

**SOUTH CHARLOTTE COUNTY
NORTH LEE COUNTY
BABCOCK/WEBB**

**SURFACE WATER MANAGEMENT
CONCEPT PLAN**

Prepared For:

**THE SOUTH FLORIDA WATER
MANAGEMENT DISTRICT**

Prepared By:

**JOHNSON
ENGINEERING**

**Civil Engineers, Land Surveyors &
Environmentalists
Fort Myers – Port Charlotte - Naples**

TABLE OF CONTENTS

	<u>SECTION</u>	<u>PAGE</u>
1.	INTRODUCTION	1-1
2.	WATERSHED MAP	2-1
3.	HISTORIC FLOW ROUTES AND EXISTING PROBLEM AREAS	3-1
4.	CONCEPTUAL SURFACE WATER MANAGEMENT PLAN	4-1
5.	CONCLUSIONS AND RECOMMENDATIONS	5-1

APPENDIX

- 1) Photographs

Back Flap Attachments: 24" x 36" Watershed Map

1. INTRODUCTION

Background

The areas covered in this report are generally South Charlotte County, North Lee County and the Babcock/Webb Wildlife Management area. It is more concisely described as the area encompassed by US 41 on the west, the South Florida Water Management District (SFWMD) boundary on the north; SR 31 on the east and Nalle Grade Road (and its theoretical east/west extensions on the south). Primary watersheds include (west to east) Gator Slough, Powell Creek, Daughtrey Creek, Bayshore Creek, Popash Creek, Stroud Creek, Palm Creek and Owl Creek.

In the 1950's, almost all of these watershed areas were drained by sheet flow in a southwesterly or southerly direction to US 41 or State Road (S.R.) 78. There was no significant development to block this southwesterly and southerly sheet flow. Flow begins to concentrate at the downstream physical boundaries of the study area outlined in paragraph one above. Major drainage structures existed at: Gator Slough/US 41 and Powell, Daughtrey, Bayshore, Popash Stroud and Palm Creeks at S.R. 78.

The next 30 years, 1950 – 1980, brought development into these sheet flow areas and significant flooding began to occur. Sheet flow from the Babcock-Webb area of 40 square miles (18 sq. mi. Gator Slough and 22 sq. mi. Daughtrey Creek) remained unchanged. However, an area parallel to and 1500' south of Oil Well Grade between I-75 and the abandoned Seaboard Airline (SAL) grade was diked, severely constricting flow from the Babcock/Webb area to the south. Sheet flow south toward the Caloosahatchee River began to be blocked by development in the Nalle Grade Area. This was especially true in the sheet flow portion of Daughtrey, Popash and Stroud Creeks.

Topographic changes since the 1980's have further blocked, constricted and concentrated what were formerly sheet flow areas. Expanded development in the study area has exacerbated both constrictions and flooding in these newly developed sheet flow areas. Sheet flow prior to 1975 normally crossed over US 41 near the Charlotte/Lee County line. This was blocked when the west lanes of US 41 were raised in 1975. Sheet flow from the upper reaches of the Gator Slough Watershed (Babcock/Webb Area) was concentrated at the 145' bridge under I-75 near the Charlotte/Lee County line when it was constructed in 1980. Developments north of Nalle Grade have created blockages to sheet flow in the Daughtrey, Popash and Stroud Watershed Areas.

Objectives

Objectives of this report are to:

1. Prepare an integrated watershed map for the identified area.
2. Define the Basic Problems and identify major areas of flooding.
3. Conceptually outline plans for Potential Solutions.

Preparation of the WATERSHED MAP is discussed in Section 2 and the 24"x36" drawing is included in the back flap of this report. Section 3 discusses restoration of HISTORIC FLOW ROUTES AND EXISTING PROBLEM AREAS and the location of today's major flood prone areas. Section 4 outlines the CONCEPTUAL SURFACE WATER MANAGEMENT PLAN options for improvements. Section 5 lists CONCLUSIONS AND RECOMMENDATIONS. The Appendix contains photographs related to the project area.

2. WATERSHED MAP

The integrated watershed map is a combination of information from Charlotte County-Babcock/Webb and Lee County reports. Information from reconnaissance of the June '95 flood and of the summer 2003 wet season were also used.

The foundation of the Watershed Map originated with the 1961 Smally, Wellford and Nalven Lee County Study. The Watershed Map in Smally's report was the result of research and "on the ground" field reconnaissance. It represents the best basic outline of watershed boundaries prior to alteration by rapidly expanding development (reference Smally-Wellford Map excerpt on page 2-2). A 1974 aerial oblique on page 2-3 provides a visual comparison of the Smally map with actual on the ground flow patterns.

No significant research or reconnaissance occurred west of US 41 or south of Nalle Grade since they were the boundaries of the study area. Watershed boundaries and outfall locations downstream of the study area are not known to have changed significantly in recent years.

Several dominant features of the Watershed Map are of note. The Babcock/Webb Area makes up over 50% of the area of the entire study areas' watersheds. The historical sheet flow from this large watershed area onto and through recently developed sheet flow areas is the primary cause of the flooding problem. Enlargement of downstream conveyances or diversion of flow to more acceptable conveyances appear to be the more practical solutions.


The 24" x 36" Watershed Map for the study is included in the separate holder at the back of this report. It provides aerial coverage with overlaid watershed boundaries in light blue. Note that in some areas, the watershed boundaries are slightly offset (example is roads) to facilitate ease of geographical location.

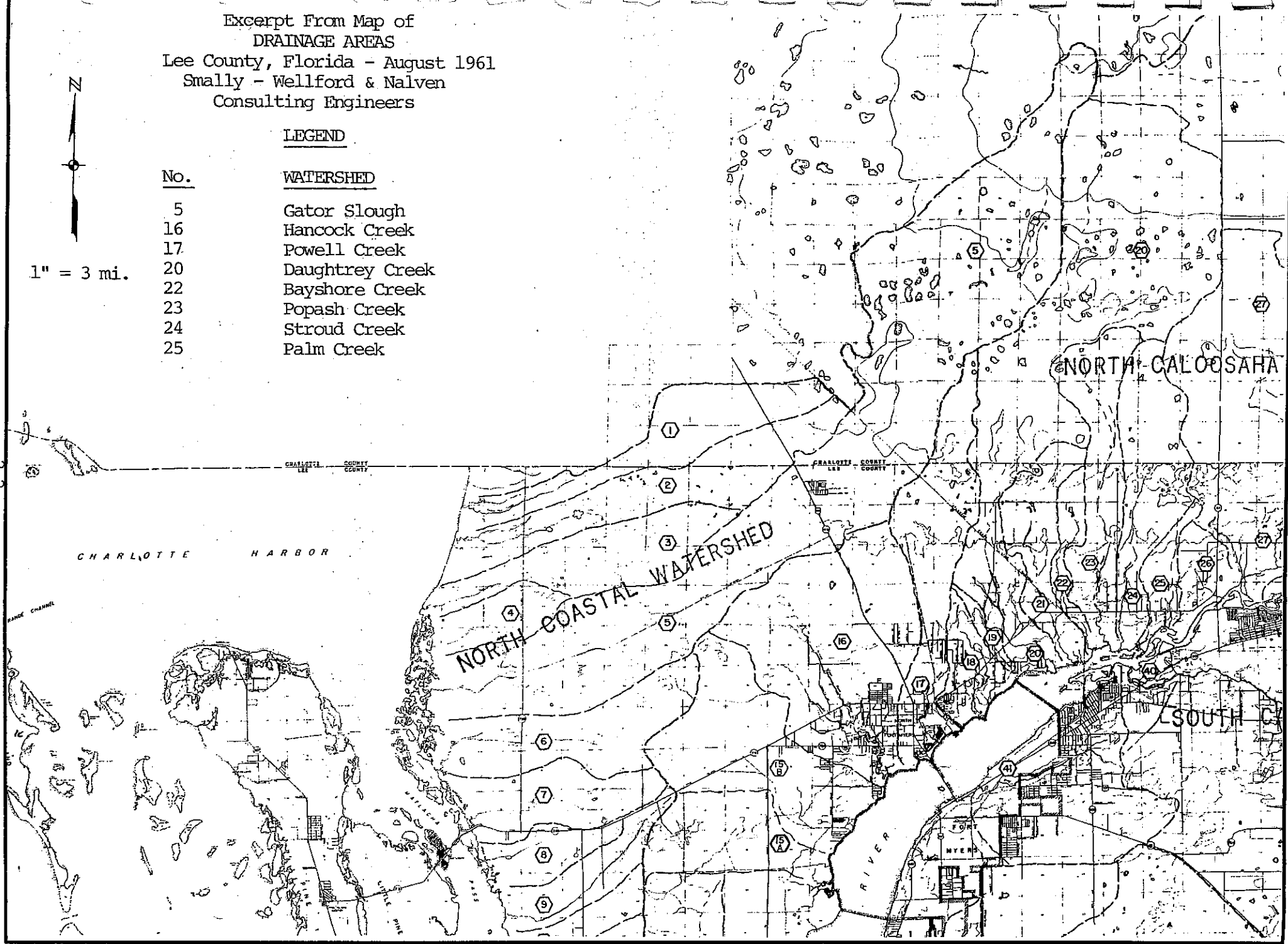
An 8 ½" x 11" schematic watershed map is shown on page 2-4 for ease of comparison to the 1961 Smally-Wellford map. A reduced 8 ½" x 11" version of the 24" x 36" Watershed Map is included on page 2-5 for ease of use.

Excerpt From Map of
DRAINAGE AREAS
 Lee County, Florida - August 1961
 Snelly - Wellford & Nalven
 Consulting Engineers

LEGEND

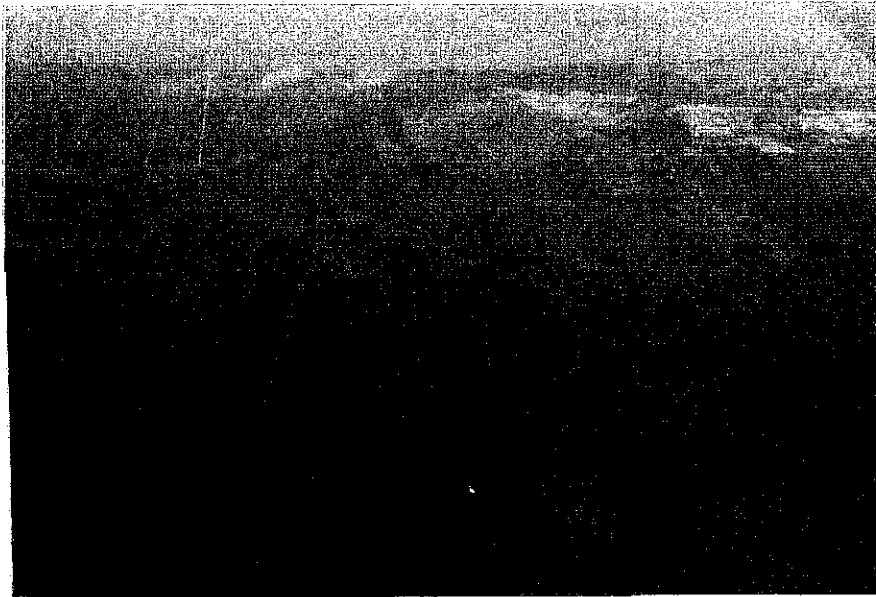
<u>No.</u>	<u>WATERSHED</u>
5	Gator Slough
16	Hancock Creek
17	Powell Creek
20	Daughtrey Creek
22	Bayshore Creek
23	Popash Creek
24	Stroud Creek
25	Palm Creek

N

 1" = 3 mi.

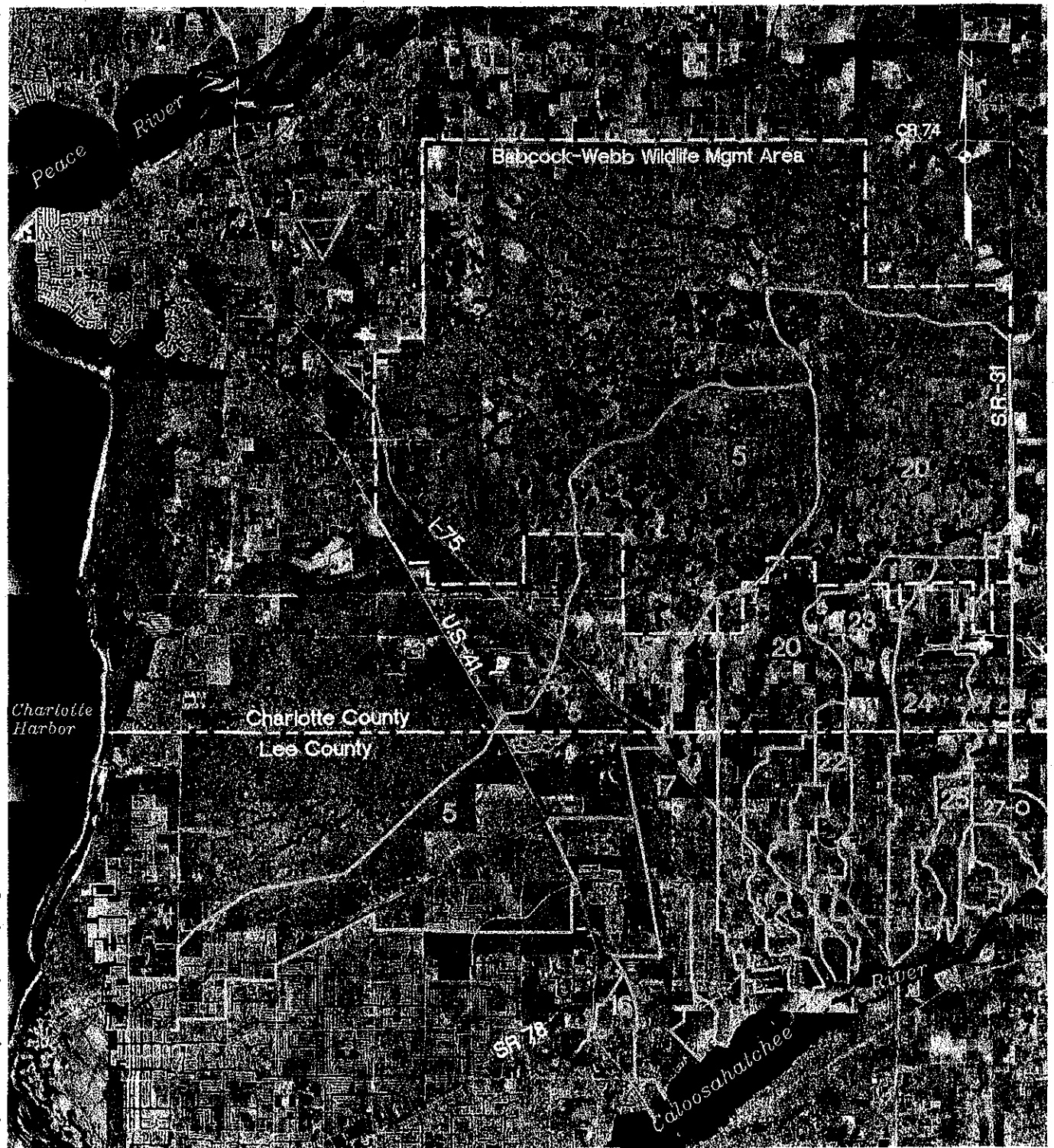


2-2

NORTH COASTAL WATERSHED



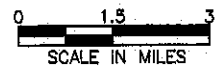
View southwesterly sheet flow from above US 41 toward Burnt Store Road on Charlotte Harbor.
Location is near Charlotte/Lee County line – Summer 1974. Note similarity to
Smally-Wellford Map on previous page of southwesterly flow pattern in area labeled
NORTH COASTAL WATERSHED.



J:\20033607\Aerial Report Map.dwg

NOTE: Aerial is from USGS DOQ imagery and is dated 1999. Watersheds are from Lee County Watershed Master Plan. Babcock-Webb boundary is from SWFWMD and is approximate.

- | <u>Watersheds</u> | |
|-------------------|-----------------|
| 5 | Gator Slough |
| 16 | Hancock Creek |
| 17 | Powell Creek |
| 20 | Daughtrey Creek |
| 22 | Bayshore Creek |
| 23 | Popash Creek |
| 24 | Stroud Creek |
| 25 | Palm Creek |
| 27-0 | Owl Creek |



AERIAL MAP WITH WATERSHED BOUNDARIES FOR PROJECT AREA

WATERSHED AREA TABLE

AREAS IN SQUARE MILES

<u>WATERSHED</u>	<u>BABCOCK/WEBB</u>	<u>CHAR.CO.(non Babcock/Webb)</u>	<u>LEE CO.(to Caloosahatchee R.)</u>	<u>TOTAL WATERSHED AREA</u>
5-GATOR SLOUGH	18.4	7.5	22.8	48.7
16-HANCOCK CREEK	0.0	0.0	4.8	4.8
17-POWELL CREEK	0.3	1.8	9.2	11.3
20-DAUGHTRY CREEK	22.3	7.1	4.1	33.5
22-BAYSHORE CREEK	0.0	0.4	2.5	2.9
23-POPASH CREEK	1.1	4.0	4.2	9.3
24-STROUD CREEK	0.9	4.2	4.0	9.1
25-PALM CREEK	0.0	0.0	1.8	1.8
27-0-OWL CREEK	0.7	2.6	2.4	5.7

3. HISTORIC FLOW ROUTES AND EXISTING PROBLEM AREAS

Upper reaches of primary watersheds (Gator Slough, Powell, Daughtrey, Popash and Stroud Creeks), were historically sheet flow. This historical sheet flow regime remains generally unaltered in the Babcock/Webb area of the watersheds.

However, downstream of Babcock/Webb, as development occurred, topographic barriers and alterations of flow routes occurred. Examples of recent topographic barriers are the raising of Oil Well Grade, diking of the area generally bounded by SAL Grade, Oil Well Grade (dike parallel and to south of Oil Well) and I-75, raising of US 41 westerly lanes and the raising of Nalle Grade. General outfall flow routes are shown on the shaded map on page 3-3.

The impact of these obstructions is clearly demonstrated by the flood prone area map on page 3-5.

Confirming these constrictive impacts are the "measured and estimated" outfall flows shown in the table below. It should be noted that both flow reconnaissances were made in periods after heavy and continuous rainfalls, with the second reconnaissance being taken immediately after Tropical Storm Henri on September 5 and 6. The purpose of these reconnaissances was to make flow measurements at strategic locations to determine if runoff from upstream sheet flow areas (example is Babcock/Webb) were reaching downstream conveyances. Both reconnaissances were made after several days of intense rainfall (generally 3"-5"). Upstream sheet flow areas were already full prior to these days of short intense rainfall creating a situation where runoff to the downstream strategic locations (measured) should have been significant. Absence of significant flows would indicate upstream constrictions or blockages resulting in significant ponding and flooding.

Simple hypothetical runoff comparisons shown below demonstrate the impact of upstream blockages (see map pg. 3-4 for locations):

Location	Upstream Watershed Area	Calculated flow for 1"/day runoff	Measured flow 7/22/03	Estimated flow 9/6/03
1.Gator Box @ US 41	30	807	14	10
2.Powell Box @ Laurel Dr.	6	161	92	80
3.Daughtrey Bridge @ Nalle Grade	31	834	64	78
4.Popash Bridge @ Nalle Grade	6	161	50	70
5.Stroud Culv. near Nalle Grade	6	161	15	-
6.Owl Box @ SR 31	8	215	32	-

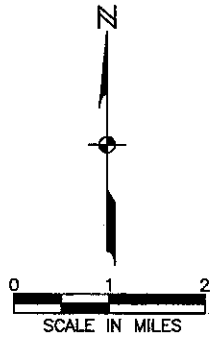
The above calculated flows assume a runoff of 1" per day for ease of comparison. The largest watersheds, Gator Slough and Daughtrey Creek were only discharging in the range of 0.02" and 0.08"/day respectively. These figures make it easy to focus on 2003 conditions. With a June through September rainfall total of over 50" (Page Field) and estimated runoffs in the range of 1.5" per month, it is easy to understand why upstream flooding occurs.

Generally, the annual runoff in Southwest Florida varies between eight and fifteen inches per year. The majority of this runoff comes within the four month wet season which is typically June through September. This would provide an average runoff of between two and three and three-quarter inches per month based on a rainfall depth for the same period of about thirty-four inches. This past year fifty-two inches were received in June through September. This amount is approximately one and one-half times the average rainfall. Therefore, the runoff should have been at least one and one-half times that amount, if not greater. It is readily apparent that the runoff average of one and one-half inches per month is well below the expected runoff in this area based on normal conditions. Obviously constrictions, blockages and excess storage in places that historically have not stored water to the extent that is currently being stored created the major reduction in runoff.

The problem is clearly that upstream flood prone areas have no outfall route for accomplishing drawdowns between periods of successive intense rainfall. Therefore, downstream outfall routes must be restored to draw down upstream flood pools and storage areas required to attenuate flood flows downstream. Once the upstream areas are full, similar to June 1995, significant additional rainfall insured massive downstream flooding without any quick effective means of resolution.

The impact of obstruction of historical flow routes is clearly demonstrated by the flood prone map on page 3-5. Flooding in the Oil Well Grade area east of I-75 is the result of downstream diking and constriction of the outfall along the SAL Grade to the I-75 Bridge. Flooding east of US 41 in the area north of the Gator Slough Box Culvert results from the inability of flood flows to find an adequate route from the 145' I-75 bridge to the US 41 Gator Slough 4 - 10' x 6' Box Culvert.

BABCOCK-WEBB WATERSHED AREAS DRAINING INTO LEE COUNTY



- 5 Gator Slough
- 16 Hancock Creek
- 17 Powell Creek
- 20 Daughtrey Creek
- 22 Bayshore Creek
- 23 Popash Creek
- 24 Stroud Creek
- 25 Palm Creek
- 27-0 Owl Creek
- Bridge Location

Direction Of Flow

3-3

Charlotte Harbor

Charlotte County
Lee County

Babcock-Webb Boundary

Tuckers Grade

SAL Grade

FP&L R/W

Oil Well Grade

US 41

Cook-Brown Rd

SR 31

Nalle Grade

I-75

Caloosahatchee River
SR 80

5

17

22

24

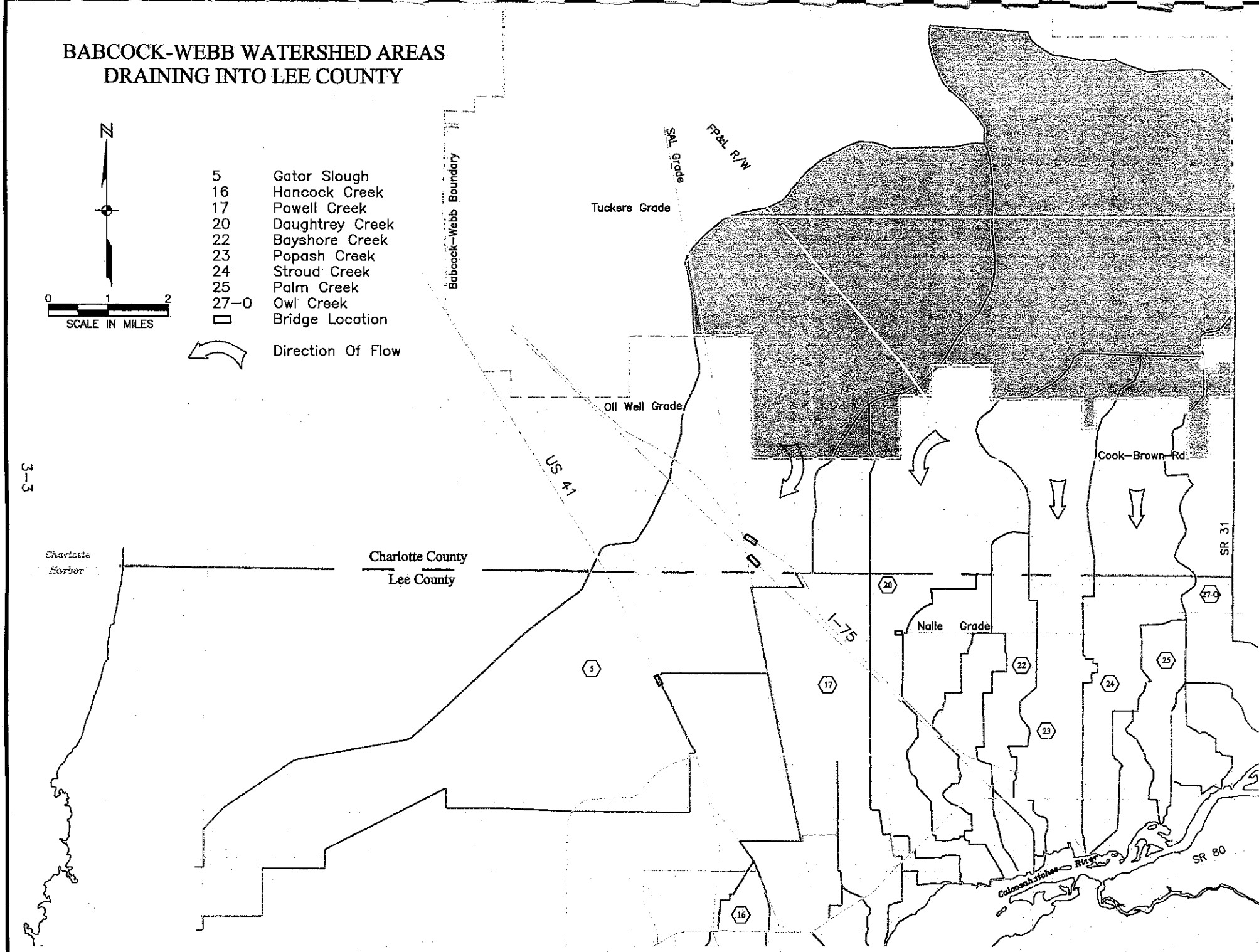
25

23

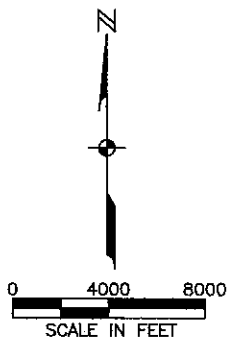
16

27-0

SR 80



**MEASURED AND ESTIMATED FLOWS
TAKEN IN 2003 AFTER PERIODS OF
HEAVY RAINFALL**

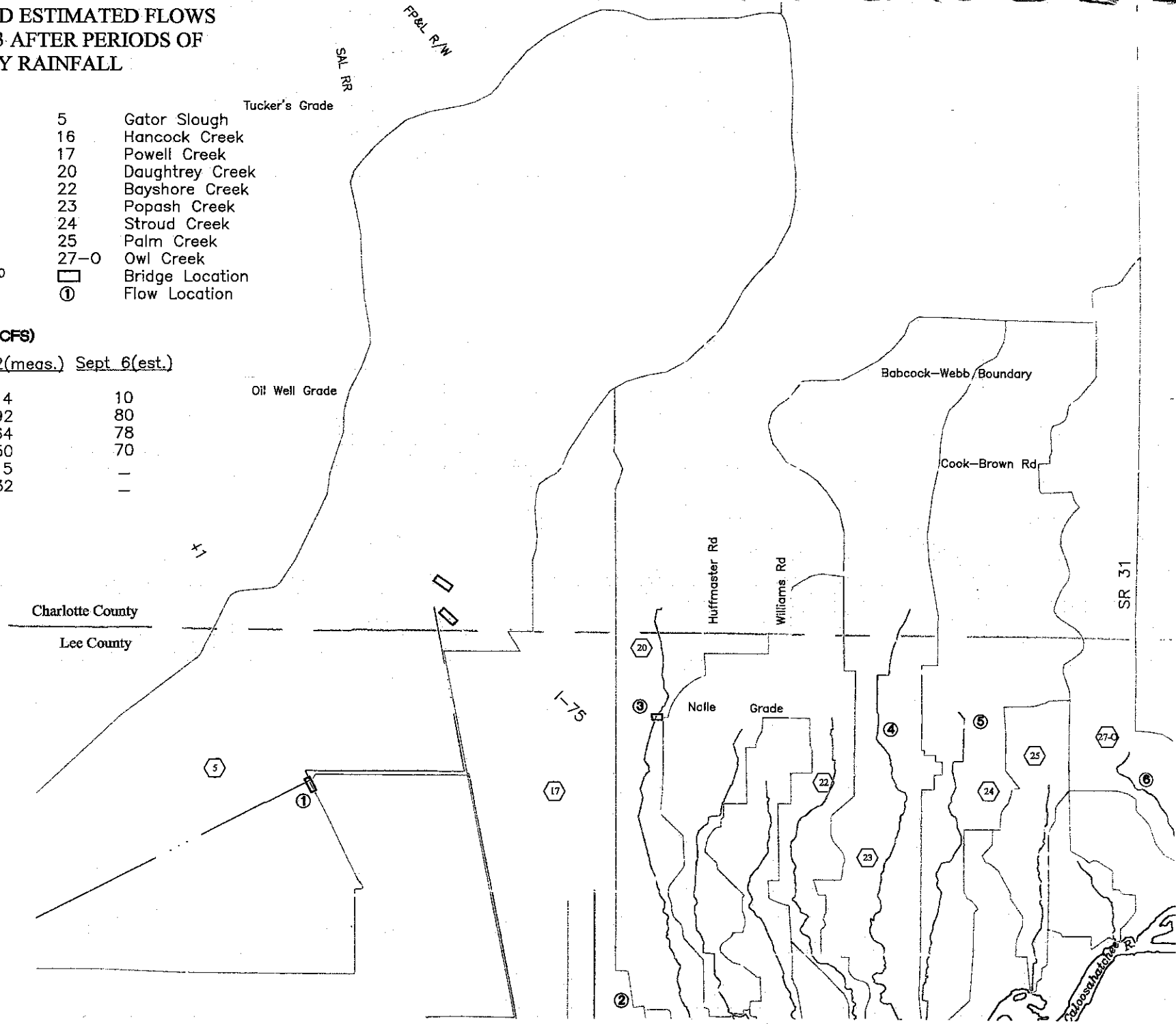


- 5 Gator Slough
- 16 Hancock Creek
- 17 Powell Creek
- 20 Daughtrey Creek
- 22 Bayshore Creek
- 23 Popash Creek
- 24 Stroud Creek
- 25 Palm Creek
- 27-0 Owl Creek
- Bridge Location
- ① Flow Location

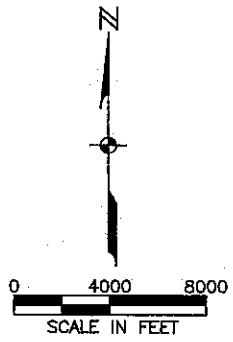
FLOWS (in CFS)



Location	July 22(meas.)	Sept 6(est.)
1	14	10
2	92	80
3	64	78
4	50	70
5	15	—
6	32	—

3-4

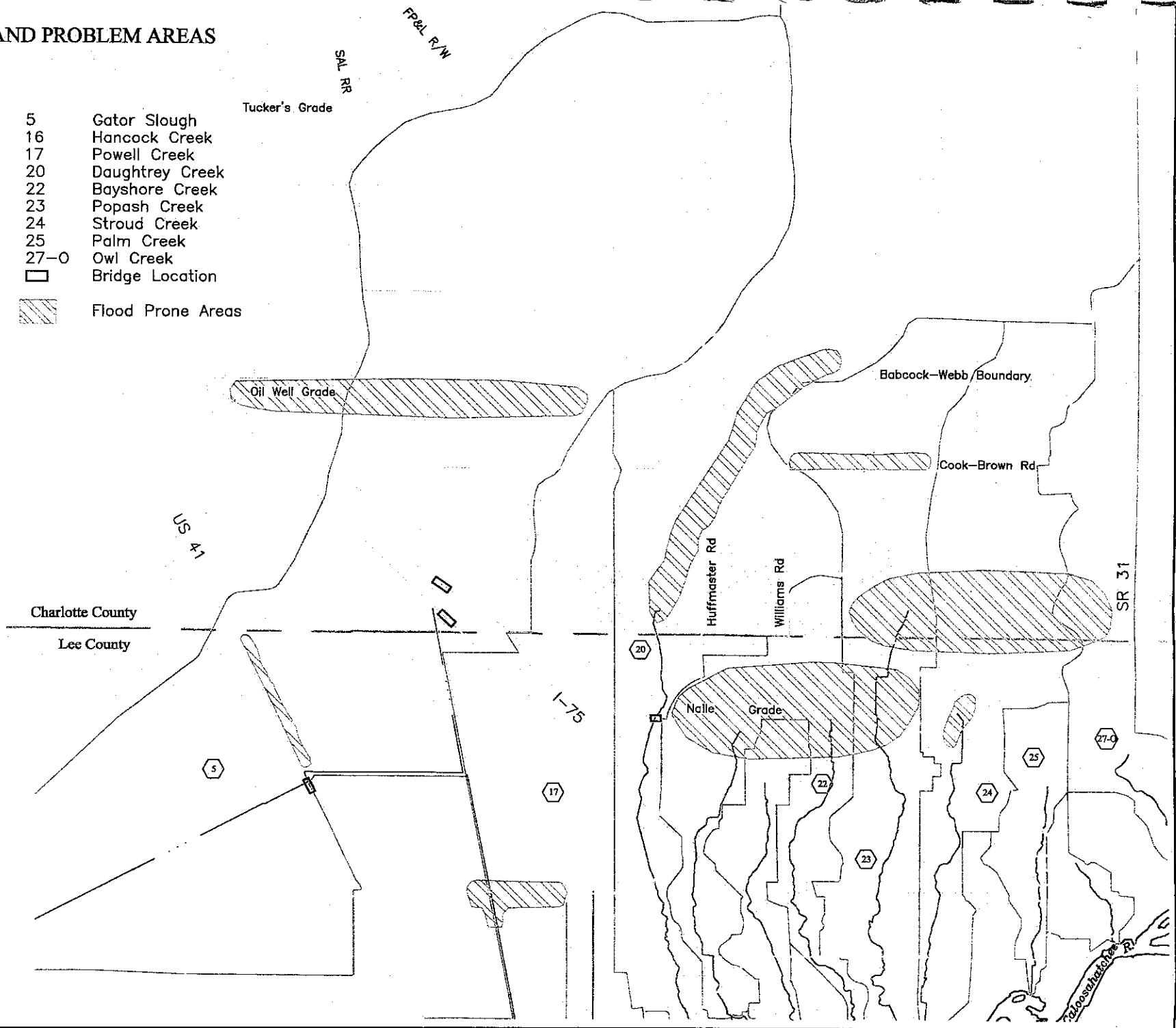


FLOOD PRONE AND PROBLEM AREAS



- 5 Gator Slough
- 16 Hancock Creek
- 17 Powell Creek
- 20 Daughtrey Creek
- 22 Bayshore Creek
- 23 Popash Creek
- 24 Stroud Creek
- 25 Palm Creek
- 27-0 Owl Creek
-  Bridge Location
-  Flood Prone Areas

3-5



HISTORIC FLOW ROUTE



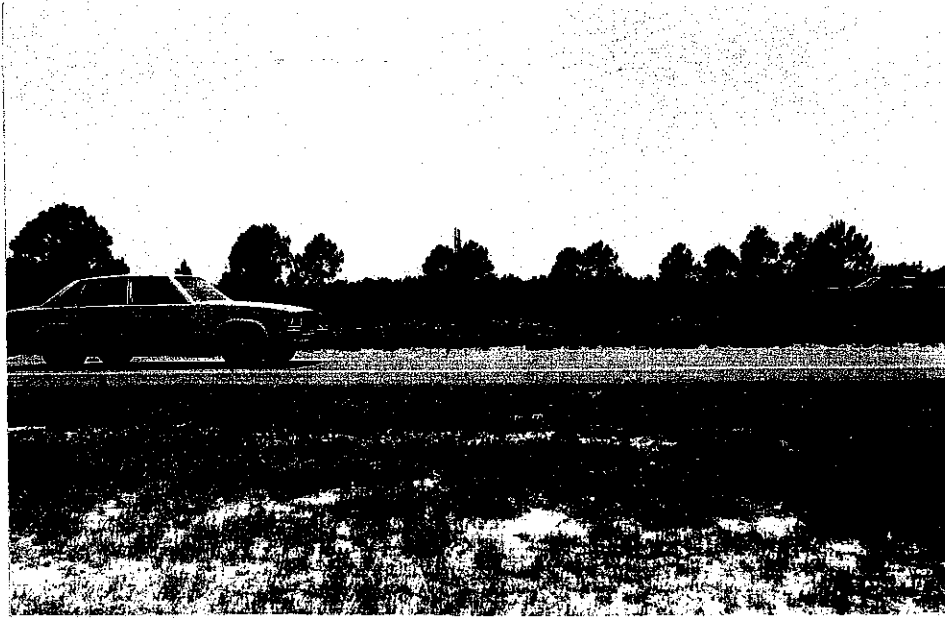
View southwest. I-75 145' Bridge is in center foreground with U.S. 41, Gator Slough and Cape Coral in background. Note how bridge is aimed directly at Gator Slough in this 1983 photo. Also note that bridge has been blocked off by diking along SAL RR grade (bottom center) and along I-75. Diked area (bottom right of photo-north of I-75) shows much drier because of diking. Diking blocks surface water flowing from Webb Area to 145' I-75 Bridge.

HISTORIC FLOW ROUTE



Gator Slough Watershed Area – October 2003.
View southwest with 145' Bridge on I-75 (see lower arrow) oriented toward Gator South (upper arrow). Historical route from I-75 Bridge to U.S. 41 Gator Slough Box Culvert should be perpetuated.

HISTORIC FLOW ROUTE



Four laning of U.S. 41 in 1970's resulted in raising of road fill near Charlotte-Lee County line. Note difference in elevation between near (old) and far (new) lanes.



View southwest at U.S. 41 and Gator Slough Box Culvert at arrow. Typical summer flooding situation in mid 1970's.

FLOOD PRONE AREAS

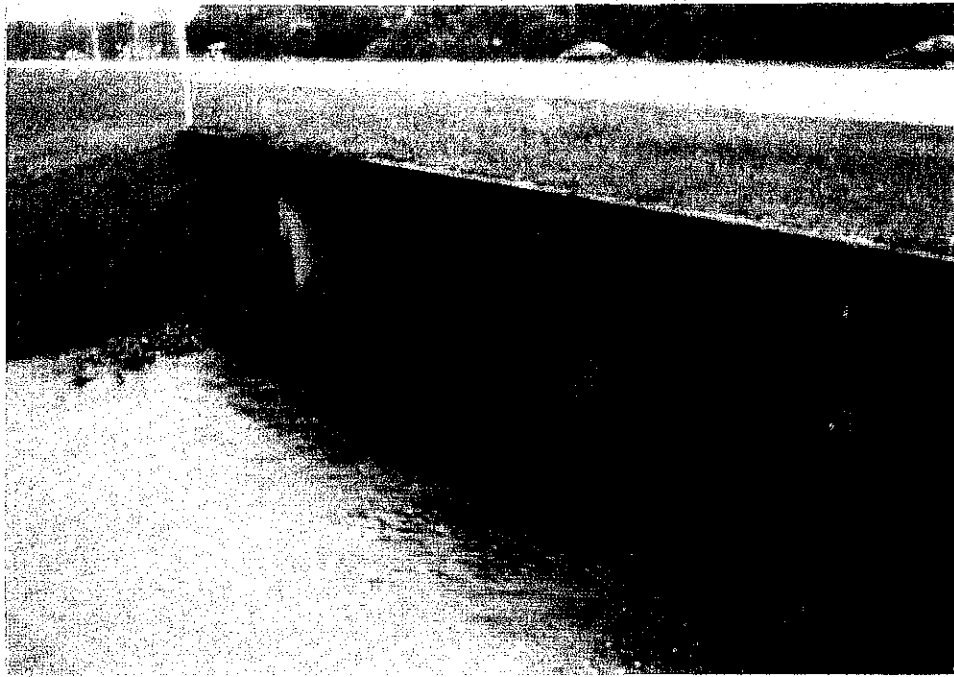


View northwest along Oil Well Grade near intersection of old Railroad Grade March 21, 1983. Typical flooding conditions. Note breaches in road at arrow.



View south down SAL Grade – September 21, 2003. SAL Grade at intersection with Oil Well Grade is at lower arrow, SAL Grade at intersection with I-75 (@ 145' Bridge) is at upper arrow.

HISTORIC FLOW ROUTE - POTENTIAL IMPROVEMENT



View northeast at Gator Slough Box Culvert at US 41 – September 6, 2003.
Note box culvert flowing only ½ full during period of serious flooding in
upstream watershed.

4. CONCEPTUAL SURFACE WATER MANAGEMENT PLAN

An Integrated Watershed Map for South Charlotte County, North Lee County and Babcock/Webb was prepared, and discussed in Section 2 of this report. Basic Problems were outlined and Major Areas of Flooding identified in Section 3. Conceptual plans for Potential Solutions follow. This fulfills the 3 objectives outlined in the Introduction.

Basically there are three primary options to flood control problems in the study area:

1. Take no action.
2. Acquisition of undeveloped and developed land generally north of Nalle Grade and Del Prado Extension.
3. Opening and perpetuation of primary flow ways (esp. Gator Slough and Daughtrey Creek), diversion of flows (primarily from Babcock/Webb) and development of off site detention areas to help attenuate flood flows where practical.

The 1) Take no action option clearly will not result in a status quo result. Expansive growth is occurring north of Nalle Grade in the area of the Charlotte/Lee County line. This is especially true in the Huffmaster-Williams Road area, which extends several miles into Charlotte County.

The option of 2) Acquisition of undeveloped and developed land generally north of Nalle Grade and Del Prado Extension does not appear practical. Much of this land has already been divided into small tracts, which are mostly owned individually. Unlike the East Bonita Springs Area where development was sparse and land relatively inexpensive, this is not the case in the study area. A good feature of this area, however, is the Babcock/Webb Wildlife Management Area, which should remain undeveloped in the foreseeable future. It is again noted that the downstream flooding problem is not the result of changes in Babcock/Webb, which continues to sheet flow southwesterly, and south, and remains basically unchanged. The problem area clearly results from 1) downstream development in historical sheet flow areas and 2) successive constrictions generally resulting from this development moving into sheet flow areas.

This leads to option 3), which is the restoration of historical flow-ways, removal of significant constrictions, diversion of flood flows away from flood prone problem areas and development of off line detention areas where land is available for purchase. The following conceptual options can significantly improve flood control at practical costs. However, clearly the cost of full flood control for all of these flood prone areas does not seem to be a realistic option.

Concepts, which appear practical to pursue, are listed below and subsequently discussed in further detail:

1. Re-open historical Gator Slough Drainage Way.
2. Purchase storage areas for off line storage.
3. Remove constrictions in Powell Creek - Del Prado extension area.
4. Protect and perpetuate Daughtrey Creek flow-way.
5. Investigate a potential diversion swale along the east side of FP&L R/W.
6. Enlarge gate on Daughtrey Creek impoundment to provide added drawdown protection for downstream.

PROBLEM AREAS – POTENTIAL CONCEPTUAL IMPROVEMENTS



Location is on Daughtrey Creek near Nalle Grade. View northeast at 76"x48" culvert located approximately 500' upstream of Nalle Grade Bridge (see below).



View southeast at Daughtrey Creek Bridge on Nalle Grade. Bridge is approximately 10 times larger in cross section than upstream culvert constriction.

CONCEPTUAL SURFACE WATER PLAN



View southwest at Daughtrey Slough Impoundment – October 2003

Tucker's Grade is along south boundary of Impoundment.

Main 48" Riser Outfall is at arrow. Construction of a major gate and opening under Tucker's Grade would allow more rapid drawdown of impoundment to better attenuate downstream flows.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In a very basic evaluation there are three primary options to approaching flood control problems in the study area. They are as follows:

- 1) Take no action
- 2) Acquisition of undeveloped and developed land generally north of Nalle Grade and Del Prado Extension
- 3) Opening and perpetuation of primary flow ways, diversion of flows (primarily from Babcock/Webb) in the Gator Slough and Daughtrey Creek outfalls and development of off line detention areas to help attenuate flood flows where practical.

Options 1 and 2 do not appear viable. Increased and accelerating development pressures will exacerbate flood problems. Without action the situation will only become worse. The purchase of large tracts of land (example- East Bonita Springs area) has been effective in areas of very sparse population. However, the South Charlotte/N. Lee County does not lend itself to this option. Option 3 – although it may not ever completely resolve the flood problem, appears the most practical to accomplish.

There are potential areas where Option 3 appears practical:

1. Re-open historical Gator Slough Drainage Way
2. Acquire land areas for off line storage.
3. Remove constrictions in Powell Creek – Del Prado area.
4. Protect and perpetuate Daughtrey Creek flow-way.
5. Investigate a potential diversion swale along the east side of FP&L R/W.
6. Enlarge gate on Daughtrey Creek impoundment to provide added protection for downstream.

Recommendations

1. Acquire right-of-ways along Gator Slough Outfall as listed below:
 - 1) Oil Well Grade to 145' I-75 bridge
 - 2) I-75 to Northeast corner of Western Acres
 - 3) Northeast corner of Western Acres west to existing Tara Woods Channel.
2. Acquire "online" storage areas where practical to attenuate flood flows as they move south.
3. Open up Powell Creek and Del Prado extension area to route flows south. Care must be taken to not overload downstream structures as they are designed for runoff from only an 11 sq. mile upstream watershed area.

4. Protect Daughtrey Creek flow way route from encroachment and remove constrictions (example is 48" x 72" ORCP located approximately 500 ' upstream of the Nalle Grade - Daughtrey Creek Bridge).
5. Actuate plan for preparation of an FP&L right-of-way flow way and connection to Palm Creek or Caloosahatchee River.
6. Enlarge gate on Daughtrey Creek impoundment in Babcock/Webb to provide added protection downstream.
7. SFWMD advise consultant if additional information is needed related to design flow and pipe sizing.

FLOOD PRONE AREAS



Tropical Palm Mobile Home Park just south of Charlotte/Lee County line.
View west toward US 41 – August 21, 2003



View west across FP&L and flooding in Nalle Grade area July 15, 2003