CAROPINES/DEERFIELD STORM DRAINAGE OUTFALL STUDY

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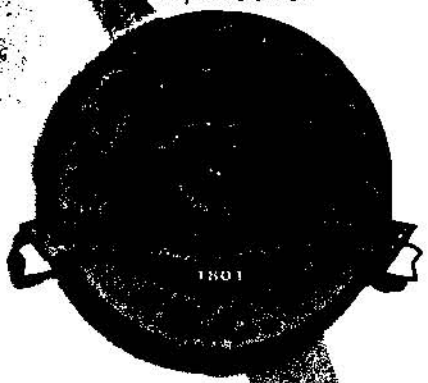

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CAROPINES/DEERFIELD
STORM DRAINAGE OUTFALL STUDY

Prepared For:

HORRY COUNTY

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4/26/00

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THE LPA GROUP INCORPORATED

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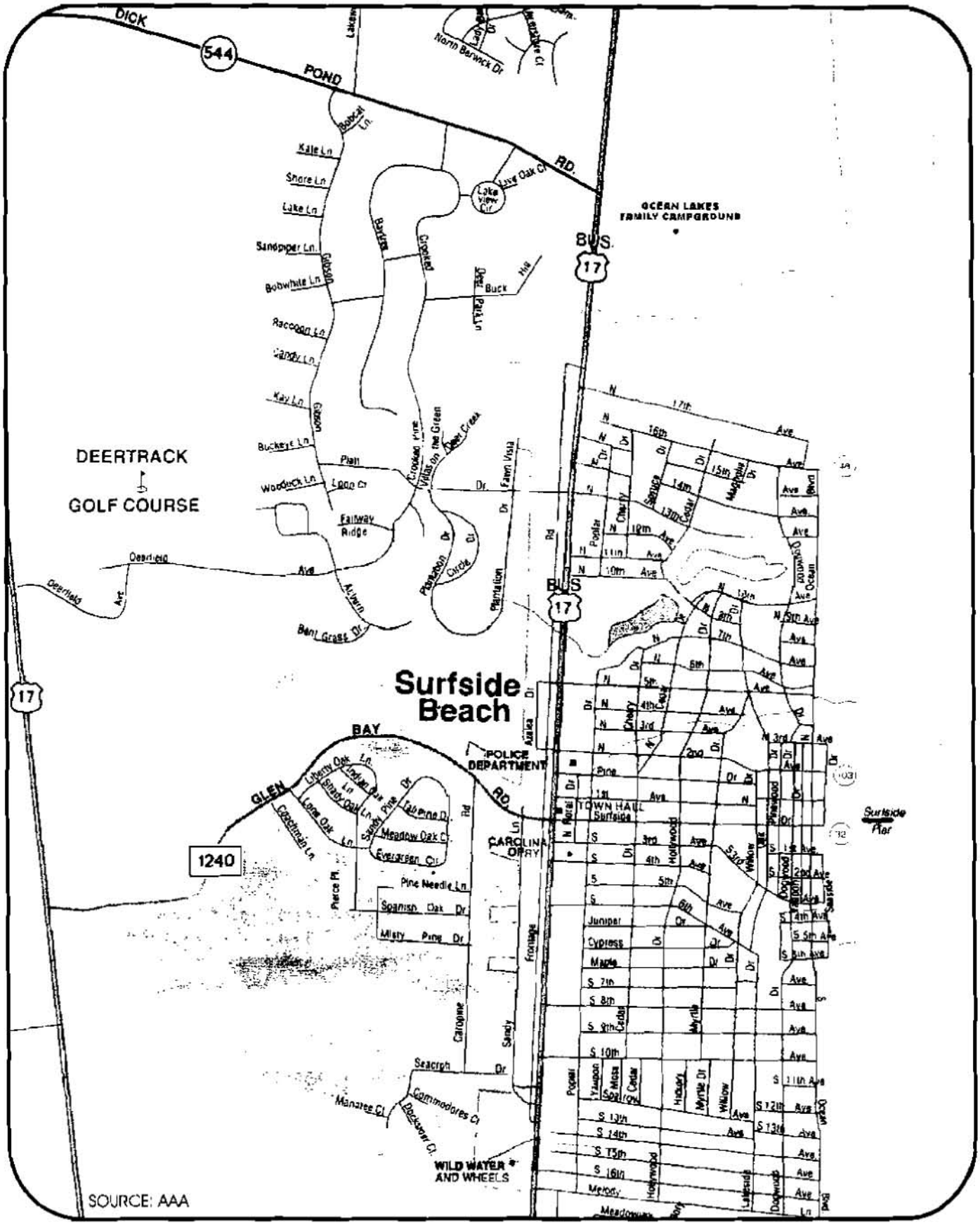
Section 1.0
PURPOSE OF DRAINAGE STUDY

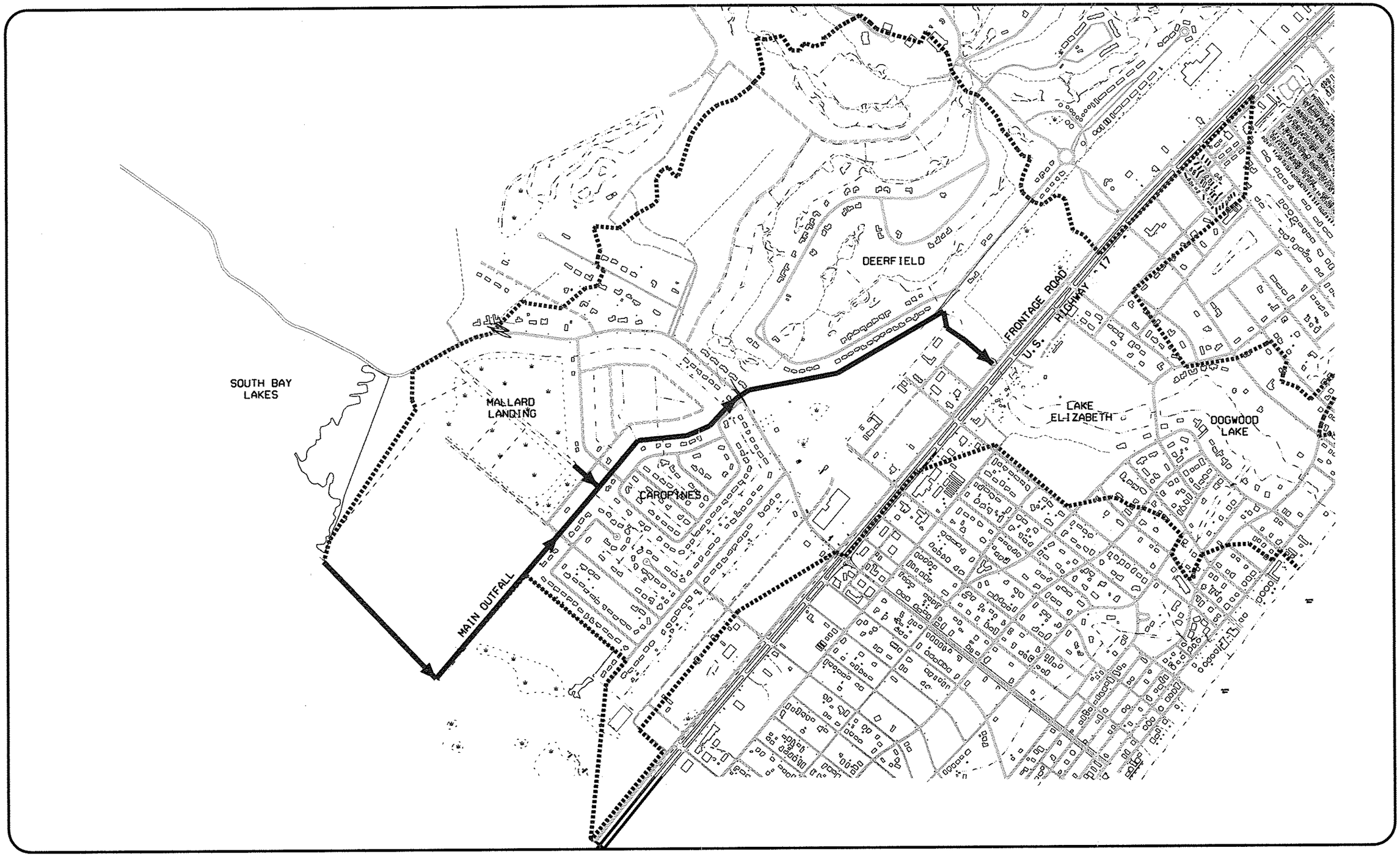
The purpose of this Drainage Study Report is to develop and evaluate alternative solutions for relieving flooding in the Caropines and Deerfield subdivisions without adversely impacting conditions downstream. Since Caropines and Deerfield are located upstream of Dogwood Lake, the project study area is identified as the Dogwood Lake Watershed (refer to Figure 1-1.) The primary outfall channel for this watershed conveys runoff from the Caropines subdivision across Glens Bay Road, under U.S. Route 17 Business, through the Town of Surfside, and into the Atlantic Ocean (refer to Figure 1-2.)

This report provides the methodology used to study the Dogwood Lake Watershed and identifies the existing areas within the basin that experience flooding. In addition, the report outlines the proposed alternatives for relieving flooding, the impact of these solutions on the entire study area, and an estimated construction cost for each of the alternatives.



Project Location Map

Figure 1-1



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LEGEND

ORIGINAL WATERSHED BOUNDARY

EXISTING DRAINAGE

MAIN OUTFALL

25 0 500 1000 1500 FEET

N

FIGURE 1-2
DOGWOOD LAKE WATERSHED
CAROPINES/DEERFIELD
STORM DRAINAGE OUTFALL STUDY

Section 2.0
METHODOLOGY

The methodology used to analyze the Dogwood Lake Watershed consisted of a series of steps that are briefly described below:

1. Inventory existing drainage basin data and perform initial site investigation;
2. Analyze the existing drainage system;
3. Identify the existing flooding areas for the 10-year, 25-year, and 100-year storms;
4. Gather additional input from the public, Horry County officials, Town of Surfside officials, and site investigations;
5. Calibrate the model using information gathered; and,
6. Determine proposed alternatives for eliminating flooding for the 25-year storm.

Due to the topography and the type of existing structures within the Dogwood Lake Watershed, the XP-SWMM program was identified as the preferred method of analyzing the existing and proposed drainage systems. In addition to accounting for available storage within the system, the XP-SWMM software is a dynamic, time-step model. This allows the user to identify methods of reducing the number of flooded sites and to evaluate the amount of time flooding occurs at each of those sites.

Section 3.0
EXISTING DRAINAGE SYSTEM

This section describes the information gathered for developing the initial XP-SWMM model, the calibration of the model, and the results of the analysis of the existing drainage system.

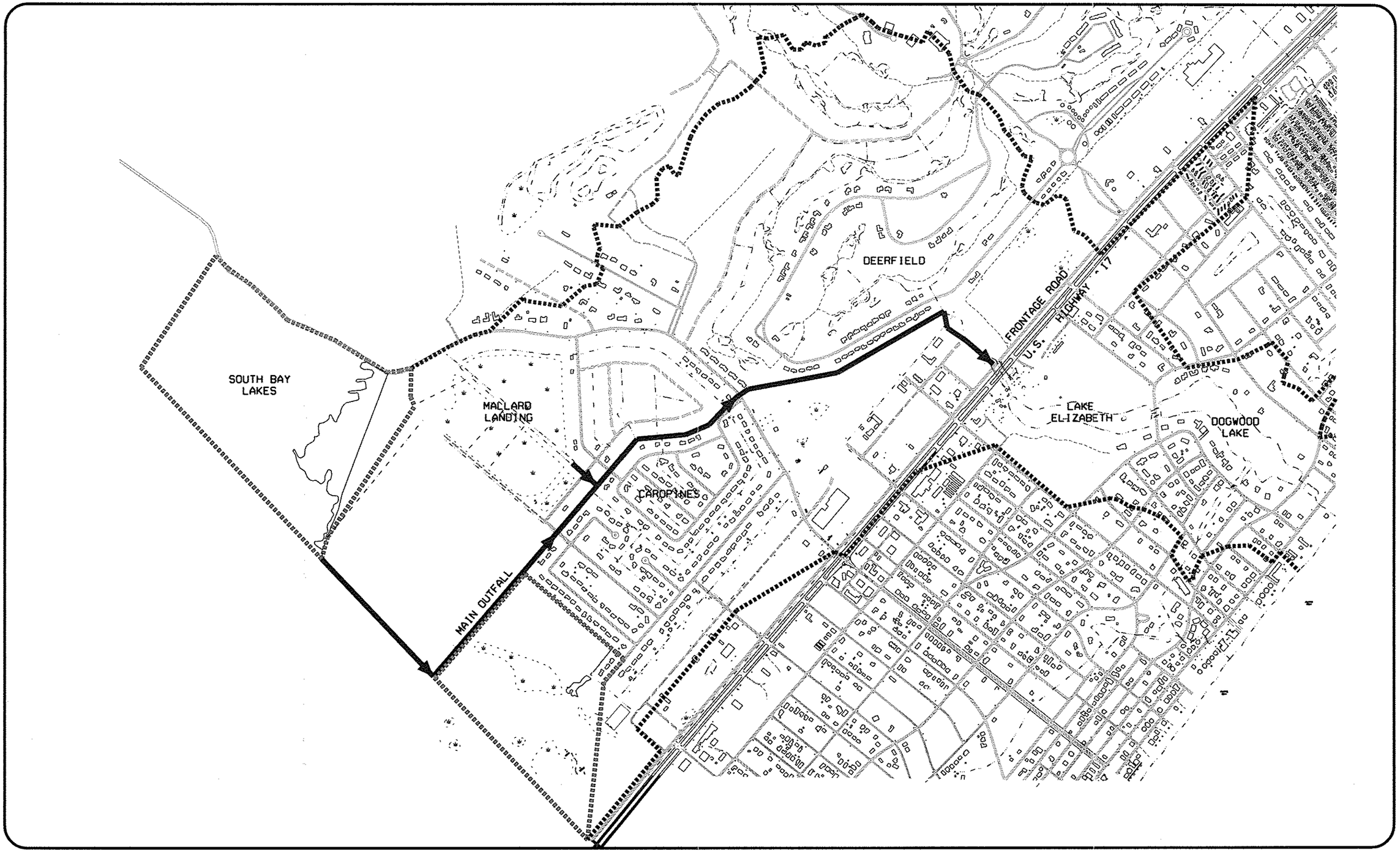
3.1 INVENTORY OF EXISTING DRAINAGE BASIN DATA

In order to develop the model of the existing drainage system for the Dogwood Lake Watershed, the following information was gathered:

- Available mapping and contour data from Horry County;
- Preliminary field surveys consisting of a profile of the main outfall channel, cross sections at key locations along the outfall, and sizes, inverts, and lengths of the existing pipes along the outfall;
- Town of Surfside Beach Stormwater Management Study Final Report, Proctor-Davis-Ray Engineers, Myrtle Beach, South Carolina, 1985 (refer to Appendix A);
- Engineering plans provided by Nelson Hardwick, Nelson Hardwick and Associates, for the outlet structure at the South Bay Lakes Pond and information on various culverts located in Deerfield;
- Construction plans for the Town of Surfside Drainage Discharge System project, prepared in September, 1989; and,
- Soil Conservation Service (SCS) Soil Survey for Horry County, South Carolina.

Based on the watershed delineation developed in the 1985 report for the Town of Surfside, it was determined that the northernmost point of the Dogwood Lake Watershed was the Caropines and Deerfield subdivisions. The most recent Horry County mapping indicated this as well. However, based on field reconnaissance performed for this drainage study, the new South Bay Lakes subdivision currently drains through the Caropines subdivision and contributes runoff to Dogwood Lake. Figure 3-1 illustrates the boundaries of the revised Dogwood Lake Watershed.

The Dogwood Lake Watershed is approximately 1115 acres and encompasses South Bay Lakes, Caropines Subdivision, Deerfield Subdivision, Mallard Landing, and a portion of the Town of Surfside bounded by Sixth Avenue North, U.S. Route 17 Business, Fourteenth Avenue North, and the Atlantic Ocean. The majority of the area is residential with some commercial development, especially



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LEGEND

ORIGINAL WATERSHED BOUNDARY

AREA ADDED TO WATERSHED

EXISTING DRAINAGE

MAIN OUTFALL

25 0 500 1000 1500 FEET

N

FIGURE 3-1
REVISED DOGWOOD LAKE WATERSHED
CAROPINES/DEERFIELD
STORM DRAINAGE OUTFALL STUDY

along U.S. Route 17 Business. The land slopes range from very flat to flat throughout the watershed. The watershed consists of mostly poorly drained soils north of U.S. Route 17 Business and well drained soils south of U.S. Route 17 Business.

3.2 ANALYSIS OF EXISTING SYSTEM

Using the information gathered above for the Dogwood Lake Watershed, an XP-SWMM model was developed and analyzed to determine the flooding locations for the 10-year, 25-year, and 100-year storms. Since gaging station data is not available for the study area, the model was calibrated based on visual observations made in the field during the site investigations as well as input from Horry County staff, Town of Surfside officials, and local residents. At locations where discrepancies were noted, adjustments were made to the model to more accurately depict the actual observed water surface elevations. There were three major adjustments made to the original model:

1. Channel data upstream of Spanish Oaks Drive, Pine Valley Lane, and Plantation Drive were gathered;
2. Construction plans for South Bay Lakes and Mallard Landing were used to include the outfall structures for each development; and,
3. Information from Nelson Hardwick and Associates was used to adjust the Deerfield Plantation outfall.

Based on the discussions with the local officials and residents, the revised XP-SWMM model produces results that reasonably depict the existing flooding conditions within the study area. Figure 3-2 identifies the locations where flooding occurs during the 10-year, 25-year, and 100-year storms. For more information regarding water surface elevations, duration of flooding, etc., refer to the XP-SWMM results contained in Appendix B.

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Flooding Areas for Existing Conditions

● Floods During 10-yr., 25-yr., & 100-yr. Storms
● Floods During 25-yr. & 100-yr. Storms
Main Outfall Channel

Figure 3-2

Note: Numbers indicate node numbers in the XP-SWMM Model.

Section 4.0
PROPOSED DRAINAGE IMPROVEMENTS

Three alternative solutions for relieving flooding within the Caropines and Deerfield subdivisions have been developed. However, regardless of the alternative selected, the following improvements should be made to the existing drainage system:

- The main outfall channel should be excavated to the original grade in order to promote positive drainage from the top of the watershed to U.S. Route 17 Business. This will increase the capacity of the main channel and eliminate stagnant water from ponding in the channel.
- There are three existing pipes along the main channel that should be replaced to improve flow and reduce water surface elevations. These pipes and the proposed pipe inverts are listed in Table 4-1.

TABLE 4-1

PIPE REPLACEMENTS IN MAIN OUTFALL CHANNEL
ALTERNATIVE 1

Location	Existing Culvert Size (inches)	Proposed Improvements	Proposed U.S. Invert (feet)	Proposed D.S. Invert (feet)
Indian Oaks Lane	36	Lower existing 36″ pipe	18.2	18.1
Pine Valley Lane	24	Add another 24″ pipe	21.0	20.4
Glens Bay Road	24 & 42	Replace 24″ with 42″ pipe	17.9	17.5

The following sections describe each of the proposed alternatives, the impact of the proposed improvements to the overall watershed, and the estimated costs associated with each alternative.

4.1 ALTERNATIVE 1

4.1.1 Proposed Improvements

Alternative 1 consists of constructing five detention ponds at specific locations within the Dogwood Lake Watershed upstream of U.S. Route 17 Business (refer to Figure 4-1.) There are no improvements proposed within the Town of Surfside City limits with this alternative. Table 4-2 lists the locations where detention is proposed and the amount of storage required. With each of these ponds, the storage should be located as close to the main outfall channel as possible to reduce the amount of pipe required to divert the flow and to improve the hydraulics of the drainage system.

TABLE 4-2

PROPOSED POND LOCATIONS
ALTERNATIVE 1

Location	Minimum Storage Required (Acre-feet)	Land Availability
Spanish Oaks Drive	82	Land is currently being developed.
Pine Valley Lane	20	This area is fully developed and would require acquisition of a developed parcel(s).
Glens Bay Road	2	This area is fully developed and would require acquisition of a developed parcel(s).
Plantation Drive	90	There is some area available on the existing golf course and within the residential subdivision.
U.S. 17 Business Frontage Road	66	Small undeveloped area adjacent to a small existing pond. Also, two vacant residential lots behind the shopping center and approximately 14 acres to the right of the shopping center. Storage within a pipe system could be placed under the existing shopping center parking lot.

4.1.2 Results of Analysis

Using the calibrated XP-SWMM model for the existing condition in the Dogwood Lake Watershed, a model was created to reflect the proposed Alternative 1 improvements. The results of this analysis are included in Appendix C. Figure 4-2 illustrates the impact of Alternative 1 on the flooding situation within the area. As indicated, the number of flooded areas has been significantly reduced from the

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Proposed Detention Pond Locations

● Pond Locations

Main Outfall Channel

Figure 4-1

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Flooding Areas for Alternative 1

- Floods During 10-yr., 25-yr., & 100-yr. Storms
- Floods During 25-yr. & 100-yr. Storms
- Floods During 100-yr. Storm
- Main Outfall Channel

Figure 4-2

Note: Numbers indicate node numbers in the XP-SWMM Model.

existing condition and there are no impacts to the system within the Town of Surfside.

4.1.3 Estimated Construction Cost

Table 4-3, page 4-6 provides a preliminary construction estimate for Alternative 1.

TABLE 4-3

ESTIMATED COST
ALTERNATIVE 1

Description	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$65,000.00	$65,000.00
Existing Channel Improvements	5900	LF	$30.00	$177,000.00
24" RCP	40	LF	$45.00	$1,800.00
36" RCP	44	LF	$50.00	$2,200.00
42" RCP	76	LF	$55.00	$4,180.00
Pavement Repair	1000	SY	$40.00	$40,000.00
Rip Rap	10	TON	$100.00	$1,000.00
Pond Excavation	420,000	CY	$5.00	$2,100,000.00
Seeding	100	ACRE	$800.00	$80,000.00
Clearing/Demolition	80	ACRE	$1,500.00	$120,000.00
SUBTOTAL CONSTRUCTION				$2,591,180.00
CONTINGENCIES & ENGINEERING (15%)				$388,677.00
TOTAL CONSTRUCTION COST				$2,979,857.00
LAND ACQUISITION				
Upstream of Glens Bay Road	1	ACRE	$300,000.00	$300,000.00
Upstream of Pine Valley Lane	7	ACRE	$360,000.00	$2,520,000.00
Upstream of Spanish Oaks Drive	28	ACRE	$47,400.00	$1,327,200.00
Upstream of Plantation Drive	20	ACRE	$70,000.00	$1,400,000.00
Upstream of Node 63	2	ACRE	$125,000.00	$250,000.00
Upstream of U.S. 17 Business	15	ACRE	$120,000.00	$1,800,000.00
TOTAL LAND ACQUISITION				$7,597,200.00
TOTAL COST OF ALTERNATIVE 1				**$10,600,000.00**

4.2 ALTERNATIVE 2

4.2.1 Proposed Improvements

The proposed improvements for this alternative consist of modifications to the existing drainage system throughout the Dogwood Lake Watershed that would allow the runoff generated during a 25-year storm to be passed through the system to the Atlantic Ocean. These modifications would include increasing the pipe sizes at several locations, including the pipes under U.S. Route 17 Business, as well as modifying the outlet structures at Lake Elizabeth and Dogwood Lake.

Table 4-4 lists the pipes that would be modified or added for the improvements in Alternative 2.

TABLE 4-4

ADDITIONAL PIPE REPLACEMENTS FOR ALTERNATIVE 2

Location	Existing Culvert Size (inches)	Proposed Culvert Size (inches)	Proposed U.S. Invert (feet)	Proposed D.S. Invert (feet)
Stub into Junction Box Upstream of Frontage Road	48	72	15.3	14.8
Frontage Road	48	72	14.8	13.3
U.S. Highway 17 Southbound	48	72	13.3	11.6
U.S. Highway 17 Northbound	48	72	11.6	9.9
Cedar Lane	54	2 - 54	5.4	5.2

Note: These pipe replacements are in addition to those described in Table 4-1.

The modifications required for the outlet structures at Lake Elizabeth and Dogwood Lake would include the following:

- Adding a 4-foot by 5-foot inlet box similar to the existing structure at Lake Elizabeth;
- Adding a second pipe under Cedar Lane; and,
- Modifying the weir at Dogwood Lake from 50 feet to an effective length of 200 feet.

The final design of the weirs at each lake will be set so that the additional flow will be passed through the lake without increasing the existing water surface elevations for the design storm events.

4.2.2 Results of Analysis

An XP-SWMM model was created to include the proposed improvements for Alternative 2. Portions of the XP-SWMM output for this model are included in Appendix D. Figure 4-3 indicates the number of flooding sites that result with the Alternative 2 modifications in place. Although the number of flooded areas are more than with Alternative 1, there is still a significant improvement over the existing condition.

4.2.3 Estimated Construction Cost

A preliminary estimate of the construction cost for Alternative 2 is provided in Table 4-5, page 4-10.