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~ ~ HURRICANE OPAL ~ ~

FLORIDA PANHANDLE

WIND AND WATER LINE SURVEY

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Prepared by Michael Baker Jr, Inc.  
Oct. '95

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**HURRICANE OPAL  
FLORIDA PANHANDLE  
WIND AND WATER LINE SURVEY**

**OCTOBER 1995**

**Prepared by**

**Michael Baker Jr., Inc  
Alexandria, VA**

**for**

**Federal Emergency Management Agency  
Washington, D.C.**

**and**

**Property Loss Research Bureau  
Schaumburg, IL**

## **Hurricane Opal - Wind and Water Line Survey**

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### **ACKNOWLEDGMENTS**

Responding to the request for a wind and water line survey to document the approximate storm surge inundation limits caused by Hurricane Opal required a cooperative effort of many individuals and agencies. We would like to thank all of those involved with this effort, and specifically, the following individuals who provided assistance during the coordination, preparation, deployment, and field surveys the week following the landfall of Hurricane Opal along the Florida panhandle shoreline on October 4, 1995:

James Shortley, Chief, Property Claims Division, FEMA, Washington, D.C.

William Massey, FEMA Region IV, Atlanta, GA

Michael Buckley, Chief, Hazard Identification Branch, Mitigation Directorate, FEMA, Washington, D.C.

Karl Mohr, Mitigation Directorate, FEMA, Washington, D.C.

Hugh Strawn, Disaster Catastrophe Service, Property Loss Research Bureau

Howard Wittington, Chief, Hydrology and Hydraulics Branch, U.S. Army Corps of Engineers, Mobile District

Doug Otto, Chief, Hydrologic Investigations Section, U.S. Army Corps of Engineers, Mobile District

John (Bud) Lee, Hydrologic Investigations Section, U.S. Army Corps of Engineers, Mobile District

Glen Duvall, Hydrologic Investigations Section, U.S. Army Corps of Engineers, Mobile District

Steve Davis, Hydrologic Investigations Section, U.S. Army Corps of Engineers, Mobile District

Ray Townsend, U.S. Army Corps of Engineers, Coastal Engineering Research Center

Tom Waters, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems

## **Hurricane Opal - Wind and Water Line Survey**

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### **INTRODUCTION**

Michael Baker Jr., Inc., on behalf of the Federal Emergency Management Agency (FEMA) and Property Loss Research Bureau (PLRB), conducted a wind and water line survey of the Hurricane Opal landfall area near Navarre and Ft. Walton Beach in Santa Rosa County, Florida, and other areas east of the landfall to Mexico Beach in Bay County, Florida. The goal of the investigation and study was to determine the approximate high water elevation of the storm surge and combined storm surge and wave runup in the open coast and inland bay areas affected by Hurricane Opal. The establishment of a wind and water line documents the inundation limits of the storm surge flooding and areas subject to both flooding and wind damages or losses. Areas outside of the inundation zone would likely be subject to only wind damages and losses.

The high water marks (HWM) observed and surveyed for this report throughout the Hurricane Opal impact area reflect either the stillwater elevation of the storm surge (areas outside the influence of breaking wave and wave runup) or the stillwater elevation plus the wave runup component (areas in the wave swash zone - either breaking waves or wave runup).

The stillwater elevation HWMs are generally recovered inside ( i ) of commercial or residential structures and found as mud lines on walls or doors. The storm surge plus wave runup HWMs are generally found as debris or trash lines along the coastal dunes, sloping terrain of the bay shoreline or the outside (O) perimeter and exterior area of a structure. Each HWM is marked and located on a map accordingly, providing another piece of the puzzle, and documenting the approximate water surface elevation used to establish a wind/water line. The information also assists in understanding the nature of the storm influence in the immediate area.

### **HURRICANE OPAL - STORM SUMMARY**

As of October 13, 1995, there have been 17 named tropical storms and hurricanes for the 1995 Hurricane season, making it the most active season since 1933 (with 21 tropical storms and hurricanes). After passing over the Yucatan Peninsula, the 15th storm of the season, Hurricane Opal, intensified in the early morning hours on Tuesday October 3 while in the Bay of Campeche area of the Gulf of Mexico. Hurricane Opal started moving to the north-northeast while gaining size and intensity over the next day and half.

The landfall of Hurricane Opal along the Florida panhandle coastline (see map in Appendix A), near Ft. Walton Beach, was the second hurricane of the season to impact the panhandle area. Hurricane Erin, a Category 1 hurricane on the Saffir-Simpson scale (Table 1), passed through the

## **Hurricane Opal - Wind and Water Line Survey**

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**Table 1. Saffir-Simpson Hurricane Scale Ranges.**

<b>Scale Number (Category)</b>	<b>Central (mbar)</b>	<b>Pressure (in)</b>	<b>Winds (mi/h)</b>	<b>Surge (ft)</b>	<b>Damage</b>
1	$\geq 980$	$\geq 28.94$	74 - 95	4 - 5	Minimal
2	965 - 979	28.50 - 28.91	96 - 110	6 - 8	Moderate
3	945 - 964	27.91 - 28.47	111 - 130	9 - 12	Extensive
4	920 - 944	27.17 - 27.88	131 - 155	13 - 18	Extreme
5	< 920	< 27.17	>155	>18	Catastrophic

Source: *Hebert, Jarrell, and Mayfield, 1995.*

region in early August, causing flooding and damages along the coast. Hurricane Opal's landfall as a Category 3 storm included 125 mph (110 kt) winds and expected storm surges up to 15 foot in height, significantly more damaging than Hurricane Erin. The coastal flooding affected the coastal areas from Gulf Shores, Alabama to Tampa, Florida, with hurricane force winds impacting Florida, Alabama and Georgia, and tropical storm force winds stretching from Florida upward into North Carolina and Tennessee. Fortunately for the Gulf of Mexico coastal residents, Hurricane Opal was losing intensity as it approached the coast on Wednesday, October 4. At mid-day on October 4, Hurricane Opal had been classified as a Category 4 hurricane with winds close to 150 mph (130 kt). The cooler waters of the northern Gulf of Mexico and other atmospheric conditions appear to have been the cause of the reduced intensity of Hurricane Opal at time of landfall on October 4, estimated to have occurred around 6:00 PM Central Daylight Time (CDT) (or approximately time 2200 Z).

Preliminary estimates place Hurricane Opal as the third costliest natural disasters to affect the United States this century, right after Hurricane Andrew and the Northridge Earthquake. In Florida alone, the damage estimates range from \$1.8 to 2.8 million, with the numbers increasing daily as more damage reports are received. The coastal and bay storm surge impacts were far reaching and appear to be the major cause of destruction and damages to commercial and private residences. The storm surge also overtopped and eroded 10 to 30 foot high dune fields on the barrier island beaches of Santa Rosa Island, with the high surf accompanying the storm surge scouring and undermining the foundations on oceanfront structures from Destin to Panama City Beach resulting in settlement or collapse into the ocean. The wind impacts continued from the Florida panhandle up into Tennessee and North Carolina.

## **Hurricane Opal - Wind and Water Line Survey**

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### **HIGH WATER MARK SURVEY SUMMARY**

The HWM information was collected during the field survey period from October 6 to 10, 1995, immediately following the landfall of the storm. The HWM surveys and HWM elevations shown on the maps in Appendix B were conducted and collected through a joint effort by Michael Baker Jr., Inc. and the U.S. Army Corps of Engineer's Hydrologic Investigations Section, Mobile District. The recorded HWM stillwater and combined stillwater/wave runup elevations ranged from 6 feet at the east end of Choctawhatchee Bay to over 20 feet along the coast near Grayton Beach in Walton County (Table 2). Other HWM surveys are currently underway by the Alabama and Florida Geological Survey for the Alabama and Pensacola-Appalachicola-Carrabelle areas, but are not included in this report.

**Table 2. Hurricane Opal High Water Mark survey information.**

<b><u>HWM #</u></b>	<b><u>Elev. (ft)</u></b>	<b><u>Type</u></b>	<b><u>Location</u></b>	<b><u>Latitude</u></b>	<b><u>Longitude</u></b>
1 a	10.5	(O)	Santa Rosa Island	86:59:29	30:21:29
1 b	9.8	(O)	Santa Rosa Island	86:56:10	30:22:01
1 c	10.2	(O)	Santa Rosa Island	86:56:10	30:22:01
1 d	9.9	(I)	Santa Rosa Island	86:52:07	30:22:52
1 e	10.2	(O)	Santa Rosa Island	86:52:07	30:22:52
1 f	11.1	(O)	Santa Rosa Island	86:51:13	30:22:56
1	10.9	(O)	Santa Rosa Island	86:48:28	30:23:23
2	9.8	(I)	Wynnhaven Beach	86:47:22	30:24:26
3	9.0	(O)	Santa Rosa Island	86:42:05	30:24:03
4	7.6	(O)	Mary Esther	86:42:08	30:24:31
5	10.9	(I)	Ft. Walton Beach	86:38:41	30:24:25
6	8.6	(I)	Ft. Walton Beach	86:37:30	30:24:15
7	7.5	(O)	Santa Rosa Island	86:35:26	30:23:40
8	11.3	(I)	Santa Rosa Island	86:31:36	30:23:17
9	10.3	(O)	Santa Rosa Island	86:31:44	30:23:30
10	6.5	(O)	Ft. Walton Beach	86:35:32	30:24:20
11	10.0	(O)	Ft. Walton Beach	86:35:19	30:24:42
12	8.0	(O)	Shalimar	86:35:15	30:26:05
13	7.7	(I)	Shalimar	86:35:15	30:26:05
14	13.0	(O)	N. of Ocean City	86:34:14	30:27:12
15	6.8	(O)	Shalimar	86:35:12	30:26:57

## **Hurricane Opal - Wind and Water Line Survey**

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**Table 2. Hurricane Opal High Water Mark survey information (continued).**

<b><u>HWM #</u></b>	<b><u>Elev. (ft)</u></b>	<b><u>Type</u></b>	<b><u>Location</u></b>	<b><u>Latitude</u></b>	<b><u>Longitude</u></b>
16	7.5	(O)	Eglin Village/Eglin AFB	86:32:43	30:27:11
17	7.8	(O)	Valparaiso	86:29:15	30:31:09
18	9.5	(O)	Destin	86:30:59	30:23:48
19	8.3	(O)	Destin	86:30:11	30:23:18
20	14.3	(I)	Destin	86:27:59	30:23:03
21	21.5	(O)	E. of Miramar Beach	86:24:00	30:22:43
22	20.0	(O)	Miramar Beach	86:21:55	30:22:28
23	15.6	(O)	W. of Miramar Beach	86:20:25	30:22:25
23 a	17.8	(O)	Santa Rosa Beach	86:15:43	30:21:36
24	6.0	(O)	Choctawhatchee Bay	86:15:20	30:29:09
25	20.9	(O)	Blue Mountain Beach	86:12:16	30:20:18
26	10.5	(I)	Grayton Beach	86:10:13	30:19:48
27	12.0	(O)	E. of Seagrove Beach	86:05:51	30:18:46
28	9.7	(O)	W. of Inlet Beach	86:03:42	30:17:42
29	18.6	(O)	Inlet Beach	86:00:47	30:16:29
30	11.0	(O)	Phillips Inlet/Powell Lake	85:59:20	30:16:25
31	10.2	(O)	Phillips Inlet/Powell Lake	85:58:47	30:16:02
32	14.5	(I)	Hollywood Beach	85:58:11	30:15:34
33	7.3	(O)	GIICW/West Bay	85:51:27	30:17:34
34	7.6	(O)	Burnt Mill Cr/West Bay	85:46:00	30:19:40
35	8.2	(O)	Panama City	85:42:01	30:09:59
36	6.0	(O)	Panama City	85:41:28	30:09:52
37	9.2	(O)	Panama City	85:40:10	30:09:32
38	8.5	(O)	Springfield	85:36:58	30:08:05
39	8.4	(O)	Tyndall Air Force Base	85:35:25	30:03:42
40	10.5*	(O)	Panama City Beach	85:44:01	30:07:19
41	7.6	(O)	Davis Beach/Tyndall AFB	85:27:53	29:58:04

\* All HWMs are referenced to MSL datum except HWM 40 which is referenced to MLLW.

## **Hurricane Opal - Wind and Water Line Survey**

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### **SUMMARY AND CONCLUSIONS**

The Florida counties which had the greatest impact from storm surge effects were Escambia, Santa Rosa, Okaloosa, Walton and Bay Counties, and were the primary survey areas for the wind and water line survey. The preliminary information indicates that more than 3,300 structures were destroyed and over 18,000 damaged by the effects of storm surge and waves along the coastal and bay regions of Alabama and the Florida panhandle.

There were noticeable differences in the HWM elevations for areas located in the wind/wave fetch zone as compared to the areas behind the barrier islands and peninsulas along the bay. The open fetch areas subject to storm surge rise and wind driven waves had much higher HWM elevations, especially along the open coast of the barrier island in the landfall area (Navarre to Ft. Walton Beach) and areas further to the east (as far away as Mexico Beach). The wave runup component of the coastal flooding was as much as 10 feet higher than the estimated stillwater level on the open coast barrier islands. The shorelines along the north side of the sound or bay behind the barrier islands also had wave runup with the storm surge rise.

The coastal areas from Destin west to Navarre were overtopped by high storm surge levels resulting in massive loss of the natural dune fields, some 10 to 30 feet high and 100 to 300 feet wide. The erosion of the dune deposited sand inside structures, across roadways and into Santa Rosa Sound. The coastal areas from Destin east to Mexico Beach had severe erosion of the beaches and dunes, and undermining of the oceanfront structures. The dunes were very steep west of Phillips Inlet, and the beaches in and around Panama City Beach were smaller and provided less protection to the upland oceanfront structures. Many destroyed and collapsed structures were observed in this region.

The shorelines along the western side of inland bays also had high waves accompanying the storm surge rise, with evidence of wave runup up to 5 feet above the estimated stillwater levels. This was evident along the western side of Choctawhatchee Bay where HWM levels of 13 feet were measured, more than 5 feet higher than the other HWM levels in protected areas of the bay. Severe erosion of the bay shoreline was observed in these reaches of the bay, with most of the damages observed inflicted upon docks, boathouses and bulkheads.

### **MISCELLANEOUS**

A collection of photographs of storm damages and impacts are located in Appendix C of this report, and a summary of the survey data collected by Michael Baker Jr., Inc. at each HWM survey location is located in Appendix D (note: not all HWMs were used due to lack of bench mark information or duplicate HWMs at the same location). Detailed information on the HWM survey data collected by the U.S. Army Corps of Engineers and others are not available for this report.

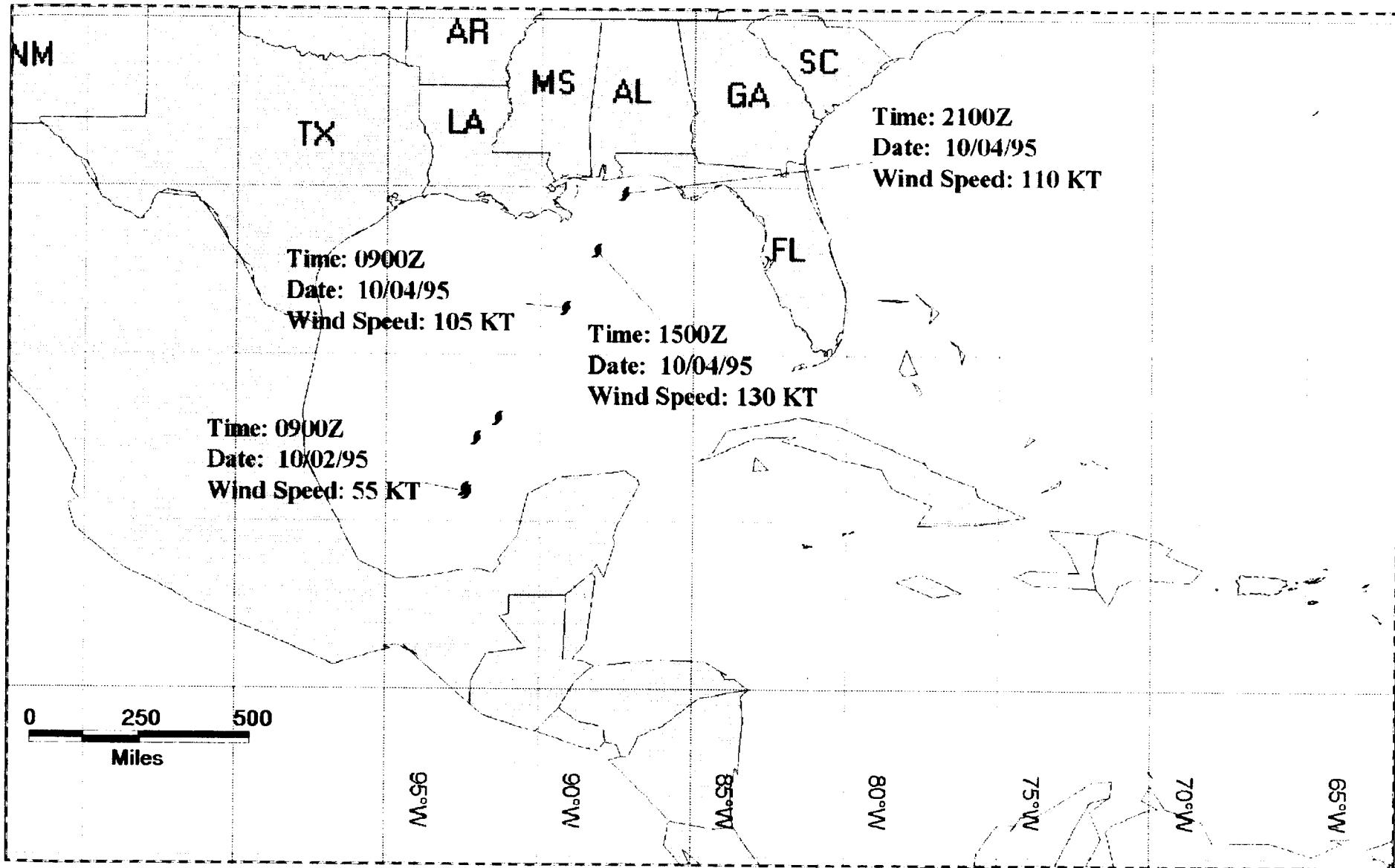
# **HURRICANE OPAL - WIND AND WATER LINE SURVEY**

## **APPENDIX A**

### **HURRICANE TRACK MAP**



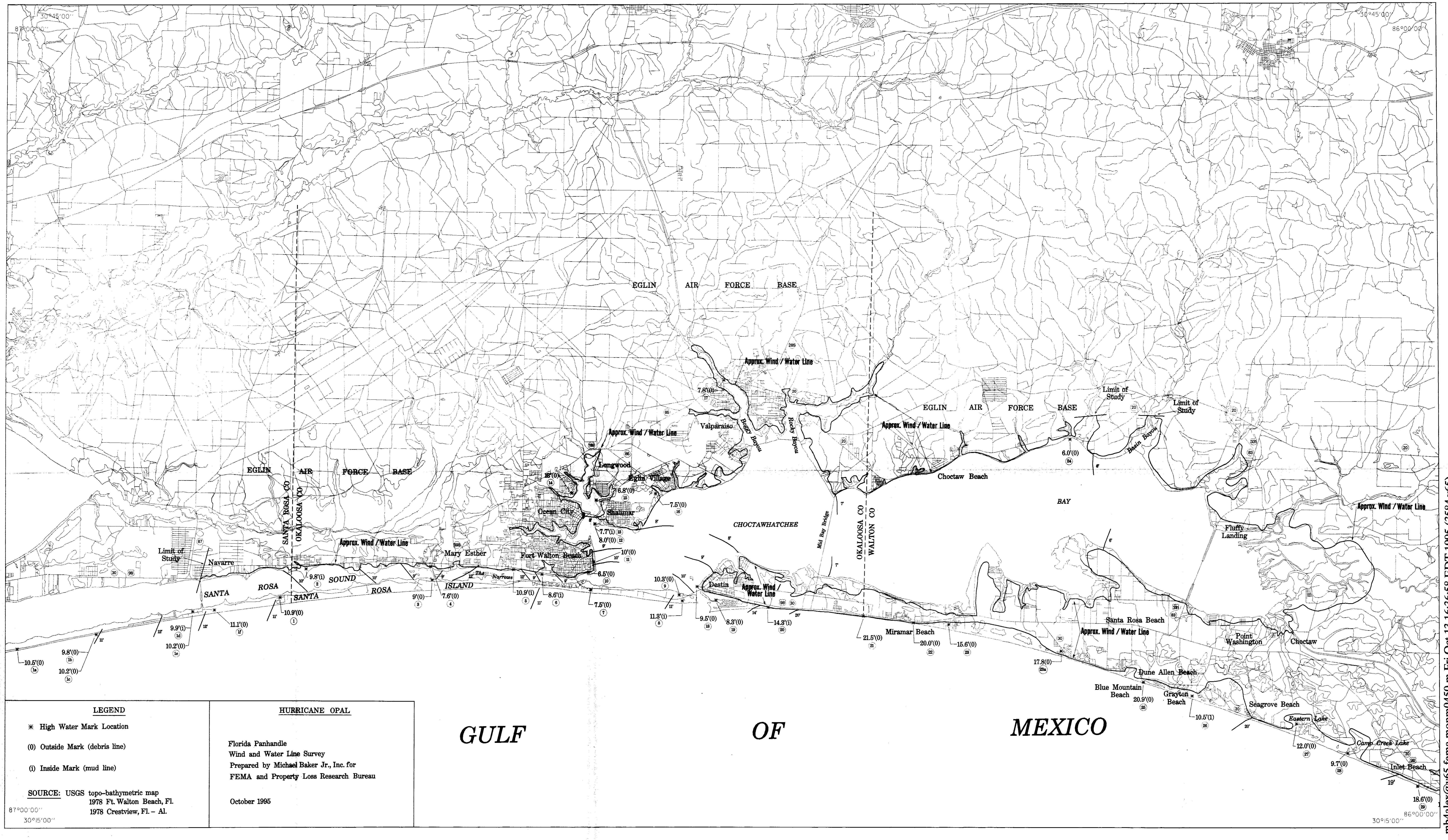
# Hurricane Opal

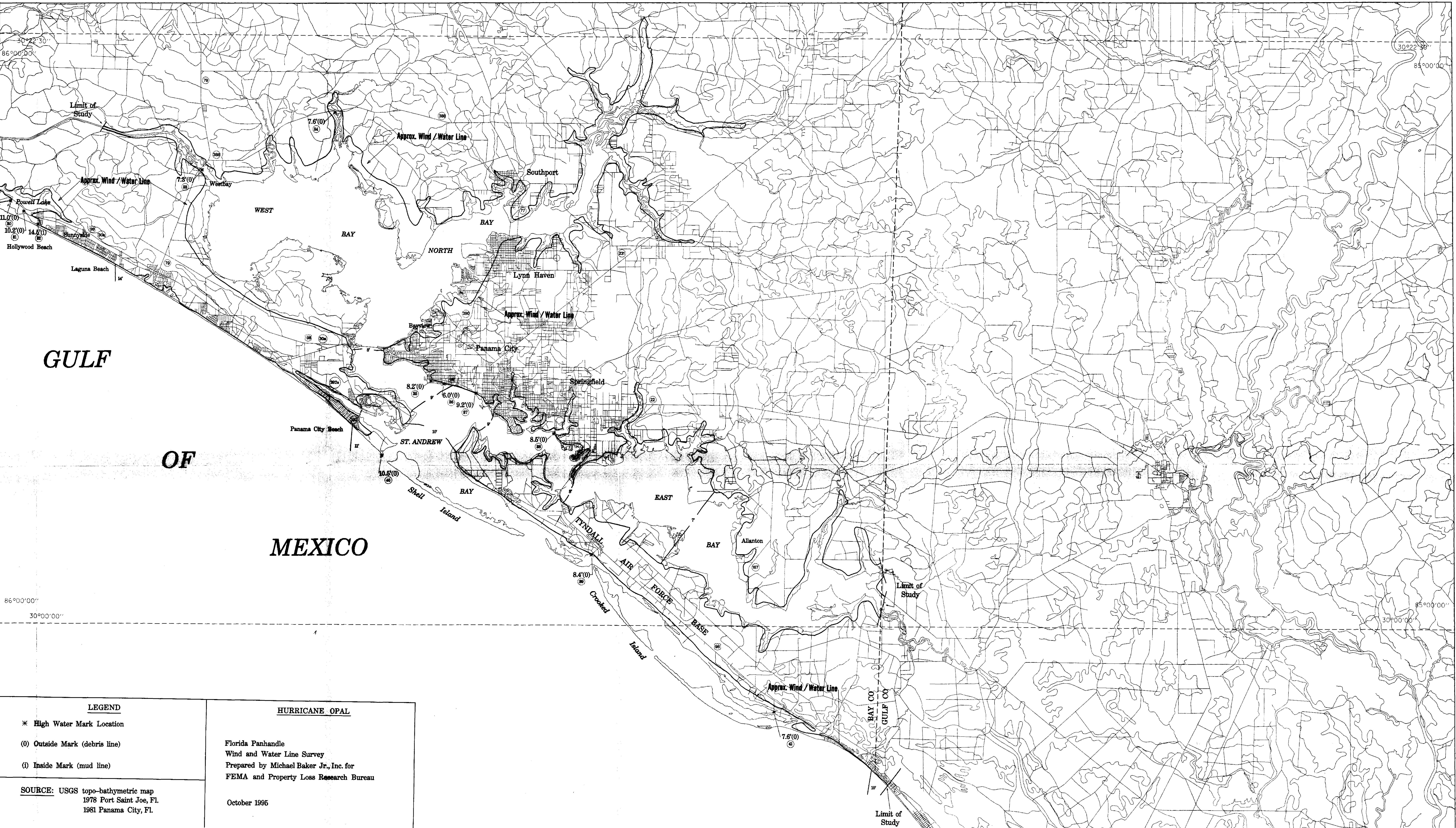


**HURRICANE OPAL - WIND AND WATER LINE  
SURVEY**

**APPENDIX B**

**HWM LOCATION MAP  
AND  
APPROX. WIND/WATER LINE  
(2 MAPS)**





# **HURRICANE OPAL - WIND AND WATER LINE SURVEY**

## **APPENDIX C**

### **STORM DAMAGE PHOTOGRAPHS**



PHOTO NO. 1 LOCATION MARY ESTER, FL ON  
SANTA ROSA SOUND & EMERALD POINTE SUBDIV.



PHOTO NO. 2 LOCATION MARY ESTER, FL ON  
SANTA ROSA SOUND & 800 BLOCK, MIRACLE STRIP SW.

**HURRICANE OPAL - FIELD SURVEY**

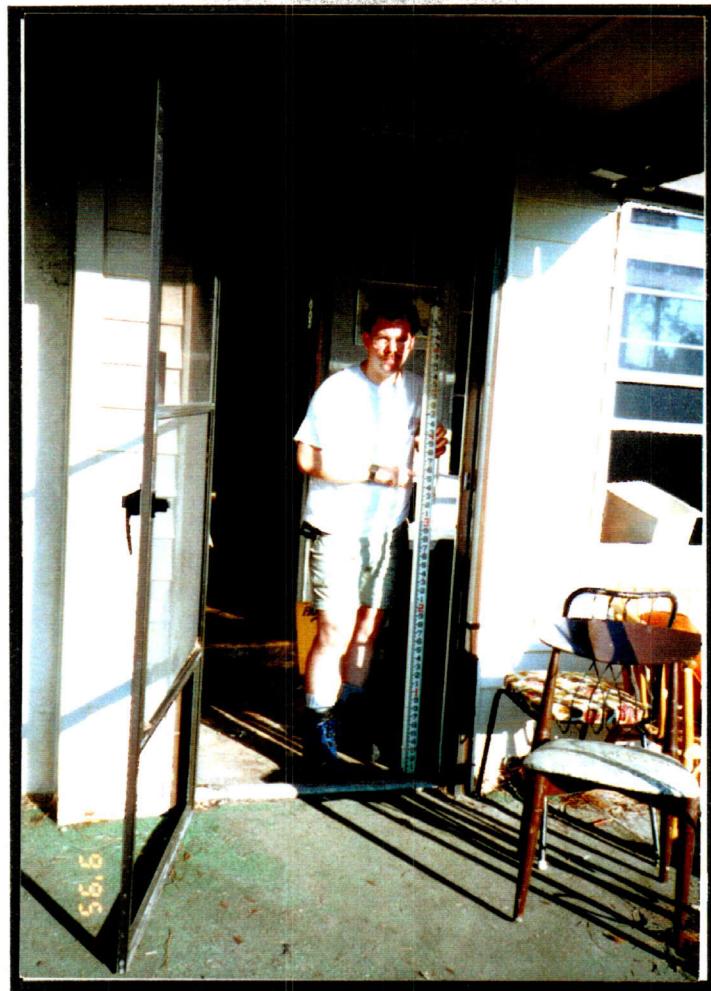


PHOTO NO. 3 LOCATION FT. WALTON BEACH, FL ON SANTA ROSA SOUND @ EBB TIDE MOTEL



PHOTO NO. 4 LOCATION FT. WALTON BEACH, FL ON SANTA ROSA SOUND @ EBB TIDE MOTEL, 129 MIRACLE STRIPS.W.



PHOTO NO. 5 LOCATION SANTA ROSA Is, FL  
ON GULF OF MEXICO @ HOLIDAY INN



PHOTO NO. 6 LOCATION SANTA ROSA ISLAND, FL ON  
GULF OF MEXICO @ HOLIDAY INN

HURRICANE OPAL - FIELD SURVEY



PHOTO NO. 7 LOCATION SANTA ROSA ISLAND, FL ON  
ON GULF OF MEXICO @ OKALOOSA STATE PARK AND U.S. 98

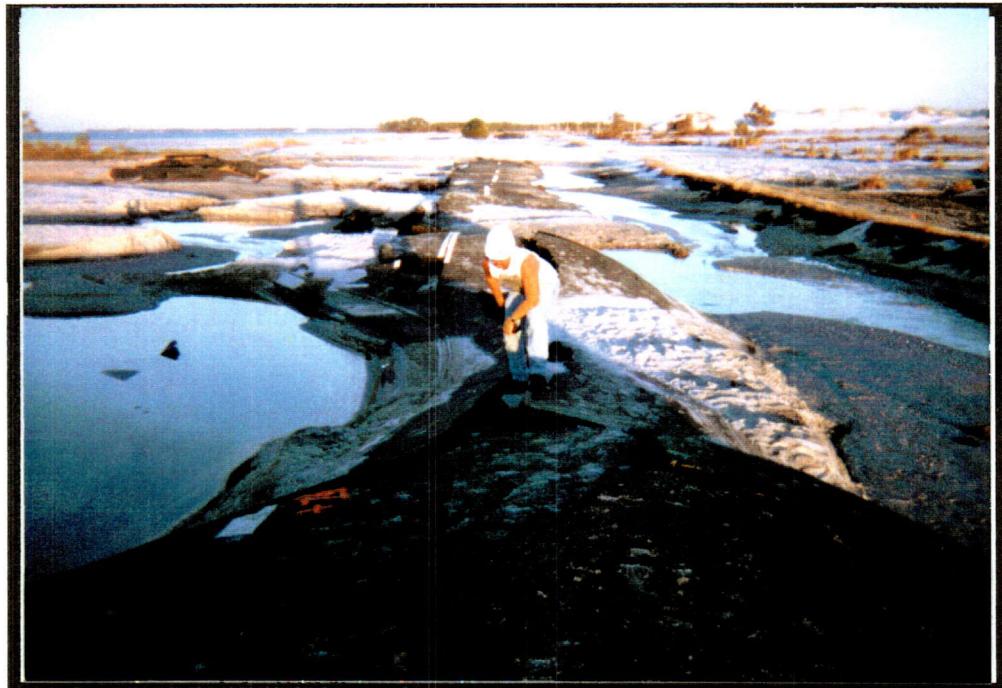


PHOTO NO. 8 LOCATION SANTA ROSA ISLAND, FL ON  
GULF OF MEXICO @ OKALOOSA STATE PARK AND U.S. 98

HURRICANE OPAL - FIELD SURVEY



PHOTO NO. 9 LOCATION FORT WALTON BEACH, FL ON  
GARNIER BAYOU/CHOCTAWHATCHEE BAY @ MOONEY DRIVE



PHOTO NO. 10 LOCATION EGLIN A.F.B. ON CHOCTAWHATCHEE  
BAY @ BEN'S LAKE MARINA

**HURRICANE OPAL - FIELD SURVEY**



PHOTO NO. 11 LOCATION CHOCTAW BEACH, FL ON  
CHOCTAWHATCHEE BAY ON STATE Hwy 20



PHOTO NO. 12 LOCATION CHOCTAWHATCHEE BAY  
AT CYDE D. WELLS BRIDGE / STATE Hwy 331

**HURRICANE OPAL - FIELD SURVEY**

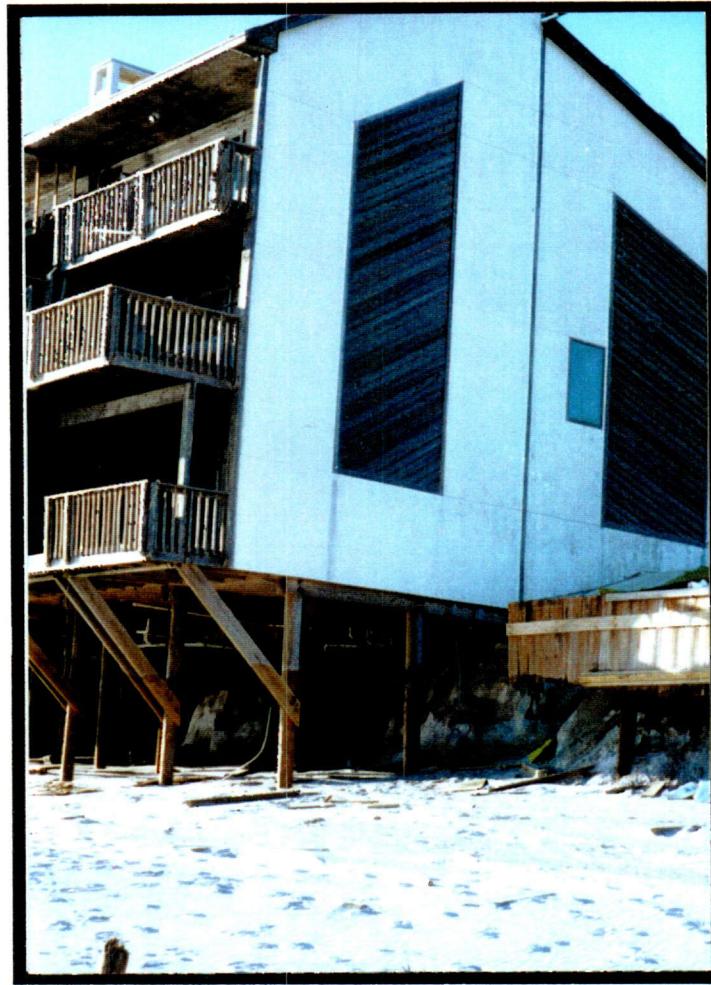


PHOTO NO. 13 LOCATION MIRAMAR BCH, FL  
ON GULF OF MEXICO @ 1600 BLOCK, ALT. U.S. 98

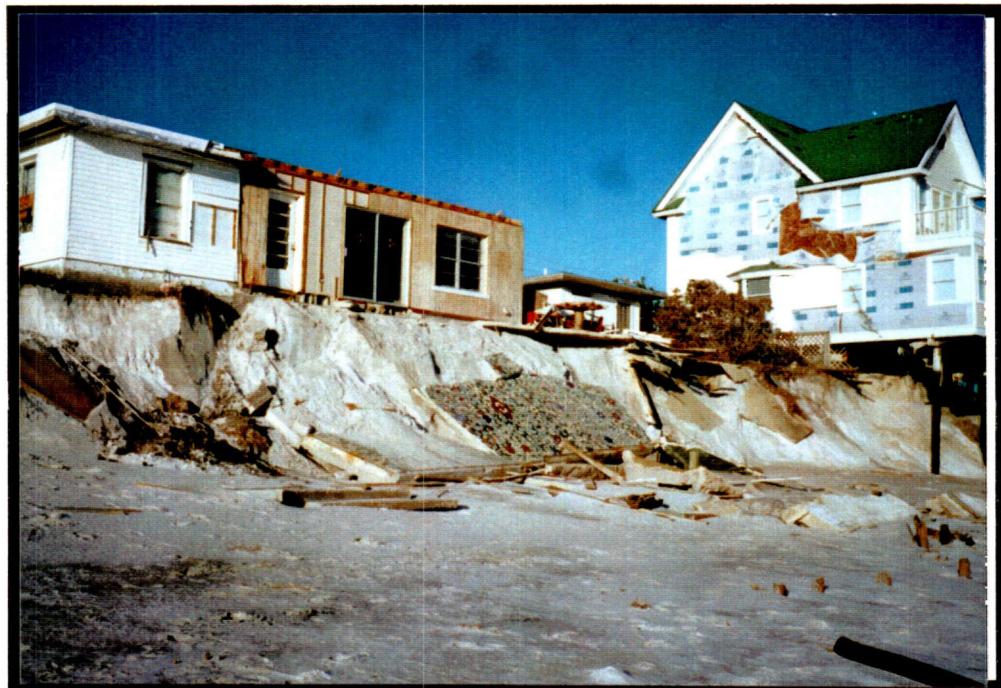


PHOTO NO. 14 LOCATION MIRAMAR BEACH, FL ON  
GULF OF MEXICO @ 1600 BLOCK, ALT. U.S. 98



PHOTO NO. 15 LOCATION TANG O'MAR BEACH, FL ON  
GULF OF MEXICO @ ALT. U.S. 98



PHOTO NO. 16 LOCATION GRAYTON BEACH, FL ON  
GULF OF MEXICO @ ALT. U.S. 98

**HURRICANE OPAL - FIELD SURVEY**



PHOTO NO. 17 LOCATION LAGUNA BEACH, FL ON  
GULF OF MEXICO @ ALT. U.S. 98 (SCENIC ROUTE)



PHOTO NO. 18 LOCATION LAGUNA BEACH, FL ON  
GULF OF MEXICO @ ALT. U.S. 98 (SCENIC ROUTE)

HURRICANE OPAL - FIELD SURVEY



PHOTO NO. 19 LOCATION PANAMA CITY  
BCH, FL ON GULF OF MEXICO @ INT. OF ALT U.S. 98 & U.S. 79



PHOTO NO. 20 LOCATION PANAMA CITY BEACH, FL ON  
GULF OF MEXICO @ ALT. U.S. 98 (SCENIC ROUTE)

HURRICANE OPAL - FIELD SURVEY

# **HURRICANE OPAL - WIND AND WATER LINE SURVEY**

## **APPENDIX D**

### **HWM SURVEY DATA SHEETS**

HWM 16

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 1a

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) HATHENAY / KLEENE

ADDRESS AT HWM EGLIN AIR FORCE BASE @ BEVIS LAKE MARINA

LOCATION DESCRIPTION BEVIS LAKE MARINA OFF  
CHOKTAWHATCHEE BAY [HWM 1]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE \_\_\_\_\_ MARK ON FIXED

OUTSIDE X DEBRIS LINE X STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 7.76 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 4.0 DATUM \_\_\_\_\_

SOURCE OF BENCHMARK ELEVATION NATIONAL OCEANOGRAPHIC SURVEY

BENCHMARK LOCATION PK NAIL IN LIGHT POST NEAR  
MARINA DOCK

LEVELING METHOD AUTO LEVEL AND PHILLY ROD

OTHER OBSERVATIONS GPS COORDINATES

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 16

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 1b

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) HATHENAY / KLEENE

ADDRESS AT HWM BENS LAKE MARINA / EGLIN AFB

LOCATION DESCRIPTION MARINA ON BENS LAKE OFF OF  
CHOCKIAWHATCHEE BAY [HWM 2]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 7.99 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM NGVD

BENCHMARK ELEVATION (FEET) 4.0 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION NATIONAL OCEANOGRAPHIC SURVEY

BENCHMARK LOCATION PK NAIL IN LIGHT POST NEAR MARINA

DOCK FLAGGED WITH ORANGE RIBBON

LEVELING METHOD AUTO LEVEL AND PHILLY ROD

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 16

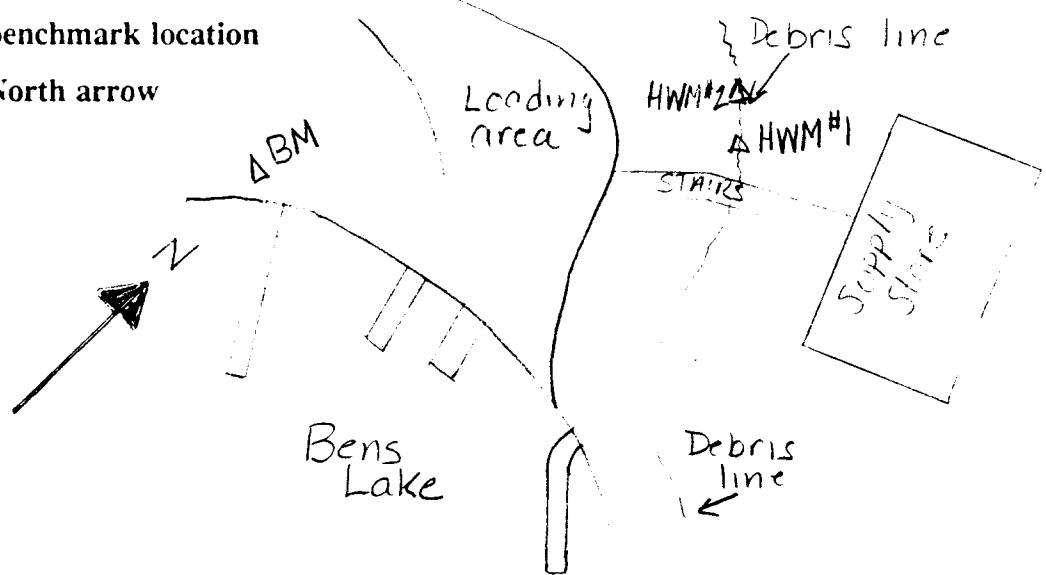
## HURRICANE OPAL

### HIGH WATER MARK (HWM) REPORT

Report # 1a & b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



### PLAN

### ELEVATION

HWM 13

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 29

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) D HATHAWAY / W H LEENE

ADDRESS AT HWM 200 OLD FERRY RD

LOCATION DESCRIPTION INSIDE MARK IN HOUSE LOCATED NEAR  
MARINA ON OLD FERRY ROAD [HWM 3]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE X MUD LINE X MARK ON FIXED

OUTSIDE \_\_\_\_\_ DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) 7.72 DATUM NGVD

GROUND ELEVATION (FEET) 5.60 DATUM NGVD

BENCHMARK ELEVATION (FEET) 7.0 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION PRIOR PROPERTY SURVEY

BENCHMARK LOCATION ELEVATION MARK (7 Ft) ON MARINA

BUILDING WALL

LEVELING METHOD AUTO LEVEL AND PHILLY RD

OTHER OBSERVATIONS GPS COORDINATES N 30° 26.12 W 086° 35.10

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 12

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 2b

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) D. HATHAWAY / W. KLEENE

ADDRESS AT HWM CLO FERRY RD MARINA

LOCATION DESCRIPTION MARK LOCATED ON EAST WALL OF MARINA

BUILDING [HWM 4]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE X MARK ON FIXED

OUTSIDE X DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) 7.95 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 7.0 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION PROPERTY SURVEY

BENCHMARK LOCATION ELEVATION MARK (7 ft) ON MARINA  
WALL

LEVELING METHOD AUTO LEVEL AND PHILLY ROD

OTHER OBSERVATIONS GPS COORDINATES N30°26.1 W86°35.1

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 12 1/3

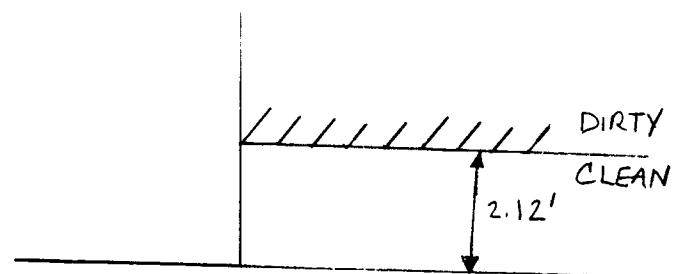
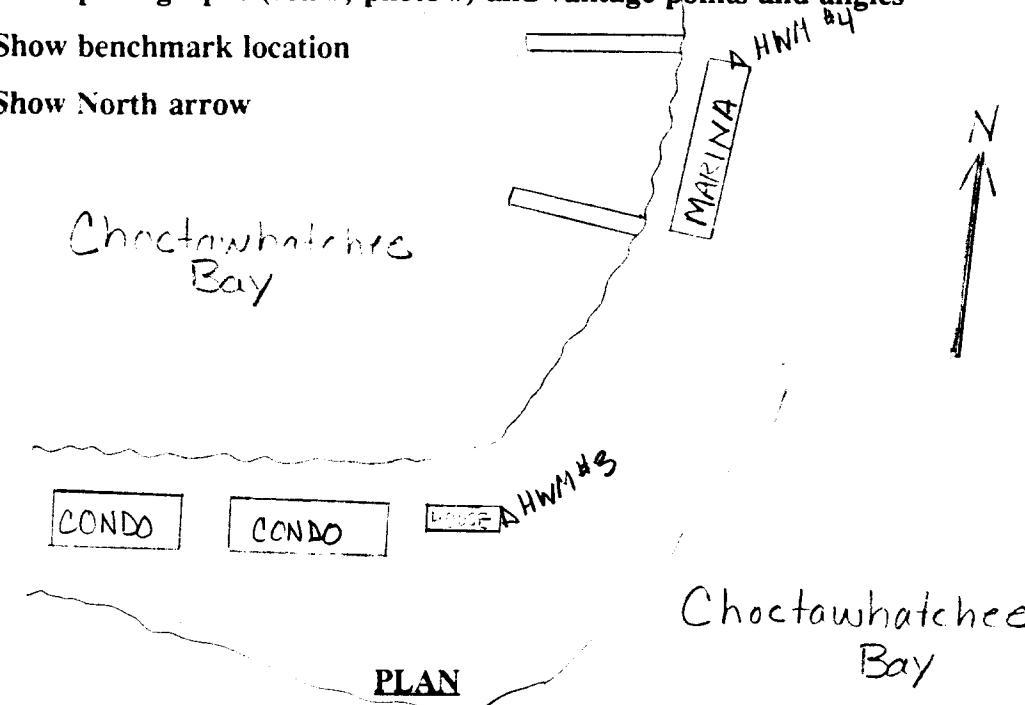
HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 2a/b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



ELEVATION

HWM 15

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 3

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) D. HATHAWAY / W. KEEENE

ADDRESS AT HWM RICHBURG ST. AND CARL BRANDT DR. INTERSECTION

LOCATION DESCRIPTION DEBRIS LINE NW OF CARL BRANDT DR NEAR  
BRICK FENCE [HWM 5]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE \_\_\_\_\_ MARK ON FIXED

OUTSIDE X DEBRIS LINE X STRUCTURE       

HWM ELEVATION (FEET) 6.83 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 15.81 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION NOS

BENCHMARK LOCATION Q297 ON RICHBURG STREET, BRASS

PLATE NEAR UTILITY POLE

LEVELING METHOD AUTO LEVEL AND PHILLY ROD

OTHER OBSERVATIONS GPS COORDINATES N 30°26.9' W 86°34.1'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

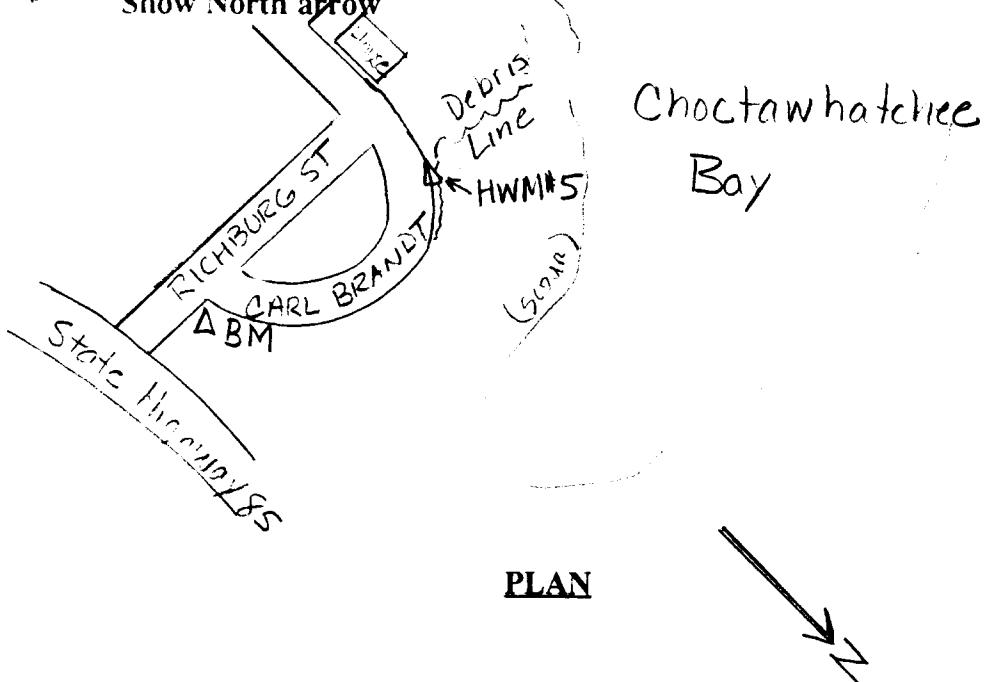
HWM 15

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 3

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



ELEVATION

HWM 14

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 4

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) D. HATHAWAY / W. KLEENE

ADDRESS AT HWM 132 Troy Circle, Ft. Walton Beach

LOCATION DESCRIPTION NW Choktawatchee Bay @ Garnier  
Bayou [HWM 6]

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 13.08 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 0.5 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION Water level calculated from HWM5 survey

BENCHMARK LOCATION \_\_\_\_\_

LEVELING METHOD Auto level and phillly rod

OTHER OBSERVATIONS GPS coordinates N30°27.2' W 86°36.1'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

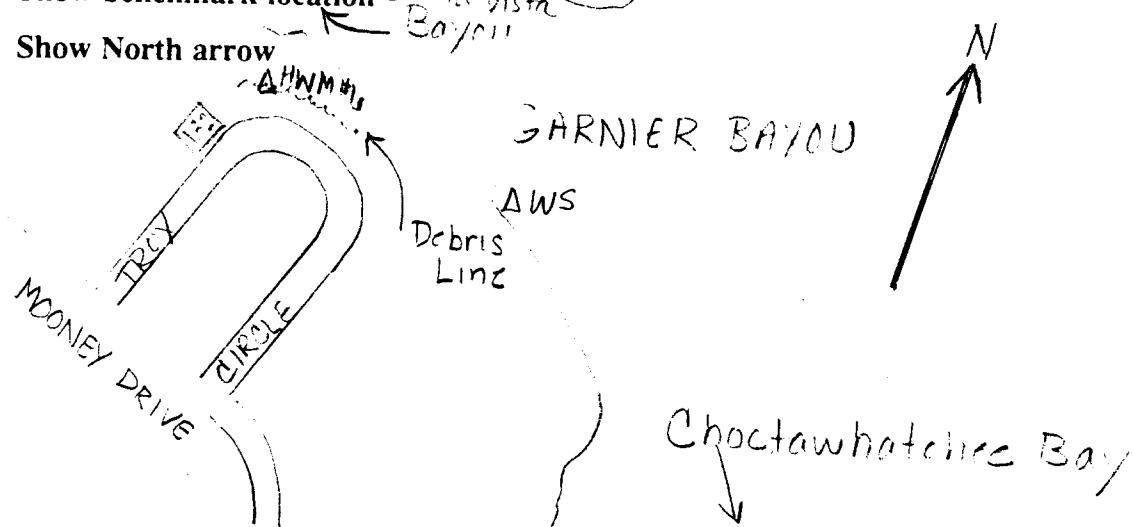
HWM 14

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 4

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location *Julia Vista Bayou*
- \* Show North arrow



PLAN

ELEVATION

HWM 5

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 5a

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D Hatheway / W Kleene

ADDRESS AT HWM 849 Miracle Strip, Mary Ester, Fla

LOCATION DESCRIPTION HWM 7 is in the bedroom  
closet in the back of the house

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE X MUD LINE X MARK ON FIXED

OUTSIDE \_\_\_\_\_ DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) 10.895 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 15.197 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION Coast Geodetic Survey - C180-1957

BENCHMARK LOCATION So. side of along US 98/Miracle Strip) adjacent  
to 849 Miracle Strip

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS near Santa Rosa Sound

GPS benchmark N 30° 24.49' W 86° 38.56'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 5 b

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D. Hatheway / W. Kleene

ADDRESS AT HWM 849 Miracle Strip, Mary Ester, Fla

LOCATION DESCRIPTION HWM is along the back wall (stucco)  
of the house @ 849 Miracle Strip

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE X MARK ON FIXED

OUTSIDE X DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) 10.572 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 15.197 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION Coast & Geodetic Survey - C180-1957

BENCHMARK LOCATION along South side of US98/Miracle  
Strip adjacent to 849 Miracle Strip

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS near Santa Rosa Sound.

GPS@benchmark N 30°24.49' W 86°38.56'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 5

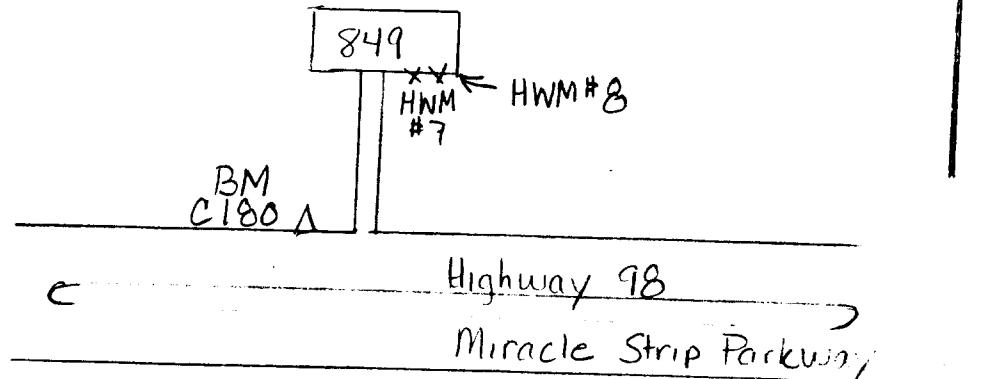
HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 5 a½ b

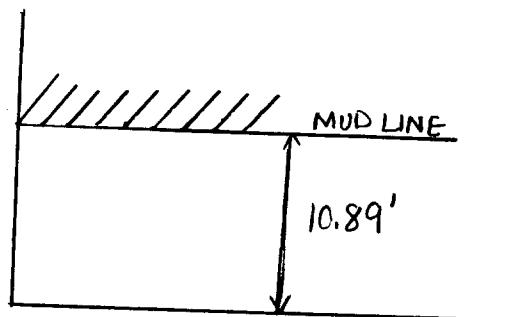
Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

SANTA ROSA SOUND



PLAN



ELEVATION

HWM 6

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 6

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D. Hatheway / W. Kleene

ADDRESS AT HWM 128 Miracle Strip, SW

LOCATION DESCRIPTION inside office of Ebb Tide Motel  
(HWM 19)

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 8.628 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 3.678 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION NGS J297-1967

BENCHMARK LOCATION Disk in headwall along the  
North side of US 98

LEVELING METHOD Auto level and phily rod

OTHER OBSERVATIONS Near Santa Rosa Sound.

GPS reading @ BM N30°24.31' W86°37.33'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 6

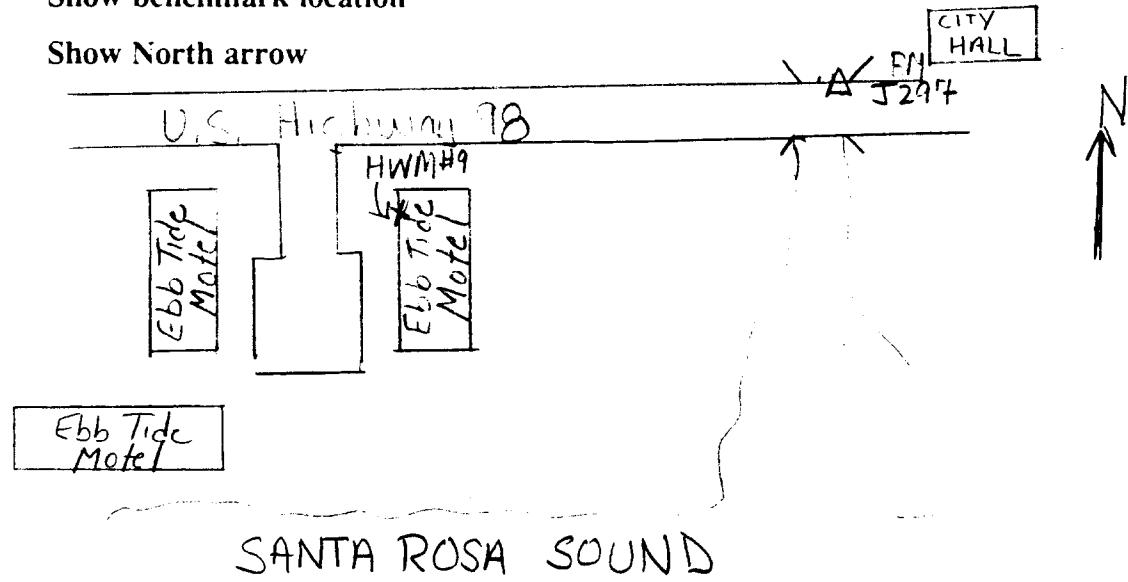
## HURRICANE OPAL

### HIGH WATER MARK (HWM) REPORT

Report # 6

Sheet 2 of 2

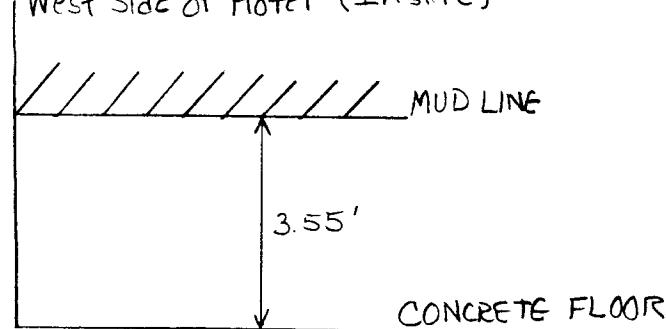
- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



## SANTA ROSA SOUND

### PLAN

West Side of Hotel (Inside)



### ELEVATION

MICHAEL BAKER JR., INC.

HWM 10

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 7

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D Hatheway / W. Kleene

ADDRESS AT HWM Waikridge Road

LOCATION DESCRIPTION Backside of house on garage door [HWM 10]

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE X MARK ON FIXED

OUTSIDE X DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) ~ 6 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) ~ 6.5 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION spot elevation from USGS Quadrangle

BENCHMARK LOCATION intersection of Waikridge Road and Brooks St.

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS near Choktawhatchee Bay

GPS reading @ bm N30°24.33' W86°35.41'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

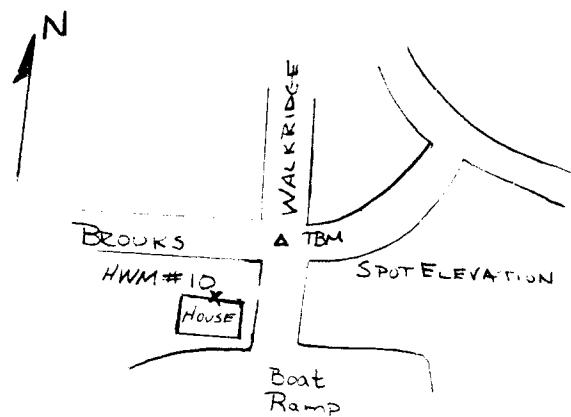
MICHAEL BAKER JR., INC.

HWM 10

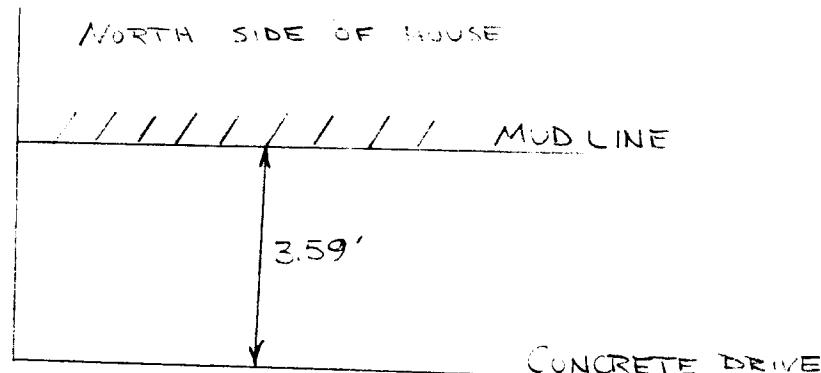
HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 7  
Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



Choktawhatchee Bay  
PLAN



ELEVATION

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 8 a

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D. Hatheway I W Kleene

ADDRESS AT HWM SE end of US85 bridge, Valparaiso

LOCATION DESCRIPTION HWM 12 is on the north side of  
the lounge along US85 east of Boggy Bayou

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE X

HWM ELEVATION (FEET) 7.227 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 8.067 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION FLHD V292

BENCHMARK LOCATION Cast of Boggy Bayou on the  
south side of US85

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS GPS rdg @ BM N30°31.39' W86°29.90'  
North of Choctawhatchee Bay

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 17

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 8b

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D Hatheway, L W Kleene

ADDRESS AT HWM SE end of US85 bridge, Valparaiso

LOCATION DESCRIPTION HWM 13 is on the north side of the  
lounge along US85 east of Boggy Bayou

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE \_\_\_\_\_ MARK ON FIXED

OUTSIDE X DEBRIS LINE X STRUCTURE X

HWM ELEVATION (FEET) 7.847 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 8.067 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION FLHD V292

BENCHMARK LOCATION east of Boggy Bayou on the  
south side of US85

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS GPS rdg @ BM N30°31.39' W86°29.90'  
North of Chactawachee Bay

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 17

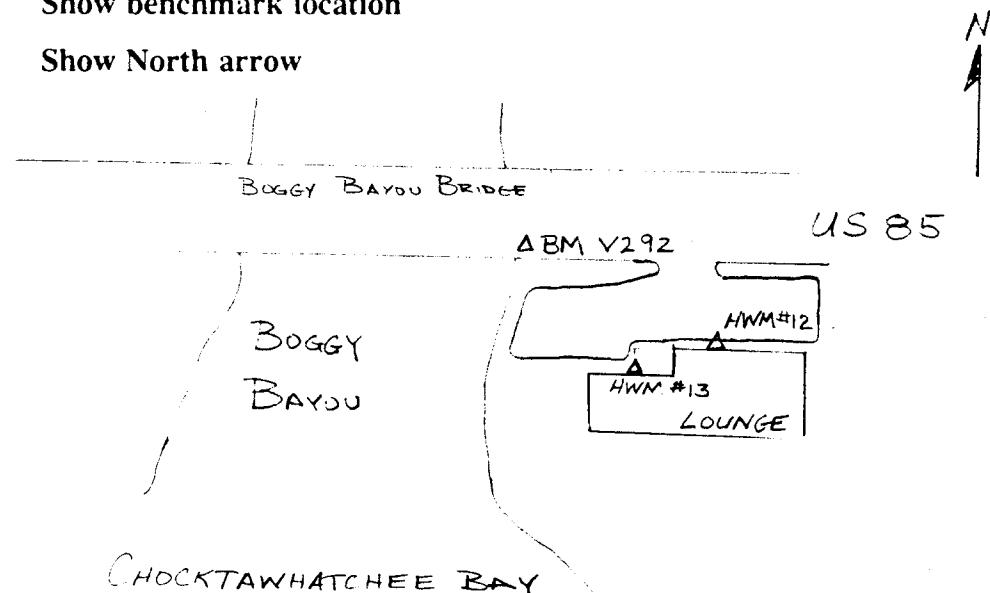
HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

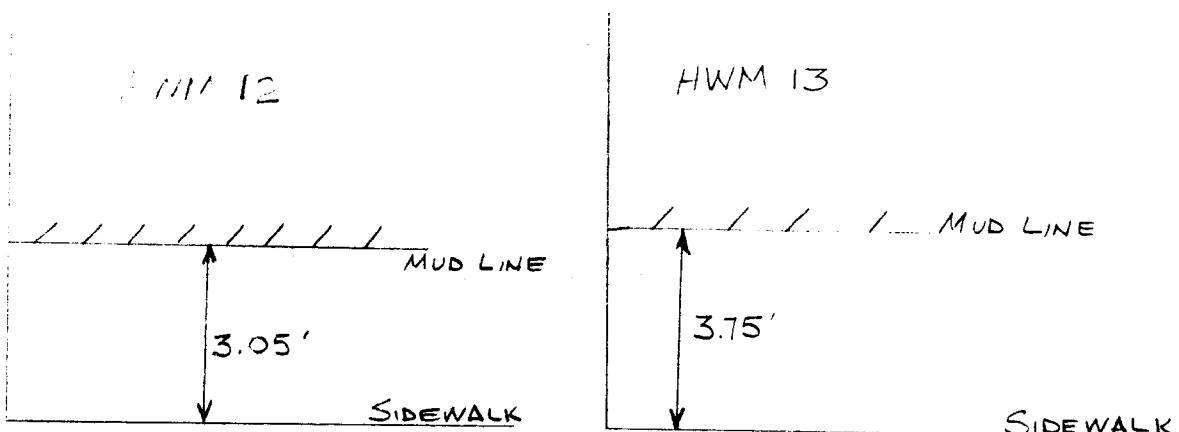
Report # 8a½b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



PLAN



ELEVATION

MICHAEL BAKER JR., INC.

HWM II

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 9

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) D Hatheway, L W Kleene

ADDRESS AT HWM Bay Dr NE

LOCATION DESCRIPTION HWM II is 2 houses south of the intersection of Hollywood Dr & Bay Dr. NE.

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) ~10 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) ~10 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION spot elev. from USGS quad

BENCHMARK LOCATION sewer manhole cover at the intersection of Hollywood Dr. & Bay Dr.

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS Scour erosion & damage to docks. GPS rdg: N30°24.70' W86°35.31'. Surge & wave runoff

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

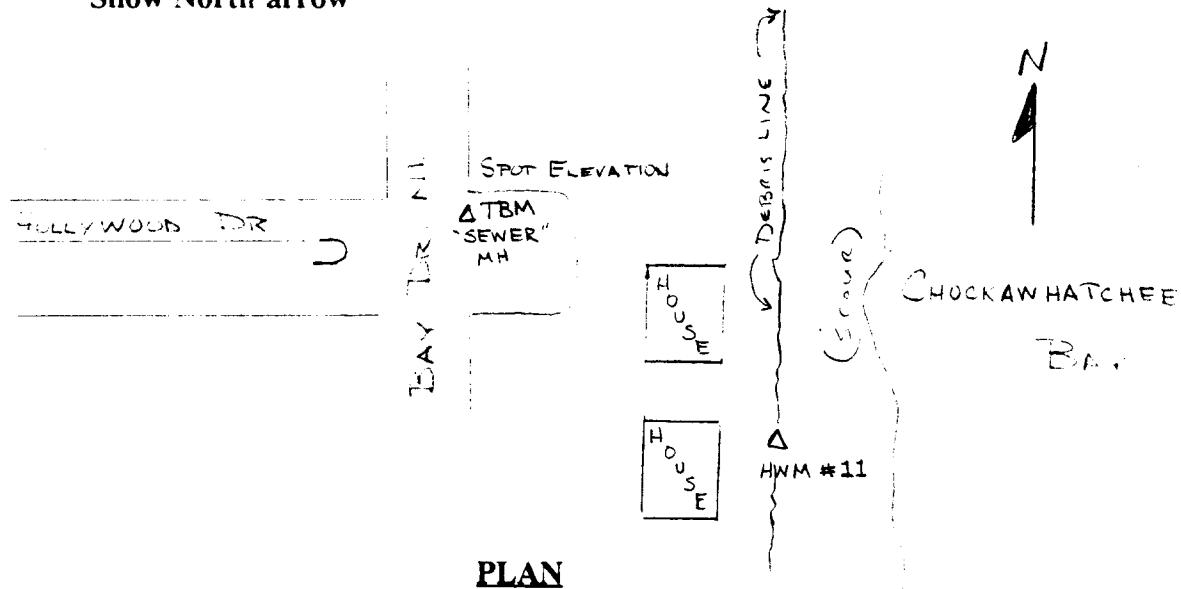
HWM 11

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 9

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



ELEVATION

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 10 a

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) J.N. PIRRELLO / P. SEXTON

ADDRESS AT HWM East Bay - Dupont Bridge

LOCATION DESCRIPTION Pt. 1 is approx 150 feet NE  
of NE corner of the old Dupont Bridge

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 6.43 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 14.1 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Army Corps of Engineers - BM#4

BENCHMARK LOCATION NE corner of the old Dupont Bridge.

boss plate on wingwall

LEVELING METHOD Auto level and phillip rod

OTHER OBSERVATIONS GPS coordinates N 30°06.3' W 85°36.2'

Slight erosion along banks of East Bay,

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 10 b

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM East Bay - Dupont Bridge

LOCATION DESCRIPTION Pt. 2 is approx. 100 feet SE  
of NE corner of the old Dupont Bridge

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 6.65

DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_

DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 14.10 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Army Corps of Engineers - BM#

BENCHMARK LOCATION NE corner of the old Dupont

Bridge, brass plate on wingwall.

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 10c

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM East Bay - Dupont Bridge

LOCATION DESCRIPTION Pt. 3 is approx. 120 feet SE  
of the NE corner of the old Dupont Bridge.

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE MUD LINE MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 6.65 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 14.10 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Army Corps of Engineers - BM #L

BENCHMARK LOCATION NE corner of the old Dupont Bridge,  
brass plate on wingwall

LEVELING METHOD Auto level and phillip rod

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

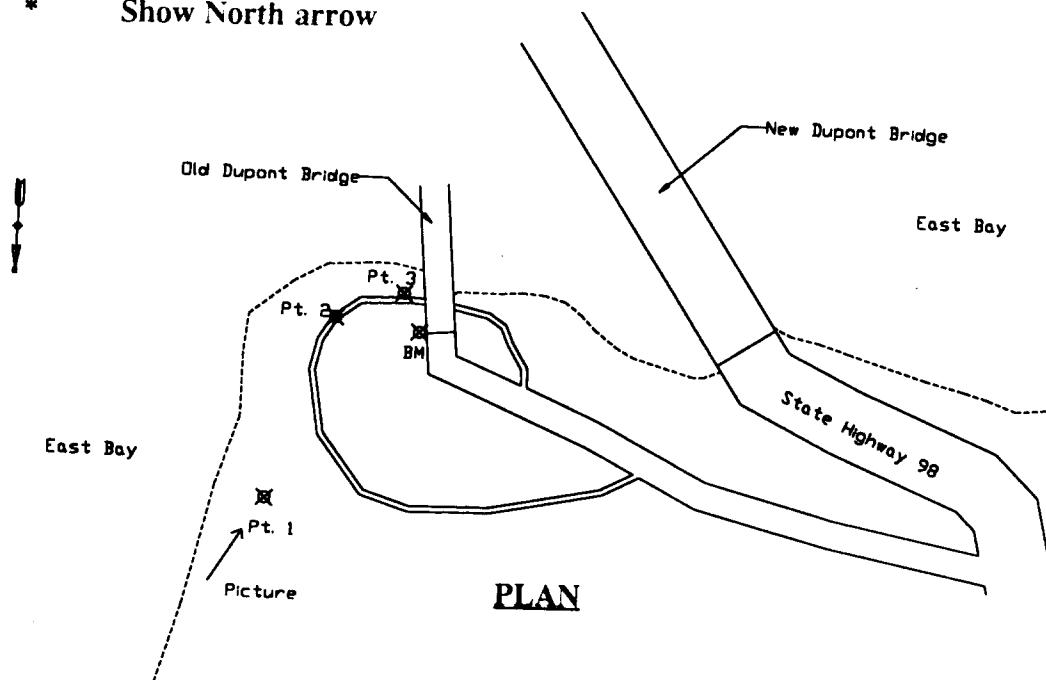
MICHAEL BAKER JR., INC.

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 10 a, b & c

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



**ELEVATION**

MICHAEL BAKER JR., INC.

HWM 2

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 11

Sheet 1 of 2

DATE OF REPORT 10/8/95

REPORTING INDIVIDUAL(S) D Hatheway / W Kleene

ADDRESS AT HWM Emerald Point Drive

LOCATION DESCRIPTION HWM 25 off of Emerald Point Drive

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE X MUD LINE X MARK ON FIXED

OUTSIDE \_\_\_\_\_ DEBRIS LINE \_\_\_\_\_ STRUCTURE X

HWM ELEVATION (FEET) 9.76 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 13.215 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION NGS W298

BENCHMARK LOCATION W298 Located on U.S 98 near Emerald Point Subdivision

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS GPS coordinates of BM

N 30° 24.6' W 86° 47.3'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

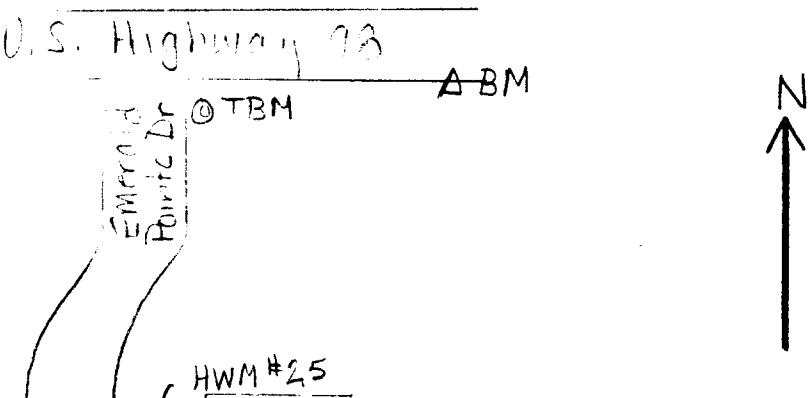
(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

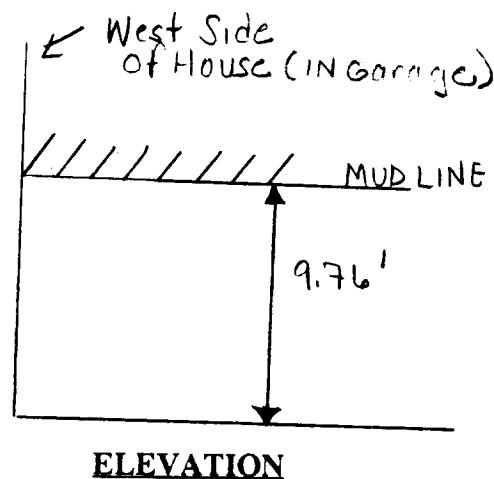
**HURRICANE OPAL****HIGH WATER MARK (HWM) REPORT**Report # 11

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow



Gulf of Mexico  
PLAN



HWM 36

**HURRICANE OPAL**

**HIGH WATER MARK (HWM) REPORT**

Report # 12 a

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM Corner of Frankford and Beach Drive

LOCATION DESCRIPTION Pt. 1 is approx. 30 feet northeast  
of corner of Frankford and Beach Drive

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 5.77 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 5.95 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Coast and Geodetic Survey - R H 175

BENCHMARK LOCATION SE corner of the intersection of  
Frankford and Beach Drive

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS GPS coordinates for BM - N 30° 09.9', W 55° 41.5'  
Heavy debris line consisting of timber, trees, and shrubs

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

**MICHAEL BAKER JR., INC.**

HWM —

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 12 b

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) M. PIRRELLI / P. SEXTON

ADDRESS AT HWM Corner of Frankford and Beach Drive

LOCATION DESCRIPTION Pt. 2 is 40 feet northeast of corner  
of Frankford and Beach Drive

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 6.18 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 5.95 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Coast and Geodetic Survey - RM 175

BENCHMARK LOCATION SE corner of the intersection of  
Frankford and Beach Drive

LEVELING METHOD Auto level

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 36

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 12 a/b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

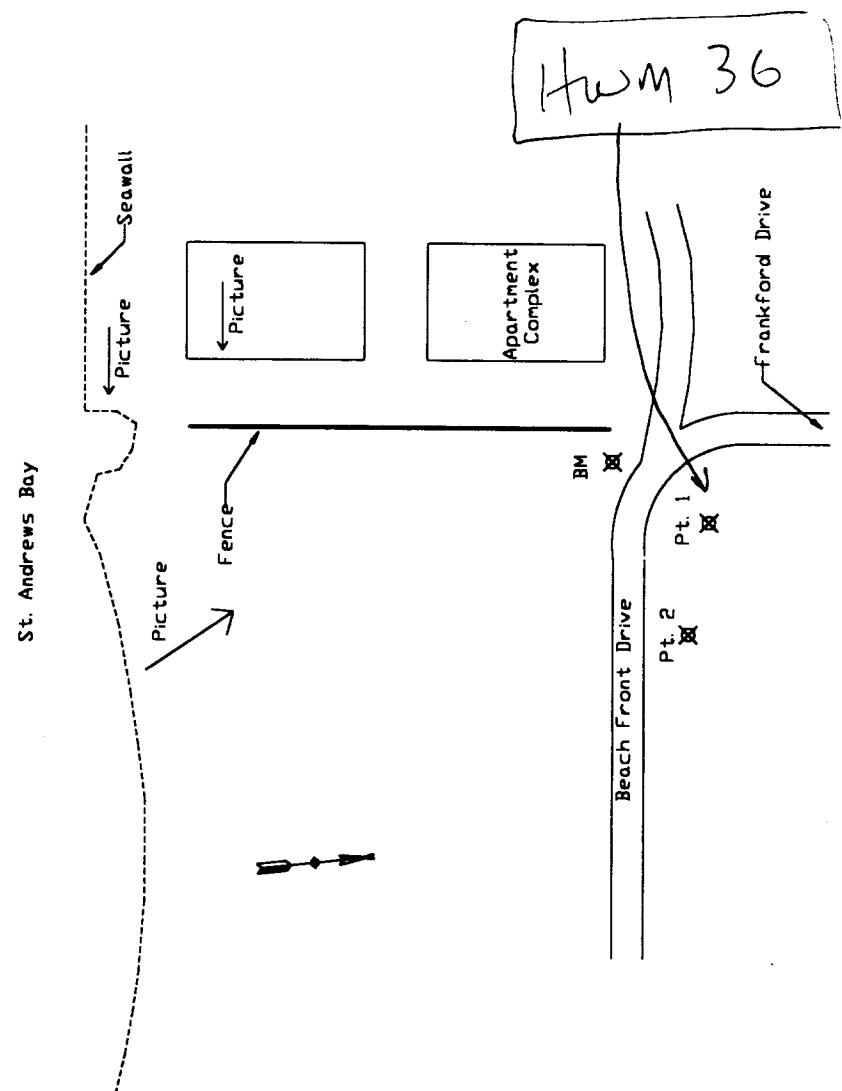
(See attached)

**PLAN**

**ELEVATION**

MICHAEL BAKER JR., INC.

12 a/b



HWM 35

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 13

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) MR. PIRKELLC / P. SEXTON

ADDRESS AT HWM 2629 9th Street

LOCATION DESCRIPTION 150' SW of the corner of 9th Street  
and Chestnut Street

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE \_\_\_\_\_ MARK ON FIXED

OUTSIDE X DEBRIS LINE X STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 8.22 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 12.91 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION National Geodetic Survey R42

BENCHMARK LOCATION NE corner of 9th Street and  
Chestnut Street

LEVELING METHOD Auto level and phillips rod

OTHER OBSERVATIONS GPS coordinates for B.M N 30° 10.0' W 85° 42.0'  
Heavy debris line (nearly 1.5' high) of trees and shrubs

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 35

**HURRICANE OPAL**

**HIGH WATER MARK (HWM) REPORT**

Report # 13

Sheet 2 of 2

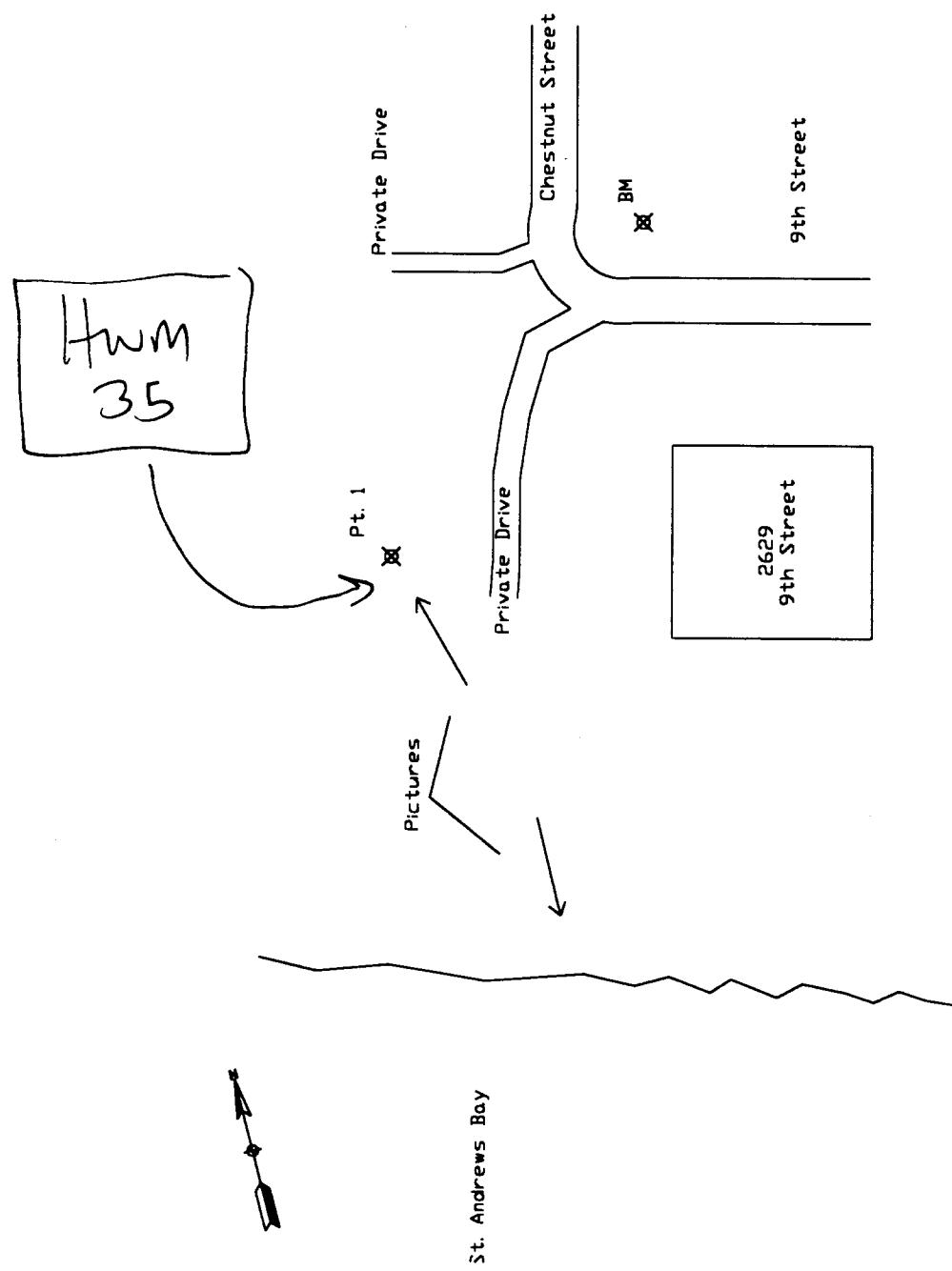
- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

(see attached)

**PLAN**

**ELEVATION**

MICHAEL BAKER JR., INC.



HWM 24

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 14

Sheet 1 of 2

DATE OF REPORT 10/12/95

REPORTING INDIVIDUAL(S) M. PIRRELL / P. SEXTON

ADDRESS AT HWM State Highway 20 at Basin Bayou

LOCATION DESCRIPTION Pt. 1 is approx 50 feet west of the SW corner of Basin Bayou Bridge

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 5.98 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 10.53 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION National Geodetic Survey #3-1975

BENCHMARK LOCATION SW corner of Basin Bayou Bridge,  
atop concrete bridge railing

LEVELING METHOD Auto level and phillips rod

OTHER OBSERVATIONS GPS coordinates for BM 30°29.2'N, 86°15.6'W  
Debris line of shrubs, eroded soil and dead grass also noted

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 24

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 14

Sheet 2 of 2

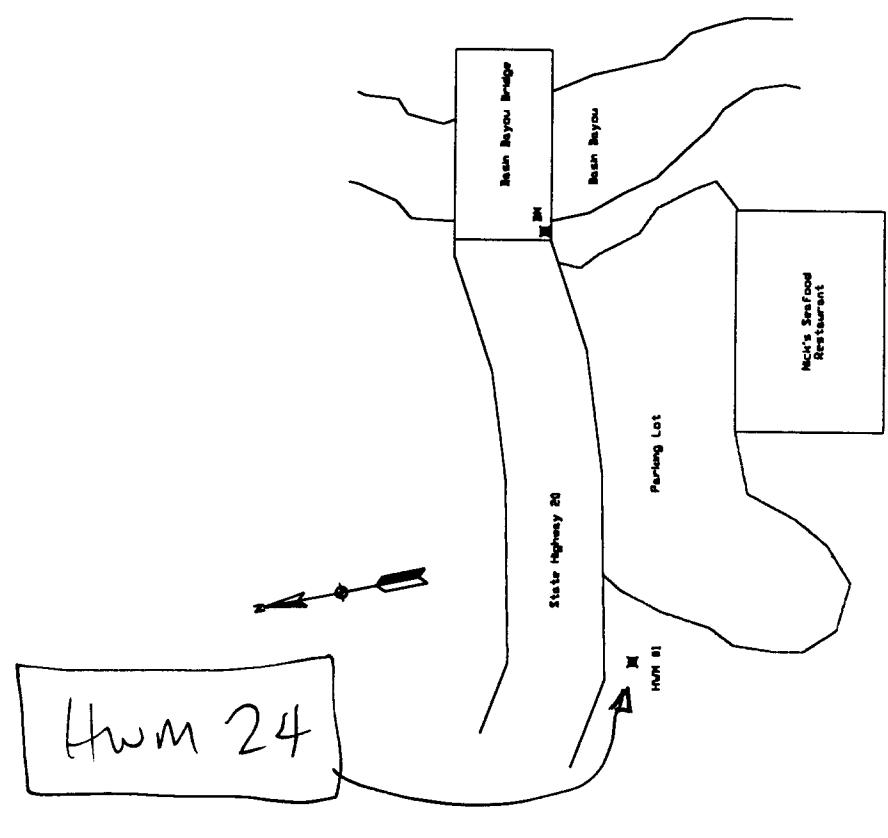
- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

(see attached)

**PLAN**

**ELEVATION**

MICHAEL BAKER JR., INC.



HWM 23

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 15 a

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) M. PIKRELLO / P. SEXTON

ADDRESS AT HWM State Highway 79 over West Bay

LOCATION DESCRIPTION Pt. 11 is approx 30 Feet SE of the SE corner of the old State Highway 79 Bridge.

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 7.2 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 11.78 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION National Oceanic Survey - 1975, BM#6

BENCHMARK LOCATION SE corner of the old (abandoned)

State Highway 79 Bridge, on concrete wingwall

LEVELING METHOD Auto level and Philly rod

OTHER OBSERVATIONS CPS coordinates - N 30° 17.6' W 85° 57.5'

Debris line consisted of weeds, shrubs, and tree branches

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 23

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 15 b

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM State Highway 79 over West Bay

LOCATION DESCRIPTION Pt. 2 is approx 50 feet SE of the SE corner of the old State Highway 79 Bridge

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_ MUD LINE \_\_\_\_\_ MARK ON FIXED

OUTSIDE X DEBRIS LINE X STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 7.34 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 11.78 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION National Oceanic Survey -1975

BENCHMARK LOCATION SE corner of the old (abandoned)

State Highway 79 Bridge, on concrete wing wall

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(ROLL # \_\_\_\_\_. PHOTO # \_\_\_\_\_.)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 23

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 15 a & b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

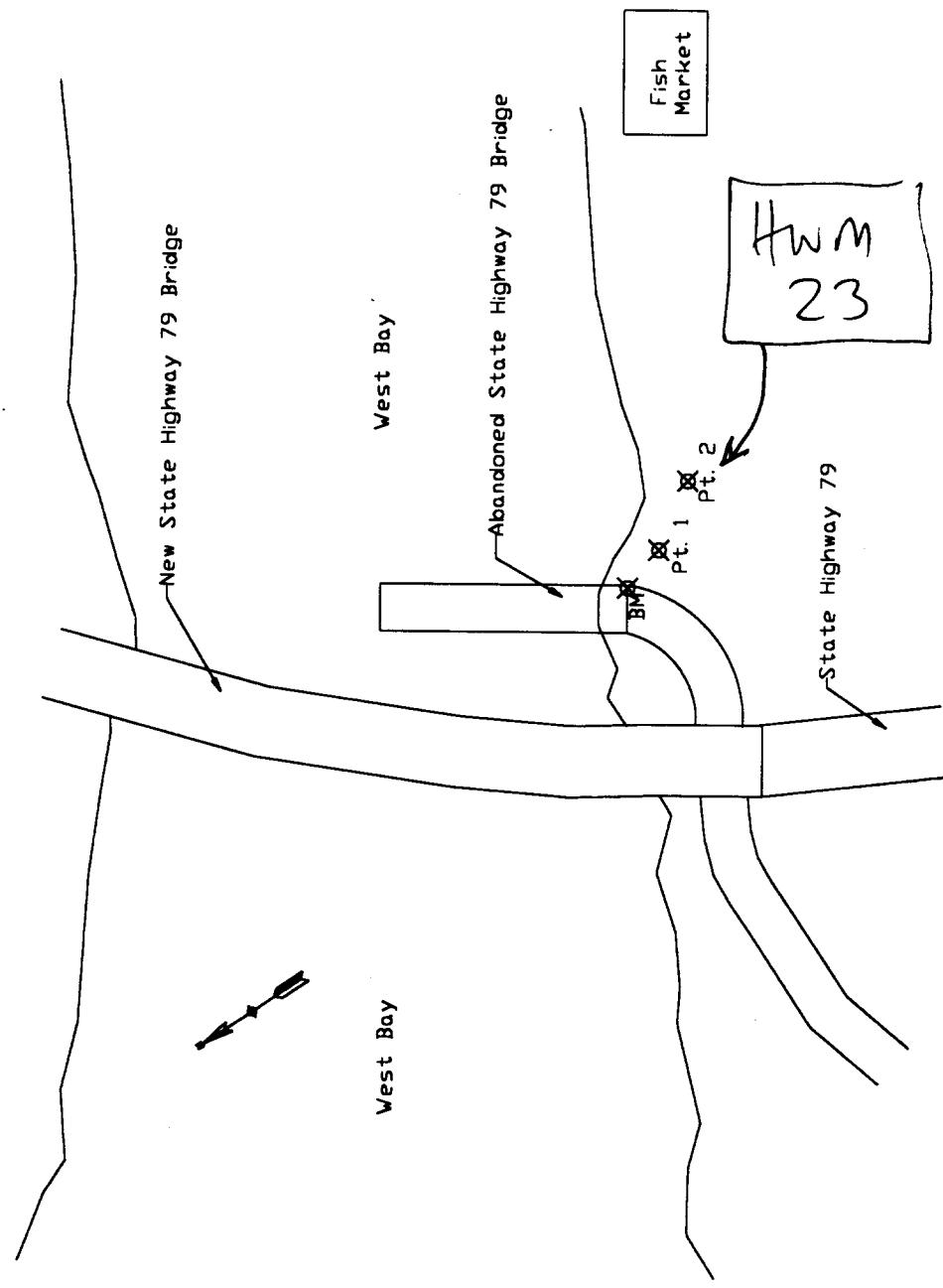
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PLAN

ELEVATION

MICHAEL BAKER JR., INC.

15 a  $\frac{1}{2}$  b



HWM ~~3~~

## HURRICANE OPAL

### HIGH WATER MARK (HWM) REPORT

Report # 169

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM North Bay Bridge - State Highway 77

LOCATION DESCRIPTION Approx 40 feet from NW corner of  
North Bay Bridge - Pt. 1

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 7.60 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 9.03 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Coast and Geodetic Survey - Y290

BENCHMARK LOCATION NE corner of North Bay Bridge, on  
bridge abutment

LEVELING METHOD Auto level and phlly rod

OTHER OBSERVATIONS GPS coordinates N 30° 15.7' W 85° 38.7'  
Light and scattered debris line

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 166  
Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM North Bay Bridge - State Highway 77

LOCATION DESCRIPTION Pt. 2 is approx. 70 feet from NW corner of North Bay Bridge

DATE OF HWM OCCURRENCE 10/14/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 7.19' DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 9.03' DATUM NGVD

SOURCE OF BENCHMARK ELEVATION U.S. Coast and Geodetic Survey - Y290

BENCHMARK LOCATION NE corner of North Bay Bridge, on bridge abutment

LEVELING METHOD Auto level and philly rod

OTHER OBSERVATIONS \_\_\_\_\_

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM ~~3~~

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 16 a½ b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

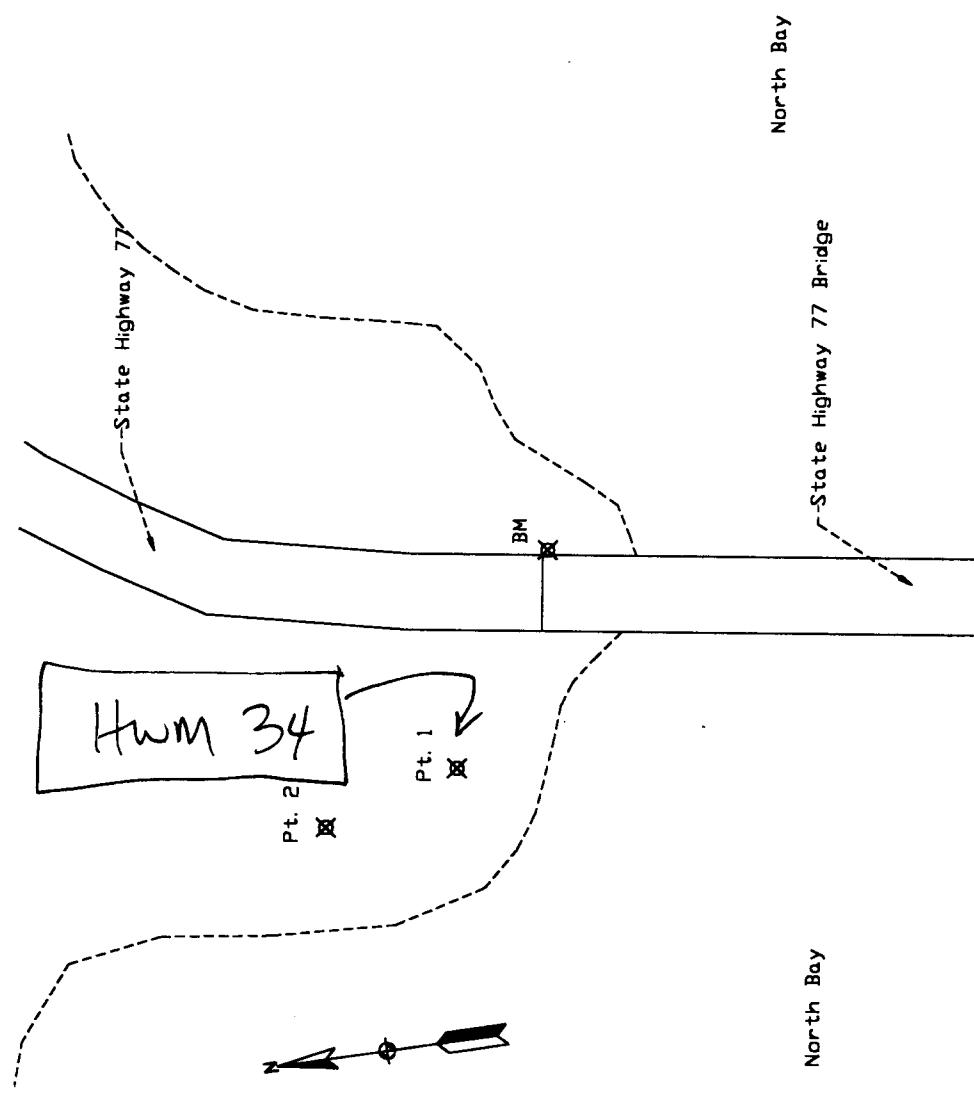
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**PLAN**

**ELEVATION**

MICHAEL BAKER JR., INC.

16 a<sub>3</sub> b



HWM 34  
(ANG)

**HURRICANE OPAL**  
**HIGH WATER MARK (HWM) REPORT**

Report # 17a

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) J.J. PIKELLO / P. SEXTON

ADDRESS AT HWM State Highway 33E Bridge, c/nr. Blnt 1111 Circle

LOCATION DESCRIPTION Pt. 1 is approx. 400'-ccf NW c/c. NE

(center of bridge)

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE \_\_\_\_\_

MUD LINE \_\_\_\_\_

MARK ON FIXED

OUTSIDE X

DEBRIS LINE X

STRUCTURE \_\_\_\_\_

HWM ELEVATION (FEET) 5.69 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 15.94 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION FL. Dept of Transportation - 9154F

BENCHMARK LOCATION NE Corner of bridge, atop concrete  
piling

LEVELING METHOD Auto level and phlly rod

OTHER OBSERVATIONS GPS coordinates - N30°19.7' W85°45.7'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

**MICHAEL BAKER JR., INC.**

HWM 34  
(ANG)

HURRICANE OPAL  
HIGH WATER MARK (HWM) REPORT

Report # 17b

Sheet 1 of 2

DATE OF REPORT 10/13/95

REPORTING INDIVIDUAL(S) M. PIRRELLO / P. SEXTON

ADDRESS AT HWM State Highway 338 Bridge over Bent Mill Creek

LOCATION DESCRIPTION Pt. 2 is approx. 415 feet upstream from NE corner of Highway 338 bridge

DATE OF HWM OCCURRENCE 10/4/95 TIME \_\_\_\_\_

DURATION OF OCCURRENCE \_\_\_\_\_

TYPE OF MARK (CHECK ALL THAT APPLY)

INSIDE  MUD LINE  MARK ON FIXED

OUTSIDE  DEBRIS LINE  STRUCTURE

HWM ELEVATION (FEET) 7.14 DATUM NGVD

GROUND ELEVATION (FEET) \_\_\_\_\_ DATUM \_\_\_\_\_

BENCHMARK ELEVATION (FEET) 15.94 DATUM NGVD

SOURCE OF BENCHMARK ELEVATION F.I. Dept of Transportation - 9154F

BENCHMARK LOCATION NE corner of bridge, atop concrete railing

LEVELING METHOD Auto level and phillips red

OTHER OBSERVATIONS GPS coordinates - N 30°19.7' W 85°45.7'

PHOTOGRAPHS: (ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(ROLL # \_\_\_\_\_, PHOTO # \_\_\_\_\_)

(NOTE: Illustrate HWM on sheet 2 with map and sketch.)

MICHAEL BAKER JR., INC.

HWM 34  
AUG

HURRICANE OPAL

HIGH WATER MARK (HWM) REPORT

Report # 17a 1/2 b

Sheet 2 of 2

- \* Show HWM
- \* Show photographs (roll #, photo #) and vantage points and angles
- \* Show benchmark location
- \* Show North arrow

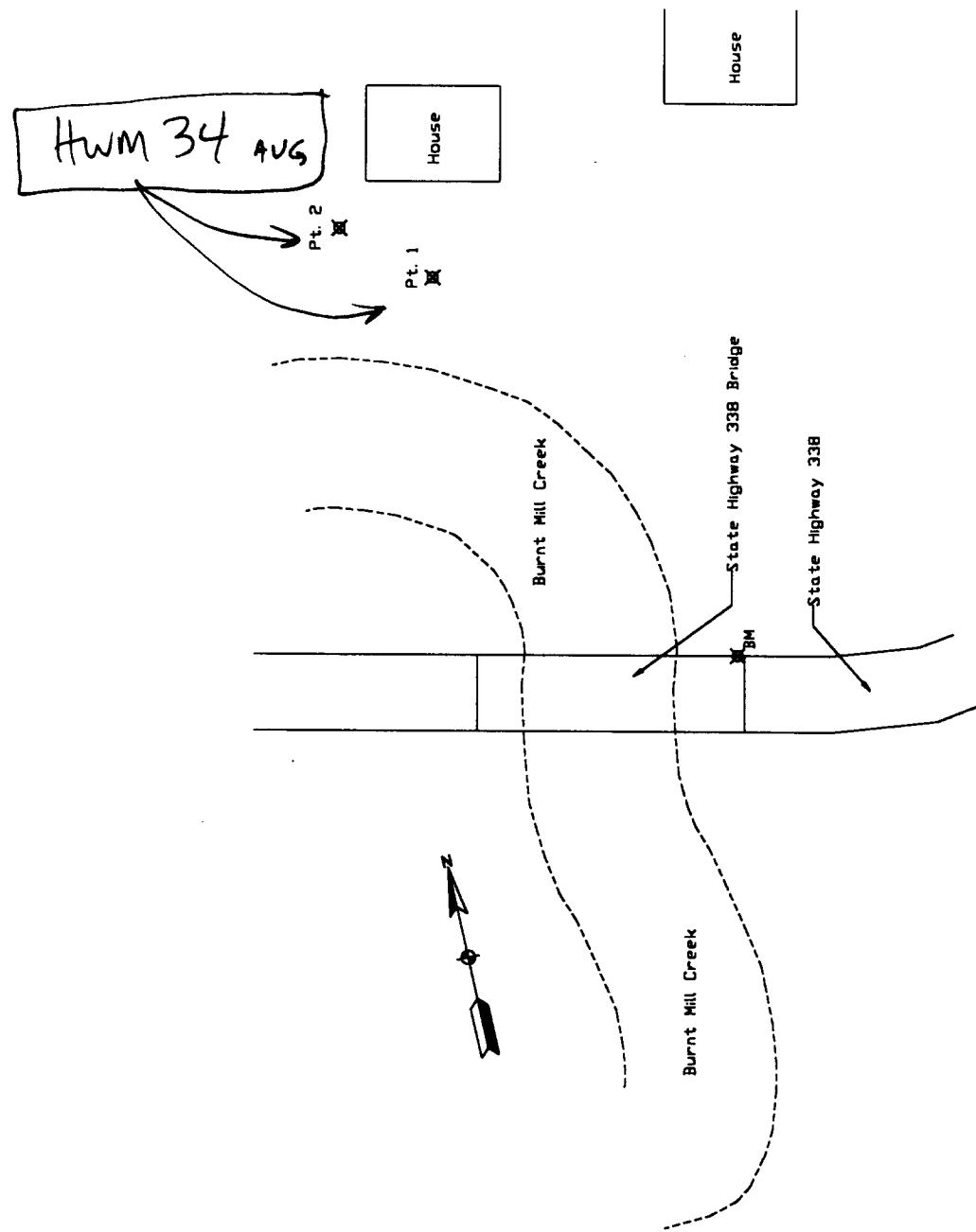
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**PLAN**

ELEVATION

MICHAEL BAKER JR., INC.

17 at b



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