQI is used to determine the water quality level of service (WQLOS) as illustrated in the following table.

WQLOS	A	B	C	D	E	F
WQI	WQI = 5	5>WQI≥4	4>WQI≥3	3>WQI≥1	2>WQI≥1	WQI<1

A preliminary assessment of the Matheny Creek Watershed resulted in a WQI of 1.02 and a WQLOS of E based upon the following assumptions:

- 34% watershed BMP coverage provides stormwater quality treatment which meets or exceeds state water quality standards.
- Watershed does not contain any designated preserve areas.
- WQI = .34 (3) + .66 (0) = 1.02

5.1.2.4 <u>FLORIDA NONPOINT SOURCE ASSESSMENT</u>

In 1988 the Florida Department of Environmental Protection (formerly the Department of Environmental Regulation) published the 'Florida Nonpoint Source Assessment'. This publication presented general assessments of water quality within Florida watersheds based upon a compilation of input from local, regional, state and federal sources. From the database, nonpoint sources, surface water symptoms, and pollutants were estimated for each watershed. A water quality rating system was also developed consisting of five categories: good, suspected, threatened, moderate, and severe. Each watershed was given a water quality rating. These five categories correspond to differing degrees of water quality impairment as identified below.

Water Quality Rating System

Good	No impairment of the water body's designated use throughout the water body.
Suspected	No known impairment from pollution of the water body's designated use, throughout the water body, but knowledge indicates that the water body may be experiencing impairment in part or in all of its aerial extent from non-point causes.
Threatened	No current impairment from pollution of the water body's designated use throughout the water body but knowledge indicates: 1. an existing or potential downward trend in water quality that, in the absence of additional management, will lead to use impairment in some or all portions of the water body within the next five (5) years, or 2. will lead to degradation of an "Outstanding Florida Waters" or Florida Wild and Scenic River.
Moderate	Some interference with designated uses of the water body from pollution but impairment is not throughout the water body's entirety.
Severe	Designated use of water body is precluded for the entire water body.

With respect to the Matheny Creek basin, the 1988 Florida Nonpoint Source Assessment indicated likely sources of pollutants to be urbanization and septic tanks. Surface water symptoms identified were turbidity/siltation and oxygen depletion. Pollutants identified included sediments, nutrients, bacteria, debris, and habitat alteration. Matheny Creek was given a water quality rating of severe.

It should be noted that the Florida Department of Environmental Protection is currently in the process of soliciting information for the purpose of updating the Florida Nonpoint Source Assessment. Input recently provided by Sarasota County indicated that the Matheny Creek basin would have an impairment rating of threatened. Nonpoint sources identified by Sarasota County included wastewater, septic tanks, municipal urban stormwater, land development construction, removal of riparian vegetation, waste storage/storage tank leaks, highway maintenance and runoff, and recreational activities. Turbidity was identified as a surface water symptom and nonpoint source pollutants include nutrients, bacteria, sediments and oxygen depletion.

The discrepancy between the SEVERE rating in the 1988 Nonpoint Source Assessment and the THREATENED rating recently indicated by Sarasota County may be attributable to inaccurate and/or out-of-date information being utilized for the former.

With respect to WQLOS under this criteria, a severe rating would warrant a clear objective of improving existing water quality while a threatened rating would warrant an objective of maintaining or improving existing water quality.

5.2 LEVEL OF SERVICE DEFICIENCIES

5.2.1 FLOOD PROTECTION LEVEL OF SERVICES DEFICIENCIES

Water quantity level of service deficiencies are identified for each of the major subbasins in the Matheny Creek basin in TABLES 5.2.1.a through 5.2.1.e. A brief discussion of these deficiencies for each subbasin is provided below:

5.2.1.1 U.S. 41 SUBBASIN

The level of modeling detail did not reveal any apparent flood protection level of service deficiencies in this small subbasin.

5.2.1.2 LOWER MATHENY CREEK SUBBASIN

As summarized in TABLE 5.2.1.a, no emergency shelters/essential services or employment/service centers are anticipated to be susceptible to flooding up to and including the 100-year design storm. However, 7 habitable structures are estimated to be susceptible to flooding during the 25-year design event and 14 habitable structures are estimated to be flood prone during the 100-year design storm. Flooding of habitable structures was estimated by comparing site computed flood elevations with SWFWMD 1-ft. contour maps. The final determination of flood susceptibility of structures should be subject to field survey measurements of finished floor elevations.

With respect to road access, two (2) designated collectors roads and eleven (11) designated neighborhood roads were determined to be deficient from the proposed level of service objectives for flood protection. These deficiencies are highlighted on TABLE 5.2.1.a.

Most of the flood protection level of service (FPLOS) deficiencies in this subbasin could generally be resolved by addressing inadequate conveyance throughout the Breakwater Lateral system which services the Gulf Gate Golf Course area and outfalls through Woodside South Condominium and by addressing inadequate conveyance at the Gulf Gate Drive crossing of Matheny Creek Main. One other item noted on TABLE 5.2.1.a which should be resolved through conveyance improvements throughout the Breakwater Lateral system is the apparent cross basin flows to the overtaxed Elligraw Bayou drainage basin which occur during the 100-year design storm.

5.2.1.3 UPPER MATHENY CREEK SUBBASIN

TABLE 5.2.1.b indicates that this subbasin does not contain any apparent level of service deficiencies with respect to structures. However, seven (7) neighborhood roads fall below the proposed FPLOS objectives. The extent of these road access deficiencies are noted on TABLE 5.2.1.b.

Most of the road access level of service deficiencies occur within the Gulf Gate East subdivision and result from inadequate internal conveyance. Resolution of internal conveyance deficiencies may be problematic in that it may also require mitigation of the resulting increased runoff to the Upper Matheny Creek Main. However, noting that the Upper Matheny Creek Main has accumulated +2 feet of sediment along its entire length, it may be first worthwhile to investigate the resulting relief to the road access level of service deficiencies gained by restoring the canal invert to its original design grade.

5.2.1.4 DENHAM ACRES LATERAL SUBBASIN

Gulf Gate Elementary School is a designated hurricane shelter and is located within this subbasin. Based upon the analyses, it would not be susceptible to flooding for up to and including the 100-year design storm. However, as indicated in TABLE 5.2.1.c, the 100-year design storm would inundate an estimated 14 habitable structures and 5 employment/service center buildings. This structure flooding is predicted to occur in portions of Trinity Village Condominium and Colonial Terrace Subdivision. Again, the final determination of structures flood susceptibility should be subject to field survey measurements of finished floor elevations.

Lockwood Ridge Road through this subbasin is a designated Hurricane Evacuation Route. The analyses indicated that this road is susceptible to flooding during the 100-year design storm at two locations. A portion of Gulf Gate Drive, a designated collector road, is also estimated to be susceptible to flooding during the 5, 10, 25, and 100 year design storms. In addition to these apparent level of service deficiencies, seven (7) neighborhood roads throughout the subbasin do not meet the proposed FPLOS. The specific areas of deficiency are indicated on TABLE 5.2.1.c.

Other than FPLOS deficiencies resulting from the Clark Road system to the north, it is anticipated that most deficiencies in this subbasin result from inadequate conveyance, maintenance and accessibility of the Williamsburg Branch, the Gulf

Gate Branch, and the Shadow Lakes Feeder.

5.2.1.5 CORAL LAKES BRANCH SUBBASIN

The Gulf Gate Fire Station was determined to be an essential service in this subbasin. Based upon the analyses, it is not susceptible to flooding for all events up to and including the 100-year design storm. However, 8 habitable structures and 7 employment/service center buildings are estimated to be susceptible to flooding during the 100-year design storm, as indicated in TABLE 5.2.1.d. This structure flooding is predicted to occur surrounding the intersection of Gateway Avenue and Mall Drive as well as in portions of Coral Lake Condominium and Gulf Gate Manor. Final determination of structure flood susceptibility should be subject to field survey measurements of finished floor elevations.

TABLE 5.2.1.d also summaries road access FPLOS deficiencies within the Coral Lakes Branch subbasin. These FPLOS deficiencies include Gateway Avenue, a designated collector road, and four (4) neighborhood roads. It should be noted that all deficient roads within this subbasin are flooded approximately 2 feet during the 100-year design storm.

Since much of the FPLOS deficient areas within this subbasin are located within historical flood prone (i.e. low-lying) areas, efforts to resolve these deficiencies may ultimately need to include conveyance improvements within the Denham Acres Lateral.

5.2.1.6 CLARK ROAD SUBBASIN

As indicated on TABLE 5.2.1.e, it is estimated that 25 habitable structures and 2 employment/service center buildings within this subbasin do not meet the proposed FPLOS. These deficiencies primarily occur along the north side of Clark Road in portions of Los Lagos Condominium, Summerside Condominium, and an unplatted subdivision along Blount Avenue. In addition, the eastern portion of Swifton Villas appears especially susceptible to flooding. Final determination of structure flood susceptibility should be subject to field survey measurements of finished floor elevations.

Clark Road through this subbasin is a designated Hurricane Evacuation Route. The existing conditions analyses indicate that the portion of this roadway generally located between Swift Road and Nutmeg Avenue is extremely susceptible to flooding. In addition, Lockwood Ridge Road, a designated collector in this subbasin, and twelve (12) neighborhood roads do not meet the proposed FPLOS, as indicated on Table 5.2.1.e.

It is anticipated that a combination of storage upstream of Clark Road and increased conveyance capacity to the Clark Road drainage system is needed to resolve the FPLOS deficiencies identified in this subbasin. In addition, increased storage capacity and conveyance in the Denham Acres Lateral subbasin may be warranted to fully implement improvements in this subbasin. It should be noted that a preliminary analysis of the future Clark Road conditions indicates that these improvements are not expected to result in increased flood levels downstream. However, this analysis is very preliminary and does not accurately reflect the implications of the loss of storage presently existing along both sides of the present two lane roadway.

Finally, it is estimated that this subbasin contains three (3) cross basin flow locations to the Phillippi Creek basin. In addition to the two (2) locations identified on TABLE 5.2.1.e (Britania Road/Britania Drive and Grafton Street/Cambell Street), cross basin flows to the Phillippi Creek basin are also expected to occur through Swifton Villas. Resolution of the FPLOS deficiencies in this subbasin should address the cross basin flow transfers as well.

LOWER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(EXISTING CONDITIONS)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Florida Cities Wastewater Treatment Plant						
B. Habitable		0	0	0	7	15
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials						
• U.S. 41	14.5	5.9	7.6	8.4	9.0	10.6
C. Collectors						
• Gulf Gate Drive	13.5	11.3	12.6	13.3	13.9	14.5
• Lockwood Ridge Road	13.9	11.9	13.0	13.8	14.6	14.9
D. Neighborhood						
• Bright Creek Drive	11.2	10.3	12.3	13.2	13.6	14.1
• Willow Tree Drive	12.8	10.3	12.3	13.2	13.6	14.1
• Grey Squirrel Boulevard	13.0	10.3	12.3	13.2	13.6	14.1
• Breakwater Circle East	14.5	13.3	14.6	15.0	15.8	16.2
Southeast	13.6	14.3	15.2	15.5	15.8	16.2
• Bounty Drive	15.0	15.7	16.8	17.0	17.2	17.5
• Cass Street	15.1	14.3	15.2	15.5	*15.8	*16.2
• Cardwell Way	14.5	14.3	15.2	15.5	*15.8	*16.2
• Bluewater Avenue	15.6	13.9	15.0	15.5	16.2	17.0
• Kenmore Drive	16.1	14.2	15.5	16.1	16.7	17.6
• Keystone Drive	16.1	14.8	16.0	16.6	17.2	18.1

* Cross Basin Flows to Elligraw Bayou

673905-2.D28(MTY-RPT)

TABLE 5.2.1.a

FPLOS Deficiency

UPPER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(EXISTING CONDITIONS)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	28.3	24.1	24.7	25.0	25.3	25.9
B. Arterials						
• Beneva Road	17.2	14.2	14.7	15.0	15.5	16.5
C. Collector						
• Sawyer Road		15.3	16.2	16.7	17.3	18.3
D. Neighborhood						
• Roxbury Drive	14.4	14.1	14.6	15.0	15.3	16.2
• Waterford Circle	17.3	15.9	17.0	17.4	17.7	18.5
• Kingston Loop	17.3	16.0	17.1	17.5	18.2	18.8
• Kingston Blvd. Southeast	17.8	16.8	18.4	18.8	19.0	19.2
North	17.5	15.8	16.9	17.4	17.9	18.6
East	17.8	15.8	16.9	17.5	18.0	18.7
• Easton Lane	17.8	16.8	18.4	18.8	19.0	19.2
• Easton Court	17.8	16.6	18.1	18.6	18.8	19.1
• Easton Street	17.8	16.0	17.2	17.8	18.2	18.8

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TABLE 5.2.1.b

FPLOS Deficiency (shaded cells: Roxbury Drive 10-YR, 25-YR, 100-YR; Waterford Circle 100-YR; Kingston Loop 25-YR, 100-YR; Kingston Blvd. Southeast 10-YR, 25-YR, 100-YR; North 100-YR; Easton Lane 10-YR, 25-YR, 100-YR; Easton Court 10-YR, 25-YR, 100-YR)

DENHAM ACRES LATERAL SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(EXISTING CONDITIONS)

I. BUILDINGS (No. of Structures below)			2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)							
• Gulf Gate Elementary School							
B. Habitable			1	2	2	4	9
C. Employment/Service Centers			0	0	0	0	1
II. ROAD ACCESS (Elevation)		**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation							
• Lockwood Ridge Road	North	18.5	16.6	17.5	17.9	18.2	18.7
	South	17.8	16.3	17.1	17.5	17.9	18.3
B. Arterials (not applicable)							
C. Collectors							
• Gulf Gate Drive		13.4	12.9	14.0	14.3	14.7	15.1
D. Neighborhood							
• Anchor Way		13.4	14.0	14.8	15.0	15.3	15.8
• Harbour Drive		12.5	12.1	13.0	13.4	13.9	14.6
• Concord Street		14.0	14.3	15.0	15.5	15.9	16.3
• Valley Forge Street	West	13.8	13.0	14.0	14.5	14.9	15.5
	East	15.1	14.5	15.4	15.7	16.0	16.4
• Rowena Street		18.5	17.1	18.8	19.2	19.3	19.7
• Nelson Avenue		17.1	17.1	18.8	19.2	19.3	19.7

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TABLE 5.2.1.c

FPLOS Deficiency

CORAL LAKES BRANCH SUBBASIN
FLOOD CONTROL LEVEL OF SERVICE DEFICIENCIES
(EXISTING CONDITIONS)

I. BUILDINGS (No. of Structures below)			2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services							
• Gulf Gate Fire Station							
B. Habitable			0	0	0	4	11
C. Employment/Service Centers			0	0	0	1	7
II. ROAD ACCESS (Elevation)		**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)							
B. Arterials (not applicable)							
C. Collectors							
• Gateway Avenue		13.3	11.7	12.8	13.5	14.0	14.7
		12.7	11.5	12.6	13.2	14.0	14.6
D. Neighborhood							
• Terry Lane	Northeast	12.8	11.9	13.4	14.1	14.6	15.2
	South	12.3	11.5	12.5	13.1	13.6	14.4
• Linda Street		13.3	11.9	13.4	14.1	14.6	15.2
• Mall Drive		12.7	11.5	12.6	13.2	13.9	14.6

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TABLE 5.2.1.d

░ FPLOS Deficiency

CLARK ROAD SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(EXISTING CONDITIONS)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters (not applicable)						
B. Habitable		1	4	7	10	12
C. Employment/Service Centers		0	0	0	1	2
II. ROAD ACCESS (Elevation)	E/P	2-YR	5-YR	10-YR	25-YR	100-YR
A. Evacuation						
• Clark Road	17.0	16.9	17.2	17.3	17.6	17.8
	17.3	16.9	17.2	17.3	17.7	18.1
	16.9	17.0	17.2	17.2	17.7	18.1
	17.1	17.8	18.2	18.2	18.3	18.5
	19.9	16.9	17.2	17.3	17.7	20.3
	21.0	16.9	21.2	21.4	21.5	21.6
B. Arterials (not applicable)						
C. Collectors						
• Lockwood Ridge Road	20.9	20.0	20.5	20.7	20.9	21.2
D. Neighborhood						
• Britania Road/Britania Drive	14.6	*15.8	*16.1	*16.2	*16.3	*16.8
• Nutmeg Avenue	16.7	17.9	18.2	18.3	18.4	18.6
• Murdock Avenue	18.0	18.5	18.7	18.8	18.9	19.0
• Blount Avenue	21.3	20.9	22.0	22.3	22.4	22.5
• West Wind Lane	21.5	21.0	22.1	22.4	22.6	22.7
• Mohawk Street	22.8	24.7	25.1	25.2	25.4	25.7
• Arapaho Street	24.3	24.7	25.1	25.2	25.4	25.7
• McCallum Terrace	24.9	25.1	25.4	25.6	25.6	25.7
• Grafton Street	24.5	25.1	25.4	*25.6	*25.6	*25.7
• Cambell Street	24.5	25.1	25.4	*25.6	*25.6	*25.7

* Cross Basin Flows to Phillippi Creek

673905-5.D28(MTY-RPT)

TABLE 5.2.1.e

FPLOS Deficiency

5.2.2 WATER QUALITY LEVEL OF SERVICE DEFICIENCIES

Based upon discussion with, and correspondence from the SBNEP, Stormwater Pollutant Load Reduction Goals (PLRGs') of 7% for nutrient (nitrogen) loads and 27% for toxin loads are to be proposed baywide by the SBNEP. Based upon the Pollutant Loading Analyses performed for existing conditions, the following PLRGs' would be warranted for the Matheny Creek drainage basin.

POLLUTANT LOAD REDUCTION GOALS (WQLOS DEFICIENCIES)

PARAMETER	POLLUTANT LOAD (in lbs/yr)	
	Existing	PLRG
TKN	11,220	10,435
$NO_2 + NO_3$	2,081	1,935
TSS	982,659	717,341
Lead	744	543
Copper	315	230
Zinc	562	410
Cadmium	16	12

TABLE 5.2.2.a

The results of the existing conditions pollutant loading analyses are provided in APPENDIX C and are summarized by parameter and basin/subbasin in TABLE 5.2.2.b.

POLLUTANT LOADING ANALYSIS - SUMMARY OF RESULTS

Basin		Runoff (acre-ft/yr)	BOD (lbs/yr)	COD (lbs/yr)	TSS (lbs/yr)	TDS (lbs/yr)	Total-P (lbs/yr)	Dissolved-P (lbs/yr)	TKN (lbs/yr)	NO3 + NO2 (lbs/yr)	Lead (lbs/yr)	Copper (lbs/yr)	Zinc (lbs/yr)	Cadmium (lbs/yr)
	Loading Factors	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Basin Matheny 1	Drainage Area (acres)	73	73	73	73	73	73	73	73	73	73	73	73	73
	Impervious Area (acres)	39	39	39	39	39	39	39	39	39	39	39	39	39
	% Impervious	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%
	Total Gross Load	201	5,460	36,573	59,014	54,776	117	62	641	104	98	21	53	1
	Total Net Load	201	5,125	34,469	55,901	51,338	112	58	604	100	89	20	49	1
	% Pollutant Removal		6.1%	5.8%	5.3%	6.3%	4.4%	5.5%	5.7%	4.0%	8.3%	6.1%	7.7%	6.5%
Basin Matheny 2	Drainage Area (acres)	333	333	333	333	333	333	333	333	333	333	333	333	333
	Impervious Area (acres)	89	89	89	89	89	89	89	89	89	89	89	89	89
	% Impervious	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%	26.6%
	Total Gross Load	503	16,723	130,003	230,037	158,530	571	234	2,260	546	89	69	80	3
	Total Net Load	503	13,521	101,229	169,181	136,519	442	170	1,828	395	68	51	63	2
	% Pollutant Removal		19.1%	22.1%	26.7%	13.9%	22.5%	27.2%	19.1%	27.7%	23.4%	25.3%	21.1%	21.9%
Basin Matheny 3	Drainage Area (acres)	456	456	456	456	456	456	456	456	456	456	456	456	456
	Impervious Area (acres)	168	168	168	168	168	168	168	168	168	168	168	168	168
	% Impervious	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%
	Total Gross Load	979	26,741	195,294	328,617	266,117	697	331	3,308	652	358	109	219	5
	Total Net Load	979	22,187	144,115	216,933	263,374	514	190	2,749	396	177	65	153	4
	% Pollutant Removal		17.0%	26.2%	34.0%	1.0%	26.2%	42.5%	16.9%	39.3%	50.6%	40.6%	30.0%	28.9%
Basin Matheny 4	Drainage Area (acres)	513	513	513	513	513	513	513	513	513	513	513	513	513
	Impervious Area (acres)	186	186	186	186	186	186	186	186	186	186	186	186	186
	% Impervious	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%	36.2%
	Total Gross Load	1,089	31,255	235,676	392,870	296,152	971	427	4,056	919	269	131	193	6
	Total Net Load	1,089	27,683	198,361	313,693	283,254	817	329	3,595	710	202	102	160	5
	% Pollutant Removal		11.4%	15.8%	20.2%	4.4%	15.9%	23.0%	11.4%	22.7%	25.0%	22.0%	16.9%	16.4%
Basin Matheny 5	Drainage Area (acres)	94	94	94	94	94	94	94	94	94	94	94	94	94
	Impervious Area (acres)	58	58	58	58	58	58	58	58	58	58	58	58	58
	% Impervious	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%	61.9%
	Total Gross Load	292	7,995	55,851	86,559	79,302	171	93	924	153	143	33	79	2
	Total Net Load	292	5,612	37,170	53,182	60,497	116	55	656	89	85	20	50	1
	% Pollutant Removal		29.8%	33.4%	38.6%	23.7%	32.2%	41.5%	29.0%	41.7%	40.9%	40.0%	36.4%	34.7%
Basin Matheny 6	Drainage Area (acres)	255	255	255	255	255	255	255	255	255	255	255	255	255
	Impervious Area (acres)	98	98	98	98	98	98	98	98	98	98	98	98	98
	% Impervious	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%	38.4%
	Total Gross Load	563	16,068	120,112	201,155	153,022	474	217	2,024	452	154	67	105	3
	Total Net Load	563	14,098	104,912	173,769	136,231	418	186	1,788	391	123	57	87	3
	% Pollutant Removal		12.3%	12.7%	13.6%	11.0%	11.6%	14.2%	11.7%	13.4%	19.7%	14.4%	16.6%	13.7%
Matheny Creek	Total Gross Load	3,687	103,653	768,984	1,291,415	1,002,454	2,981	1,355	13,139	2,806	1,107	427	725	19
	Total Net Load	3,687	87,638	615,712	975,023	925,760	2,401	980	11,146	2,062	740	312	560	15
	Total Pollutant Removal		16,016	153,252	316,392	76,693	581	375	1,993	744	367	114	165	4
	% Pollutant Removal Efficiency		15.5%	19.9%	24.5%	7.7%	19.5%	27.7%	15.2%	26.5%	33.1%	26.8%	22.8%	21.1%

TABLE 5.2.2.b

6.0 ALTERNATIVE SOLUTIONS TO UPGRADING LEVEL OF SERVICE

Conceptual alternatives developed to address both flood protection and water quality level of service deficiencies in each subbasin are presented herein. Initially, the following strategies might be worthy of investigation from a basin-wide perspective.

(1) Require all new public and private development within the study area to conform with the Level of Service objectives of the Matheny Creek Basin Master Plan. The effectiveness of this strategy may be somewhat limited due to the fact that this basin is already over 90% developed.

(2) Encourage regional common-use stormwater management facilities over small single-use facilities wherever feasible.

(3) Develop a basin-wide maintenance program. To this end, schedules for sediment removal and vegetation harvesting should be established for stormwater management facilities.

(4) Pro-actively investigate the re-use of treated wastewater effluent from the Florida Cities Gulf Gate Wastewater treatment plant. Currently, this AWA plant has a direct discharge to the tidal portion of Matheny Creek just west of U.S. 41. The pollutant loading analysis estimated in the NPDES permit application for this point source indicated significant annual pollutant loads from this source and therefore a substantial opportunity exists for the reduction of pollutant loads through effluent re-use. Florida Cities has indicated a willingness to provide effluent irrigation water to the Gulf Gate golf course which surrounds it. Significant pollutant load reductions may be attainable through such re-use activities.

(5) Pro-actively encourage and possibly assist in the connection of existing septic tanks in the Matheny Creek watershed to the Florida Cities wastewater treatment plant.

(6) Pro-actively participate in the Florida Yards and Neighborhoods program.

(7) Enhance the pollutant removal efficiencies of all existing, man-made stormwater storage and conveyance facilities to the maximum extent practical.

(8) Prohibit the perpetuation of open swale enclosures without assurances of both adequate conveyance provisions and water quality mitigation.

Specific capital improvement projects for each subbasin are identified below for consideration.

6.1 CONCEPTUAL ALTERNATIVES INVESTIGATED

6.1.1 U.S. 41 SUBBASIN

6.1.1.1. FLOOD PROTECTION

(1) None

6.1.1.2. WATER QUALITY

(1) Provide a regional stormwater treatment facility west of U.S. 41 and south of Matheny Creek bulkhead in cooperation with the Florida Department of Transportation. This facility could service future needs of U.S. 41 as well as those of subbasin areas 04030, 04040, 04050, and 04060.

(2) Provide a regional stormwater treatment facility in existing open space area of subbasin area 04010. This facility could service the needs of subbasin

areas 04010, 04011, and possibly the southern portion of subbasin area 04020.

(3) Provide a regional stormwater treatment facility in the vacated site located north of Cass Way and east of U.S. 41. This facility could service the future needs of U.S. 41 as well as those of subbasin area 04020.

(4) Clean, reshape and revegetate in-stream segment from downstream end of bulkhead (west of U.S. 41) to Matheny Creek Main and Denham Acres Lateral water level control structures, MC-1 and DL-1, respectively.

6.1.2 LOWER MATHENY CREEK SUBBASIN

6.1.2.1 FLOOD PROTECTION

(1) Improve conveyance at Matheny Creek Main and Gulf Gate Drive.

(2) Improve inlet capacity at intersection of Lockwood Ridge Road and Markridge Road.

(3) Increase equalizer and outfall culverts to and from Mirror lake, respectively.

(4) Increase Breakwater Lateral outfall culvert (through Woodside South Condominium).

(5) Increase conveyance at Breakwater Lateral and Breakwater Circle.

(6) Increase conveyance at intersection of Bounty Drive and Post Road.

(7) Expand Gulf Gate Golf Course Lakes.

(8) Increase conveyance capacity and maintainability of Breakwater Lateral between Breakwater Circle West and Breakwater Circle East.

(9) Provide additional storage in open space area along the south side of Gulf Gate Subdivision, Unit No. 8 and along the north side of Siesta Heights Subdivision.

(10) Provide storage facility in open space area located in the northeast portion of Woodside South and west of Gulf Gate Unit No. 8.

6.1.2.2 WATER QUALITY

(1) Provide outfall structure at downstream end of Gulf Gate Golf course lakes to maximize pollutant removal efficiency.

(2) Open up closed outfall for Breakwater Lateral to the extent possible.

(3) Modify Mirror Lake outfall structure as necessary to maximize pollutant removal efficiency.

(4) Modify Lower Matheny Creek Main outfall structure to enhance pollutant removal efficiency.

(5) Divert untreated area along Boline Drive to Mirror Lake.

(6) Reshape and maintain open ditch between Gulf Gate Drive and Lockwood Ridge Road (Regatta Feeder).

(7) Open to the extent possible, reshape, and maintain ditch between Regatta Circle and Bowline Drive (Markridge Feeder).

(8) Provide a regional stormwater treatment facility in available open space located in subbasin area 04151 (east of Lockwood Ridge Road, north of Goodwater Street, and west of Bluewater Avenue). This regional facility could service portions of Gulf Gate Elementary School, Lockwood Ridge Road, and depending on existing water table depths, could be equalized with Mirror Lake to assist in providing treatment for its service area.

6.1.3 UPPER MATHENY CREEK SUBBASIN

6.1.3.1. FLOOD PROTECTION

(1) Remove sediment accumulation in upper Matheny Creek main (i.e. restore bottom profile to design invert).

(2) Expand southern Winn-Dixie lake westward to the railroad spur.

(3) Create a definitive ridge between upper Matheny Creek subbasin and the Catfish Creek basin by elevating future McIntosh Road to elevation 21.5 NGVD, minimum.

(4) Enhance storage capacity of upper Matheny Creek Main.

(5) Increase conveyance capacity at Kingston Boulevard and Tract B.

(6) Increase equalizer conveyance between Tract B lake and Tract C lake in Gulf Gate East.

(7) Expand Tract C lake to the extent possible.

(8) Increase conveyance capacity from Tract F lake in Gulf Gate East to Matheny Creek Main. Increase equalizer conveyance between Tract F lake, Tract E lake and Tract D lake in Gulf Gate East.

(9) Divert outfall from Roxbury Drive to downstream end of water level control structure MC-2.

6.1.3.2 WATER QUALITY

(1) Provide stormwater treatment facilities within open space floodplain areas along the south side of the upper Matheny Creek Main to service subbasin areas 04127C, 04128, 04129, 04173, and 04132. Divert untreated runoff from south Beneva Road to regional facility shared by subbasin areas 04127C and 04138.

(2) Modify outfall structures from Gulf Gate East subdivision to maximize pollutant removal efficiency.

(3) Modify outfall structures from Beneva Oaks subdivision to maximize pollutant removal efficiency.

(4) Test, remove, and properly dispose of sediment accumulation in upper Matheny Creek Main. Reshape canal banks to minimize erosion and scouring.

(5) Enhance values and functions of impacted wetlands on northern half of Publix Warehouse site.

6.1.4 DENHAM ACRES LATERAL SUBBASIN

6.1.4.1 FLOOD PROTECTION

(1) Re-construct existing water level control weir at Denham Acres Lateral (DL-1) outfall for more efficient conveyance.

(2) Increase conveyance capacity at Denham Acres Lateral and Gulf Gate Drive.

(3) Increase conveyance capacity at Denham Acres Lateral and Mall Drive.

(4) Investigate feasibility of constructing water level control structure south of Mall Drive in Denham Acres Lateral and excavating Denham Acres Lateral upstream of said water level control structure as originally proposed in 1967 by Smally, Wellford and Nalven.

(5) Increase conveyance capacity of Denham Acres Branch with concrete wall at or above the 2-year flood level.

(6) Extend Gulf Gate Branch south along the east side of St. Thomas Moore church and under Gulf Gate Unit 6 Subdivision to Lower Matheny Creek Main.

(7) Increase conveyance capacity at Gulf Gate Branch and the entrance to St. Thomas Moore church.

(8) Increase conveyance capacity at Gulf Gate Branch and Gulf Gate Drive.

(9) Increase conveyance capacity of Shadow Lakes Feeder at Lockwood Ridge Road and along the north side of Gulf Gate School.

(10) Construct a flood storage facility along the east side of the Gulf Gate Branch in existing open space located in the western portion of Gulf Gate Elementary School.

(11) Replace and increase efficiency of equalizer culverts between Lake Irene and Wright Lake.

(12) Elevate Valley Forge Street 12 inches at Gulf Gate Branch crossing.

(13) Improve conveyance in Gulf Gate Branch between Williamsburg Street and New England Street.

(14) Increase conveyance capacity at Gulf Gate Branch and Valley Forge Street.

(15) Increase conveyance capacity at Gulf Gate Branch and Williamsburg Street.

(16) Increase conveyance capacity at Williamsburg Branch and Murdock Avenue.

(17) Increase conveyance capacity at Williamsburg Branch and Lockwood Ridge Road.

(18) Increase conveyance capacity at Williamsburg Branch and Nelson Avenue.

(19) Construct vehicular/pedestrian crossing at Williamsburg Branch and Colonial Street with sufficient conveyance.

(20) Line banks of Williamsburg Branch with concrete at or above the 2-year flood level.

(21) Develop a flood protection abatement plan.

6.1.4.2 WATER QUALITY

(1) Modify/Reconstruct existing water level control structure in Denham Acres Lateral to enhance it's pollutant removal efficiency.

(2) Provide a regional stormwater treatment facility in the wooded open space area located east of the Denham Acres Lateral and south of the Gulf Gate Branch. Divert untreated runoff from subbasin areas 04204, 0400A, and 0400B to this regional facility.

(3) Provide a regional stormwater treatment facility in open space area at western portion of Gulf Gate Elementary School. Divert untreated runoff from subbasin areas 04406, 04411, 04404B, and 04405A to this regional facility.

(4) Provide an outfall control structure at the north end of Shadow Lake to enhance pollutant removal efficiency.

(5) Modify outfall control structures in Wright Lake to maximize pollutant removal efficiency.

(6) Modify outfall control structure in Sun Haven Lake to maximize pollutant removal efficiency.

(7) Provide outfall control for Lake Bernice to enhance pollutant removal efficiency.

(8) Construct water level control structure at west end of Williamsburg Branch and reconstruct open ditch to enhance the pollutant removal efficiency of system.

(9) Reconstruct upper segment of Denham Acres Lateral in accordance with original 1967 proposal to enhance the pollutant removal efficiency of the system.

(10) Reshape/Stabilize side slopes on Gulf Gate Branch.

(11) Provide a regional stormwater management facility in the open space area located east of Lockwood Ridge Road and south of Shadow Lakes Subdivision. Equalize facility with lakes in Shadow Lakes Subdivision and

perimeter canal. Locate a control structure in this regional system east of Lockwood Ridge Road. Combined regional system could service subbasin areas 04413, and 04414 as well as subbasin areas 04415, 04416, and 04505B.

(12) Provide small stormwater treatment retention areas along Matheny Creek to service subbasin 04117.

6.1.5 CORAL LAKES BRANCH SUBBASIN

6.1.5.1 FLOOD PROTECTION

(1) Elevate berm along east side of Gulf Gate Mall lake.

(2) Expand Gulf Gate Mall lake to the south.

(3) Place curbing along north side of Gulf Gate Mall to detain stormwater on parking lot.

(4) Construct one-way flap gate or orifice control at outfall to Coral Lake and enlarge equalizer culvert to small unnamed lake located east of Gateway Avenue.

(5) Re-construct/modify existing water level control structure in Denham Acres Lateral (DL-1) to provide for more efficient flood protection.

(6) Develop a flood protection abatement plan.

6.1.5.2 WATER QUALITY

(1) Re-construct inlets in westerly portion of Gulf Gate Mall parking lot with open bottoms to take advantage of underlying type "A" soils.

(2) Modify control structure at Coral Lake outfall to maximize pollutant removal efficiency.

(3) Modify ditch segment of the Coral Lakes Branch located west of Gateway Avenue to enhance its pollutant removal efficiency (i.e. construct water level control structure, stabilize side slopes) and divert Coral Lakes outfall pipe downstream of modified ditch segment.

(4) Expand Gulf Gate Mall lake to the south as a regional stormwater facility and divert first flush of runoff from subbasin area 301 to this facility.

(5) Stabilize open ditch segment of the Coral Lakes Branch located east of Gateway Avenue.

6.1.6 CLARK ROAD SUBBASIN

6.1.6.1 FLOOD PROTECTION

(1) Develop a flood protection abatement plan.

(2) Reconstruct inlets in Arapaho Street to increase efficiency.

(3) Provide inlets in Nutmeg Avenue and outfall to large lake to the west.

(4) Expand large lake along the eastern boundary of Ashton Lakes to the north.

(5) Convert open ditch segment along east property boundaries of Merchants Pointe Shopping Center and Swifton Villas into a stormwater lake. Extend into existing lake located along northeast boundary of Swifton Villas and construct a berm between this created water body and Swifton Villas.

(6) Increase conveyance under Clark Road.

(7) Improve drainage from Mohawk Street south through Sun Haven Subdivision.

(8) Provide regional flood storage facility in open space area located north of Ashton Road and east of McCallum Terrace.

(9) Provide a regional flood storage facility in open space area located north of Clark Road and east of Westwind Lane.

(10) Provide a regional flood storage facility in open space area located north of Clark Road and west of Westwind Lane.

(11) Increase conveyance capacity for Britannia Road outfall.

6.1.6.2 WATER QUALITY

(1) Modify outfall control structure for Villa Gardens subdivision to maximize pollutant removal efficiency.

(2) Provide regional stormwater treatment facility north of Clark Road and west of Westwind Lane to service subbasin areas 04617A and 04617B.

(3) Provide regional stormwater treatment facility along east boundary of Merchants Pointe Shopping Center and Swifton Villas to service subbasin areas 04633, 04634 and 04635.

(4) Provide outfall control structure for Sunnyside Lake to enhance pollutant removal efficiency.

(5) Modify outfall control structure for Mohawk Lake to maximize pollutant removal efficiency.

(6) Modify existing ditch along west side of Hidden Forest Subdivision to enhance the pollutant removal efficiency of the system.

6.2 ALTERNATIVES SELECTED FOR DETAILED HYDROLOGIC AND HYDRAULIC INVESTIGATION

6.2.1 FLOOD PROTECTION

As agreed during a meeting between Kimley-Horn and Associates, Inc. and the Sarasota County Stormwater Environmental Utility, the conceptual alternatives developed to address flood protection level service (FPLOS) deficiencies and inventoried in Section 6.1 were prioritized into one of three levels. The first priority level projects were selected as those believed to result in the most dramatic reductions in flood levels in areas where habitable structure flooding has been identified. The second priority level projects were categorized as those believed to provide additional reductions in flood elevations and also considered addressing FPLOS deficiencies with respect to arterial and collector roads. Third priority level projects are those expected to address neighborhood road FPLOS deficiencies. Therefore, the three (3) alternative programs are intended to build upon one another, with each subsequent program being subject to modifications based upon the results of the preceding program. The three alternative programs and their effectiveness in resolving FPLOS deficiencies are discussed herein.

6.2.1.1 ALTERNATIVE 1 - FIRST PRIORITY LEVEL PROJECTS

This alternative considered basin conveyance and storage enhancement improvements to address the FPLOS deficiencies in the basin, particularly with respect to habitable structure flooding. By subbasin, these improvements included the following components.

6.2.1.1.a LOWER MATHENY CREEK SUBBASIN

Improvements proposed under alternative 1 are all located in a sub-area of the Lower Matheny Creek Subbasin which encompasses Breakwater Circle, Post Drive, Bounty Drive, Woodside South Condominium, the Gulf Gate golf course, etc. By reach, alternative 1 modifications to the model included:

Reach No.	Existing Conditions	Alternative 1
140MOD1	36" RCP	4' x 7' RCBC
141MOD1	30" CMP	38" x 60" ERCP
143MOD1	30" CMP	38" x 60" ERCP
144MOD1	30" CMP	38" x 60" ERCP
145MOD1	17" x 29" CMPA	24" x 38" ERCP
146MOD1	18" CMP	24" RCP

The detailed analyses for alternative 1 are provided in APPENDIX B and are summarized in TABLE 6.2.1.1.a. Based upon the analyses, these improvements are expected to resolve all previously identified FPLOS deficiencies with respect to habitable structure flooding. Specifically, an estimate 7 homes will be removed from the 25-year floodplain and 15 homes will be removed from the 100-year floodplain. In addition, the analyses indicate that these improvements will be effective in preventing existing cross-basin overflows to the Elligraw Bayou drainage basin. The depth of roadway flooding of designated collectors, Gulf Gate Drive and Lockwood Ridge Road, will increase slightly. However, the depth of flooding of neighborhood roads will for the most part decrease significantly. Of particular note, existing FPLOS deficiencies for Willow Tree Drive, Gray Squirrel Boulevard, East Breakwater Circle, and Cass Street will be addressed.

6.2.1.1.b UPPER MATHENY CREEK BASIN

The existing conditions analyses indicated that the Upper Matheny Creek Subbasin does not contain any habitable structures which are susceptible to flooding. However, homeowners in Gulf Gate East subdivision have reported that the upper portion of the Matheny Creek Main has had a significant build-up of sediment. These reports were substantiated by comparing the original approved construction plans for this portion of the Main with recent field survey information relative to the existing invert of the Main. By reach, alternative 1 modifications to the model included:

Reach No.	Existing Conditions	Alternative 1
126MOD1	Ditch Inv. = 10.6	Ditch Inv. = 7.20
127MOD1	RCBC Inv. = 10.6	RCBC Inv. = 7.73
128MOD1	Ditch Inv. = 10.4	Ditch Inv. = 7.83
129MOD1	Ditch Inv. = 10.9	Ditch Inv. = 8.00
130MOD1	Ditch Inv. = 10.9	Ditch Inv. = 8.20
131MOD1	Ditch Inv. = 10.7	Ditch Inv. = 8.34
132MOD1	Ditch Inv. = 10.1	Ditch Inv. = 8.60

The alternative 1 analyses revealed that restoring the upper portion of the Matheny Creek Main to its original section would not affect the existing neighborhood road FPLOS deficiencies with the Upper Matheny Creek Subbasin. However, flood elevations within the upper Main would be reduced between ±0.15' and ±0.35' for all events other than the 100-year flood. Flood levels in the Upper Main for the 100-year flood will not change significantly, due to the significant amount of out-of-bank storage during this event.

The results of alternative 1 as they relate to FPLOS deficiencies in the Upper Matheny Creek Subbasin are summarized in TABLE 6.2.1.1.b.

6.2.1.1.c DENHAM ACRES LATERAL SUBBASIN

Improvements proposed under alternative 1 generally involve re-constructing the Denham Acres Lateral water level control structure, construction of an emergency overflow lateral to the Matheny Creek Main from the Gulf Gate Branch, and modification of existing conveyance facilities within the Gulf Gate Branch, the Williamsburg Branch, and the Shadow Lakes Feeder. By reach, alternative 1 modifications to the model included:

Reach No.	Existing Conditions	Alternative 1
200MOD1	WLCS @ El. 7.74 w/ 18" bleeder @ El. 2.97	WLCS @ El. 4.50 (no bleeder)
402NEW1	-	5' x 7' RCBC w/30' WLCS @ 11.5
407MOD1	Ditch Inv. = 13.0	Ditch Inv. = 11.3
408MOD1	14" x 23" ERCP	38" x 60" ERCP
410MOD1	24" CMP	24" x 38" ERCP
503MOD1	19" x 30" ERCP (2)	30" RCP (2)
505MOD1	16" x 25" CMPA (2)	30" RCP (2)
505AMOD1	22" x 36" CMPA	34" x 53" ERCP
506MOD1	14" x 23" ERCP (2)	30" RCP (2)
520MOD1	14" x 23" ERCP	36" RCP
521MOD1	21" RCP	30" RCP
522MOD1	19" x 30" ERCP	24" x 38" ERCP
500MOD1	Ditch Inv. = 10.6	Concrete Wall @ El. 13.9 Ditch Inv. = 9.6
501AMOD1	Ditch Inv. = 10.6	Concrete Wall @ El. 13.7 Ditch Inv. = 11.1
501BMOD1	Ditch Inv. = 12.8	Ditch Inv. = 11.5

The detailed analyses relative to the Denham Acres Lateral Subbasin are included in APPENDIX B and are summarized in TABLE 6.2.1.1.c. The analyses indicate that these improvements are expected to remove 1 of 1 homes from the 2-year floodplain, 1 of 2 homes from 5-year floodplain, 2 of 4 homes from the 25-year floodplain, and 3 of 9 homes from the 100-year floodplain. In addition, most existing FPLOS deficiencies with respect to roadway flooding will be reduced. Existing FPLOS deficiencies for north Lockwood Ridge Road, Harbour Drive, and Rowena Street are expected to be addressed by alternative 1 improvements.

6.2.1.1.d <u>CORAL LAKES BRANCH SUBBASIN</u>

Under existing condition, water levels in the Coral Lakes Branch back up into the lakes which service Coral Lakes Condominium and Gulf Gate Manor. This results in extensive flooding of habitable structures which surround these lakes. Apparently this has been a chronic problem as Gulf Gate Manor proposed to install a restriction in the outfall pipe to prevent back flow in 1971. The alternative 1 simulation was performed to be consistent with this earlier proposal by only allowing one-way flow. In reality, this proposal could be effectuated with a flap gate or similar mechanism on the downstream end of the culvert. In addition, based upon the existing conditions analyses the stormwater lake located in the northeast portion of Gulf Gate Mall is over topped during a 10-year storm resulting in the flooding of commercial developments located to the east. The alternative 1 simulation was conducted assuming that this overtopping could not occur. This scenario was effectuated by shutting off the overbank reach in the model. By reach, alternative 1 modifications to the model included:

Reach No.	Existing Conditions	Alternative 1
312MOD1	Berm @ Elev. 14.6 along east side of Gulf Gate Mall stormwater lake	Shut-off
320MOD1	Coral Lake Outfall	Simulate one-way flow only

The results of the alternative 1 analyses with respect to FPLOS deficiencies in the Coral Lakes Subbasin are summarized in TABLE 6.2.1.1.d. Based upon these analyses, 4 of 4 habitable structures would be removed from the 25-year floodplain and 6 of 11 habitable structures would be removed from the 100-year floodplain as a result of the proposed basin modifications. Reductions in several existing roadway FPLOS deficiencies are also indicated by the alternative 1 analyses.

6.2.1.1.e CLARK ROAD SUBBASIN

Improvements considered in the Clark Road Subbasin under alternative no. 1 include the enlargement and connection of three existing lakes to form a regional stormwater management system. This regional stormwater management system consists of Sunnyside Lake, Bernice Lake, the FDOT lake constructed for Clark Road, and the conversion of existing developed areas located south of the Swift/Clark Road intersection into a lake. It is anticipated that this regional stormwater lake can provide stormwater treatment and attenuation benefits for roughly 80% of the Clark Road

Subbasin, including Clark Road itself. In addition, conveyance improvements are proposed immediately downstream of Phillippi Shores subdivision to address FPLOS deficiencies in the northwest portion of the subbasin. By reach, alternative 1 modifications to the model included:

Reach No.	Existing Conditions	Alternative 1
600MOD	Part of Clark Road Off-site Bypass System	Directed to Regional Stormwater System
606NEW1	-	Connects Bernice Lake to Regional Stormwater System
661MOD1	Sunnyside Lake Weir @ El. 16.6	Sunnyside Lake connected to Regional Stormwater System
645MOD1	FDOT Lake for Clark Road	Expanded to include existing developed areas south of Clark/ Swift Road intersection
610AMOD1	Part of Clark Road Off-site Bypass System	Directed to Regional Stormwater System
621MOD1	Part of Clark Road Off-site Bypass System	Deleted
622MOD1	Part of Clark Road Off-site Bypass System	Deleted
641MOD1	24" RCP	30" RCP
642MOD1	30" CMP	30" RCP
643MOD1	30" CMP	30" RCP
522MOD1	Outfall from Bernice Lake to Gulf Gate Branch	Shut off

The results of the alternative 1 analyses with respect to FPLOS deficiencies in the Clark Road subbasin are summarized in TABLE 6.2.1.1.e. Based upon the analyses, only 1 of 7, and 1 of 10 habitable structures would be removed from the 10-year and 25-year floodplains, respectively. These analyses do indicate that additional improvements are needed in the upper portion of the basin, particularly in and around Mohawk Lake and north of Ashton Road to address habitable structure and roadway FPLOS deficiencies in these portions of the subbasin.

LOWER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 1)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Florida Cities Wastewater Treatment Plant						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials						
• U.S. 41	14.5	5.9	7.9	8.8	9.6	10.7
C. Collectors						
• Gulf Gate Drive	13.5	11.4	13.0	13.6	14.1	14.7
• Lockwood Ridge Road	13.9	12.0	13.2	14.1	14.8	15.0
D. Neighborhood						
• Bright Creek Drive	11.2	9.2	10.3	10.8	11.3	12.5
• Willow Tree Drive	12.8	9.2	10.3	10.8	11.3	12.5
• Grey Squirrel Boulevard	13.0	9.2	10.3	10.8	11.3	12.5
• Breakwater Circle East	14.5	13.3	14.1	14.4	14.6	15.0
Southeast	13.6	13.6	14.7	15.1	15.3	15.7
• Bounty Drive	15.0	14.4	15.4	15.9	16.3	16.8
• Cass Street	15.1	13.6	14.7	15.1	15.3	15.7
• Cardwell Way	14.5	13.6	14.7	15.1	15.3	15.7
• Bluewater Avenue	15.6	13.9	15.0	15.6	16.2	17.1
• Kenmore Drive	16.1	14.2	15.5	16.1	16.7	17.6
• Keystone Drive	16.1	14.8	16.0	16.7	17.2	18.1

* Cross Basin Flows to Elligraw Bayou

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TABLE 6.2.1.1.a

FPLOS Deficiency

UPPER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 1)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	28.3	24.1	24.7	25.0	25.3	25.9
B. Arterials						
• Beneva Road	17.2	14.1	14.8	15.1	15.6	16.4
C. Collector						
• Sawyer Road		15.2	15.9	16.4	17.1	18.2
D. Neighborhood						
• Roxbury Drive	14.4	14.1	14.7	15.0	15.6	16.4
• Waterford Circle	17.3	15.8	17.0	17.4	17.8	18.5
• Kingston Loop	17.3	15.9	17.1	17.5	18.2	18.8
• Kingston Blvd. Southeast	17.8	16.8	18.4	18.8	19.0	19.2
North	17.5	15.7	16.7	17.3	17.9	18.6
East	17.8	15.8	16.8	17.3	17.9	18.6
• Easton Lane	17.8	16.8	18.4	18.8	19.0	19.2
• Easton Court	17.8	16.6	18.1	18.5	18.8	19.1
• Easton Street	17.8	16.0	17.2	17.7	18.2	18.8

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TABLE 6.2.1.1.b

FPLOS Deficiency

DENHAM ACRES LATERAL SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 1)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)						
• Gulf Gate Elementary School						
B. Habitable		0	1	2	2	6
C. Employment/Service Centers		0	0	0	0	1
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Lockwood Ridge Road North	18.5	16.3	17.1	17.5	17.8	18.5
South	17.8	16.3	16.9	17.4	17.7	18.2
B. Arterials (not applicable)						
C. Collectors						
• Gulf Gate Drive	13.4	12.4	13.3	13.8	14.1	14.6
D. Neighborhood						
• Anchor Way	13.7	13.7	14.5	14.9	15.1	15.6
• Harbour Drive	12.5	11.6	12.0	12.2	12.3	13.0
• Concord Street	14.0	13.8	14.6	15.2	15.4	16.2
• Valley Forge Street West	13.8	13.1	14.1	14.6	15.1	15.5
East	15.1	13.9	14.8	15.4	15.6	16.2
• Rowena Street	18.5	16.4	17.4	17.9	18.4	19.5
• Nelson Avenue	17.1	16.4	17.4	17.9	18.4	19.5

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TABLE 6.2.1.1.c

FPLOS Deficiency

CORAL LAKES BRANCH SUBBASIN
FLOOD CONTROL LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 1)

I. BUILDINGS (No. of Structures below)			2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services							
• Gulf Gate Fire Station							
B. Habitable			0	0	0	0	5
C. Employment/Service Centers			0	0	0	1	7
II. ROAD ACCESS (Elevation)		**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)							
B. Arterials (not applicable)							
C. Collectors							
• Gateway Avenue		13.3	11.3	12.3	12.9	13.3	14.1
		12.7	11.2	12.6	13.4	14.0	14.7
D. Neighborhood							
• Terry Lane	Northeast	12.8	11.6	13.0	13.8	14.3	15.0
	South	12.3	11.1	11.9	12.4	12.8	13.6
• Linda Street		13.3	11.6	13.0	13.8	14.3	15.0
• Mall Drive		12.7	11.2	12.6	13.4	14.0	14.7

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TABLE 6.2.1.1.d

FPLOS Deficiency

CLARK ROAD SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 1)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters (not applicable)						
B. Habitable		1	4	6	9	12
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	17.0	16.4	17.3	17.6	17.7	17.7
	17.3	16.4	17.3	17.6	17.8	18.1
	16.9	17.0	17.3	17.5	17.6	17.9
	17.1	17.1	18.0	18.2	18.2	18.4
	19.9	16.4	17.3	17.6	20.0	20.3
	21.0	16.4	21.2	21.4	21.5	21.6
B. Arterials (not applicable)						
C. Collectors						
• Lockwood Ridge Road	20.9	19.8	20.5	20.7	20.9	21.2
D. Neighborhood						
• Britania Road/Britania Drive	14.6	15.2	*16.0	*16.1	*16.3	*16.5
• Nutmeg Avenue	16.7	17.4	18.0	18.2	18.3	18.5
• Murdock Avenue	18.0	18.2	18.6	18.8	18.8	18.9
• Blount Avenue	21.3	20.8	22.0	22.3	22.4	22.5
• West Wind Lane	21.5	20.8	22.1	22.4	22.6	22.7
• Mohawk Street	22.8	24.7	25.1	25.2	25.4	25.7
• Arapaho Street	24.3	24.7	25.1	25.2	25.4	25.7
• McCallum Terrace	24.9	25.1	25.4	25.6	25.6	25.7
• Grafton Street	24.5	25.1	25.4	*25.6	*25.6	*25.7
• Cambell Street	24.5	25.1	25.4	*25.6	*25.6	*25.7

* Cross Basin Flows to Phillippi Creek

T-621E.M25(MTY-RPT)

TABLE 6.2.1.1.e

▒ FPLOS Deficiency

6.2.1.2 ALTERNATIVE 2 - SECOND PRIORITY LEVEL PROJECTS

This alternative considered the first priority level projects as well as additional basin conveyance and storage enhancement improvements needed to address both habitable structure flooding and major roadway flooding (expressway and arterial) FPLOS deficiencies in the basin. By subbasin, these improvements included the following components.

6.2.1.2.a LOWER MATHENY CREEK SUBBASIN

The two improvements proposed under alternative 2 are located in the Lower Matheny Creek Main. The first improvement considered was the reconstruction of water level control structure no. 1 (WLCS MC-1) to lower its crest from elevation 5.0 NGVD to 4.0 NGVD and to remove the existing bleeder pipe at elevation 1.97 NGVD. The former modification is intended to provide greater flood control efficiency while the latter improvement is intended to conserve water resources. The second improvement considered was the enlargement of the bridge/culvert crossing at the Matheny Creek Main and Gulf Gate Drive.

By reach, alternative 2 modifications to the model included:

Reach No.	Existing Conditions	Alternative 2
113MOD2	WLCS @ El. 5.00 w/18" CMP bleeder @ El. 1.93	WLCS @ El. 4.00 (no bleeder)
120MOD2	204" x 62.5" CMPA	240" x 72" Bridge (240" x 84" ConSpan)

The detailed analyses for alternative 2 are provided in APPENDIX B and are summarized in TABLE 6.2.1.2.a. In addition to the flood protection benefits resulting from the alternative 1 improvements, the alternative 2 analyses indicate that all FPLOS deficiencies for designated collectors, Gulf Gate Drive and Lockwood Ridge Road will be addressed, with the exception of the 100-year design event relative to Lockwood Ridge Road. It is also noted that the combination of the two improvements proposed under this alternative will result in higher flood stages downstream of Gulf Gate Drive for all events greater than the 2-year design storm. However, based upon the review of topographic aerials, these increased downstream flood stages are not expected to create adverse impacts (i.e. additional FPLOS deficiencies).

6.2.1.2.b <u>UPPER MATHENY CREEK BASIN</u>

To mitigate for the increased conveyance efficiency proposed in the Lower Matheny Creek Basin under the alternative 2 analyses, water level control structure no. 2 (WLCS MC-2) was modified to reduce its width from 46 feet to 25 feet. This modification to the model is indicated below:

Reach No.	Existing Conditions	Alternative 2
125MOD2	WLCS @ El. 12.4 (46' wide)	WLCS @ El. 12.4 (25.5' wide)

The alternative 2 analyses revealed that reconstruction of WLCS MC-2 will generally result in increased flood stages extending to just upstream of Beneva Road. However, the magnitude of these increases are inversely proportional to the magnitude of the storm and with the possible exception of Roxbury Drive, are not expected to result in adverse impacts (i.e. additional FPLOS deficiencies).

The results of alternative 2 as they relate to FPLOS deficiencies in the Upper Matheny Creek Subbasin are contained in APPENDIX B and are summarized in TABLE 6.2.1.2.b.

6.2.1.2.c <u>DENHAM ACRES LATERAL SUBBASIN</u>

Improvements proposed under alternative 2 generally involved measures to increase the conveyance efficiency in the lower to mid-reach sections of the Denham Acres Lateral. In addition, enlargement of the existing bridge/culvert crossing at the Gulf Gate Branch and Gulf Gate Drive is proposed. By reach, alternative 2 modifications to the model included:

Reach No.	Existing Conditions	Alternative 2
202 MOD2	Natural Ditch	Concrete Wall @ El. 10.5
204 MOD2	Natural Ditch	Concrete Wall @ El. 10.5
206 MOD2	192" x 85" CMPA	288" x 84" Bridge (288" x 96" ConSpan)
208 MOD2	192" x 85" CMPA	240" x 84" Bridge (240" x 96" ConSpan)
403 MOD2	72" x 44" CMPA	76" x 48" ERCP
Node No.		
405	1.12 acres @ El. 15.5	3.44 acres @ El. 15.5

The detailed analyses relative to the Denham Acres Lateral Subbasin are included in APPENDIX B and are summarized in TABLE 6.2.1.2.c. In general, the analyses indicate that these improvements will be effective in reducing flood levels within the lower and mid segments of the Denham Acres Lateral and the lower Gulf Gate Branch for all events except the 100-year design storm. For the 100-year design storm, the model indicates that flood levels will actually increase in certain areas. However, one addition residential structure is expected to be removed from the 10-year floodplain. The Alternative 2 analyses also indicate that although flood levels generally decrease on neighborhood roads within this basin, the decreases are not significant enough to address the FPLOS deficiencies remaining after the alternative 1 analyses. However, the alternative 2 improvements proposed within the Denham Acres Lateral basin appear to benefit the Coral Lakes Branch and Clark Road basins located upstream.

6.2.1.2.d CORAL LAKES BRANCH BASIN

Improvements proposed under alternative 2 generally involved measures to increase and more effectively utilize flood storage in the basin. Specifically, this objective could be facilitated by the expansion of the existing lake in Gulf Gate Mall to the south into an undeveloped area and the improved equalization of the two lakes which service Coral Lakes Condominium and Gulf Gate Manor. The node and reach modifications to the model are identified below for the alternative 2 modifications:

Reach No.	Existing Conditions	Alternative 2
321MOD2	30" RCP	36" RCP
322MOD2	24" RCP	30" RCP
Node No.		
311	1.102 acres @ El. 11.5	1.928 acres @ El. 11.5

The results of the alternative 2 analyses are included in APPENDIX B and are summarized in TABLE 6.2.1.2.d. Based upon these analyses, 2 of 5 remaining habitable structures would be removed from the 100-year floodplain. In addition, 1 of 1 and 4 of 7 remaining floodprone employment/service center structures would be removed from the 25-year and 100-year floodplains, respectively. Significant reductions in road access FPLOS deficiencies are also expected based upon the alternative 2 analyses. Specifically, Gateway Avenue would no longer have FPLOS deficiencies for the 10-year and 25-year design flood and the depth of flooding during the 100-year flood would be reduced from 2.0 feet to 1.5 feet. Terry Lane and Mall Drive would no longer have FPLOS deficiencies during the 10-year design flood. Linda Street and Mall Drive would no longer have FPLOS deficiencies during the 25-year design flood and the depth of flooding on Terry Lane would be reduced from 1.5 feet to 0.9 foot. The depth of flooding on Terry Lane, Linda Street, and Mall Drive would be reduced from 2.2 feet to 1.7 feet, 1.7 feet to 1.2 feet, and 2.0 feet to 1.5 feet, respectively for the 100-year design flood. As previously indicated, the benefits associated with reduced flood levels in this basin are partially a result of improvements proposed within the Denham Acres Lateral Basin as well as the Coral Lakes basin.

6.2.1.2.e CLARK ROAD BASIN

Improvements considered in the Clark Road Subbasin under alternative no. 2 include numerous storage additions and conveyance modifications. Specifically, these modifications include (1) the relocation of the Clark Road regional stormwater discharge control weir to the south side of Clark Road and directly to the upstream end of the Denham Acres Lateral; (2) the expansion of Sunnyside Lake to the north and the diversion of the northern portion of Nutmeg Avenue to this lake; (3) the expansion of Lily Pond and the reduction in the width of the existing discharge control structure; (4) the enlargement of the discharge control structure for Mohawk Lake; the addition of a flood storage area north of Ashton Road and east of McCullum Terrace; and (6) the enlargement of pipe culverts at Ashton Road to improve conveyance. The node and reach modifications to the model are identified below for the alternative 2 modifications:

Reach No.	Existing Conditions	Alternative 2
522MOD2	Outfall from Bernice Lake to Gulf Gate Branch	Shut off
644MOD2	FDOT Lake Weir	Relocated to south side of Clark Road regional stormwater system
645MOD2	FDOT Lake Weir	Shut off
672MOD2	Mohawk Lake 1.0' Weir @ El. 24.0	Revised weir width to 1.5' @ El. 24.0
690MOD2	Lily Pond 1.8' Weir @ El. 20.5	Revised weir width to 2.0' @ El. 20.5
710MOD2	23" x 14" ERCP	38" x 24" ERCP
720MOD2	18" x 12" ERCP	30" x 19 ERCP (2)
Node No.		
661	3.51 ac @ El. 15.0	4.23 ac @ El. 14.5
690	0.82 ac @ El. 20.5	1.48 ac @ El. 20.5
710	0.12 ac @ El. 24.0	1.13 ac @ El. 24.0

The results of the alternative 2 analysis with respect to FPLOS deficiencies in the Clark Road basin are included in APPENDIX B and are summarized in TABLE 6.1.2.1.e.

The alternative no. 2 analyses indicate that 1 of 4, 2 of 6, 3 of 9, and 3 of 12 habitable structures will be removed from the 5-year, 10-year, 25-year and 100-year design storms, respectively.

In addition, placement of the outfall weir for the Clark Road regional stormwater system to the upstream end of the Denham Acres Lateral will result in a significant reduction in flood stages within this regional system to the extent that FPLOS deficiencies within the Clark Road corridor will be reduced from 5 to 1 for the 5-year design storm, 5 to 2 for the 10-year and 25-year design storms, and 6 to 3 for the 100-year design storm. However, flood stages within the upper segment of the Denham Acres Lateral will increase between 0.20 feet and 0.50 feet.

LOWER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 2)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Florida Cities Wastewater Treatment Plant						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials						
• U.S. 41	14.5	6.0	7.8	9.0	9.9	11.1
C. Collectors						
• Gulf Gate Drive	13.5	11.0	12.2	12.7	13.2	14.4
• Lockwood Ridge Road	13.9	11.9	12.7	13.3	13.9	14.9
D. Neighborhood						
• Bright Creek Drive	11.2	9.2	10.2	10.8	11.5	12.6
• Willow Tree Drive	12.8	9.2	10.2	10.8	11.5	12.6
• Grey Squirrel Boulevard	13.0	9.2	10.2	10.8	11.5	12.6
• Breakwater Circle East	14.5	13.3	14.1	14.4	14.6	15.0
Southeast	13.6	13.6	14.7	15.1	15.3	15.7
• Bounty Drive	15.0	14.4	15.4	15.9	16.3	16.8
• Cass Street	15.1	13.6	14.7	15.1	15.3	15.7
• Cardwell Way	14.5	13.6	14.7	15.1	15.3	15.7
• Bluewater Avenue	15.6	13.9	14.9	15.5	16.1	16.9
• Kenmore Drive	16.1	14.2	15.5	16.0	16.7	17.5
• Keystone Drive	16.1	14.8	16.0	16.6	17.2	18.1

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TABLE 6.2.1.2.a

▒ FPLOS Deficiency

UPPER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 2)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	28.3	24.1	24.7	25.0	25.3	25.9
B. Arterials						
• Beneva Road	17.2	14.5	15.0	15.4	15.6	16.5
C. Collector						
• Sawyer Road		15.3	16.0	16.5	17.1	18.2
D. Neighborhood						
• Roxbury Drive	14.4	14.4	14.9	15.3	15.5	16.3
• Waterford Circle	17.3	16.0	17.0	17.4	17.8	18.5
• Kingston Loop	17.3	16.0	17.1	17.5	18.2	18.8
• Kingston Blvd. Southeast	17.8	16.8	18.4	18.8	19.0	19.2
North	17.5	15.7	16.8	17.4	17.9	18.6
East	17.8	15.8	16.9	17.4	18.0	18.6
• Easton Lane	17.8	16.8	18.4	18.8	19.0	19.2
• Easton Court	17.8	16.6	18.1	18.5	18.8	19.1
• Easton Street	17.8	16.0	17.2	17.8	18.2	18.8

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TABLE 6.2.1.2.b

FPLOS Deficiency

DENHAM ACRES LATERAL SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 2)

I. BUILDINGS (No. of Structures below)			2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)							
• Gulf Gate Elementary School							
B. Habitable			0	1	1	2	6
C. Employment/Service Centers			0	0	0	0	1
II. ROAD ACCESS (Elevation)		**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation							
• Lockwood Ridge Road	North	18.5	16.3	17.1	17.5	17.8	18.5
	South	17.8	16.3	17.0	17.3	17.7	18.2
B. Arterials (not applicable)							
C. Collectors							
• Gulf Gate Drive		13.4	11.8	12.4	13.6	13.9	14.3
D. Neighborhood							
• Anchor Way		13.7	13.8	14.4	14.7	15.0	15.5
• Harbour Drive		12.5	11.6	12.0	12.2	12.3	13.5
• Concord Street		14.0	13.9	14.9	15.3	15.5	16.1
• Valley Forge Street	West	13.8	13.3	14.3	14.7	15.1	15.8
	East	15.1	14.0	14.9	15.3	15.6	16.2
• Rowena Street		18.5	16.4	17.4	17.9	18.4	19.5
• Nelson Avenue		17.1	16.4	17.4	17.9	18.4	19.5

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TABLE 6.2.1.2.c

FPLOS Deficiency

CORAL LAKES BRANCH SUBBASIN
FLOOD CONTROL LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 2)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Gulf Gate Fire Station						
B. Habitable		0	0	0	0	3
C. Employment/Service Centers		0	0	0	0	3
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials (not applicable)						
C. Collectors						
• Gateway Avenue	13.3	11.1	12.1	12.6	13.1	14.0
	12.7	10.8	12.0	12.5	13.0	14.3
D. Neighborhood						
• Terry Lane Northeast	12.8	11.3	12.4	13.0	13.7	14.5
South	12.3	11.0	11.9	12.3	12.8	13.6
• Linda Street	13.3	11.3	12.4	13.0	13.7	14.5
• Mall Drive	12.7	10.8	12.0	12.5	13.0	14.3

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TABLE 6.2.1.2.d

▒ FPLOS Deficiency

CLARK ROAD SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 2)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters (not applicable)						
B. Habitable		1	3	4	6	9
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	17.0	15.7	16.0	16.3	16.6	17.0
	17.3	15.7	16.0	16.3	16.6	17.0
	16.9	15.7	16.0	16.3	16.6	17.0
	17.1	15.7	17.7	17.9	18.1	18.2
	19.9	15.7	16.0	16.3	16.6	20.2
	21.0	15.7	16.0	21.1	21.3	21.6
B. Arterials (not applicable)						
C. Collectors						
• Lockwood Ridge Road	20.9	19.4	20.4	20.7	20.8	21.1
D. Neighborhood						
• Britania Road/Britania Drive	14.6	15.3	*16.0	*16.2	*16.3	*16.5
• Nutmeg Avenue	16.7	16.9	17.7	17.9	18.1	18.3
• Murdock Avenue	18.0	17.8	18.5	18.7	18.8	18.9
• Blount Avenue	21.3	20.0	21.6	22.0	22.2	22.4
• West Wind Lane	21.5	20.1	21.7	22.0	22.2	22.6
• Mohawk Street	22.8	24.7	25.0	25.1	25.3	25.6
• Arapaho Street	24.3	24.7	25.0	25.1	25.3	25.6
• McCallum Terrace	24.9	24.6	25.1	25.2	25.4	25.7
• Grafton Street	24.5	24.6	25.1	25.2	25.4	*25.7
• Cambell Street	24.5	24.6	25.1	25.2	25.4	*25.7

* Cross Basin Flows to Phillippi Creek

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TABLE 6.2.1.2.e

░ FPLOS Deficiency

6.2.1.3 ALTERNATIVE 3 - THIRD PRIORITY LEVEL PROJECTS

These alternative projects build upon both the first and second level projects (i.e. alternatives 1 and 2). Included are additional basin conveyance and storage enhancement improvements intended to address remaining FPLOS deficiencies. The individual components of these basin improvements are discussed herein by subbasin.

6.2.1.3.a LOWER MATHENY CREEK SUBBASIN

Improvements considered under alternative 3 within the Lower Matheny Creek subbasin primarily focused on the remaining FPLOS deficiencies within: (1) the portions of Gulf Gate and Gulf Gate Woods subdivisions located adjacent to the Gulf Gate Golf Course, and (2) the portion of Gulf Gate subdivision located adjacent to Mirror Lakes. To address the former, three existing lakes within the Gulf Gate Golf Course were expanded to provide additional flood storage. The latter problem area was analyzed by considering the addition of an overflow flood storage area for Mirror Lakes proposed within an existing open space area located west Bluewater Avenue and north of Goodwater Street. In addition, the conveyance efficiency between and from Mirror Lakes was increased. Finally, increased conveyance was considered at Regetta Drive in an effort to relieve the remaining FPLOS deficiencies at Lockwood Ridge Road.

The alternative 3 model modifications for this subbasin included:

SUBBASIN NO.	EXISTING CONDITIONS	ALTERNATIVE 3
113 MOD3	24.18 acres	22.17 acres
144 MOD3	46.88 acres	48.89 acres
151 MOD3	26.28 acres	23.39 acres
164 NEW3	0.00 acres	2.89 acres
NODE NO.		
143	0.15 acres @ El. 10.5	0.39 acres @ El. 10.5
144	1.85 acres @ El. 11.0	3.22 acres @ El. 11.0
146	0.04 acres @ El. 14.0	1.38 acres @ El. 14.0
164	non-existent	1.31 acres @ El. 15.5
REACH NO.		
150 MOD3	48" CMP	68" x 43" ERCP
162 MOD3	36" x 22" CMPA	38" x 24" ERCP
163 MOD3	24" CMP	38" x 24" ERCP
164 NEW3	non-existent	38" x 24 ERCP w/15' weir @ El. 15.5

The detailed analyses for alternative 3 are provided in APPENDIX B. A summary of results with respect to FPLOS deficiencies within the Lower Matheny Creek Subbasin is provided in TABLE 6.2.1.3.a. The analyses indicate that the proposed improvements will address FPLOS deficiencies for Bounty Drive, Cardwell Way, Bluewater Avenue and Kenmore Drive. However, FPLOS deficiencies persist for three (3) neighborhood roads including Bright Creek Drive and Keystone Drive for the 100-year design storm and the southeast portion of Breakwater Circle for the 10-year, 25-year, and 100-year design storms.

6.2.1.3.b UPPER MATHENY CREEK SUBBASIN

In an attempt to resolve persistent FPLOS deficiencies for roadways with Gulf Gate East, increased conveyance efficiency was considered. To mitigate the potential downstream impacts of this improvement, two (2) floodplain storage enhancement areas were considered along the south side of the Upper Matheny Creek Main. In addition, a small interior lake within the Gulf Gate East subdivision was expanded as was the southern lake at the Winn-Dixie Warehouse facility.

For this subbasin, the alternative 3 model modifications are inventoried below:

SUBBASIN NO.	EXISTING CONDITIONS	ALTERNATIVE 3
126 MOD3	Directed to node 126	Redirected to node 124
127C MOD3	Directed to node 127	Redirected to new node 135
128 MOD3	Directed to node 128	Redirected to new node 135
129A MOD3	Directed to node 129	Redirected to new node 136
132A MOD3	Directed to node 132	Redirected to new node 136
173 MOD3	Directed to node 173	Redirected to new node 136
NODE NO.		
127	Adjusted lost out of bank storage of Upper Matheny Creek Main due to proposed floodplain enhancement areas.	
128	Adjusted lost out of bank storage of Upper Matheny Creek Main due to proposed floodplain enhancement areas.	
129	Adjusted lost out of bank storage of Upper Matheny Creek Main due to proposed floodplain enhancement areas.	
130	Adjusted lost out of bank storage of Upper Matheny Creek Main due to proposed floodplain enhancement areas.	
131	Adjusted lost out of bank storage of Upper Matheny Creek Main due to proposed floodplain enhancement areas.	
135	non-existent	Floodplain Enhancement Area No. 1
136	non-existent	Floodplain Enhancement Area No. 2
178D	0.30 acres @ El. 14.5	0.60 acres @ El. 14.5
198	3.83 acres @ El. 14.0	5.32 acres @ El. 14.0

REACH NO.		
128 MOD3	Adjusted right top-of-bank to account for berm between Upper Matheny Creek Main and proposed floodplain enhancement areas (FEA)	
129 MOD3	Adjusted right top-of-bank to account for berm between Upper Matheny Creek Main and proposed floodplain enhancement areas (FEA)	
130 MOD3	Adjusted right top-of-bank to account for berm between Upper Matheny Creek Main and proposed floodplain enhancement areas (FEA)	
131 MOD3	Adjusted right top-of-bank to account for berm between Upper Matheny Creek Main and proposed floodplain enhancement areas (FEA)	
132 MOD3	Adjusted right top-of-bank to account for berm between Upper Matheny Creek Main and proposed floodplain enhancement areas (FEA)	
135 NEW3	non-existent	7.5' Weir @ El. 14.0
136A NEW3	non-existent	7.5' Weir @ El. 14.5
136B NEW3	non-existent	7.5' Weir @ El. 14.5
170 MOD3	36" x 22" CMPA w/12' Weir @ El. 14.5	38" x 24" ERCP w/15' Weir @ El. 14.5 (redirected to FEA 1)
170A MOD3	Directed to Upper Matheny Creek Main	Redirected to FEA 1
171 MOD3	36" CMP	36" RCP
172A MOD3	36" x 22" CMPA	38" x 24" ERCP
172B MOD3	29" x 18" CMPA	38" x 24" ERCP
172C MOD3	24" CMP	38" x 24" ERCP
173 MOD3	Directed to Upper Matheny Creek Main	Redirected to FEA 2
174 MOD3	58" x 36" CMPA U.S. Inv. = 13.44	60" x 38" ERCP U.S. Inv. = 12.72
175 MOD3	36" CMP	60" x 38" ERCP
178A MOD3	58" x 36" CMPA	60" x 38" ERCP
178B MOD3	50" x 31" CMPA	53" x 34" ERCP
178C MOD3	30" CMP	45" x 29" ERCP
178D MOD3	27" CMP	45" x 29" ERCP

The detailed analyses for alternative 3 are provided in APPENDIX B. A summary of results with respect to FPLOS deficiencies within the Upper Matheny Creek Subbasin is provided in TABLE 6.2.1.3.b. The analyses indicate that the improvements will resolve FPLOS deficiencies for Roxbury Drive, Kingston Loop, north and east portions of Kingston Boulevard, and Easton Court. However, two

(2) neighborhood road FPLOS deficiencies remain (southeast Kingston Boulevard and Easton Lane) for the 100-year design storm. It is anticipated that these FPLOS deficiencies could be resolved without significant additional effort.

6.2.1.3.c DENHAM ACRES LATERAL SUBBASIN

Additional improvements considered under Alternative 3 within the Denham Acres Lateral Subbasin primarily deal with providing increased conveyance to address remaining roadway FPLOS deficiencies.

The alternative 3 model modifications for this subbasin are inventoried below:

SUBBASIN NO.	EXISTING CONDITIONS	ALTERNATIVE 3
405BMOD3	Directed to node 405	Directed to new node 409
NODE NO.	EXISTING CONDITIONS	PROPOSED CONDITIONS
409	Non-existent	West Gulf Gate School Storage Area 3.69 acres @ El. 14.5

REACH NO.	EXISTING CONDITIONS	ALTERNATIVE 3
205 MOD3	Natural Ditch Section	Concrete walls @ El. 11.0
403 MOD3	76" x 48" ERCP	84" x 60" RCBC
404 MOD3	Natural Ditch Section	Concrete walls @ El. 13.75
409A NEW3	Non-existent	15' Weir @ El. 14.5 to node 404
409B NEW3	Non-existent	15' Weir @ El. 14.5 to node 405
410 MOD3	643 LF - 24" CMP Directed to node 405	35 LF - 29" x 45" RCP Directed to node 409
412 MOD3	30" x 19" ERCP	45" x 29" ERCP
506 MOD3	2 - 30" RCP	2 - 53" x 34" ERCP

The detailed analyses for alternative 3 are provided in APPENDIX B. A summary of results with respect to FPLOS deficiencies within the Denham Acres Lateral Subbasin is provided in TABLE 6.2.1.3.c. The results of the analyses indicate that FPLOS deficiencies for Anchor Way and Nelson Avenue would be resolved for the 10-year and 25-year design storms. In addition, FPLOS deficiencies for all employment/service centers are expected to be resolved. Remaining FPLOS deficiencies include an estimated six (6) habitable structures and Gulf Gate Drive for the 100-year design storm. In addition, FPLOS deficiencies persist for Concord Street and Valley Forge Street for the 10-year, 25-year and 100-year design storms. These latter FPLOS deficiencies as well as the habitable structure deficiencies associated with Colonial Terrace subdivision may not be cost effective to resolve.

6.2.1.3.d CORAL LAKES BRANCH SUBBASIN

Additional subbasin modifications considered under alternative 3 included the redirection of the western portion of the Gulf Gate Mall to the proposed expanded lake along the east side of the property. In addition, a two feet high curbing was assumed along the north and east property boundaries of the Gulf Gate Mall to bring available parking lot storage up to elevation ±17.0 into play.

The alternative 3 model modifications for this subbasin are inventoried below:

SUBBASIN NO.	EXISTING CONDITIONS	ALTERNATIVE 3
304 MOD3	Directed to node 303	Redirected to node 311
NODE NO.		
310	Storage ends at El. 15.5	Storage extended to El. 17.0
311	Storage ends at El. 15.5	Storage extended to El. 17.0 and parking lot storage added (0.60 ac @ 16.0, 2.41 @ 17.0)
REACH NO.		
310 MOD3	2' Weir @ El. 12.41	4' Weir @ El. 12.41

The detailed analyses for alternative 3 are provided in APPENDIX B. A summary of results with respect to FPLOS deficiencies within the Coral Lakes Branch Subbasin is provided in TABLE 6.2.1.3.d. The results of the analyses indicate that other than resolving FPLOS deficiencies for the northeast portion of Terry Lane during the 25-year design storm, the proposed improvements considered under alternative 3 will not be effective in resolving the remaining FPLOS deficiencies in the subbasin.

6.2.1.3.e CLARK ROAD SUBBASIN

From all previous analyses, it is apparent that the resolution of FPLOS deficiencies within the Phillippi Gardens area may not be practical. However, the majority of this subdivision lies within the Phillippi Creek drainage basin and is serviced by an existing storm sewer network which discharges to a tidal canal of Phillippi Creek. Resolution of the FPLOS deficiencies for the small portion of the Phillippi Gardens subdivision located in the Matheny Creek drainage basin could be addressed by hydraulically connecting to the Phillippi Creek storm sewer outfall. The alternative 3 analyses considered this to be the case.

The alternative 3 model modifications for this subbasin are inventoried below:

SUBBASIN NO.	EXISTING CONDITIONS	ALTERNATIVE 3
642 MOD3	Phillippi Gardens	Hydrography Inactivated
643 MOD3	Phillippi Gardens	Hydrography Inactivated
REACH NO.		
643 MOD3	Phillippi Gardens Outfall	Outfall Inactivated
672 M0D3	Mohawk Lake - 1.0' Weir @ El. 24.0	Revised weir width to 3.5' @ El. 24.0
690 MOD3	Lily Pond - 1.8' Weir @ El. 20.5	Revised weir width to 1.5' @ El. 20.5
711 NEW3	non-existent	36" RCP equalizer culvert between nodes 710 and 730
730 MOD3	Gypsy Street Lake Overflow	Inactivated
731 NEW3	non-existent	2' weir @ El. 23.0 outfall for Grafton Street Lake to Phillippi Creek

The detailed analyses for alternative 3 are provided in APPENDIX B. A summary of results with respect to FPLOS deficiencies within the Clark Road Subbasin is provided in TABLE 6.2.1.3.e. The results of the analyses indicate that the alternative 3 improvements will only reduce 1 of 9 habitable structure FPLOS deficiencies during the 100-year design storm. However, FPLOS for Britania Road/Britania Drive, West Wind Lane, Grafton Street and Cambell Street will be resolved for all design storms; and FPLOS deficiencies for Arapaho Street and

Murdock Street will remain for the 10-year design storm only. Other remaining FPLOS deficiencies include four (4) segments of Clark Road, Nutmeg Avenue, Blount Avenue, and Mohawk Street.

LOWER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 3)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Florida Cities Wastewater Treatment Plant						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials						
• U.S. 41	14.5	5.8	7.7	8.7	9.4	11.1
C. Collectors						
• Gulf Gate Drive	13.5	10.8	12.0	12.4	12.8	14.1
• Lockwood Ridge Road	13.9	11.6	12.4	12.8	13.3	14.7
D. Neighborhood						
• Bright Creek Drive	11.2	8.7	9.9	10.4	11.1	12.5
• Willow Tree Drive	12.8	8.7	9.9	10.4	11.1	12.5
• Grey Squirrel Boulevard	13.0	8.7	9.9	10.4	11.1	12.5
• Breakwater Circle East	14.5	12.6	13.5	13.9	14.2	14.7
Southeast	13.6	12.6	13.9	14.3	14.8	15.3
• Bounty Drive	15.0	13.8	14.2	14.7	15.1	15.9
• Cass Street	15.1	12.9	13.9	14.3	14.8	15.3
• Cardwell Way	14.5	12.9	13.9	14.3	14.8	15.3
• Bluewater Avenue	15.6	13.9	15.0	15.6	15.9	16.6
• Kenmore Drive	16.1	14.1	15.2	15.8	16.2	17.0
• Keystone Drive	16.1	14.2	15.3	15.9	16.4	17.3

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TABLE 6.2.1.3.a

FPLOS Deficiency

UPPER MATHENY CREEK SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 3)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)						
B. Habitable		0	0	0	0	0
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation						
• Clark Road	28.3	24.1	24.7	25.0	25.3	25.9
B. Arterials						
• Beneva Road	17.2	14.3	14.9	15.1	15.6	16.2
C. Collector						
• Sawyer Road		15.2	16.0	16.4	16.9	18.1
D. Neighborhood						
• Roxbury Drive	14.4	12.6	13.3	13.7	14.5	15.4
• Waterford Circle	17.3	15.6	16.6	17.1	17.4	18.0
• Kingston Loop	17.3	15.7	16.7	17.2	17.5	18.2
• Kingston Blvd. Southeast	17.8	16.0	16.9	17.5	18.1	18.9
North	17.5	15.6	16.4	16.8	17.3	18.2
East	17.8	15.8	16.5	16.9	17.4	18.3
• Easton Lane	17.8	16.0	16.9	17.5	18.1	18.9
• Easton Court	17.8	15.9	16.8	17.4	18.0	18.8
• Easton Street	17.8	15.8	16.6	17.1	17.6	18.5

T-6213B.S19(MTY-RPT)

TABLE 6.2.1.3.b

▒ FPLOS Deficiency

DENHAM ACRES LATERAL SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 3)

I. BUILDINGS (No. of Structures below)			2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services (N/A)							
• Gulf Gate Elementary School							
B. Habitable			0	1	1	2	6
C. Employment/Service Centers			0	0	0	0	0
II. ROAD ACCESS (Elevation)		**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation							
• Lockwood Ridge Road	North	18.5	16.3	17.2	17.5	17.8	18.5
	South	17.8	16.2	16.7	17.0	17.4	18.0
B. Arterials (not applicable)							
C. Collectors							
• Gulf Gate Drive		13.4	12.0	12.8	13.2	13.6	14.3
D. Neighborhood							
• Anchor Way		13.7	13.2	14.0	14.2	14.4	14.9
• Harbour Drive		12.5	11.7	12.0	12.2	12.4	13.4
• Concord Street		14.0	13.7	14.6	15.2	15.4	16.1
• Valley Forge Street	West	13.8	13.1	14.2	14.5	15.0	15.6
	East	15.1	13.8	14.7	15.2	15.5	16.1
• Rowena Street		18.5	16.3	17.2	17.6	17.8	19.0
• Nelson Avenue		17.1	16.3	17.2	17.6	17.8	19.0

T-6213C.S19(MTY-RPT)

TABLE 6.2.1.3.c

FPLOS Deficiency

CORAL LAKES BRANCH SUBBASIN
FLOOD CONTROL LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 3)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters/Essential Services						
• Gulf Gate Fire Station						
B. Habitable		0	0	0	0	3
C. Employment/Service Centers		0	0	0	0	3
II. ROAD ACCESS (Elevation)	**E/P**	**2-YR**	**5-YR**	**10-YR**	**25-YR**	**100-YR**
A. Evacuation (not applicable)						
B. Arterials (not applicable)						
C. Collectors						
• Gateway Avenue	13.3	11.0	12.0	12.5	13.1	13.9
	12.7	10.4	11.6	12.1	12.8	14.2
D. Neighborhood						
• Terry Lane Northeast	12.8	11.2	12.4	13.0	13.6	14.5
South	12.3	10.9	11.8	12.2	12.7	13.5
• Linda Street	13.3	11.2	12.4	13.0	13.6	14.5
• Mall Drive	12.7	10.4	11.6	12.1	12.8	14.3

T-6213D.S19(MTY-RPT)

TABLE 6.2.1.3.d

FPLOS Deficiency

CLARK ROAD SUBBASIN
FLOOD PROTECTION LEVEL OF SERVICE DEFICIENCIES
(ALTERNATIVE 3)

I. BUILDINGS (No. of Structures below)		2-YR	5-YR	10-YR	25-YR	100-YR
A. Emergency Shelters (not applicable)						
B. Habitable		0	1	3	4	8
C. Employment/Service Centers		0	0	0	0	0
II. ROAD ACCESS (Elevation)	E/P	2-YR	5-YR	10-YR	25-YR	100-YR
A. Evacuation						
• Clark Road	17.0	17.0	17.0	17.0	17.0	17.0
	17.3	17.3	17.3	17.3	17.3	17.3
	16.9	17.0	17.0	17.0	17.0	17.1
	17.1	17.1	17.7	18.0	18.1	18.3
	19.9	20.0	20.0	20.0	20.0	20.2
	21.0	21.0	21.0	21.1	21.2	21.5
B. Arterials (not applicable)						
C. Collectors						
• Lockwood Ridge Road	20.9	19.3	20.4	20.7	20.8	21.1
D. Neighborhood						
• Britania Road/Britania Drive	14.6	10.8	10.8	10.8	10.8	10.8
• Nutmeg Avenue	16.7	17.0	17.6	18.0	18.1	18.3
• Murdock Avenue	18.0	17.8	18.5	18.7	18.8	19.0
• Blount Avenue	21.3	19.9	21.5	21.9	22.1	22.4
• West Wind Lane	21.5	19.9	21.6	22.0	22.2	22.5
• Mohawk Street	22.8	24.6	24.8	25.0	25.1	25.3
• Arapaho Street	24.3	24.6	24.8	25.0	25.1	25.3
• McCallum Terrace	24.9	24.0	24.5	24.7	24.9	25.2
• Grafton Street	24.5	24.0	24.5	24.7	24.9	25.2
• Cambell Street	24.5	24.0	24.5	24.7	24.9	25.2

* Cross Basin Flows to Phillippi Creek

T-6213E.S19(MTY-RPT)

TABLE 6.2.1.3.e

FPLOS Deficiency

6.2.2 WATER QUALITY

Although Section 6.1 identifies numerous water quality improvement projects, only those which could be quantified in terms of BMP coverage increases were considered. Since the pollutant loading model is capable of predicting the reduction in gross pollutant loads resulting from increased BMP coverage within the watershed, the following modifications were considered:

U.S. 41 Subbasin

- Wet detention BMP's were added to service all subbasins.

Lower Matheny Creek Subbasin

- Wet detention BMP's were added to service subbasin 04151 and 04160.

Upper Matheny Creek Subbasin

- Wet detention BMP's were added to service subbasin 04127A, 04127B, 04128, 04129A, 04132A, and 04173.

Denham Acres Lateral Subbasin

- Wet detention BMP's were added to service subbasins 04204A, 04204B, 04400A, 04400B, 04404A, 04404B, 04405A, 04405B, 04411, 04413, and 04414.

- Land use acreage was reduced for subbasins 04211B and 04505A.

Coral Lake Branch Subbasin

- Retention and Wet detention BMP's were added to service subbasin 04304.

Clark Road Subbasin

- Six new subbasins were added to this basin (i.e. 04608, 04609, 04642, 04643, 04645, and 04652).

- Wet detention BMP's were added to service subbasin 04600 through 04609, 04610B, 04617A, 04617B, 04633, 04635, 04645 through 04668, 04710, 04720, and 04730.

- Land use acreages changed for subbasins 04600 through 04607, 04610A through 04613B, 04614 through 04619, 04635, 04651, and 04690 as a result of the Clark Road expansion.

In addition, the expansion of Clark Road will be responsible for in an increase of the total acreage in the Matheny Creek watershed of approximately 1 acre compared with existing conditions (TABLE 6.2.2.a). Figure 6.2.2.a illustrates the land uses for the Matheny Creek watershed under the alternative condition. The estimated gross and net pollutant loads for the Matheny Creek watershed under this alternative condition are presented in TABLE 6.2.2.b. Under this alternative condition, additional BMP's (i.e., retention and wet detention ponds) will be placed in all six basins.

Based on the pollutant loading analyses, the gross pollutant loads under the alternative condition are expected to be reduced from 9 to 52% by the proposed BMP's compared a reduction of 8 to 33% under existing conditions. The largest decrease in gross pollutant loads under this alternative condition was observed for trace metals (i.e., 34 to 52%). As a result of the additional proposed BMP's for the Matheny Creek watershed, the net pollutant loads for trace metal, except cadmium, are expected to be 13 to 19% lower than the estimated net loading under existing conditions. This decrease in trace metals is associated with an additional 18% removal of suspended solids under the alternative condition.

Pollutant loads for nutrient estimated under the alternative condition are expected to decrease. In general, the net nutrient load under the proposed improvement of the stormwater management systems is expected to decrease between 8 and 20% compared with existing conditions. Dissolved nitrogen and phosphorus loads are expected to have the most significant reduction. Based on the WMM analyses of the Matheny Creek watershed, the proposed improvements to the stormwater management systems is predicted to have an overall removal efficiency of 36% or approximately 14% greater than under existing conditions.

Pollutant loading reductions for each basin under the alternative condition are presented in TABLE 6.2.2.c. A comparison of gross and net pollutant loads and removal efficiencies under existing and alternative conditions is summarized in TABLE 6.2.2.d. All results of the pollutant loading analysis for the proposed improvements in the Matheny Creek watershed are presented in APPENDIX C.

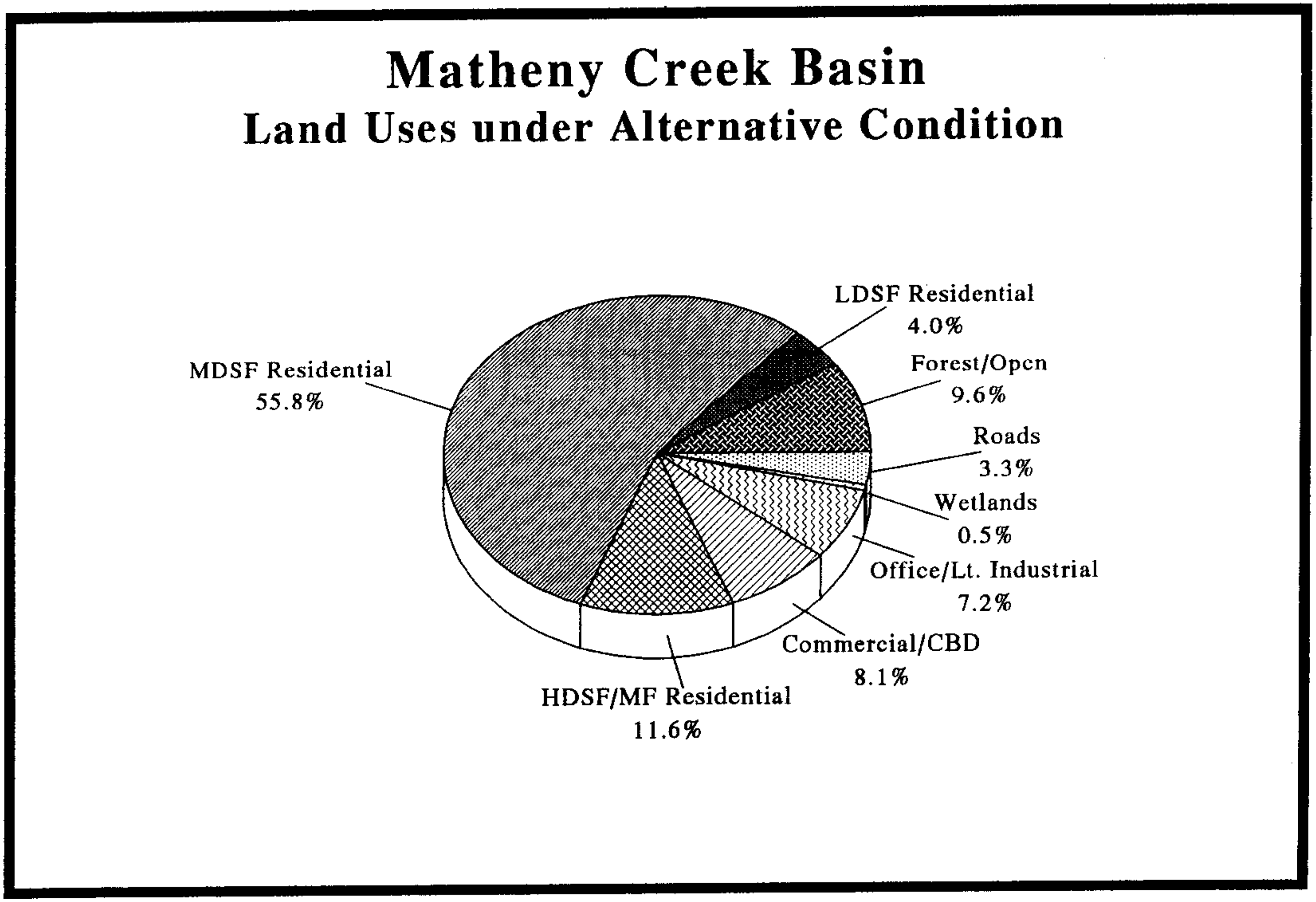

Figure 6.2.2.a Land Use in the Matheny Creek Watershed under the Alternate Condition.

TABLE 6.2.2.a LAND USES IN MATHENY CREEK UNDER THE ALTERNATIVE CONDITION.

	Basin No.						
	1	2	3	4	5	6	Total
Number of Sub-basins:	7	23	33	45	7	49	164
Land Use Type (Acres):							
Forest/Open	8	55	63	20	0	18	165
Agricultural/Pasture	0	0	0	0	0	0	0
Cropland	0	0	0	0	0	0	0
LDSF Residential	0	0	70	0	0	0	70
MDSF Residential/Instit.	29	267	183	348	18	118	962
HDSF/MF Residential	0	3	2	89	27	78	199
Commercial/CBD	32	0	6	34	46	21	139
Office/Light Industrial	3	0	107	13	0	1	124
Heavy Industrial	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0
Wetlands	0	0	8	0	0	0	8
Roads	0	7	17	7	3	21	56
Optional Land Use #1	0	0	0	0	0	0	0
Optional Land Use #2	0	0	0	0	0	0	0
Optional Land Use #3	0	0	0	0	0	0	0
Total	73	333	456	511	94	257	1,724

TABLE 6.2.2.b ESTIMATED TOTAL POLLUTANT LOADING UNDER THE ALTERNATIVE CONDITION FOR SURFACE RUNOFF IN THE MATHENY CREEK WATERSHED, SARASOTA COUNTY, FLORIDA.

Parameters	Gross Load[a]	Removal[b]	Net Load[c]
Total Drainage Area (acres)	1,724	-----	1,724
Total Impervious Area (acres)	642	-----	642
Total Surface Runoff (acre-ft/yr)	3,727	-----	3,727
Biochemical Oxygen Demand (lbs/yr)	104,708	24,982	79,726
Chemical Oxygen Demand (lbs/yr)	784,249	259,026	525,222
Total Suspended Solids (lbs/yr)	1,312,577	555,580	756,996
Total Dissolved Solids (lbs/yr)	1,013,544	91,528	922,017
Total Phosphorus (lbs/yr)	2,996	954	2,042
Dissolved Phophorus (lbs/yr)	1,365	650	715
Total Kjeldahl Nitrogen (lbs/yr)	13,252	3,089	10,163
Nitrate + Nitrite (lbs/yr)	2,818	1,292	1,526
Total Lead (lbs/yr)	1,401	724	677
Total Copper (lbs/yr)	434	199	235
Total Zinc (lbs/yr)	738	272	466
Total Cadmium (lbs/yr)	20	7	13

[a] Gross Load - Total pollutant load with no conveyance of runoff through a stormwater management system.
[b] Removal - Mass of pollutants removed from stormwater by BMP's.
[c] Net Load - Total pollutant load after treatment by BMP's.

TABLE 6.2.2.c POLLUTANT LOADING REDUCTIONS PER BASIN UTILIZING BMP'S IN THE MATHENY CREEK WATERSHED UNDER THE ALTERNATIVE CONDITION.

Constituents (lbs/yr)	Basin No. 1	2	3	4	5	6	Total
Biochemical Oxygen Demand	1,768	3,500	5,916	5,827	3,962	4,010	24,982
Chemical Oxygen Demand	17,757	32,793	69,195	66,150	28,677	44,455	259,026
Total Suspended Solids	38,229	71,255	153,088	150,025	48,275	94,708	555,580
Total Dissolved Solids	3,438	22,020	2,742	12,898	34,862	15,568	91,528
Total Phosphorus	52	144	259	273	79	147	954
Dissolved Phosphorus	45	74	192	182	55	103	650
Total Kjeldahl Nitrogen	200	472	743	750	440	484	3,089
Nitrate + Nitrite	68	175	371	393	83	201	1,292
Total Lead	84	27	206	109	97	201	724
Total Copper	15	21	59	52	19	33	199
Total Zinc	29	20	78	53	48	44	272
Total Cadmium	0.5	0.7	1.9	1.6	0.9	1.1	6.7
Mitigation Type	Retention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	Retention Wet Detention	

Removal Efficiencies (CDM, 1992):

Retention — 90% efficiency for all constituents.

Wet Detention — Biochemical Oxygen Demand = 30%; Chemical Oxygen Demand = 50%; Total Suspended Solids = 70%, Total Dissolved Solids = 0%, Total Phosphorus = 50%, Dissolved Phosphorus = 80%, Total Kjeldahl Nitrogen = 30%, Nitrate + Nitrite = 80%; Total Lead = 80%, Total Copper = 75%, Total Zinc = 50%, Total Cadmium = 50%.

TABLE 6.2.2.d A COMPARISON OF POLLUTANT LOADING RATES ESTIMATED UNDER EXISTING CONDITIONS AND THE ALTERNATIVE CONDITION FOR THE MATHENY CREEK WATERSHED.

Constituents (lbs/yr)	Existing Condition (1,723 Acres) Gross Load	Net Load	Removal Efficiency	Alternative Condition (1,724 Acres) Gross Load	Net Load	Removal Efficiency
Biochemical Oxygen Demand	104,242	88,226	15.4%	104,708	79,726	23.9%
Chemical Oxygen Demand	773,509	620,256	19.8%	784,249	525,222	33.0%
Total Suspended Solids	1,299,052	982,659	24.4%	1,312,577	756,996	42.3%
Total Dissolved Solids	1,007,908	931,213	7.6%	1,013,544	922,017	9.0%
Total Phosphorus	3,001	2,419	19.4%	2,996	2,042	31.8%
Dissolved Phosphorus	1,364	988	27.6%	1,365	715	47.6%
Total Kjeldahl Nitrogen	13,213	11,220	15.1%	13,252	10,163	23.3%
Nitrate + Nitrite	2,826	2,081	26.4%	2,818	1,526	45.8%
Total Lead	1,111	744	33.3%	1,401	677	51.7%
Total Copper	430	315	26.7%	434	235	45.8%
Total Zinc	729	562	22.9%	738	466	36.8%
Total Cadmium	20	16	20.0%	20	13	34.3%

6.3 RECOMMENDED CAPITAL IMPROVEMENT PROJECTS FOR PRELIMINARY DESIGN

6.3.1 FLOOD PROTECTION

Based upon the cumulative alternative analyses, it is estimated that the capital improvement projects considered will be successful in removing 2 of 2, 4 of 6, 5 of 9, 19 of 25, and 30 of 47 habitable structures from the 2-year, 5-year, 10-year, 25-year, and 100-year floodplains, respectively. Additionally, all roadway access FPLOS deficiencies are reduced and with the exceptions indicated in TABLE 6.3.1, are resolved. For reference TABLES 6.3.1.a through 6.3.1.h compare 100-year water surface elevations for each alternative with existing conditions in each study reach. Descriptions of the recommended improvements considered effective in addressing FPLOS deficiencies are provided for each major subbasin.

REMAINING ROAD ACCESS FPLOS DEFICIENCIES

ROADWAY	DESIGNATION	10-YEAR (Ft. > Allowed)	25-YEAR (Ft. > Allowed)	100-YEAR (Ft. > Allowed)
Bright Creek Drive	Neighborhood	-	-	+0.3'
Breakwater Circle (SE)	Neighborhood	+0.2'	+0.4'	+0.7'
Keystone Drive	Neighborhood	-	-	+0.2'
Kingston Boulevard (SE)	Neighborhood	-	-	+0.1'
Easton Lane	Neighborhood	-	-	+0.1'
Lockwood Ridge (South)	Neighborhood	-	-	+0.2'
Gulf Gate Drive	Collector	-	-	+0.1'
Anchor Way	Neighborhood	-	-	+0.2'
Concord Street	Neighborhood	+0.7'	+0.6'	+1.1'
Valley Forge Street (West)	Neighborhood	+0.2'	+0.4'	+0.8'
Nelson Avenue	Neighborhood	-	-	+0.9'
Gateway Avenue (South)	Collector	-	-	+0.5'
Terry Lane (NE)	Neighborhood	-	-	+0.7'
Terry Lane (S)	Neighborhood	-	-	+0.2'
Linda Street	Neighborhood	-	-	+0.2'
Mall Drive	Neighborhood	-	-	+0.6'
Clark Road	Evacuation	-	-	+0.2'
		+0.9'	+1.0'	+1.2'
		-	-	+0.3'
		+0.1'	+0.2'	+0.5'
Nutmeg Avenue	Neighborhood	+0.8'	+0.6'	+0.6'
Murdock Avenue	Neighborhood	+0.2'	-	-
Blount Avenue	Neighborhood	+0.1'	-	+0.1'
Mohawk Street	Neighborhood	+1.7'	+1.5'	+1.5'
Arapaho Street	Neighborhood	+0.2'	-	-

TABLE 6.3.1

LOWER MATHENY CREEK MAIN (CANAL 10-198)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
110	U.S. 41 (D.S.)	7.84	7.75	8.00	7.90
111	U.S. 41 (U.S.)	10.56	10.71	11.05	11.10
112	WLCS MC-1 (D.S.)	10.57	11.06	11.06	11.20
113	WLCS MC-1 (U.S.)	10.91	11.39	11.41	11.44
114	628 Ft. Downstream of Bispham Road	11.19	11.57	11.73	11.87
115	Bispham Road (D.S.)	11.44	11.89	11.95	12.00
116	Bispham Road (U.S.)	11.77	12.22	12.47	12.40
117	450 Ft. Upstream of Bispham Road	11.89	12.33	12.81	12.75
118	600 Ft. Downstream of Gulf Gate Drive	12.52	12.67	13.60	13.37
119	Gulf Gate Drive (D.S.)	13.02	13.21	14.07	13.63
120	Gulf Gate Drive (U.S.)	14.46	14.66	14.42	14.12
121	525 Ft. Upstream of Gulf Gate Drive	14.66	14.76	14.57	14.42
122	1200 Ft. Upstream of Gulf Gate Drive	14.90	15.31	15.11	14.76
123	1675 Ft. Upstream of Gulf Gate Drive	15.31	15.42	15.11	15.17
124	WLCS MC-2 (D.S.)	15.77	15.66	15.30	15.41

TABLE 6.3.1.a

UPPER MATHENY CREEK MAIN (CANAL 10-199)
COMPARISONS OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
124	WLCS MC-2 (D.S.)	15.77	15.66	15.30	15.41
125	WLCS MC-2 (U.S.)	16.00	16.02	16.03	15.79
126	Beneva Road (D.S.)	16.22	16.38	16.27	16.15
127	Beneva Road (U.S.)	16.48	16.40	16.47	16.22
128	631 Ft. Upstream of Beneva Road	16.61	16.61	16.57	16.32
129	1181 Ft. Upstream of Beneva Road	16.82	16.70	16.72	16.49
130	1739 Ft. Upstream of Beneva Road	17.03	16.80	16.83	16.63
131	2289 Ft. Upstream of Beneva Road	17.09	16.99	16.87	16.72
132	3229 Ft. Upstream of Beneva Road	17.22	17.13	17.04	16.97
133	3709 Ft. Upstream of Beneva Road	17.47	17.37	17.23	17.07
134	SCL RR Spur (D.S.)	17.65	17.48	17.52	17.36
137	SCL RR Spur (U.S.)	18.85	18.78	18.81	17.96
138	480 Ft. Upstream of SCL RR Spur	18.87	18.87	18.86	18.10

TABLE 6.3.1.b

UPPER MATHENY CREEK MAIN (CANAL 10-199)
COMPARISONS OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
124	WLCS MC-2 (D.S.)	15.77	15.66	15.30	15.41
125	WLCS MC-2 (U.S.)	16.00	16.02	16.03	15.79
126	Beneva Road (D.S.)	16.22	16.38	16.27	16.15
127	Beneva Road (U.S.)	16.48	16.40	16.47	16.22
128	631 Ft. Upstream of Beneva Road	16.61	16.61	16.57	16.32
129	1181 Ft. Upstream of Beneva Road	16.82	16.70	16.72	16.49
130	1739 Ft. Upstream of Beneva Road	17.03	16.80	16.83	16.63
131	2289 Ft. Upstream of Beneva Road	17.09	16.99	16.87	16.72
132	3229 Ft. Upstream of Beneva Road	17.22	17.13	17.04	16.97
133	3709 Ft. Upstream of Beneva Road	17.47	17.37	17.23	17.07
134	SCL RR Spur (D.S.)	17.65	17.48	17.52	17.36
137	SCL RR Spur (U.S.)	18.85	18.78	18.81	17.96
138	480 Ft. Upstream of SCL RR Spur	18.87	18.87	18.86	18.10

TABLE 6.3.1.b

BREAKWATER LATERAL (CANAL 11-209)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
114	Confluence with Matheny Creek Main	11.19	11.57	11.73	11.87
140	West Breakwater Circle (D.S.)	14.12	12.50	12.62	12.48
141	West Breakwater Circle (U.S.)	14.15	13.71	13.76	13.39
142	East Breakwater Circle (D.S)	14.17	14.05	14.12	13.76
143	East Breakwater Circle (U.S.)	16.20	15.03	15.04	14.66
144	West Post Road (U.S.)	16.22	15.70	15.70	15.34
145	Bounty Drive (U.S.)	17.49	16.77	16.77	15.92
146	East Post Road U.S.)	17.80	17.66	17.66	16.50

TABLE 6.3.1.c

DENHAM ACRES LATERAL (CANAL 10-190)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
111	WLCS DL-1 (D.S.)	10.56	10.71	11.05	11.10
200	WLCS DL-1 (U.S.)	11.61	11.15	11.46	11.50
202	Bispham Road (D.S.)	12.14	11.75	12.08	11.54
203	Bispham Road (U.S.)	12.41	12.02	12.30	12.07
204	325 Ft. Upstream of Bispham Road	12.61	12.19	12.79	12.44
205	Gulf Gate Drive (D.S.)	12.78	12.49	13.42	13.22
206	Gulf Gate Drive (U.S.)	13.66	13.48	13.60	13.43
207	Mall Drive (D.S.)	13.81	13.69	13.62	13.64
208	Mall Drive (U.S.)	14.49	14.44	13.99	13.94
209	600 Ft. Upstream of Mall Drive	14.66	14.68	14.38	14.26
210	1500 Ft. Upstream of Mall Drive	15.47	15.51	15.76	15.61
211	Clark Road (D.S.)	15.70	15.82	16.20	16.20

TABLE 6.3.1.d

CORAL LAKES BRANCH (CANAL 11-191)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
208	Confluence with Denham Acres Lateral	14.49	14.44	13.99	13.94
300	Gateway Avenue (D.S.)	14.57	14.48	14.17	14.02
301	Gateway Avenue (U.S.)	14.64	14.68	14.25	14.20
302	325 Ft. Upstream of Gateway Avenue	14.65	14.73	14.31	14.21
303	1000 Ft. Upstream of Gateway Avenue	14.83	14.93	14.44	14.25

TABLE 6.3.1.e

GULF GATE BRANCH (CANAL 10-192)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Condition	Alternative No. 1	Alternative No. 2	Alternative No. 3
205	Confluence With Denham Acres Lateral	12.78	12.49	13.42	13.22
400	St.Thomas Moore Entrance (D.S.)	13.03	12.65	13.29	13.31
401	St.Thomas Moore Entrance (U.S.)	14.41	12.84	13.31	13.36
402	Gulf Gate Drive (D.S.)	14.55	12.95	13.45	13.42
403	Gulf Gate Drive (U.S.)	15.12	14.63	14.32	14.25
404	500 Ft. Upstream of Gulf Gate Drive	15.78	15.61	15.47	14.85
405	Savage Road (D.S.)	16.05	16.00	15.91	15.36
406	Savage Road (U.S.)	16.26	16.19	16.13	16.02
[1]407	Valley Forge Street (D.S.)	16.41	16.21	16.20	16.13
408	Valley Forge Street (U.S.)	16.39	16.19	16.20	16.13
[2]501	Williamsburg Street (D.S.)	16.30	16.15	16.08	16.07
520	Williamsburg Street (U.S.) New England Street (D.S.)	16.42	16.17	16.11	16.09
521	New England Street (U.S.) Yorktown Street (D.S.)	16.85	16.29	16.30	16.26
522	Yorktown Street (U.S.) Bernice Lake	17.01	17.83	17.34	17.34

[1] High Point
[2] Low Point

TABLE 6.3.1.f

WILLIAMSBURG BRANCH (CANAL 10-194)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
210	Confluence with Denham Acres Lateral	15.47	15.51	15.76	15.61
500	630 Ft. Upstream of Confluence	15.74	15.99	15.87	15.88
501	1310 Ft. Upstream of Confluence	16.30	16.15	16.08	16.07
502	Murdock Avenue (D.S.)	16.59	16.56	16.60	16.51
503	Murdock Avenue (U.S.)	16.89	16.87	16.89	16.88
504	Lockwood Ridge Road (D.S.)	17.25	17.31	17.31	17.32
505	Lockwood Ridge Road (U.S.)	18.63	18.24	18.25	18.29
505A	Nelson Avenue (D.S.)	18.67	18.47	18.47	18.49
506	Nelson Avenue (U.S.)	19.74	19.47	19.47	19.03
507	600 Ft. Upstream of Nelson Avenue	19.83	19.53	19.53	19.15
508	1100 Ft. Upstream of Nelson Avenue	20.23	20.02	20.02	19.77
509	Sun Haven Lake	21.64	21.66	21.66	21.67

TABLE 6.3.1.g

SHADOW LAKES FEEDER (CANAL 10-196)
COMPARISON OF 100-YEAR WATER SURFACE ELEVATIONS (NGVD)

NODE	LOCATION	Existing Conditions	Alternative No. 1	Alternative No. 2	Alternative No. 3
405	Confluence with Gulf Gate Branch	16.05	16.00	15.91	15.36
410	Gulf Gate Elem. School Culvert (U.S.)	18.16	17.72	17.69	17.10
411	Lockwood Ridge Road (D.S.)	18.23	17.79	17.76	17.33
412	Lockwood Ridge Road (U.S.)	18.34	18.19	18.22	18.00
413	1000 Ft. Upstream of Lockwood Ridge Road	18.46	18.32	18.29	18.07
414	1940 Ft. Upstream of Lockwood Ridge Road	18.61	18.45	18.43	18.21
415	Lake Wright	18.60	18.40	18.40	18.38

TABLE 6.3.1.h

6.3.1.1 LOWER MATHENY CREEK SUBBASIN

Of first priority in the subbasin, the existing 36" RCP outfall culvert for the Breakwater Branch should be enlarged. A 4' x 7' RCBC was considered in the alternative analyses. This improvement is expected to provide the largest contribution to resolving habitable structure FPLOS deficiencies in the subbasin as well as addressing existing cross-basin flows from the Matheny Creek basin to the Elligraw Bayou basin.

Other recommended improvements considered effective in addressing road access FPLOS deficiencies in the lower Matheny Creek subbasin include:

- Replace and enlarge the existing corrugated metal culverts within the Breakwater Branch drainage system. Reinforced concrete culverts should be used.

- Replace and enlarge the existing bridge structure and Gulf Gate Drive and Matheny Creek.

- Modify water level control structure MC-1 to provide more efficient flood conveyance while enhancing normal ground water levels.

- Enhance storage in Gulf Gate Golf Course lakes.

6.3.1.2 UPPER MATHENY CREEK SUBBASIN

Although no habitable structure flooding is suspected within the Upper Matheny Creek subbasin, cross basin flows from the Catfish Creek drainage basin are anticipated during major storm events. It is recommended that this historic drainage divide be established when McIntosh Road is designed and constructed. This recommendation is consistent with that contained in the Clark Road Corridor - Drainage Study prepared by Kimley-Horn and Associates, Inc. in 1992.

Other recommended improvements considered effective in addressing road access FPLOS deficiencies in the Upper Matheny Creek subbasin include:

- Remove excess sediment build-up in the Upper Matheny Creek Main.

- Modify water level control structure MC-2 enhance storage within the historical Upper Matheny Creek floodplains and reduce downstream discharges.

- Enhance floodplain storage capacity within the open space of the historical Upper Matheny Creek floodplain along the south side of the Main.

- Redirect storm-sewer outfall for Roxbury Drive to the downstream side of water level control structure MC-2.

- Replace and enlarge, as appropriate, the existing corrugated metal equalizer culverts within the Gulf Gate East subdivision.

6.3.1.3 DENHAM ACRES LATERAL SUBBASIN

The Denham Acres Lateral actually services the entire Denham Acres Lateral subbasin as sell as the Coral Lakes and Clark Road subbasin. Therefore, it may be necessary to reduce flood levels in the subbasin in order to help address the FPLOS deficiencies in the upstream subbasins.

A major component of the capital improvement program for the subbasin includes the construction of overflow by-pass canal along the east side of St. Thomas Moore. This canal would be by hydraulically connected to the Lower Matheny Creek Main to provide additional relief to areas draining to the Gulf Gate Branch. Another major component intended to ultimately address upstream FPLOS deficiencies is the modification of water level control structure DL-1. The modifications to DL-1 are intended to both improve flood conveyance and enhance normal groundwater levels similar to the modifications proposed for water level control structure MC-1. It is envisioned that the design and construction of these two weir modification projects could be completed concurrently.

Other recommendation improvements considered effective in address FPLOS deficiencies in the Denham Acres Lateral subbasin include:

- Replace and enlarge crossings within the Denham Acres Lateral at Gulf Gate Drive and Mall Drive.

- Replace and enlarge culverts within Williamsburg Branch.

- Replace and enlarge culverts within the Gulf Gate Branch.

- Improve upper stage conveyance in the lower segments of the Denham Acres Lateral, the Williams burg Branch and the Gulf Gate Branch.

- Create flood storage enhancement area along east side of the Gulf Gate Branch within the western portion of Gulf Gate Elementary School.

- Replace and enlarge outfall culvert for the Shadow Lakes Feeder along the north side of the Gulf Gate Elementary School.

6.3.1.4 CORAL LAKES BRANCH SUBBASIN

Improvements considered in the subbasin are expected to remove 8 of 11 habitable structures from the 100-year floodplain. In addition, to the improvements proposed downstream of the Coral Lakes Branch within the Denham Acres Lateral, three (3) general improvements are recommended for consideration to address FPLOS deficiencies in the subbasin:

- Modify outfall for Coral Lakes to prevent backwater from the Coral Lakes Branch.

- Replace and enlarge the equalizer culvert between Coral Lakes. Direct all runoff from Gateway Avenue north of Mall Drive to Coral Lakes.

- Increase flood storage for the Gulf Gate Mall by expanding the existing lake, and/or allowing flooding in the lower portions of the parking lot. The berm along the east side of the existing lake/property line should also be elevated to prevent flooding of adjacent properties.

6.3.1.5 CLARK ROAD SUBBASIN

This entire subbasin drains to the upstream end of the Denham Acres Lateral via Clark Road. Based upon the Matheny Creek analyses, the drainage improvements currently underway by Florida Department of Transportation (FDOT) in association with the widening of Clark Road are expected to result in the more efficient transfer of water from east to west. Runoff from Clark Road itself will be conveyed by a storm sewer collection system to a retention/detention pond proposed in the northwest quadrant of the intersection of Clark Road and Swift Road. Runoff from other areas in the subbasin which drains to Clark Road will be conveyed directly to the upper end of the Denham Acres Lateral by a separate storm sewer collection system. However, during major storm events such as those considered in Matheny Creek Basin Master Plan, it is anticipated that the by-pass storm sewer system will become overloaded resulting in sheet flow of the excess runoff.

To address these anticipated adverse conditions, the expansion of the proposed FDOT pond tot he extent that the additional volume can be accommodate at a pond elevation which will alleviate or minimize the flooding of Clark Road was considered. Since the FDOT pond discharges to the upstream end of the Denham Acres Lateral, it is also important that any solution for the Clark Road area not result in adverse flood stages downstream. Specifically, it is recommended that the proposed FDOT pond be hydraulically connected to existing ponds such as Bernice Lake and Sunnyside Lake, and that other floodprone properties south of the intersection of Clark Road and Swift Road be converted to part of this expanded regional stormwater system onto Clark Road and into the roadways storm sewer collection system. This interim will over load the roadways storm sewer collection system and is expected to result in two adverse conditions. The first consequence is the flooding of Clark Road, a designated evacuation route. The depth flooding is estimated to vary between 0.4 and 1.4 feet for the 100-year design storm. The second consequence of the introduction of additional water to the Clark Road storm sewer collection system is the additional volume which will be ultimately conveyed to the proposed retention/detention pond for Clark Road. Based upon the analyses, this additional volume will result in significantly higher flood stages in the pond than anticipated by FDOT. In fact, the analyses indicate the proposed pond top-of-bank will be exceeded during the 100-year design storm resulting in the flooding of adjacent lands.

Other recommended improvements considered effective in addressing FPLOS deficiencies in the Clark Road subbasin include:

- Provide definitive outfalls to the Phillippi Creek drainage basin for portion of Phillippi Shores an area south of Gypsy Street. Although they are currently hydraulically connected to the Matheny Creek drainage basin, these areas are indicated as being within the Phillippi Creek drainage basin in the Phillippi Creek Basin Master Plan and were in fact historically contained within that basin. Based upon the alternative analyses it is expected that FPLOS deficiencies in these areas will be addressed.

- Enhance storage capacity of Lily Pond and Sunnyside Lake by expanding these facilities into adjacent open spaces.

- Create a storage facility north of Ashton Road and east of McCallum Terrace in an existing open space area. Equalize this facility with the existing lake south of Gypsy Street and increase conveyance to the south, under Ashton Road.

- Increase conveyance from Mohawk Lake.

- Direct upper portion of Nutmeg Avenue to Sunnyside Lake.

6.3.2 WATER QUALITY ALTERNATIVES

Opportunities to improve water quality by stormwater retrofit were quantified and assessed through application of the Sarasota County Pollutant Loading Model to the Matheny Creek drainage basin. Together these proposed water quality improvements constitute a water quality capital improvement program (WQCIP) for the Matheny Creek drainage basin. The effectiveness of the WQCIP was evaluated by comparison to the previously identified PLRG's in TABLE 5.2.2.a. TABLE 6.3.2 compares the pollutant loads resulting from the alternative analyses to the PLRG's for the parameters of interest.

PARAMETER	POLLUTANT LOAD (in lbs/yr)	
	PLRG	Proposed WQCIP
TKN	10,435	10,163
$NO_2 + NO_3$	1,935	1,526
TSS	717,341	756,996
Lead	543	677
Copper	230	235
Zinc	410	466
Cadmium	12	13

TABLE 6.3.2

As indicated in TABLE 6.3.2, the proposed WQCIP can be expected to be effective in meeting the SBNEP baywide PLRGs for nitrogen (i.e. TKN, and $NO_2 + NO_3$). However additional reductions for TSS, Lead, Copper and Zinc loads are believed to be within the objective reduction goal and could presumably be obtained by implementation of several of the non-quantifiable water quality improvement projects identified in Section 6.1 and through routine removal of sediments from the Matheny Creek Main and the Denham Acres Lateral.

7.0 CONCLUSIONS

Since the Matheny Creek drainage basin is essentially developed, the effectiveness of watershed management strategies other than capital improvements may be somewhat limited. However, the following alternative watershed management strategies are recommended:

- Require that all new public and private development within the Matheny Creek drainage basin be consistent with the Level of Service objectives of the Matheny Creek Basin Master Plan. Specifically, new development should be required to provide the Sarasota County Stormwater Environmental Utility with all required input data needed to update both the basin flood protection and water quality models. This will enable the Stormwater Environmental Utility to update the basin models to ensure that development proposals will not result in reductions to the adopted level of service standards, both on-site and off-site.

- Encourage regional common-use stormwater management facilities over small single-use facilities wherever feasible.

- Develop a basin-wide maintenance program. To this end, schedules for sediment removal and vegetation harvesting should be established for stormwater management facilities.

- Contingent upon documentation confirming its effectiveness, Sarasota County should pro-actively participate in the Florida Yards and Neighborhoods programs.

- Prohibit the perpetuation of open swale enclosures without both adequate conveyance provisions and water quality mitigation.

- Confirm finished floor elevations in areas identified as susceptible to flooding. Negotiate the purchase of either the real property or a flood easement with owners of structures which do not meet the adopted level of service.

With respect to flood protection, the existing level of service deficiencies were fully realized in lake June of 1992 when over 18 inches of rainfall fell on the Matheny creek drainage basin in a three day per period. As such, an immediate need exists to implement a Flood Protection Capital Improvement Program (FPCIP) to resolve the FPLOS deficiencies.

State Water Policy requires that the Southwest Florida Water Management District establish pollution load reduction goals for Matheny Creek. In addition, the National Estuary Program for Sarasota Bay is expected to reveal specific stormwater pollutant load reduction goals (PLRG's) by the end of the 1994. Preliminary discussions with the SBNEP, it is anticipated that baywide PLRG's for nitrogen and toxins of 7% and 27%, respectively, are to be proposed for stormwater. It is expected that these PLRG's will establish a baseline WQLOS standard for the entire SBNEP watershed, which contains the Matheny Creek drainage basin. It may be prudent to wait for implementation of a WQCIP until such PLRG's are formally proposed by SBNEP, adopted by SWFWMD, and assessed within the context of the entire SBNEP Watershed by the Sarasota County Pollutant Loading Model.

Therefore, it is recommended that Sarasota County proceed with the implementation of the FCIP identified in TABLE 1.5 but wait for final option of the PLRG's before proceeding with the implementation of the proposed WQCIP. Implementation of the proposed FPCIP and its storage enhancement components are expected to compliment the subsequent WQCIP. In fact, some of the projects proposed in the FPCIP are also projects considered in the WQCIP.

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DEVELOPMENT PLANS

Residential Developments

1. Ashton Lakes
2. Beneva Oaks
3. Beneva Oaks II
4. Beneva Place
5. Buccaneer Plaza
6. Colonial Terrace
7. Coral Lake Condo
8. Denham Acres, Unit No. 1
9. Golden Acres
10. Golden Acres, First and Second Additions
11. Golden Lakes, Second Addition
12. Gulf Gate, Units 4 through 15
13. Gulf Gate Church
14. Gulf Gate East, Units 1 through 5
15. Gulf Gate Garden Manor East Condominium
16. Gulf Gate Glens
17. Gulf Gate Manor, Units 1 through 3
18. Gulf Gate School
19. Gulf Gate West
20. Gulf Gate Woods, Units 1 through 3
21. Los Lagos
22. Mohawk Gardens
23. Palm Lakes
24. Phillippi Gardens (Units 5, 6, 15 & 16)
25. Pine Park Centre
26. Shadow Lakes
27. Siesta Heights
28. Siesta Heights Manor
29. St. Thomas Moore Catholic Church
30. Summerside Condominium
31. Sun Haven, Units 2 and Unit 5
32. Sun Oak
33. Sunnyside Lake
34. Swifton Villas Condominium
35. Tregate Manor
36. Village in the Pines
37. Woodside Village East
38. Woodside Oaks Condominium
39. Woodside South
40. Woodside Terrace
41. Villa Gardens

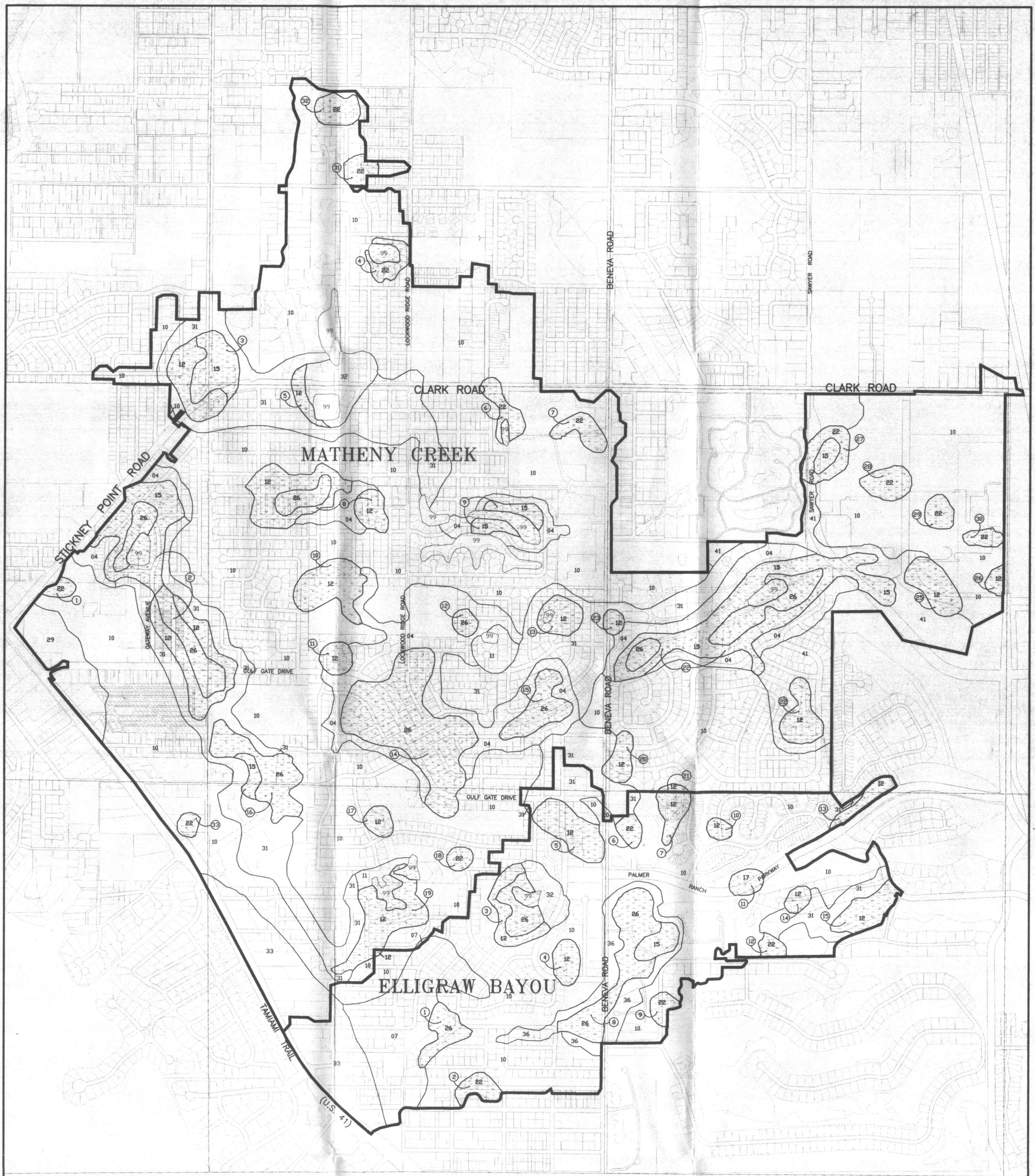
Commercial Developments

1. Beneva Village Shops
2. Gulf Gate Mall
3. Palmer Park of Commerce (Future)
4. Publix Warehouse
5. Stickney Pointe Office Center
6. Winn Dixie Warehouse

7. Outback Steakhouse
8. Robb & Stucky Furniture Store
9. Merchants Pointe Shopping Center

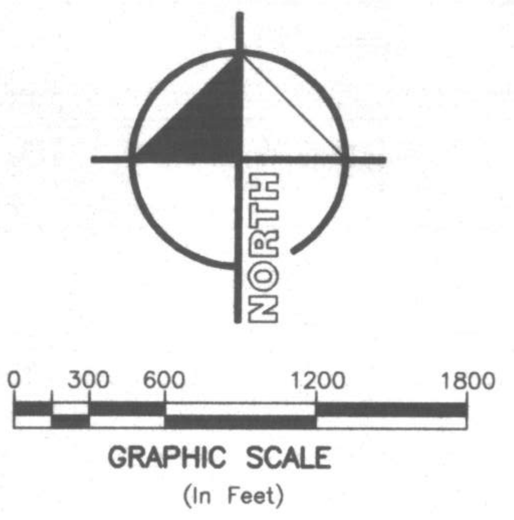
Major Roadway Corridors

1. U.S. 41 (from Stickney Pointe to Pinehurst Street)
2. Beneva Road (from Clark Road to Gulf Gate Drive)
3. Lockwood Ridge (from Ashton Road to Markridge Road)
4. Clark Road (from U.S. 41 to McIntosh Road)
5. Swift Road (from Clark Road to Ashton Road)



LEGEND

4	Bradenton fine sand
7	Cassia fine sand
10	EauGallie and Myakka fine sands
12	Felda fine sand, depressional
15	Floridian and Gator soils, depressional
17	Gator muck
22	Holopaw fine sand, depressional
26	Manatee loamy fine sand, depressional
29	Orsino fine sand
31	Pineda fine sand
33	Pomello fine sand
36	Pople fine sand
41	Wabasso fine sand
99	Pits, Lakes
(shaded)	Depressional / Frequently Flooded Soils
(33)	Historical Flood Prone Area I.D. No.



SARASOTA COUNTY 1921

1	FOR: SARASOTA BOARD OF COUNTY COMMISSIONERS TITLE: STORMWATER BASIN MASTER PLAN MATHENY CREEK / ELLIGRAW BAYOU DRAFT DESC: EXHIBIT 4 - SCS SOILS MAP	X STEPHEN M. SUAU P.E. FLA. CERT. NO. 36390 DATE:	NO. / REVISION / DATE / BY / ISSUED FOR / DATE / BY

Kimley-Horn
Engineers ◇ Planners ◇ Surveyors

Kimley-Horn and Associates, Inc.
7202 BENEVA ROAD SOUTH
SARASOTA, FLORIDA 34238
PHONE (813) 922-8187
FAX (813) 922-2351

Design By: KHA	Drawn By: E.R.B.	Checked By: S.M.S.	Project No.: 6739
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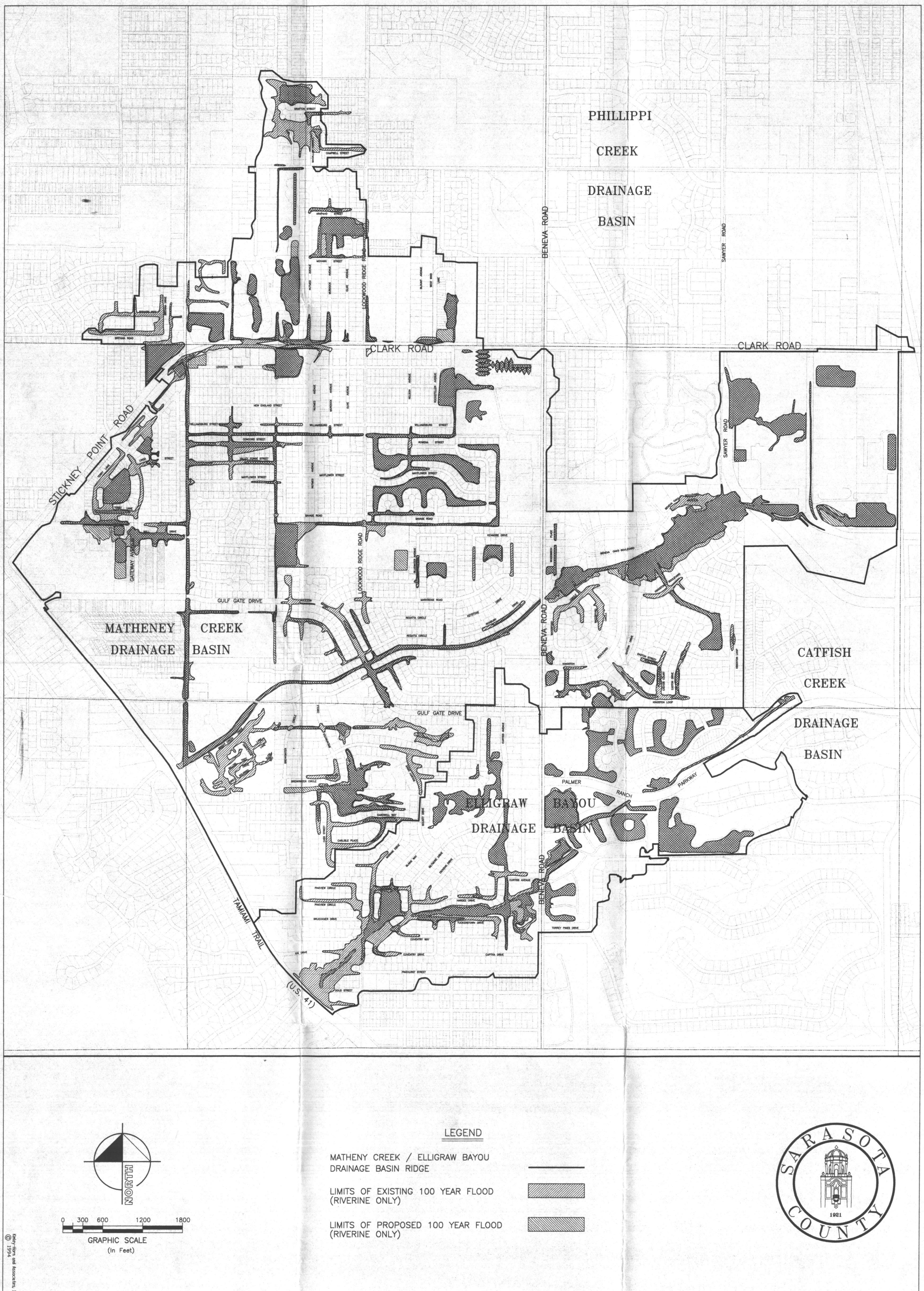

1	FOR:	SARASOTA BOARD OF COUNTY COMMISSIONERS
	TITLE:	STORMWATER BASIN MASTER PLAN MATHENEY CREEK / ELLIGRAW BAYOU
	DESC:	EXHIBIT 5 - 100 YEAR FLOODPLAIN MAP

DRAFT

X
STEPHEN M. SUAU P.E.
FLA. CERT. NO. 36309
DATE:

NO.	REVISION	DATE	BY

Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants
7202 BENEVA ROAD SOUTH
SARASOTA, FLORIDA 34238
TEL (813) 922-8187
FAX (813) 922-2351

Design By: KHA	Drawn By: ERB/RBK	Checked By: S.M.S.	Project No.: 6739-05
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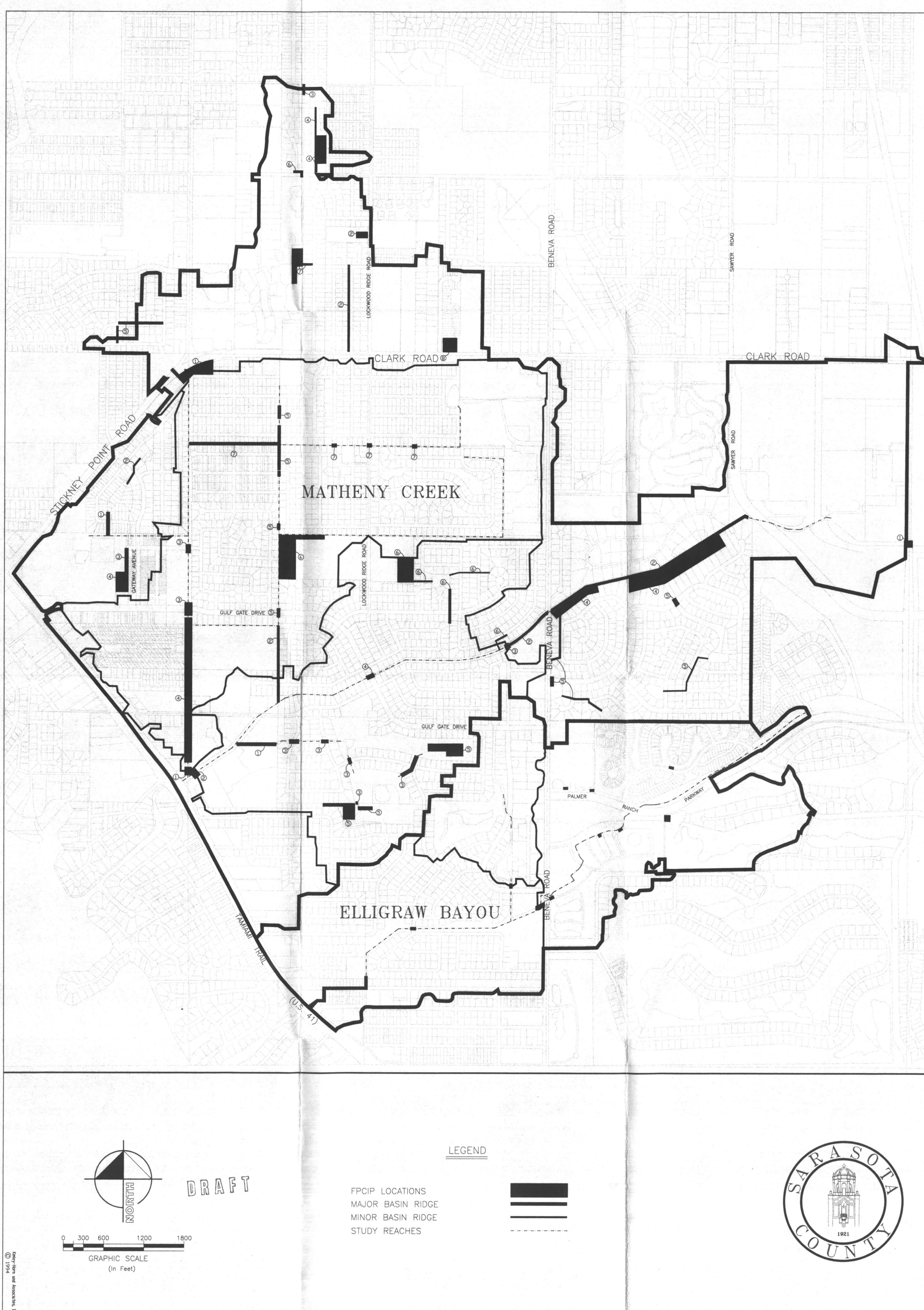

1	FOR:	SARASOTA BOARD OF COUNTY COMMISSINERS
	TITLE:	STORMWATER BASIN MASTER PLAN MATHENY CREEK / ELLIGRAW BAYOU
	DESC:	EXHIBIT 6 - FPCIP LOCATION MAP

X

STEPHEN M. SUAU P.E.
FLA. CERT. NO. 36309
DATE:

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Kimley-Horn and Associates, Inc.
Engineering, Planning and Environmental Consultants

7202 BENEVA ROAD SOUTH
SARASOTA, FLORIDA 34238
TEL (813) 922-8187
FAX (813) 922-2351

Design By: K.H.A.	Drawn By: ERB/RBK	Checked By: S.M.S.	Project No.: 6739-[illegible]
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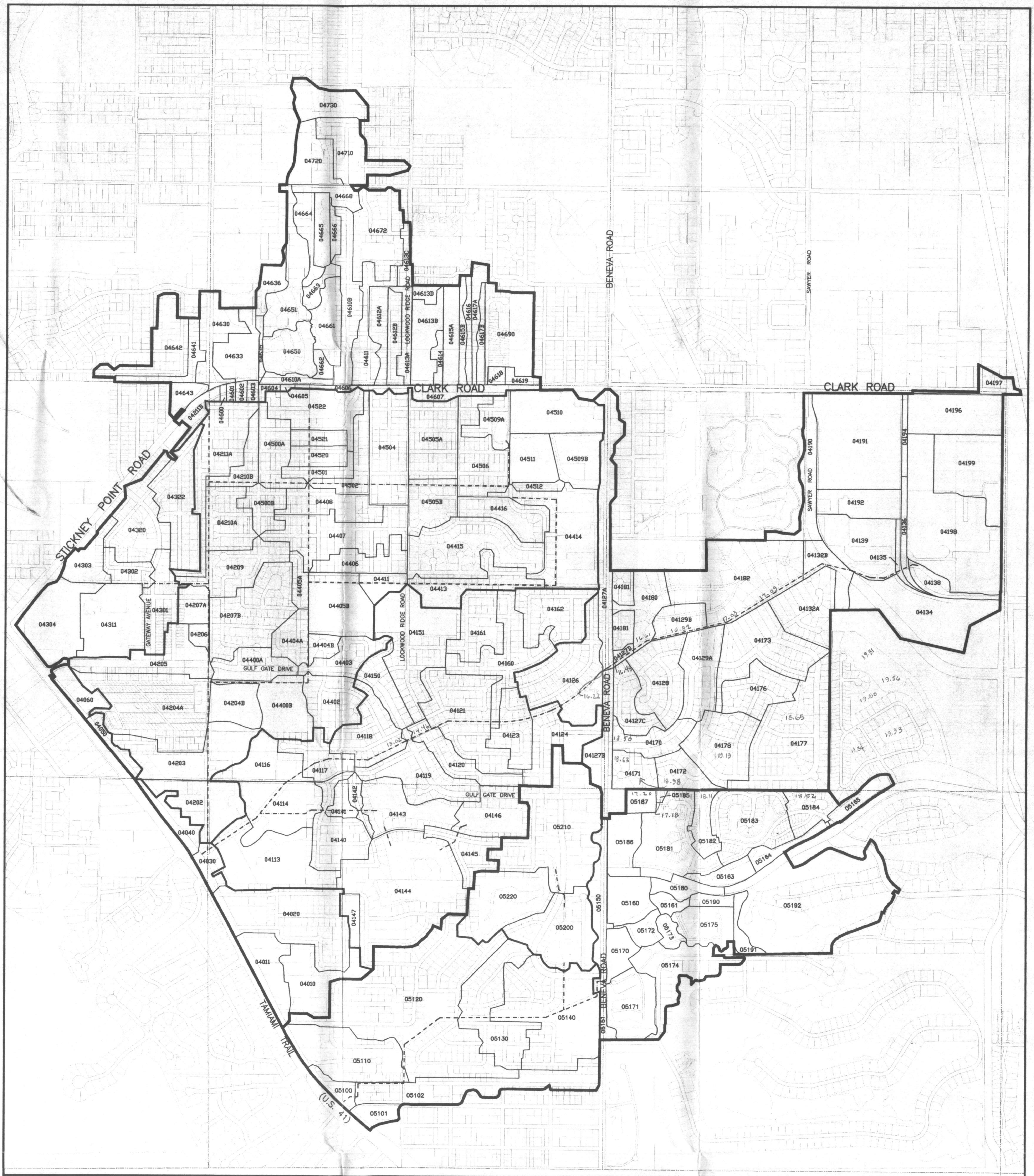

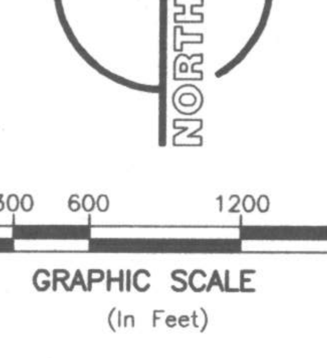

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GRAPHIC SCALE
(In Feet)

LEGEND

MAJOR BASIN RIDGE	
MINOR BASIN RIDGE	
SUBBASIN RIDGE	
SYUDY REACHES	
MATHENY CREEK SUBBASIN NUMBER	04000
ELIGRAW BAYOU SUBBASIN NUMBER	05000

1

FOR: SARASOTA BOARD OF COUNTY COMMISSIONERS
TITLE: STORMWATER BASIN MASTER PLAN
MATHENY CREEK / ELLIGRAW BAYOU
DRAFT
DESC: EXHIBIT 2 - BASIN / SUBBASIN MAP

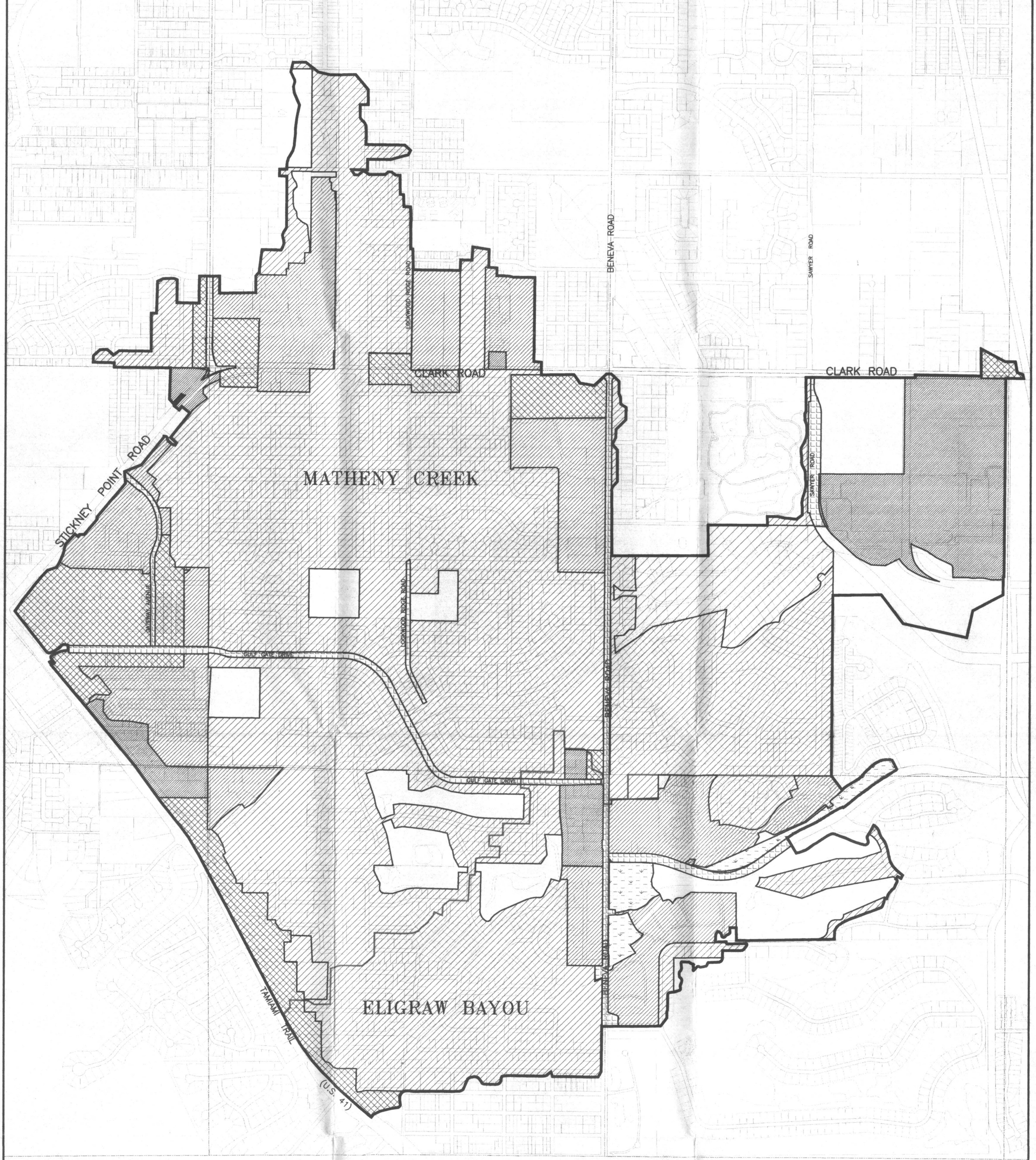
X
STEPHEN M. SUAU P.E.
FLA. CERT. NO. 36390
DATE:

NO.	REVISION	DATE	BY	ISSUED FOR	DATE	BY

Kimley-Horn
Engineers ◇ Planners ◇ Surveyors

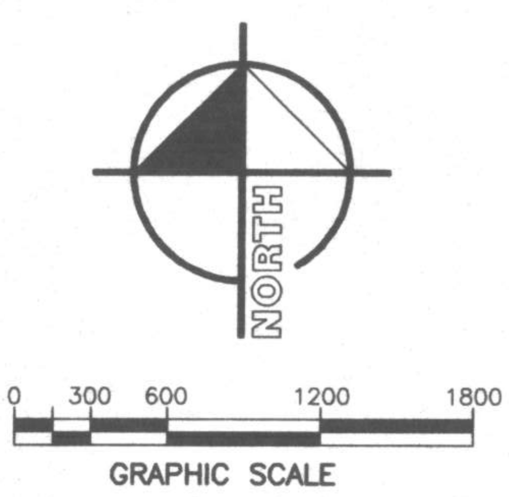
Kimley-Horn and Associates, Inc.
7202 BENEVA ROAD SOUTH
SARASOTA, FLORIDA 34238
PHONE (813) 922-8187
FAX (813) 922-2351

Design By: KHA	Drawn By: E.R.B.	Checked By: S.M.S.	Project No.: 6739
CADD File: B_BASE.DWG	Plot Index: B_BASIN.LMN	Date: JAN., 1994	SCALE: 1" = 600'



LEGEND

- MAJOR BASIN RIDGE
- FOREST / OPEN LANDS
- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- OFFICE / LIGHT INDUSTRIAL
- WETLANDS
- ROADWAYS



GRAPHIC SCALE
(In Feet)

1	FOR: SARASOTA BOARD OF COUNTY COMMISSIONERS	
	TITLE: STORMWATER BASIN MASTER PLAN DRAFT MATHENY CREEK / ELLIGRAW BAYOU	X STEPHEN M. SUAU P.E. FLA. CERT. NO. 36390 DATE:
	DESC: EXHIBIT 3 - EXISTING LAND USE MAP	

NO.	REVISION	DATE	BY	ISSUED FOR	DATE	BY

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