

COW PEN SLOUGH  
WATER MANAGEMENT INVESTIGATION  
PHASE I



SARASOTA AND MANATEE COUNTIES  
FLORIDA

BY  
J. A. MANN

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT  
MANASOTA BASIN BOARD  
5060 U.S. HIGHWAY 41 SOUTH  
BROOKSVILLE, FLORIDA 33512

MARCH 1981

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## ACKNOWLEDGEMENTS

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Appreciation is expressed to those members of the District Staff who contributed to the report by reviewing the manuscript.

Special thanks is expressed to Rebecca Hatten of the District Staff for typing the manuscript.

## EXECUTIVE SUMMARY

This investigation is an evaluation of a partially completed U.S. Department of Agriculture, Soil Conservation Service (SCS), Public Law 566 Watershed Work Plan (March, 1961), for the Sarasota West Coast Watershed Project (SWCWP) in Sarasota and Manatee Counties, Florida. In 1972, sponsors of the project suspended construction because of environmental problems in the embayment--Dona Robert's Bays--which were attributed to changes resulting from construction on the watershed project.

In November, 1978, the Sarasota County Board of Commissioners and the Sarasota Soil and Water Conservation District requested Southwest Florida Water Management District (SWFWMD) participation in the operation and/or maintenance of the partially completed project, but that request was denied by the Manasota Basin Board. However in March, 1979, the Board decided to examine the project in light of current problems and needs within the watershed and an Advisory Committee was formed to help coordinate the project evaluation with local concerns.

Work on the project began in May, 1979. The investigation is intended to be the beginning of a multi-phased project. That phase of the overall project which is covered by this report will determine conceptually the most feasible method or methods of amending the present

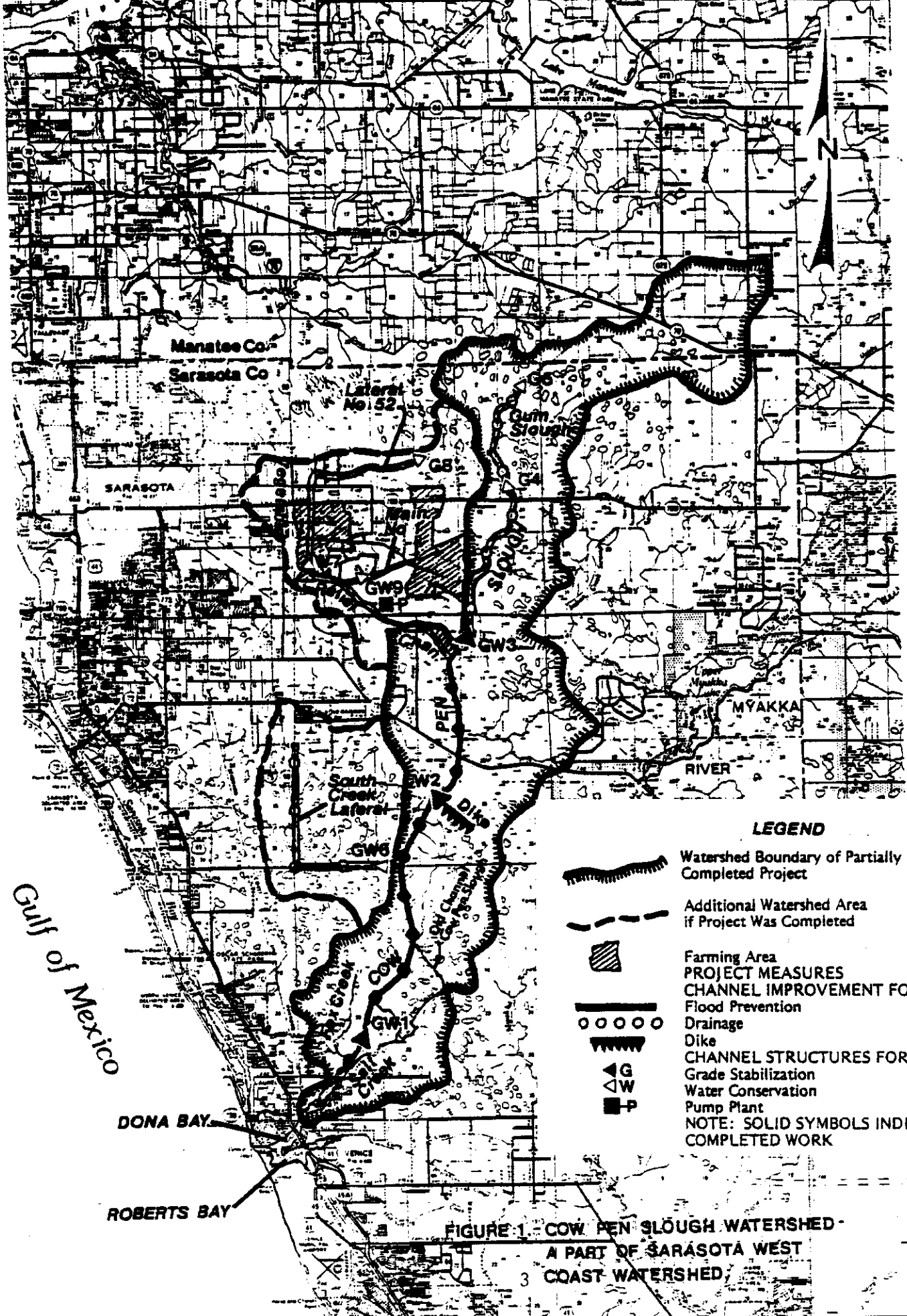
incomplete project (SWCWP) to encompass the stated project objectives so that further work can proceed to bring the amended project to a successful completion. The Staff (SWFWMD) effort was assisted by two consultant retainer contracts which were issued for specific aspects of the study.

The Phase I Study is a preliminary Staff effort to determine whether further construction should be undertaken and/or changes made in the original project, which was not designed to eliminate flooding but to limit the depth and duration of inundation (flooding) to non-damaging levels. Although the original project encompassed over 200 square miles (sqmi), the size of the watershed to be included in the Phase I Study was reduced to 65 sqmi (see Figure 1).










The specific analytical objectives of the Phase I Study are as follows:

1. Adjustments of the Cow Pen Slough (CPS) hydroperiod to reduce detrimental impacts to Dona and Robert's Bays (DARB).
2. Development of the municipal water supply potential of CPS including possible use of Phillippi Creek and Myakka River.
3. Drainage and flood control in CPS Watershed.
4. Flood control in the agriculturally productive muck lands east of Sarasota.
5. Resolution and disposition of the partially completed Public Law-566, SWCWP.





**LEGEND**

-  Watershed Boundary of Partially Completed Project
-  Additional Watershed Area if Project Was Completed
-  Farming Area
- PROJECT MEASURES**
-  CHANNEL IMPROVEMENT FOR: Flood Prevention
-  Drainage
-  Dike
- CHANNEL STRUCTURES FOR:**
-  Grade Stabilization
-  Water Conservation
-  Pump Plant
- NOTE: SOLID SYMBOLS INDICATE COMPLETED WORK

**FIGURE 1. COW PEN SLOUGH WATERSHED - A PART OF SARASOTA WEST COAST WATERSHED**

At the conclusion of the Phase I Study it should be possible to determine the most viable water management alternatives for meeting current needs and problems within the watershed. However, project alternatives were limited by the Advisory Committee in October, 1979 when they directed that no further consideration be given to any project alternative which would direct water from the farming area into CPS. The major reason for this directive was the feeling that water quality mixing could not be controlled and the result would be further degradation of water quality in DARB. This meant that a project alternative that did not incorporate either the Phillippi Creek Watershed or the CPS Watershed had to be developed to address the project objective of alleviating flooding in the farming area.

The original project recognized flooding problems on Phillippi Creek as a separate issue and did not attempt to address those problems directly. This study will also view the problems in that manner even though the muck farming area in the vicinity of Fruitville now drains by gravity flow to Phillippi Creek.

Flooding along Phillippi Creek and within the farming area in 1957 and continuing almost annually through 1962 caused several million dollars damage and began the accelerated planning on the SWCWP. The project as planned had an incidental benefit of reducing unevaluated flood damages in the residential areas along lower Phillippi Creek.

The first contract under the Watershed Work Plan (WWP) for the SWCWP was completed in 1964. The last contract was completed in 1972. The pumping station which was to be operated in conjunction with the Vegetable Area Relief Channel (VARC) to divert floodwaters to the CPS Watershed, although completed, is not operational because the VARC was never completed.

The objectives of the SWCWP were to provide flood protection for the farming area and improved pasture and range lands along the slough, to provide adequate outlets for carrying floodwater from the slough, and for water conservation during dry seasons of the year. Since the pumping station is not operational, the farming area is not receiving any benefit from the completed works.

Three control structures have been completed. Structure No. 3, the most upstream structure, has not been operational since 1967 when it was bypassed by a washout. Structures Nos. 1 and 2 are operational but are in a bad state of disrepair. Re-design of Structure No. 3 is underway by the SCS. When construction of the modifications to the structure is complete, the SWCWP probably will be "closed-out" by mutual agreement between the SCS and Sarasota County.

By formal agreement with the SCS, Sarasota County has accepted responsibility for the operation and maintenance of the completed works. However, over the years the County has not performed the maintenance

required with the exception of aquatic weed control. The results of an investigation by SWFWMD in 1979 indicated that the accumulated maintenance cost could total a quarter of a million dollars.

In 1977 an advisory group was established and an attempt was made to develop a supplement to the original WWP so that the project could be brought to a conclusion. However, because the various agencies and citizen groups having an interest in the project could not agree on priorities, the SCS re-evaluation of the project, which would have led to a design supplement, was never begun.

At the present time the SCS cannot carry out a re-evaluation of the SWCWP unless a list of project alternatives which address the environmental and water management problems in the watershed can be agreed upon by the various agencies and groups having an interest in the project. The biggest area of contention centers around the potential environmental problems in the embayment, which are blamed in part on the SWCWP.

Phase I of this study includes determining what impacts have occurred to the bays as a result of stream modifications in the slough. However, an administrative constraint of the study was that no new data were to be collected regarding any aspect of the study, including environmental. The two reports from which conclusions have been drawn regarding the impact of CPS on the embayment are: Dona Bay Study by Bernard E. Ross, Ph.D., and The Ecological Status of Dona and Robert's Bays and its Relationships to Cow Pen Slough and Other Possible Perturbations by Mote Marine Laboratory, Jeffrey L. Lincer, Ph.D., Project Coordinator.

Working with the Advisory Committee which was formed to help coordinate the Phase I Study with local concerns, points out the strong opposition to further work on the SWCWP. The problem of differences among land-owners affected by the project resulted in agreement by the County and the Sarasota Soil and Water Conservation District in May, 1979, that the project should not be completed as planned.

The CPS Watershed remains basically agricultural in nature; however, urbanization is beginning to have a significant impact in some areas. Much of the agricultural land is potential development property but the County's Zoning Regulations have placed the majority of these agricultural lands in Open Use Districts with maximum gross residential density ranging from one single family dwelling unit per two acres in Open Use Estate-2 Districts, to one single family dwelling unit per 160 acres in Open Use Agricultural Districts.

Interstate 75, which is adjacent to the farming area on the west, will impact both the Phillippi Creek and CPS Watersheds. It probably will have the greatest impact on the Phillippi Creek Watershed.

Works of improvement already installed provide adequate drainage for the farming area and pasture areas; however, flooding still is a problem in the muck farming area. Agricultural interests believe that the muckland can be productively farmed for another five to ten years and that it would be economically sound to expend money to provide flood control in

that area. Of the approximately 1,800 acres of muckland being farmed when the WWP was prepared, only about 900 acres are now being farmed. However, an additional 500 acres of the original 1,800 acres are now in citrus. Economically speaking, the agricultural operation in the farming area, although decreased in size in recent years, probably is just as valuable today as it was at the time of the SWCWP.

Some ranchers in the watershed could benefit from additional project work while others have adequate drainage. But, it must be remembered that limited pasture inundation is a feature of the original project design. There is a difference of opinion among landowners whether the South Creek Lateral portion of the original project still should be built. Some say that ranchers can get excess water to the slough without it. Also, about one-half of the area which would have benefited from the South Creek Lateral now is part of the Palmer Ranch which is being planned for residential development. There are no agricultural related problems in the Manasota County part of the watershed that need addressing by revisions to the original project.

As was discussed earlier, flooding problems on Phillippi Creek were recognized as a separate problem in the original project and in this study. However, in their report for the District on this study, Joint Venture Engineers point out that to alleviate the flooding threat on Phillippi Creek would require a reduction in flow of 5,000 cubic feet per second (cfs); or a pumping station seven times the size of the pumping station designed in the original project.

The Phase I Study revealed an obvious residential flooding problem in the CPS Watershed--King's Gate Club Development and King's Gate Travel Trailer Condominium development. Both of these developments are located near the southern end of the SWCWP in the vicinity of Structure No. 1.

The County is confident that drainage and flood control in the CPS Watershed can continue to be accomplished through application of Sub-division and Development Regulations. But, the King's Gate Club Development is an example of an instance where these regulations were circumvented.

The SWCWP was designed as an agricultural water management project and although a runoff coefficient was utilized that would allow for some urbanization, the structural measures designed into the project do not provide the level of protection needed for a moderately to highly urbanized watershed. However, the County feels that rezoning of agriculture lands for development purposes can be controlled within a maximum density of one dwelling unit per two to five acres, thereby minimizing increased runoff. Some older subdivisions may have drainage problems but the County does not feel that these problems are numerous enough to be significant.

Environmental problems in the embayment which stopped the project had been attributed to changes resulting from construction of the partially completed SWCWP. However, many other changes in land use in the watershed, generally in the immediate vicinity of the embayment have taken place since 1960.

The most severe water quality problem in the embayment since the project (SWCWP) was partially completed occurred in 1972, and it was at that time that residents of the Dona-Robert's Bays area approached the County and requested that the situation be studied. The reports by Drs. Ross and Lincer were an outgrowth of this request. Since the above two reports were completed (1973, 1975), many factors which contribute to further environmental problems in the watershed and embayment have significantly increased.

In his study for the County Dr. Ross concludes from a backwater analysis that the peak rate of runoff from CPS has approximately doubled as a result of the SWCWP--from 2200 cfs to 4400 cfs at flood stage. However, an evaluation of the data, done for this Phase I Study, indicates that at a discharge of 4400 cfs, flow would be bypassing Structure No. 1; and, there probably would be overland sheet flow occurring with Fox Creek, CPS and Salt Creek interconnected.

It would have been more meaningful to make the flow comparison at a smaller discharge--at about bankfull flow conditions. There is little doubt, that during a time when 4400 cfs is discharging from CPS, the embayment will have become a freshwater lake. However, discharges of that magnitude are infrequent; none have occurred since 1962.

As Project Coordinator for the study by Mote Marine Laboratory, Dr. Lincer summarized his work and the work of the other project investigators. His summary conclusions include the following:



1. The freshwater influx from CPS during periods of heavy rainfall disrupts the normal dynamics of Dona Bay.
2. The impact of the freshwater influx is magnified because the normal "buffering effect" of an estuary being fed by a meandering stream has been circumvented by the channelization of the SWCWP.
3. The massive transfer of freshwater, freshwater weeds and sediments into Dona Bay occurs at a rate which exceeds the ability of the estuary to handle it.
4. There is some evidence that Dona Bay may be filling-in on a much shorter time scale than many estuaries on Florida's west coast.
5. For perhaps one-half to two-thirds of the year (the dry season) Dona Bay functions as well as (or as poorly as) many of the estuaries on the west coast of Florida which are surrounded by recent development.
6. Robert's Bay is recipient of fewer runoff problems than Dona Bay, the impact of which is spent out over a longer period. In addition, Robert's Bay recovers more quickly from these perturbations because it is flushed more thoroughly by the Intracoastal Water Way and the incoming Gulf waters through the Venice jetties.
7. The effects of suburbanization on the Dona Bay, Robert's Bay and especially lower South Creek were reflected by the water quality monitoring program.

Dr. Lincer qualified the results of the Mote Marine Study by pointing out that in all fairness, the limitations set by a one year sampling do

not provide information on year to year normal variations, and in addition subtle differences between observed conditions at selected sampling periods may have been missed.

The SWCWP is designed to increase freshwater runoff from the watershed under storm conditions. But, under normal rainfall conditions, runoff from the watershed should be relatively unaffected by the channelization.

Since the extremely wet years of 1959 through 1962, and since the SWCWP was partially completed, the watershed has experienced a period of low runoff. During September and October, 1979, there was some minor flooding in the CPS Watershed, but it is estimated to have been less than the MAF event.

The basic management plan for the gates in the structures was to operate the gates to provide maximum discharge capacity during flood periods. Leaving the gates open during the rainy season should not result in a wasteful discharge of water. During that time of the year the hydrologic system normally fills to overflowing, and runoff occurs naturally. Also, crest elevations at the structures are higher than the elevations which existed naturally at those locations and channel slopes are less than pre-project, both of which would tend to counteract the increased cross-sectional areas of the channelized stream.

Project alternatives (see Figures 8 and 9) considered are as follows:  
Alternative A - A project alternative considered is the diversion of streamflow from the CPS Watershed to the Braden River Watershed. This

diversion would increase inflow to the Ward Lake Reservoir on the Braden River and thus increase water availability for public supply. At the same time freshwater inflow to the embayment would be decreased.

Maximum discharge (diversion) would be 200 cfs and during an average year the maximum annual diversion possible (divert all flow up to design flow whenever possible) is estimated to be on the order of 10-15 million gallons per day (mgd), or about 70 percent of the total average yearly flow at the point of diversion. Ten to fifteen million gallons per day is equivalent to about 15-25 cfs. When design (SWCWP) flow conditions are occurring in the watershed, the maximum rate of inflow to DARB at Structure No. 1 would be reduced by about 15 percent with a diversion capability of about 200 cfs.

Alternative A-1 - There is another potential diversion site about 1.5 mi upstream from the above site. The size and capacity of the diversion facility would be somewhat smaller than that for the previously discussed site for Alternate A. During an average year the maximum average annual diversion possible at this site is estimated to be on the order of 10 mgd (about 15 cfs) if about 70 percent of the flow is diverted. When design (SWCWP) flow conditions are occurring in the watershed, the maximum rate of inflow to DARB at Structure No. 1 could be reduced by about 10 percent with this diversion facility.

Both the above described diversions would reduce the freshwater inflow to DARB. The affects on the embayment of such reductions in flow cannot be forecast because of the lack of baseline data relating the health of the embayment to the amount of freshwater inflow.

Various diversion rates could be utilized. Two hundred cubic feet per second was chosen because it approximated the original project (SWCWP) design in the area. Further studies would be necessary to establish the most appropriate diversion scheme and consideration should be given to the needs of downstream landowners, and/or instream needs in downstream reaches of the CPS Watershed.

Alternatives B and B-1 - Flooding in the northern section of the farming area probably could be controlled by managing the inflow to this area and diverting flood flow to the Braden River Watershed. The design channel capacity should be about 200 cfs. If diversion cannot be accomplished by gravity flow, one of the pumps from the originally designed (SWCWP) pump plant on Bee Ridge Road could be relocated to these sites. To provide flood control in the southern section of the farming area, the only alternative is an outlet to CPS.

Benefits from a diversion from the farming area to the Braden River Watershed would not only be to the farming area. There would be some minimal reduction in flooding on Phillippi Creek, and the water diverted to the Braden River Watershed would eventually reach the Ward Lake

Reservoir and be made available for water supply purposes. No estimate of diversion amounts was made because of the lack of streamflow data. Generally, water from upstream of the farming area should be of good quality.

Primary Project Alternatives - The project alternatives for diverting water to the Braden River Watershed have been combined with possible diversion schemes in the lower CPS Watershed to form three primary project alternatives (see Figures 10, 11 and 12). The diversion schemes in the lower CPS Watershed would be utilized to divert streamflow to reservoirs for water supply purposes. Before the Advisory Committee directed that no further consideration be given to that part of any project alternative which diverted water from the farming area to CPS, each of the three primary project alternatives satisfied all of the project objectives of the Phase I Study.

The first of the primary project alternatives, Alternative C, includes a diversion from the farming area to the Braden River and a conceptual reservoir between CPS and the Myakka River.

The second of the primary project alternatives, Alternative D, included a diversion from the farming area via the pumping station and the VARC, or a gravity-flow diversion channel, and the conceptual reservoir of Alternative C. Since the diversion from the farming area could not be given further consideration, Alternative D would not provide flood control in the farming area or any reduction in flooding on Phillippi Creek.

The last of the primary project alternatives, Alternative E, is very similar to Alternative D in that it included a diversion from the farming area to CPS and a conceptual reservoir. It differs from Alternative D in that it has an overflow-relief channel and an additional diversion from CPS directed southward toward Curry Creek. Since the diversion from the farming area could not be given further consideration, Alternative E would not provide flood control in the farming area or any reduction in flooding on Phillippi Creek.

Each of the three primary project alternatives could include a diversion of flow from CPS into the water management facilities planned as part of the development of the Palmer Properties. A collection system of tile drains or shallow wells could also be utilized in the vicinity of the reservoir.

Order of magnitude cost estimates for project alternatives A, A-1, B, and B-1 are presented in Table No. 1. Cost estimates are not included for alternatives C, D, and E because the quantity of water to be diverted to reservoirs is not known. Neither has it been determined whether, or to what degree, the hydroperiod should be adjusted to redress environmental problems in the embayment. The diversion schemes utilizing reservoirs have been investigated as part of the Regional Water Supply Program being developed by the SWFWMD--Manasota Basin Board.

Detailed evaluation of the alternatives for controlling flooding within the farming area (not including diversions to CPS) probably could be most expeditiously handled by the SCS since their expertise lies in the area of agricultural water management, and since it would involve the re-evaluation of an existing SCS project.

Further evaluation of alternatives for diverting water to the Braden River Watershed should include assessment of the potential for flooding on the Braden River and its tributaries. Other factors to be included are engineering feasibility, environmental impact and benefit/cost analysis.

Some conceptual project alternatives which could be considered for alleviating the flood hazard at the King's Gate Club Development include:

1. Increasing the discharge capacity of the flood control works on CPS.
2. Construction of a perimeter flood-wall and installation of interior pumps.
3. Construction of upstream diversion facilities to divert flood flows to Fox Creek, Salt Creek, Myakka River or Curry Creek.

However, the King's Gate Club Development, as the name implies, is a private club, and expenditures of public funds to investigate project alternatives and/or to construct facilities to alleviate the flood hazard surrounding a private club would be highly questionable.

The specific questions directed to the consultants were enumerated in the section of this report entitled, Purpose and Scope. The answers provided by the consultants will not be summarized here, but rather pertinent sections of their reports are included in the Appendix of this report.

The Conclusions section of the report by Smally, Wellford & Nalven, Inc., and Russel & Axon, Inc. (Joint Venture Engineers), contains several recommendations which go beyond the questions asked of them. Their discussion reflects upon the many years of experience and the wealth of knowledge which they have accumulated in the watershed area.

Conclusions and Recommendations from the Phase I Study are presented in a later section of this report.



## INTRODUCTION

This investigation is an evaluation of a partially completed Public Law-PL-566 (Watershed Protection and Flood Control Act, 83rd Congress; 68 Stat. 666, as amended), Watershed Work Plan (WWP), for the Sarasota West Coast Watershed Project (SWCWP), in Sarasota and Manatee Counties, Florida (see Figure 1). The WWP was completed in March, 1961. It was prepared by the Sarasota Soil Conservation District, the Sarasota County Board of Commissioners and the Manatee River Soil Conservation District, with assistance by the U.S. Department of Agriculture, Soil Conservation Service (USDA-SCS). However, in 1972, when the project was about 40 percent complete, sponsors of the project halted construction for environmental reasons.

The environmental concerns centered on problems in Dona-Robert's Bays, the saltwater embayment which receives the freshwater runoff from part of the Sarasota West Coast Watershed including CPS and Curry Creek. The environmental concerns included siltation, water quality deterioration, aquatic weed problems and overall environmental degradation. Citizen groups in the area attributed the environmental problems in the embayment to changes resulting from construction on the watershed project.

The Sarasota County Board of Commissioners (the Commissioners) and the Sarasota Soil and Water Conservation District (by letter dated November 27, 1978 from Beverly Clay, Chairman Sarasota County Commission and Henry M. Daniels, Chairman Sarasota Soil and Water Conservation District--SSWCD;

to Derrill McAteer, Chairman, Southwest Florida Water Management District--SWFWMD--the District) formally requested SWFWMD participation in the operation and/or maintenance of the Sarasota West Coast Watershed Project--Cow Pen Slough. As a result of that request, a short-term commitment was made by the District to study the partially completed project to determine what role the District could play in the operation and/or maintenance of the existing project facilities. Subsequent to the completion of the above study, the Manasota Basin Board at its regular meeting on March 14, 1979, decided not to undertake the operation, repair and/or maintenance of the project facilities. The required repairs were extensive, an estimated \$250,000 (in-house memorandum dated February 9, 1979 from W. F. Sietman to B. R. Laseter, SWFWMD).

However, at that March meeting, the Board did approve a long-range study (by letter dated March 27, 1979, from Donald R. Feaster, Executive Director, SWFWMD to Beverly Clay, and Henry M. Daniels) to examine the SWCWP in light of current problems and needs within the watershed. The study was given the title Cow Pen Slough Water Management Investigation (CPSWMI), and is the subject of this report. The Objectives and Scope of Work for the Phase I Study were approved by the Executive Director in May, 1979.

Because the District wanted local agencies and civic groups to become involved with the project and to provide local input, an Advisory Committee was formed to help coordinate the project with local concerns.

Those serving on the Advisory Committee included: Dallas Dort, rancher in the watershed and Chairman of the SSWCD Board; Eugene Engman, Acting Chairman, Dona and Robert's Bays Environmental Society, Inc. (DARBES), and member of the SSWCD Board; Anthony Polizos, District Conservationist, SCS; and Norman Thomas, Director, Sarasota County Environmental Services.

However, in retrospect, a committee of this nature probably should not have been utilized in this phase of the study. This would have avoided the problem of having project alternatives limited by direction of the Advisory Committee.

At about the same time the District began the long-range study to examine the SWCWP, Sarasota County by resolutions of the Commissioners (May 15, 1979) and upon petition of the affected property owners, and by recommendations of the County Engineer, released temporary easements (acquired for construction and maintenance) and spoil easements (acquired for construction) in connection with the Vegetable Area Relief Channel (VARC) which is only partially complete. This channel along with the South Creek Lateral Channel, were major sections of the SWCWP on which construction had not begun or was only partially complete when work on the project was halted. The VARC in conjunction with the completed pumping station was to provide flood relief for the winter vegetable farming area (the muck farming area) of the watershed, a significant part of the original project justification.

The resolutions of the Commissioners specifically state that, "...the VARC project has been abandoned and there is no further public need for

retaining said easements...." However, the same resolutions recommend retaining permanent easements acquired along the project (assume reference is only to the completed portion of the VARC rather than the entire SWCWP) for maintenance of existing drainage and foreseeable needs unless specific circumstances warrant the release.

On May 18, 1979, the Commissioners and the SSWCD (by letter dated May 18, 1979, from Beverly Clay, Chairman, Sarasota County Commission--the Commission--and Dallas Dort, Chairman, SSWCD; to William E. Austin, State Conservationist USDA--SCS) formally advised the SCS that, "the project" --SWCWP-- "should not be completed as planned because of differences among landowners affected by the watershed channel." At the same time they requested a study be initiated by the SCS to correct the failure of Structure No. 3, the most upstream structure of the partially complete SWCWP.

The SCS reply to the request (by letter dated June 11, 1979, from William E. Austin, State Conservationist, USDA--SCS; to Beverly Clay, Chairman, the Commission and Dallas Dort, Chairman, SSWCD) discussed "...repair of Structure No. 3, and closing out the SWCWP." In connection with repair of the structure a meeting and field trip were conducted by SCS on August 14, 1979, with representatives of the SSWCD, and Sarasota County to discuss the types of repairs planned. Subsequent to the meeting and field trip, field surveys were completed, and re-design of the structure is in progress (February, 1980).

The Cow Pen Slough Water Management Investigation (CPSWMI) is to be a multi-phased project. That phase of the overall project which is covered by this report will determine conceptually the most feasible method or methods of amending the present incomplete project (SWCWP-CPS) to encompass the stated current project objectives so that further work can proceed to bring the amended project to a successful completion. However, the approach has changed somewhat with the directions from the Advisory Committee. The Committee saw such strong objection to any possibility of additional runoff entering Dona-Robert's Bays, that clear direction was given (October 1979) that no further consideration be given to any project alternative which would divert water from the muck farming area into Cow Pen Slough (CPS). The major reason for this directive was the feeling that water quality mixing could not be controlled and the result would be further degradation of water quality in DARB.

The Staff (SWFWMD) effort was assisted by two consultant retainer contracts which were issued for specific aspects of the study. The resulting reports have been completed.

## PURPOSE AND SCOPE

The Phase I Study is a preliminary Staff effort (Donald R. Feaster, Manasota Basin Board Meeting Minutes, March 1979). The overall objective of the study is to examine and analyze the SWCWP in light of development, and other changes which have occurred in the watershed since the original project was conceived. All current concerns including municipal water supply sources and environmental impacts will be considered. Water Management related problems in the watershed will be addressed and Management Alternatives evaluated. Determinations will be made regarding whether further construction should be undertaken and/or changes made in the original project. When considering current concerns and management alternatives, the basic design criteria for the original project should be remembered. That is, the original project was not designed to eliminate flooding under design conditions, but to limit the depth and duration of inundation (flooding) to non-damaging levels.

The original SWCWP encompassed over 200 square miles (sqmi) including Catfish, North and South Creeks which lie between Phillippi Creek and CPS, and the small coastal basins which lie south of CPS to the Sarasota/Charlotte County line (see Figure 2). The small coastal streams between Phillippi Creek and Cow Pen Slough were considered in project alternatives to the original project.

The size of the watershed to be included in the Phase I Study was reduced to about 65 sqmi. Major emphasis was to be on that part of the

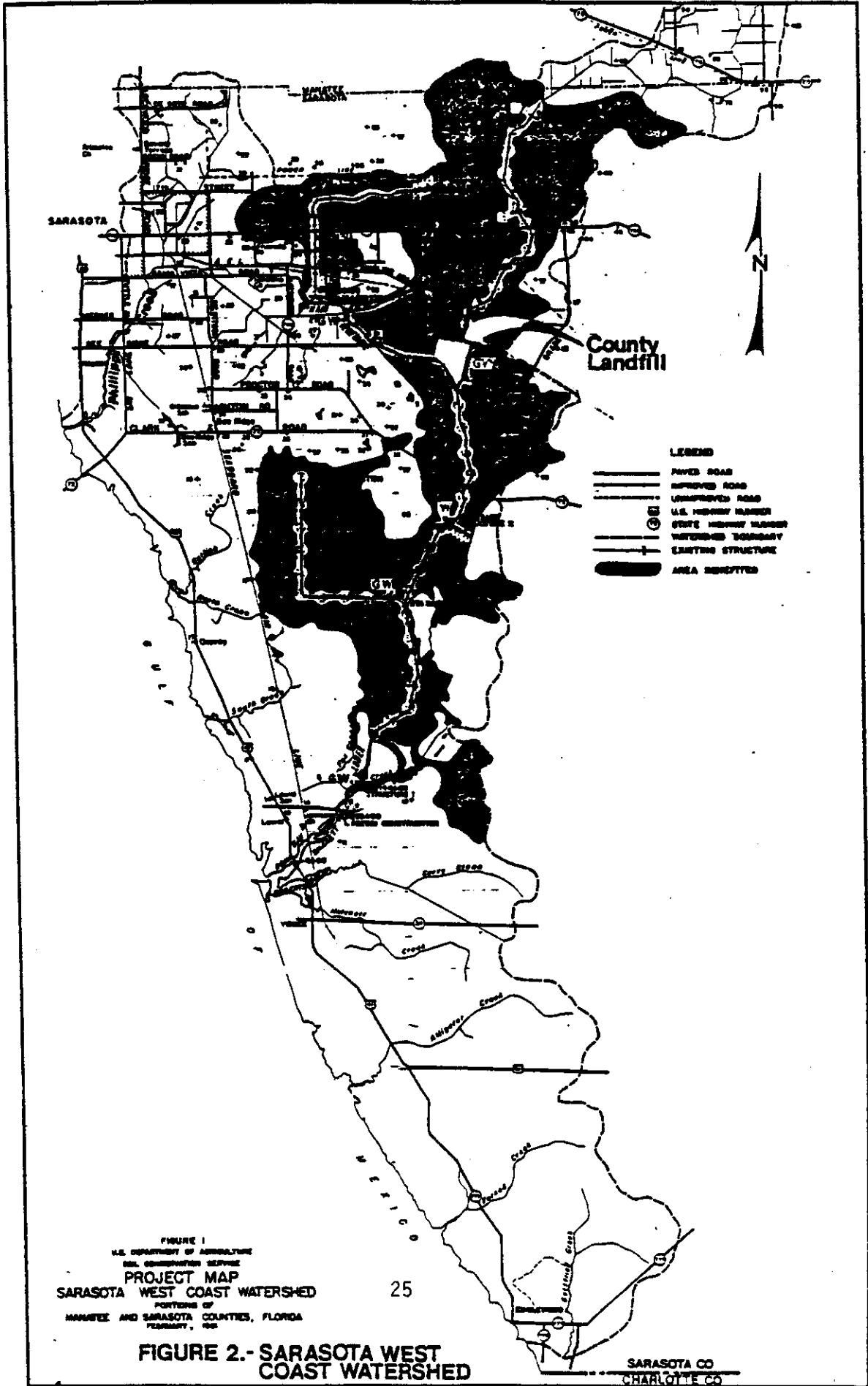


FIGURE 1  
 U.S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE  
**PROJECT MAP**  
**SARASOTA WEST COAST WATERSHED**  
 PORTIONS OF  
 MANATEE AND SARASOTA COUNTIES, FLORIDA  
 FEBRUARY, 1968

**FIGURE 2.- SARASOTA WEST  
 COAST WATERSHED**

SARASOTA CO  
 CHARLOTTE CO

original study area which was to have received benefits from the SWCWP. The study area included the muck farming area, and the pasture areas adjacent to the upper and lower slough.

In the original project, flooding problems on Phillippi Creek were recognized as a separate issue (problem) and were not directly addressed in the evaluation of the SWCWP. This study will also view the problem in that manner. However, the original project when complete would have alleviated some of the flooding on Phillippi Creek by diverting floodwaters via the pumping station and the VARC to CPS.

Following are the specific objectives which were considered as a basis for the Phase I Study.

1. Adjustments of the CPS hydroperiod to reduce detrimental impacts to Dona and Roberts' Bays.
2. Development of the municipal water supply potential of CPS including possible use of Phillippi Creek and Myakka River.
3. Drainage and flood control in CPS Watershed.
4. Flood control in the agriculturally productive muck lands east of Sarasota.
5. Resolution and disposition of the partially completed PL-566, SWCWP.



The two consultant contracts referred to in the Introduction section of this report were issued for technical support on the Phase I Study--with the understanding that answers were to be general in nature because of the very limited budget.

A contract was issued to Joint Venture Engineers to address the following points:

1. How has the flood hydroperiod changed from pre-construction to post-construction of the partially completed works?
2. a) To what extent would flooding be reduced in Phillippi Creek if the existing pumping station were made operational as was planned? Use the storm the project was designed for as a reference.  
b) To significantly reduce flooding in the Phillippi Creek Watershed, what size pumping station would be required?
3. a) Discuss a possible operational plan that could be established with the existing structures (if all three were in working order) to reduce storm inputs to Dona Bay.  
b) Discuss possible additional protection that could be obtained if some optimum number of structures were added to the system (optimum number based on your knowledge of the subject).

A contract was issued to Hydroscience Research Group, Inc., to address the following points:

1. Establish flow duration curves and monthly flow values for each system (CPS, Phillippi Creek, Myakka River).
2. State expected dependable yields if 10 percent, 30 percent, and 50 percent of the flow of each system is diverted.
3. Ascertain existing quality in relation to drinking water standards, and discuss the quality problems of each system. Give some indication of the magnitude of any quality problems and state if the data indicates that a public source could be developed.
4. Discuss the limits of the data which was reviewed for your work.

At the conclusion of the Phase I Study it should be possible to determine the most viable water management alternatives for meeting current needs and problems within the watershed including assessment of the water supply potential.

Phase II of the Study will include general design of the best solutions, and preparation of environmental impact statements. Phase III will include detailed design and construction.

## HISTORY OF THE WATERSHED

The area to be included in the Phase I Study does not include the Phillippi Creek Watershed. However, this watershed should be briefly mentioned since the muck farming area in the vicinity of Fruitville now drains by gravity flow to Phillippi Creek (see Figure 3). Prior to early channelization in the watersheds, the farming area was a part of the CPS Watershed.

The following information was excerpted from a paper entitled, Sarasota Fruitville Drainage District - Phillippi Creek Watershed (author unknown).

... "Water control for drainage purposes, and more recently for water management and conservation purposes, has been practiced in the watershed for many years. The Sarasota-Fruitville Drainage District (SFDD) was organized in 1921 and a plan was formulated to drain the muck area east of Fruitville for farming purposes (see Figure 3). The main channels were completed in 1926 and in the fall of that year farming began. Phillippi Creek originated in a marshy area west of Fruitville and after the drainage system was complete, this marshy area was also farmed.

About 5,000 acres of the CPS Watershed was included in SFDD and was separated from its natural watershed by an earthen dike. Drainage from these 5,000 acres was carried to Phillippi Creek via the Main "A" (Main No. 1) Canal which was cut through a natural topographic ridge (Tatum Ridge) dividing the Phillippi Creek and CPS Watersheds.

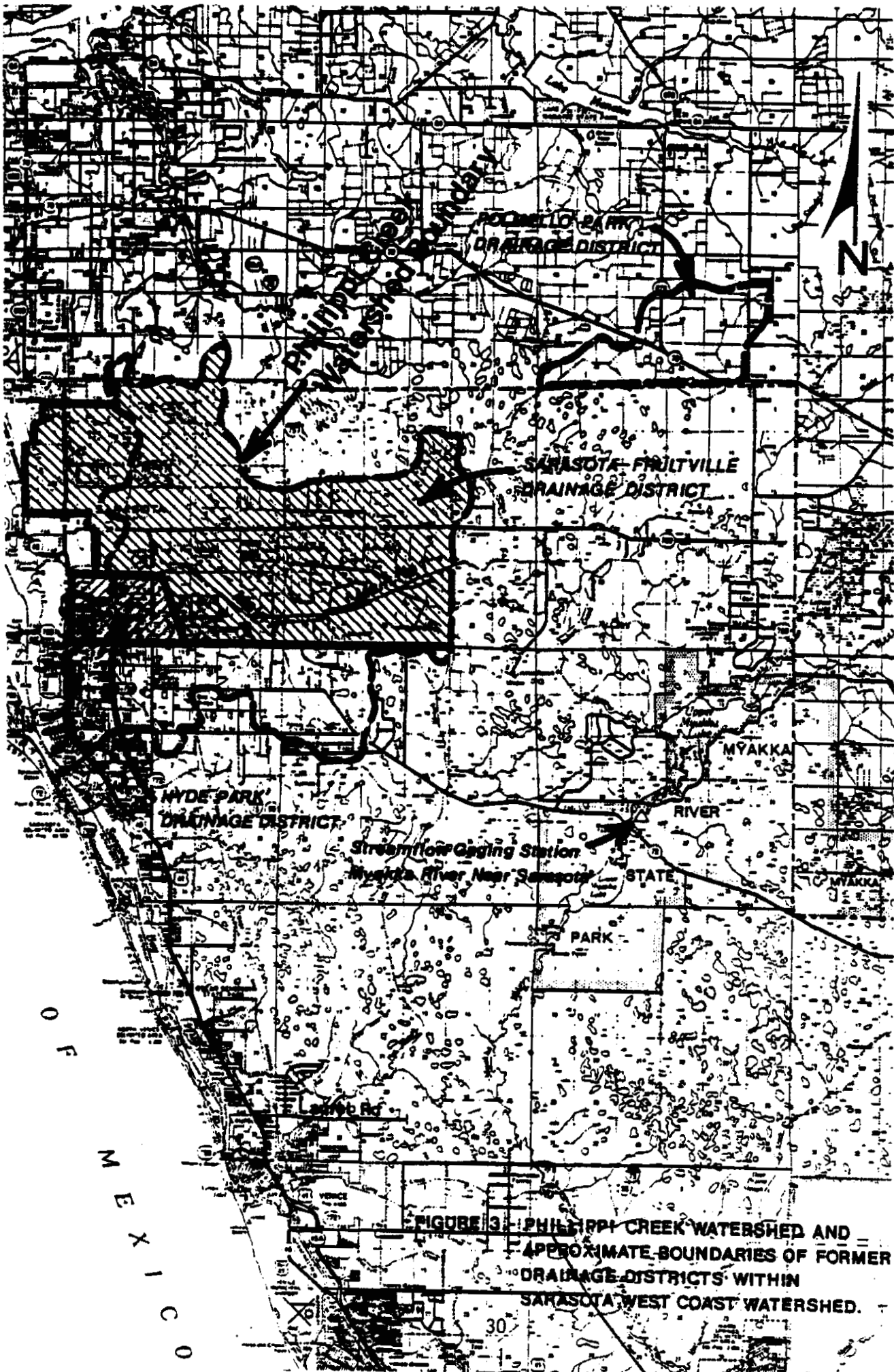


FIGURE 3. PHILIPPI CREEK WATERSHED AND APPROXIMATE BOUNDARIES OF FORMER DRAINAGE DISTRICTS WITHIN SARASOTA WEST COAST WATERSHED.

In the late thirties, farmers in the muck area organized a water holding company, built water conservation structures, and established water retention areas along Richardson Road. This was the first move in the direction of water conservation. The farmers began to recognize the necessity of having water holding capability as well as having the capability for drainage and flood control.

The original cost of the drainage system which was covered by bonds was approximately one million dollars and the SFDD spent about one million dollars in maintenance over the years until Sarasota County took it over in 1961.

Flooding in the Phillippi Creek Watershed in 1957 and continuing almost annually through 1962 caused several million dollars damage to crops and floodwater damage to homes. Subsequent to the 1958 flooding, the SCS accelerated planning on the SWCWP. The farming interests realized that urbanization in the watershed had so increased runoff rates that the SFDD outlets for carrying floodwater from the farming areas were no longer adequate.

The sponsors of the SWCWP (the Commission, and the SSWCD) approved a plan to take the agriculture part of the floodwater from the 5,000 acres originally a part of the CPS watershed, out of the area via a pumping station to CPS.

During flood times this plan would re-connect the farming area to its natural watershed--CPS. The plan would have the dual benefit of reducing the flood hazard in the farming area as well as in the residential areas along lower Phillippi Creek.

At about the same time that the SFDD was established, the Hyde Park Drainage District (HPDD) was established in the central Phillippi Creek area to provide drainage for newly established citrus groves (see Figure 3). In recent years this area has been absorbed by urbanization."...

Ranches in the Manatee County part of the watershed have a well developed drainage system which sometimes contributes to downstream flooding. This area was also part of a former drainage district, the Pomello Park Drainage District (PPDD). It generally included that part of the CPS Watershed in Manatee County. The PPDD still is in existence. Meetings are held as required by law and taxes are collected to repay the original bonding indebtedness (personal communication from Clarence Harrison, Chairman, PPDD).

The first contract awarded under the WWP for the SWCWP was for two miles of channel and one water control structure. It was completed in May, 1964. The second contract was for 11.2 miles (mi) of channel and two water control structures, and was completed in 1966. The last contract awarded before construction on the project was halted, was for the pumping station which was completed in December, 1972. As was stated

earlier, the pumping station is not operational because the VARC was never completed. The original construction cost for the completed work was \$1,093,000. The estimated replacement cost as of January, 1979, was \$3,027,500. Annual maintenance costs for the completed work is estimated at \$36,000 (much of the above information was excerpted from a memorandum report entitled, SWCWP-CPS, Background and Short Range Program, by W. F. Sietman, SWFWMD, dated March 21, 1979).

The estimated costs for completing the work to connect the pumping station to the main channel, as well as carrying out the planned work in the muck farming area, as of April, 1980 was \$2,125,000.

## STATUS OF THE ORIGINAL PROJECT

The objectives of the SWCWP were to provide flood protection for the farming area and improved pasture and range lands along the slough, to provide adequate outlets for carrying floodwater from the slough, and for water conservation during dry seasons of the year. The farming area was to be provided protection from the one-in-ten year storm and the pasture areas were to be protected from the one-in-five year storm. The design provides for adequate removal of floodwater so that depth and duration of inundation of crops and pasture grasses is limited to non-damaging levels. With the structural works of the project functioning as planned, there still will be periods of time during design conditions when crops and pastures will be inundated.

Discharge at the pumping station during design flood conditions would have been 735 cubic feet per second (cfs). Although this amount of water would have been diverted from the Phillippi Creek Watershed to CPS, it only would have relieved rather than prevented flooding in the farming area. As was mentioned in the History of the Watershed section of this report, this diversion would have provided some flood protection benefits along lower Phillippi Creek; however, since the pumping station is not operational, neither the farming area nor Phillippi Creek is receiving any benefit from the completed works of the SWCWP.

On CPS downstream of the junction with the completed section of the VARC, the actual level of flood protection exceeds design. Because the



pumping station is not operational, the channel below this junction will not be required to carry flow diverted from the Phillippi Creek Watershed. Therefore, the total discharge capacity of the channel can be utilized to carry floodwaters from the CPS Watershed.

Some modifications were made to the SWCWP after the WWP was completed. All of the modifications were on those sections of the project which were never completed. Structure No. 8, on Lateral No. 52 was moved downstream to Richardson Road and all channel work on Lateral No. 52 upstream of Richardson Road was deleted. Also, Structures Nos. 4 and 5 on the main channel and all channel work on the main channel upstream of Structure No. 3 was deleted.

Structure No. 3 has not been operational since 1967 when it was bypassed by a washout through an old stream channel. The SCS is redesigning the structure, and some type of control facility for the old channel where the washout occurred.

Structures Nos. 1 and 2 are operational but are in a bad state of disrepair. Over the years listed deficiencies on annual inspection reports have not been corrected, and maintenance work has been sadly lacking. Although the pumping station has been completed, it is not operational. It too is in a bad state of disrepair; the pump engines have not been operated for several years (excerpted from in-house memorandum dated March 21, 1979 from W. F. Sietman, to B. R. Laseter, SWFWMD).

In April, 1977, the Sponsors of the SWCWP requested that a supplement to the WWP be developed, approved locally and implemented to bring the long dormant project to a conclusion (letter dated April 6, 1977 from William A. Muirhead, Chairman, the Commission, and B. T. Longino, Chairman, SSWCD to William E. Austin, State Conservationist, SCS). As was stated in the letter, the request had the endorsement of the Dona and Robert's Bays Environmental Society (DARBES).

As a result of the letter a project up-date meeting was held with representatives of the local governments, the District, and local citizen groups with the following objectives in mind: (1) Re-acquaint sponsors and interested agencies and citizen groups with the project, (2) Determine interests of agencies and groups in the project, (3) Determine short term goals needed in the project, and (4) Determine long term goals for successful completion of the project.

It was determined that the SCS was prepared to re-evaluate the project but that prior man-power commitments would prevent full scale re-evaluation taking place for 8-12 months. During the interim period the sponsors were encouraged to develop input from other groups and agencies so that priorities were set when re-evaluation was ready to begin.

The representative of the DARBES, and a representative of another citizens group re-affirmed the need for their representation on any project advisory group. The DARBES representative also expressed concern about the repair and management of the partially completed project.

The short term goals established at the meeting were: (1) Performance of the required maintenance, and (2) Clarification of the operation and maintenance of the partially completed project.

The long term goal established was: The sponsors would lead an advisory group that would set priorities for the re-study by SCS (above information excerpted from a memorandum report on the up-date meeting; by the SCS Office, Sarasota; June 1977).

During the ensuing seventeen month period, from the project up-date meeting which was held in June, 1977, until November, 1978, little progress was made through the advisory group because the various agencies and groups could not agree on priorities. Consequently, the SCS re-evaluation of the project was never begun. Then, as was mentioned in the Introduction section of this report, on November 27, 1978, the District received a request from the sponsors to, "investigate what role the District could play in the operation and/or maintenance of the SWCWP(CPS)." Prior to the letter of request, discussions were held between the sponsors and Donald R. Feaster, the Executive Director of the District, and B. T. Longino, Chairman Ex-Officio of the Manasota Basin Board, regarding possible District participation in SWCWP(CPS).

With the execution of Operation and Maintenance Agreements with the SCS, the Board of County Commissioners, Sarasota County, and the Sarasota County Water Conservation District (both one and the same body) accepted

responsibility for the operation and maintenance of the works of improvement of the partially completed project, "simultaneously with acceptance of the works of improvement from the contractor." As was mentioned in the History of the Watershed section of this report, the first contract was completed in May 1964 and the last contract was completed in December 1972. The Operation and Maintenance Agreements were entered into on June 28, 1963, May 12, 1965 and July 17, 1969.

The agreements require at least annual inspections of the completed works, by the SCS and the Commission, and performance by Sarasota County of maintenance needs as indicated by the inspections. Records are to be maintained of all maintenance performed. Also set forth in the agreements is a plan of operation for the control gates in Structures Nos. 1, 2, and 3.

Over the years, Sarasota County has not performed the maintenance required by the agreements with SCS, with the exception of aquatic weeds. There is no indication of any money budgeted for the required maintenance of the completed works, and the little maintenance performed was done on a haphazard basis when resources could be spared from other assigned work. Now there is an accumulation of maintenance that could total a quarter of a million dollars (excerpted from in-house memorandum dated February 9, 1979 from W. F. Sietman to B. R. Laseter, SWFWMD).

The statement ..."the project should be brought to a conclusion"... in a letter dated April 6, 1977 from William A. Muirhead, Chairman, the Commission and B. T. Longino, Chairman, SSWCD, to William E. Austin, State Conservationist, SCS; and the statement "...closing out the SWCWP..." in a letter dated June 11, 1979, from William E. Austin, to Beverly Clay, Chairman, the Commission, and Dallas Dort, Chairman, SSWCD refer to completing the project as necessary, and in the best interests of the citizens of the County. It appears that with the completion of repairs to Structure No. 3, the SWCWP will be "...closed out...."

## RE-EVALUATION OF THE ORIGINAL PROJECT

A summary of the scope of the Phase I Study is included in the following re-statement of a part of the Introduction section of this report. This phase of the overall project intends to determine conceptually the most feasible method or methods of amending the present SWCWP to encompass the stated project objectives so further work can proceed to bring the amended project to a successful conclusion. The report is preliminary in nature and is an overview of the partially completed project. A conceptualization of project alternatives is to be the product of this phase of the study.

At the present time the SCS cannot carry out a re-evaluation of the original project unless a list of project alternatives which address environmental and water management problems in the watershed can be agreed upon by the various agencies and groups having interest in the project. As was discussed in the Status of the Original Project section of this report, an advisory group led by the sponsors of the project labored for over a year (1977-78) with the various agencies and groups but were unable to agree on priorities for an SCS re-evaluation.

The biggest area of contention centers around the potential environmental problems in the embayment, which are blamed in part on SWCWP; also, the benefit/cost ratio appears to be less than sufficient to justify continuation of the project (personal communications from the SCS).

It is generally agreed that any project alternatives must have a positive affect upon the embayment regardless of the effect the completed project works have had on the embayment. The Phase I Study includes determining what impacts have occurred to the bays as a result of the stream modifications in the slough. However, a constraint of the study was that no new data were to be collected regarding any aspect of the study, environmental or otherwise.

It has been suggested that a means of adjusting the CPS hydroperiod to lessen freshwater runoff to the embayment and thereby to lessen adverse impact would be to reflood some of the channelized areas. The design for the SWCWP incorporates this feature by leaving gaps in the spoil banks to utilize the flooding of these areas. As was pointed out earlier, during design conditions there would still be flooding of pasture areas, and of the farming area even if it had been connected with CPS. The WWP indicates that there will still be some flooding in the area during the mean annual flood (MAF), which has an average recurrence interval of once every 2.33 years. The following excerpt from one of the Consultant's reports addresses this point.

..."In order to reduce stormwater impacts on Dona Bay, far more storage than the channel affords would be needed. Such storage might be provided by allowing temporary flooding of low-lying adjacent lands. The original project plan called for "no spoil" openings in the dikes for this purpose, based on the principle that agricultural lands usually can stand submergence for short periods.

It is our understanding that the system has not been operating in this manner."...

(Technical Support/Cow Pen Slough Water Management Project, by Smally, Wellford and Nalven, Inc. and Russel and Axin, Inc., October, 1979).

Water supply is an area wide problem, not just a watershed problem. Since too much freshwater runoff into the embayment has been suggested as a problem, storing runoff in the watershed and/or injecting it into aquifers for future use for water supply would be a solution to this problem.

There are several large tracts of land within the watersheds of CPS and the Myakka River which hold good possibilities as water storage areas. All of these are discussed later in the report but the "Wright Estate" tract which is sometimes called the "Hawkins Tract" will be briefly mentioned here (see Figure 4). It is rather strategically located in central Sarasota County just west of the Myakka River and contains a significant part of the CPS Watershed. This tract has a uniqueness related to CPS and the Myakka River in that the Myakka River is its eastern boundary, and CPS including the old channel of the slough as well as the channelized slough flow through the western part of the tract. The property could be invaluable to the County for water storage purposes (much of the above information was excerpted from an inter-office memorandum entitled, Hawkins Tract Up-date, from Jeffrey L. Lincer, Ph.D., Environmental Specialist Sarasota County to Ed Maroney, County Administrator Sarasota County, dated June 2, 1978).



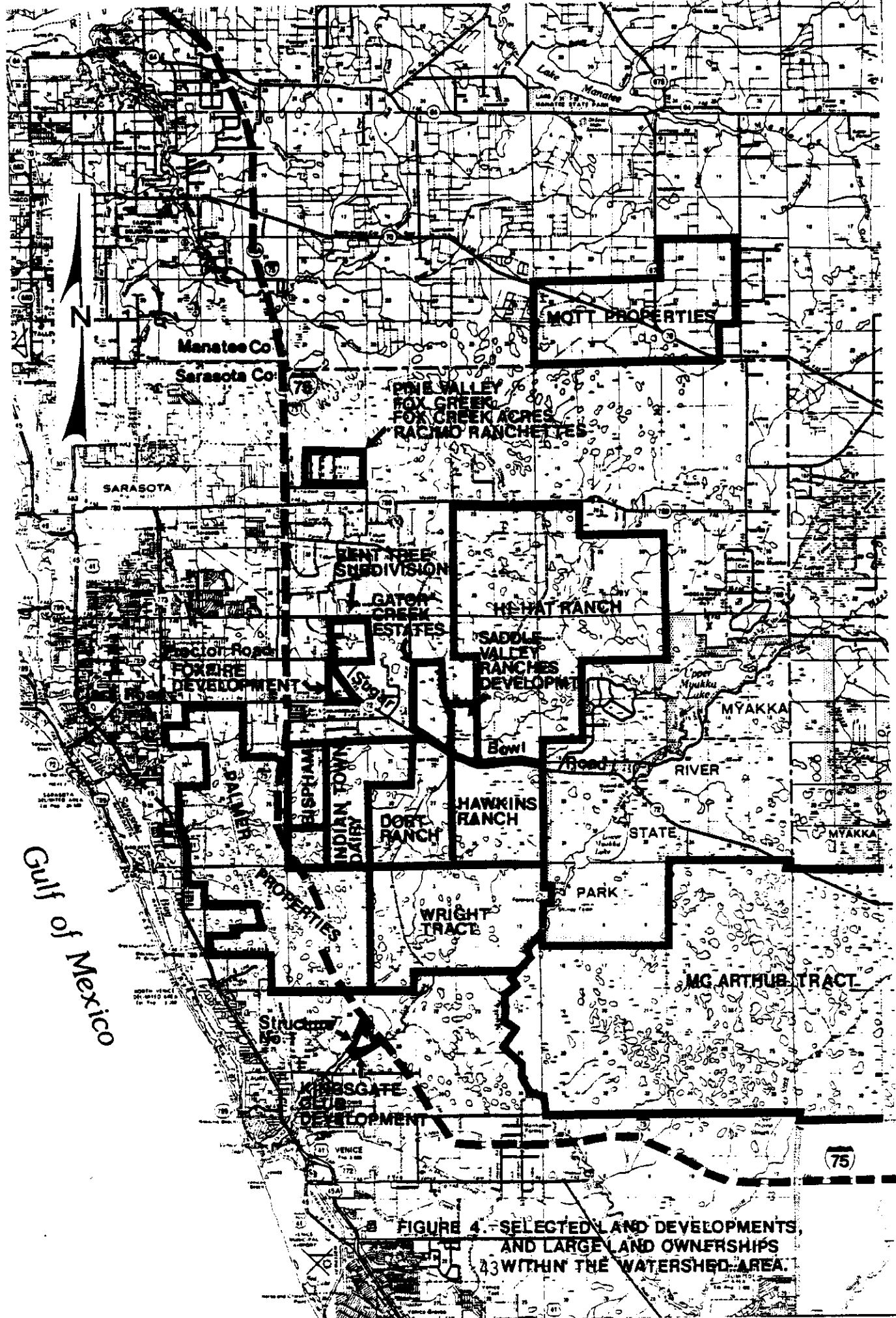


FIGURE 4. SELECTED LAND DEVELOPMENTS, AND LARGE LAND OWNERSHIPS WITHIN THE WATERSHED AREA.

The clear direction from the Advisory Committee to not give further consideration to any project alternative which would direct water from the farming area into CPS (see Introduction section of this report), meant that a project alternative that did not incorporate either the Phillippi Creek Watershed or the CPS Watershed had to be developed to address the project objective of alleviating flooding in the farming area. This is discussed in detail in the section of this report entitled, Project Alternatives.

Drainage and flood control in the watershed can be accomplished through prudent application of County Subdivision and Development Regulations, and the preparation of studies such as, Cow Pen Slough Flood Plain Study, Gator Creek Estates, by Smally, Wellford and Naiven, July 12, 1974, which was done to establish minimum safe building elevations for Gator Creek Estates, a 5-acre tract subdivision within the CPS Watershed. However, the potential flood hazard surrounding another development in the watershed, King's Gate Club, illustrates how County regulations can be circumvented. The flood hazard of the King's Gate Club development is discussed in detail in the Appendix of this report.

Operation schedules for the structures (SWCWP) were set to conserve water during dry periods as indicated by the following excerpt from the Operation and Maintenance Agreements between SCS and the County dated June 28, 1963 and May 12, 1965.

..."The Sarasota County Water Conservation District (SCWCD) and the Commissioners will cause the water control gates in Structures Nos. 1, 2 and 3 to be operated in such a manner as to obtain maximum outflow up to design discharge capacity during storms and normal rainy season, acts of God excepted. At all other times of the year the spillways will be operated to provide maximum water control and storage."...

However, the County has not followed this operation schedule, and the landowner at Structure No. 2 is permitted to operate that structure.

Since about mid-1978, the County's operation plan for the structures has been to open the gates incrementally during the rainy season from a minimum of two inches to a maximum of eight inches as water begins to build-up behind the structures. Normally the gates are not open more than eight inches unless experiencing abnormal rainfall or weather reports indicate a major storm is likely to move into the area (inter-office memorandum dated July 18, 1978 from Jeffrey L. Lincer, Ph.D., Environmental Specialist to Norm Thomas, Director, Environmental Services, Sarasota County). The operation plan is also followed by the landowner who operates Structure No. 2. This plan has the potential for requiring the release of large amounts of water at a rapid rate during times of heavy runoff.

Working with the Advisory Committee which was formed to help coordinate the Phase I Study with local concerns, points out the strong opposition to further work on the SWCWP. The strong, continuing opposition is an indication of the problem the earlier Advisory Group (see Status of the Original Project section of this report) was faced with, and could not overcome. There also is the problem of differences among landowners affected by the project as indicated by the following excerpt.

..."We have come to agreement that the project should not be completed as planned because of differences among landowners affected by the watershed channels."...

(from letter dated May 18, 1979 from Beverly Clay, Chairman, the Commission and Dallas Dort, Chairman, SSWCD; to William E. Austin, State Conservationist USDA-SCS).

## CHANGES AND CURRENT NEEDS IN THE WATERSHED

The CPS Watershed remains basically agricultural in nature; however, urbanization is beginning to have a significant impact in some areas. From Structure No. 1 north to Clark Road (S.R. 72), and from north of the VARC to the headwaters of the slough in Manatee County, the watershed remains almost totally agricultural.

On the west side of the slough, just north of S.R. 72, is the Gator Creek Estates Development which has the potential for expanding northward to near the VARC (see Figure 4). One of the property owners in this development has pulled down the westerly spoil bank of the slough and is using the area as a landing strip. Other property owners have used the spoil material to elevate the building pads for their homes. Across the slough from Gator Creek Estates is the Saddle Valley Ranches Development. Both of these developments are located in an Open Use Estate (OUE-1) Zoning Districts which allow for a maximum residential density of one dwelling unit per five acres. The following excerpt from the Zoning Ordinance of Sarasota County describes the intended use of OUE-1 Districts. It is intended by the use of these districts to retain, insofar as desirable and practicable, the open character of the land; to that end, permitted and permissible uses are basically limited to conservation, agriculture, very low density residential development, recreation, and with certain limitations, other uses not contrary to the character of these districts. It is intended and anticipated that

certain portions, but only portions, of these districts may eventually be required for more intense uses. It is the intention of these zoning regulations that such lands not be rezoned to more intensive use without a clear showing or proved need in the public interest and a clear showing of conformity with the Comprehensive Plan of Sarasota County (Zoning Ordinance, Sarasota County, Florida; adopted by the Commissioners, October 7, 1975).

Just across the drainage divide between the CPS and Phillippi Creek watersheds, on the south side of S. R. 72, is the Bent Tree Subdivision which has encroached upon the easements for the incomplete section of the VARC (see Figure 4). However, it was these easements which were released by the County in May, 1979 (see the Introduction section of this report).

The former water retention areas along Richardson Road, north (upstream) of the farming area have been impacted by urbanization. Developments such as Pine Valley, Fox Creek, Fox Creek Acres and Racimo Ranchettes now occupy areas that formerly retained runoff from the upper watershed; thereby, providing some degree of flood protection for the farming area (see Figure 4).

The Foxfire Development has impacted the area between Clark Road and Proctor Road (Sugar Bowl Road); an area which at one time was evaluated as part of a pumped impoundment system to provide flood control in the

Phillippi Creek Watershed (Engineering Feasibility and Costs of a Pumped Impoundment System for the Phillippi Creek Basin--Smally, Wellford and Naiven, Consulting Engineers; June 1966).

Interstate 75 will impact the two watersheds; however, it will have the greatest impact on the Phillippi Creek Watershed because there are no interchanges on I-75, within the CPS watershed, south of Clark Road. Therefore, it will be difficult for development to access the area of the CPS Watershed south of Clark Road. The Clark Road interchange is located about one-half mile west of the drainage divide between the two watersheds.

The majority of the agricultural land in the CPS Watershed is in large ownerships such as Bispham and Sons Dairy, the Dort Ranch, High Hat Ranch, Indiantown Dairy, Mott Properties, the Hawkins Ranch, the Palmer Ranch and the Wright Tract (see Figure 4). Palmer Ranch is in the planning stage of residential development, and preliminary discussions have been held with the County. The Wright Tract was referred to in the Re-Evaluation of the Original Project section of this report, and if it is not utilized for water storage it may soon be on the market for development purposes.

Much of the agricultural land is potential development property even though it contains significant naturally wet areas. The County's Zoning Regulations have placed the majority of these agricultural lands in Open

Use Districts including Open Use, Estate (OUE-1,2); Open Use, Rural (OUR); Open Use, Agricultural (OUA); and Open Use, Conservation (OUC). The maximum gross residential density of permitted principal structures in these districts is one single family dwelling unit per 5 acres in OUE-1 Districts, one single family dwelling unit per 2 acres in OUE-2 Districts, one single family dwelling unit per 10 acres in OUR Districts, one single family dwelling unit per 160 acres in OUA Districts, and one single family dwelling unit per 25 acres in OUC Districts. OUC Districts are intended to preserve and protect open spaces, park lands, wilderness areas, marsh lands, wetlands and water recharge areas. OUA and OUR Districts are intended to discourage non-agriculturally oriented residential development, and to prohibit all commercial and industrial development except for certain activities clearly appropriate and accessory to food and fiber production, and certain recreational activities not inappropriate to the districts. In OUE Districts, permitted and permissible uses are basically limited to conservation, agriculture, and very low density residential development. The OUE Districts are intended to be a combination of residential and agricultural activity. By utilization of low residential densities in the Open Use Districts, development plans can be structured to preserve and protect the area's inter-related land and water resources. Residential development of the agricultural areas which received benefits from the SWCWP can expect one-in-ten year, or one-in-five year storm protection provided that the capacity of the slough is not overtaxed.



Works of improvement already installed provide adequate drainage for the farming area and pasture areas; much of the drainage is a result of the Sarasota Fruitville Drainage District, but there also have been improvements by individual ranchers. However, flooding still is a problem in the muck farming area.

The farming area is being impacted by urbanization. Interstate 75 which is adjacent to the farming area on the west, and the interchanges at Bee Ridge Road, generally the southern boundary of the area and at S.R. 780, the northern boundary of the area, probably will accelerate the urbanization.

As a result of the urbanization, agricultural land use in the farming area is being phased out, and there is some question as to how much longer the muckland will be farmed. Agriculture interests believe that the muckland can be productively farmed for another 5-10 years. Urbanization already has caused more severe flooding problems. Farmers are having water problems from 3 ins (inches) of rainfall; whereas, in past years it took 6 ins of rainfall to cause flooding. The question of providing flood control for this area really becomes a question of economics. If the farming area is only to be productive for another 5-10 years, is it economically sound to expend money to provide flood control? The farmers believe that it is.

Of the approximately 1,800 acres of muckland being farmed when the WWP was prepared, only about 900 acres are now being farmed. However, an

additional 500 acres of the original 1,800 acres are now in citrus groves. The groves are protected from flooding by dikes and pumps which together form an effective water management system. Farming interests believe that part of the project which was designed to provide relief for the farming area should be completed. Economically speaking, the farming area, although decreased in size in recent years, probably is just as valuable today as it was at the time of the SWCWP because of the inflated dollar value of the crops produced. However, if farming of the muckland is being phased-out, agriculture interests say that agriculture forage production, dairying, and beef production throughout the balance of the watershed probably is not significant enough for SWCWP continuance.

It has been suggested that if farming of the muckland is phased-out, the area could be utilized for water retention purposes to assist in controlling flooding on Phillippi Creek. However, urbanization brings increased land values and if farming is phased-out, the land probably will be too valuable to use for water retention areas. Notwithstanding the value of the mucklands, the best use probably is for agricultural purposes. Development of the land probably should not be permitted because of the flood hazard, and because of its natural water retention capabilities.

Some ranchers in the watershed could benefit from additional project work while others have adequate drainage. A common problem seems to be that of inadequate water storage (water conservation) for agriculture

water supply during dry seasons of the year. A dairy operation in the South Creek Lateral area of the watershed still has some problems with pasture inundation. But, as was pointed out earlier in the report, limited pasture inundation is a feature of the original project design.

Agricultural interests in the watershed report that the construction of I-75 has not made flooding problems worse. Interstate 75 generally traverses the watershed in the area of the South Creek Lateral. The drainage problems in this area, as explained by the landowners, seem to be related to the natural topography. There are adequate openings through I-75, but west of the interstate where the water must find its way through a series of ponds to South Creek, drainage becomes sluggish.

There is a difference of opinion among landowners whether the South Creek Lateral still is needed. Some say yes, definitely; while others say ranchers can get the excess water to the slough without it. The SCS has assisted with some drainage work in the area, such as a common ditch along the east sections of the Indiantown Dairy property where it adjoins the Dort Ranch.

Approximately one-half of the area which would have benefited from the South Creek Lateral is now part of the Palmer Ranch, and as was previously mentioned in this section of the report is being planned for residential development. The other large ownerships in this part of the watershed are Bispham and Sons Dairy, the Dort Ranch and Indiantown Dairy.

There are no agricultural related problems in the Manatee County part of the watershed that need addressing by revisions to the original project (personal communications from Clarence Harrison, Chairman PPDD, and I. H. Stewart, District Conservationist, SCS, Manatee River SWCD).

In some developments such as Gator Creek Estates and King's Gate Club the spoil banks have been pulled-down to utilize as fill for the developments. This was addressed by the SCS in a letter dated June 11, 1979 from William E. Austin, State Conservationist, USDA-SCS; to Beverly Clay, Chairman, the Commission, and Dallas Dort, Chairman, SSWCD. The SCS does not have a great deal of concern over the matter providing that a minimum depth of two feet of spoil remains above the natural ground line, that the remaining spoil area is reshaped to drain away from the channel, and that a small collector swale is constructed where the spoil material meets natural ground and is graded to drain into an existing drop-pipe along the channel.

As was mentioned in the Purpose and Scope section of this report, the flooding problems on Phillippi Creek were recognized as a separate problem and not directly addressed in the original project, and this study will also view the problem in that manner. However, the matter will be briefly discussed here to bring its status up to date. No work has been done to relieve flooding problems along Phillippi Creek but new construction is being elevated. Smally, Wellford and Naiven, Inc., have prepared several reports for Sarasota County on the Phillippi Creek Watershed. One of the aims of these reports was to establish safe building elevations.

In their report for the District on this study (Technical Support/Cow Pen Slough Water Management Project, Cow Pen Slough and Phillippi Creek Basins by Smally, Wellford and Nalven, Inc., and Russell and Axon, Inc., October 1979) it is pointed out that to alleviate the flooding threat on Phillippi Creek would require a reduction of 5,000 cfs; or a pumping station seven times the size of the pumping station designed in the original project. If such a large size pumping station were feasible it would serve only to transfer the flooding problem from one basin to another; and, the additional runoff diverted to CPS would substantially increase the flood hazard surrounding the King's Gate Club Development. The flood hazard of this development is discussed briefly in the following paragraphs and in detail in the Appendix of this report.

The Phase I Study revealed one obvious residential flooding problem in the CPS Watershed; and although it is only a potential problem, it appears to be potentially severe. This is the potential flood hazard surrounding the King's Gate Club Development which was approved by the County in March, 1978, and the King's Gate Travel Trailer Condominium, for which rezoning was approved by the County in July, 1971. It can be discussed only as a potential flooding problem because; even though, what could be potentially severe flooding appears to be imminent, when this report was prepared it had not occurred. However, the flooding potential was somewhat emphasized during September-October, 1979, when during less than MAF conditions in the watershed, the slough reached near overflowing conditions in the vicinity of Structure No. 1.

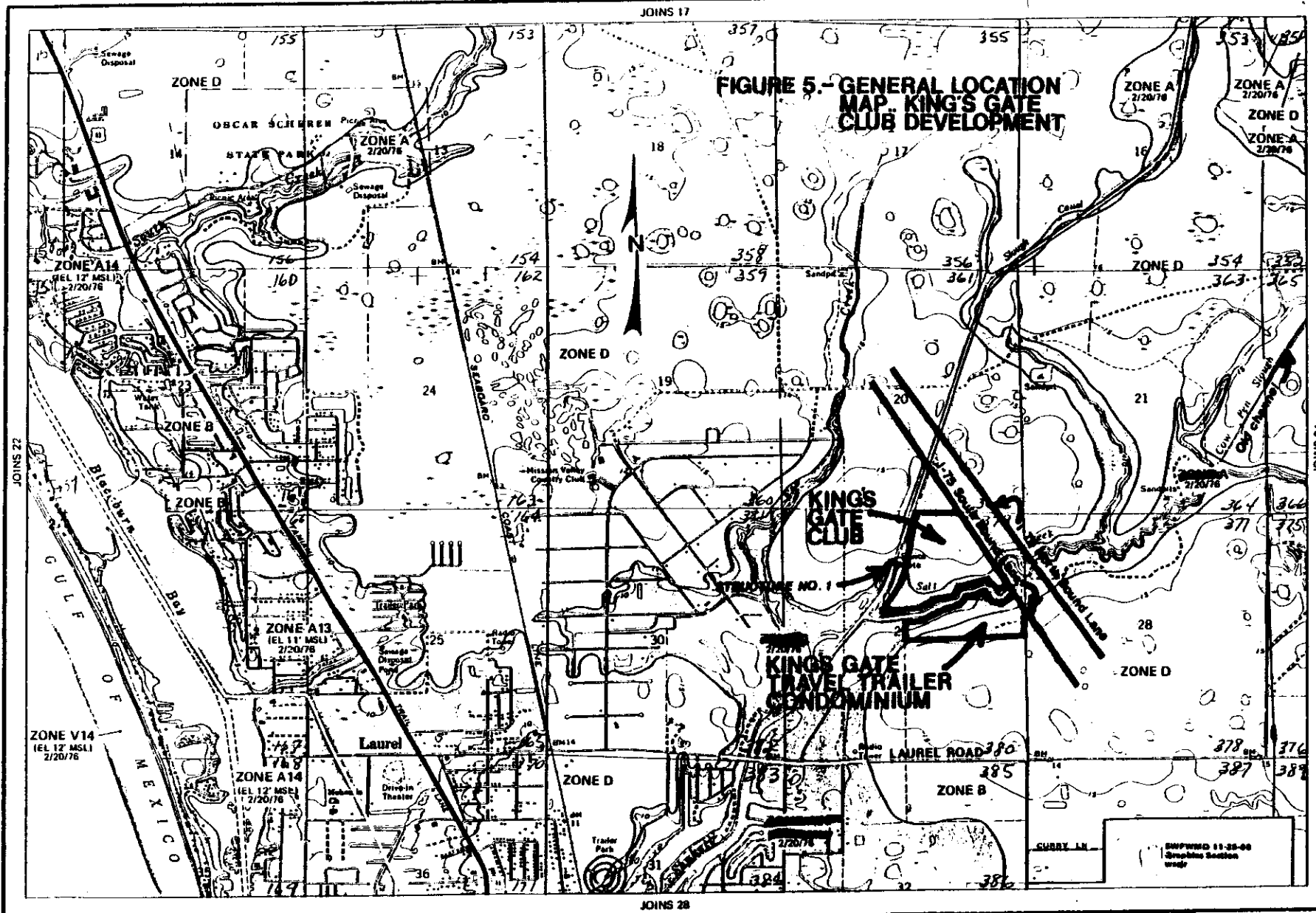
The King's Gate Club Development is located near the southern end of the SWCWP, on the east bank of CPS at Structure No. 1 (see Figures 5 and 6). This location is just downstream of the I-75 crossings of CPS and the old channel of the slough, which is named Salt Creek on the U. S. Geological Survey (USGS) Topographic Map-Laurel Quadrangle. To the immediate south of this development, across Salt Creek, is the development, King's Gate Travel Trailer Condominium.

Department of Housing and Urban Development, Flood Hazard Boundary and Flood Insurance Rate Maps, H and I-23 indicate that part of both developments lie within a flood hazard area (see Figure 6).

Of the two developments, the travel trailer development appears to be more critically located with respect to flood hazard. It is situated at a somewhat lower elevation than the club development; however, the topographic map does not clearly bear this out.

The two developments appear to have about equal flood hazard except that with adequate flood warning the dwelling units in the travel trailer development probably could be moved to a safe area. The club development is a double-wide, mobile home community in which the dwelling units are permanently affixed to building sites.

Although the flood hazard surrounding the two developments does not seem severe when one reviews the Flood Hazard Boundary Maps; when one reviews the SCS design for the SWCWP, the Department of Transportation (DOT)



**FIGURE 5.-GENERAL LOCATION MAP, KING'S GATE CLUB DEVELOPMENT**

57

JOINS 17

JOINS 28

JOINS 24

4000 FEET  
2000  
0  
APPROXIMATE SCALE

REVISED DATE  
FEBRUARY 20, 1976

FLOOD HAZARD BOUNDARY MAP H - 23  
FLOOD INSURANCE RATE MAP I - 23

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

**SARASOTA COUNTY, FL**  
(UNINCORPORATED AREAS)

H&I-23

ENPWD 11-25-66  
Graphic Section  
used

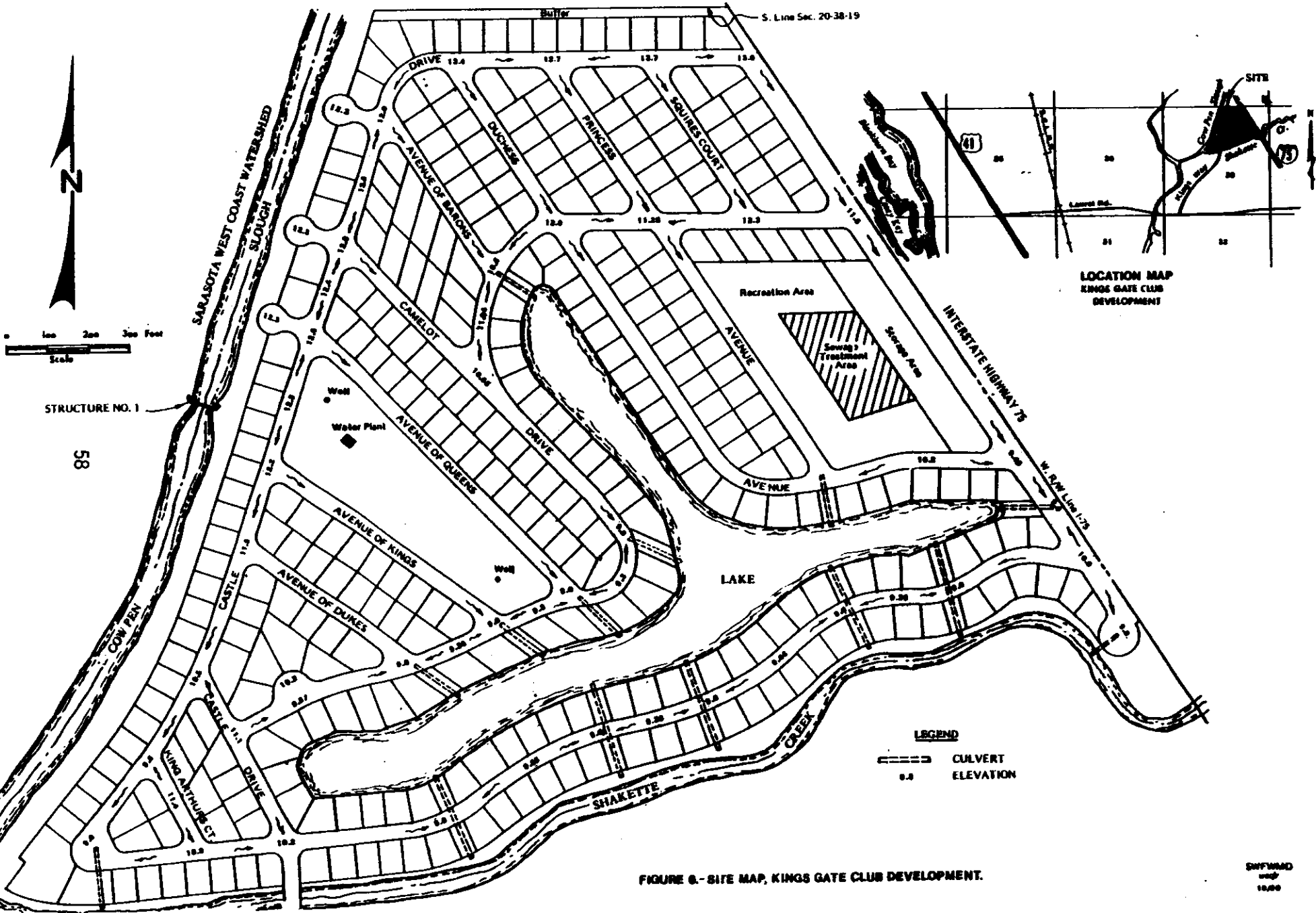


FIGURE 8.- SITE MAP, KINGS GATE CLUB DEVELOPMENT.

ENVIRO  
 1000

LOCATION MAP  
 KINGS GATE CLUB  
 DEVELOPMENT





design for the I-75 crossings of CPS, Salt Creek and Fox Creek just upstream of the developments; and the design for the King's Gate Club Development, the severity of the flood hazard surrounding both developments becomes readily apparent. The specifics of the flood hazard surrounding the travel trailer development were not reviewed; therefore, the flood hazard of that development will not be discussed in detail. However, by virtue of its location with respect to the club development, conclusions drawn regarding the flood hazard of the club development are similarly applicable to the travel trailer development.

Project alternatives and recommendations addressing the potential flooding problem of this development are discussed in the Project Alternatives to Meet the Objectives, and Recommendations sections of this report.

The County is confident that drainage and flood control in the CPS Watershed can continue to be accomplished through application of the Subdivision and Development Regulations. But, as was pointed out in the section of this report entitled Re-evaluation of the Original Project, the King's Gate Club Development is an example of an instance where these regulations were circumvented.

Although the County does not have minimum building elevations in inland areas which may be subject to flooding, the previously mentioned studies for Gator Creek Estates and for the Phillippi Creek Watershed had as one

of the purposes to establish safe building elevations. The subject of minimum building elevations is covered in the Subdivision Regulations under the section entitled, Detailed Drainage Requirements. The regulations state that, "where lands are or have been subject to periodic flooding and minimum building elevations have not been established by the County, interim minimum building elevations shall be established by the following method. The subdivider's engineer shall establish flood plains at design flood conditions. Minimum building elevations shall be at least two feet above such flood plains, and at higher elevations if so required by other County regulations" (Subdivision Regulations for Sarasota County Florida: Section 7-T; August 30, 1960--Amended April 6, 1971).

In areas of tidal flooding where Department of Housing and Urban Development flood insurance data are being utilized to establish minimum building elevations, the difference in elevation between old and new construction is very evident. This difference was noted in the vicinity of Laurel Road along canals connecting with Shakett Creek, and along the northern shoreline of Dona Bay upstream of U. S. Highway 41. New construction appears to be about three feet higher in elevation than old construction.

Except in small isolated areas of the watershed, septic tanks are functioning properly. However, they continue to be installed around embayments such as Dona-Robert's Bays, and are an almost constant source

of pollution of the bays. Prior to 1972, septic tank systems could be located as close as twenty-five feet to a water course or body of water, but since that time the requirement has been increased to fifty feet which has helped somewhat. In areas of the watershed where a high water table is critical with respect to the operation of septic tank systems, the County Health Department requires that finished grade on new construction be a minimum of thirty-nine inches above the water table at the wettest season of the year.

The SWCWP was designed as an agricultural water management project and although a runoff coefficient was utilized that would allow for some urbanization, the structural measures designed into the project do not provide the level of protection needed for a moderately to highly urbanized watershed. The County is preparing the Drainage Element of the Comprehensive Plan, but upgrading the SWCWP design from agricultural runoff capability to urban runoff capability has not been included. However, some County Staff are strong advocates of the need for an in-depth study of the watershed to determine the feasibility of modifying the design of the SWCWP to meet the needs of urbanization.

Because County Zoning Regulations have placed the majority of agricultural lands in Open Use Districts, the County feels that rezoning these lands for development purposes can be controlled within a maximum density of one dwelling unit per two to five acres. Such rezoning would

be within Open Use District classification. With on-site retention and utilization of natural retention areas, increased runoff resulting from development should be minimal. As was discussed earlier in this section of the report, it is the intention of the zoning regulations that lands in Open Use Districts not be rezoned to more intense use without a clear showing or proved need in the public interest.

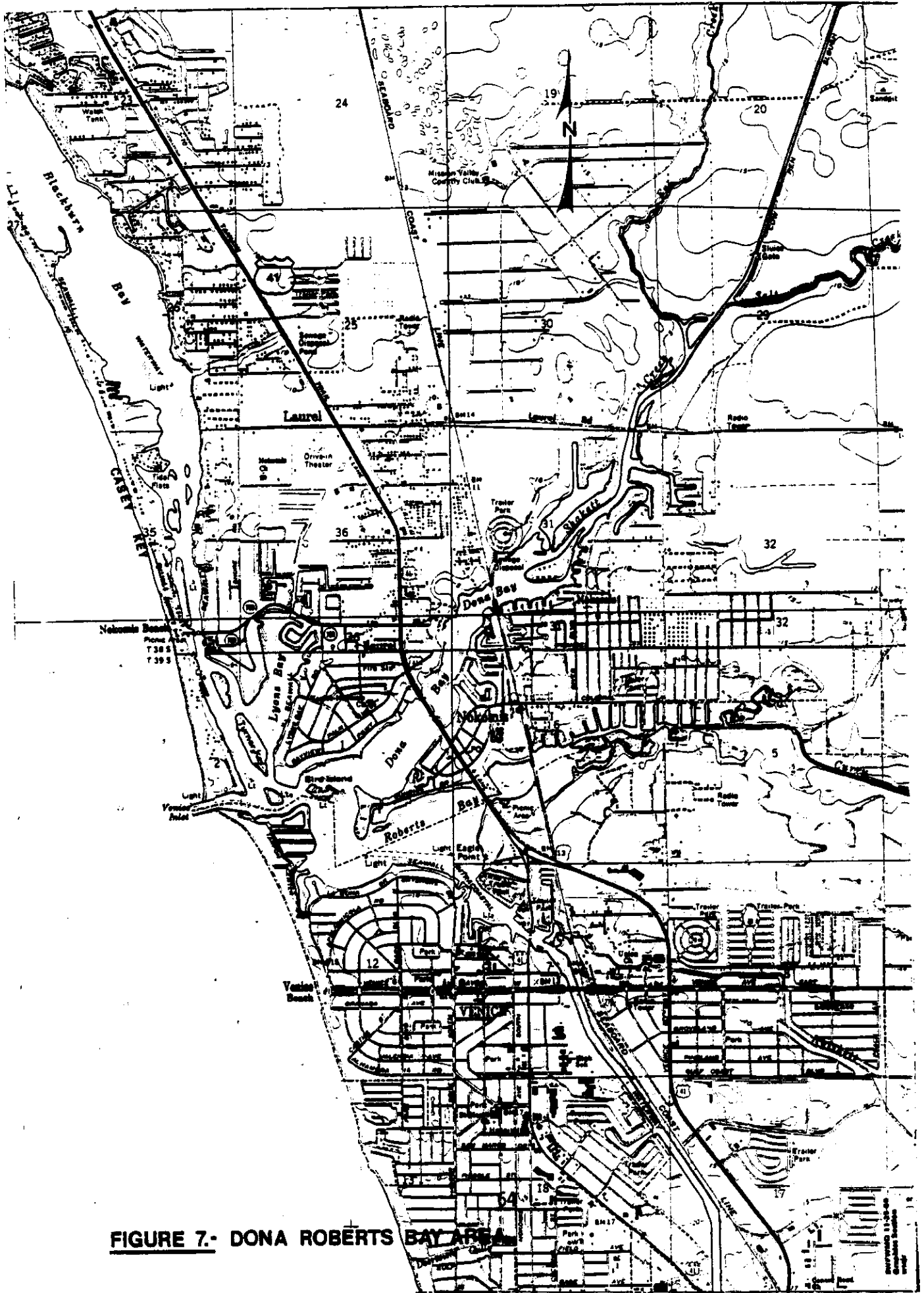
Some older subdivisions may have drainage problems resulting from inadequate fill for roadways and slabs, or the invert of final outfall being situated too low; but the County does not feel that these problems are numerous enough to be significant. In some instances when a problem of this nature has been identified, the County has accomplished remedial work. An example of this would be in the Richardson Road area where some drainage has been rerouted to the west to alleviate a problem.

## ENVIRONMENTAL PROBLEMS THEN AND NOW

The project was stopped because of environmental problems in the watershed area. As mentioned in the Introduction section of this report, the environmental concerns centered on problems in Dona-Robert's Bays. These problems had been somewhat attributed to changes resulting from construction of the partially completed SWCWP. However, many other changes in land use in the watershed, generally in the embayment had taken place since 1960. These changes were typical of changes taking place throughout Florida's coastal areas. They probably had as much, or more of an impact on the embayment than did the SWCWP.

The following is excerpted from the Introduction section of the report by Jeffrey L. Lincer, Ph.D., previously referenced in the Re-evaluation of the Original Project section of this report. It is a very detailed description of the changes which took place in the watershed.

..."During a period just prior to the construction of CPS, significant changes took place in the reach of Shakett Creek between Laurel Road and U.S. Highway 41 (see Figure 7). Mangroves and other filtering, biologically active fringe plants were replaced by seawalls and other man-made structures. Dead-end canals and homesites replaced marshes while shallow estuarine areas were dredged to accommodate the boats of the new owners. Since approximately 1960, in lower Dona Bay and generally in the entire DARB (Dona and Robert's Bays) region, almost 100 percent of the natural,



**FIGURE 7.- DONA ROBERTS BAY AREA**

shoreline, vegetation has been replaced by seawalls and other man-made structures. At a time almost coincident with the connection of CPS to upper Shakett Creek, the Intracoastal Waterway was also dredged through the Venice area. It was completed in late 1966 and dedicated January 1, 1967."...

With all of the instability described in the above excerpt, it would be very difficult to identify the major cause or causes of the environmental problems in the embayment. The environmental concerns included siltation, water quality deterioration, aquatic weed problems and overall environmental degradation.

The most severe water quality problem in the embayment since the project (SWCWP) work was partially completed occurred in 1972 and resulted from freshwater weeds washing into the embayment from CPS. Evidently this problem was caused by the method of aquatic weed control being utilized in CPS at that time, combined with the discharge of freshwater resulting from runoff in the upstream watershed. When Structure No. 1 was opened to release water, the accumulated growth of freshwater weeds flushed into the embayment. It was at this time that residents of the Dona-Robert's Bays area approached the County and requested that the situation be studied. The reports by Drs. Ross and Lincer were the outgrowth of the Commission responding to the request of the residents.

Looking at the streamflow record for the Myakka River near Sarasota (see Figure 3), the period of maximum runoff in 1972 was not a period of high

freshwater runoff. The annual maximum discharge (peak rate of runoff) was considerably less than the MAF. The total runoff for the 1972 water year (October 1, 1971 through September 30, 1972) was slightly less than the median year for the nineteen year period 1960 through 1978. Similar conditions probably existed on other watersheds in the area including South Creek and CPS. Therefore, the water quality problem in DARB probably was the result of the influx of freshwater weeds rather than the result of an abnormally high rate or total volume of freshwater inflow to the embayment.

The last contract for the channelization and construction of control structures on the SWCWP was completed in 1966. During the ensuing fourteen years, urbanization has increased in the upland watershed and also in the area of the embayment--probably more so in the area of the embayment. Dr. Lincer described these changes up to the date of his report, 1975 and certainly during the five years since that time, the rate of growth and urbanization in the watershed area has increased over what it had been from 1966 to 1975. Many factors which contribute to further environmental problems in the watershed and embayment have significantly increased. These include urban and suburbanization, and continued installation of septic tank systems in the immediate area of Dona and Robert's Bays.

Two other potential change-factors in the upland watershed have been the construction of I-75, and the operation of a County landfill which is located adjacent to Structure No. 3, on a triangular-shaped plot of



ground between the partially completed VARC and the main channel of CPS (see Figure 2). The County is monitoring the effects of the landfill on the hydrologic environment in the watershed.

Although the construction of I-75 is significant because of its very size, the construction itself has not adversely impacted the watershed. The interstate route skirts the western boundary of the CPS watershed until it swings to the southeast just upstream of Structure No. 1 (see Figure 4). The impact of urbanization which will be brought about by the construction of I-75 is discussed in the section of this report entitled, Changes and Current Needs in the Watershed.

Two reports address the question of the impact of CPS on the embayment; Dr. Lincer's report mentioned earlier in this section, and the report by Bernard E. Ross, Ph.D., previously referenced in the Re-evaluation of the Original Project section of this report. The report by Dr. Ross was done in 1973 and the report by Dr. Lincer was done in 1975. Following are summaries of the two reports.

The study by Dr. Ross was to address the causes of flooding and deteriorating water quality in the Dona Bay-Shakett Creek Area. As part of the study a digital model of CPS was constructed to determine the rate of freshwater inflow to the embayment before and after construction of the structural facilities of the SWCWP. A second part of the study involved constructing a digital model of the Dona Bay-Shakett Creek-Venice Inlet system, to examine the hydraulic behavior of that system.

The final part of the study included mathematical simulation of flushing characteristics of the system before and after construction of the SWCWP. Dr. Ross points out that many variables associated with urbanization in the Dona Bay-Shackett Creek area affect the flooding and water quality deterioration in the bay but that his work considered only the changes resulting from construction of the SWCWP.

Dr. Ross concluded from his model of inflow to the bay, that for the same storm passage the peak rate of flood discharge from CPS has doubled since construction of the SWCWP--from 2200 cfs to 4400 cfs at flood stage. However, an evaluation of the data, done for this Phase I Study, indicates that at a discharge of 4400 cfs, flow would be bypassing Structure No. 1; and, there probably would be overland sheet flow occurring with Fox Creek, CPS and Salt Creek interconnected.

It would have been more meaningful to make the flow comparison at a smaller discharge--at about bankfull flow conditions. There is little doubt, that during a time when 4400 cfs is discharging from CPS, the embayment will have become a freshwater lake. However, discharges of that magnitude are infrequent; none have occurred since 1962.

No field studies of water quality in Dona Bay were included in Dr. Ross' study. However, he believes that water quality in the embayment is deteriorating. He points out that the only natural force deterring the ultimate fate of Dona Bay is the flushing which occurs during peak

runoff periods. Although channelization of CPS has added to the deterioration of water quality in Dona Bay, Dr. Ross concludes that the significant underlying cause of deteriorating water quality in the embayment is the reduced flow capacity of the water body.

To relieve the present problems of flooding and deteriorating water quality in the embayment, Dr. Ross recommends constructing a navigation channel 120 ft wide and 8 ft deep in Dona Bay-Shakett Creek. He suggests that a channel such as this would allow the runoff from CPS to flow through Dona Bay with the least possible discomfort to the residents of the area.

In conclusion, certainly Dr. Ross' report points out the excellent value modeling has in evaluating a dynamic system such as Dona-Robert's Bays. One of the most important aspects of his study was the assessment of the change in rate of runoff as a result of construction of the SWCWP. The rates of runoff used by Dr. Ross were significant in size, and the effect upon the embayment with respect to flooding, pollutant load, flushing action and initial shock to the system was also significant.

The study by Mote Marine Laboratory, for which Dr. Lincer was the Project Coordinator, addressed the ecological status of Dona-Robert's Bays and the relationship to construction of the SWCWP-CPS and other possible perturbations. In addition to acting as Project Coordinator, Dr. Lincer authored and co-authored several sections of the report. Eleven other specialists combined their expertise to evaluate various aspects of the ecological status of the embayment. A comparative

approach, between the DARB system and the nearby South Creek estuary, was utilized in the study to ascertain the relative productivity and health of the two systems. Buck Creek, a small estuarine system about 45 mi south of Sarasota, was also briefly surveyed for comparative data.

The report points out that many other changes in land use in the watershed, generally in the embayment have taken place since 1960 when the SWCWP was conceived; and all have contributed to the environmental problems in the embayment.

In addition to the conclusions of the authors of the various sections of the report, Dr. Lincer prepared a Conclusions And Recommendations section of the report which basically summarizes the conclusions of the individual authors. The most significant of those conclusions are as follows:

The freshwater influx from CPS during periods of heavy rainfall disrupts the normal dynamics of Dona Bay.

The impact of the freshwater influx is magnified because the normal "buffering effect" of an estuary being fed by a meandering stream has been circumvented by the channelization of the SWCWP.

The massive transfer of freshwater, freshwater weeds and sediments into Dona Bay occurs at a rate which exceeds the ability of the estuary to handle it.

There is some evidence that Dona Bay may be filling-in on a much shorter time scale than many estuaries on Florida's west coast.

For perhaps one-half to two-thirds of the year (the dry season) Dona Bay functions as well as (or as poorly as) many of the estuaries on the west coast of Florida which are surrounded by recent development.

Robert's Bay is recipient of fewer runoff problems than Dona Bay, the impact of which is spent out over a longer period. In addition, Robert's Bay recovers more quickly from these perturbations because it is flushed more thoroughly by the ICWW and the incoming Gulf waters through Venice jetties.

The effects of suburbanization on Dona Bay, Robert's Bay and especially lower South Creek were reflected by the water quality monitoring program.

Dr. Lincer qualifies the results of the Mote Marine study by pointing out that in all fairness, the limitations set by a one year sampling do not provide information on year to year normal variations, and in addition subtle differences between observed conditions in June and December may have been missed. Authors of other sections of the report have also qualified their individual sections.

The report by Mote Marine Laboratory is viewed as "an impressively intense ecological review of Dona Bay and Robert's Bay as they relate to runoff aspects and storm flows produced by CPS, and as a valuable contribution toward future conclusions that could embrace all of the complex matters and lead to reasonably satisfactory solutions" (from report entitled, Cow Pen Slough and Phillippi Creek Basins, by Smally, Wellford and Naiven, Inc., and Russell and Axon, Inc., October 1979).

As was described earlier the Advisory Committee formed to help coordinate this study with local concerns felt that there still was such strong opposition to the possibility of additional runoff entering the Dona Robert's Bay, they directed that any alternatives which would divert water from the farming area into CPS be given no further consideration.

These environmental concerns were the major reason the SCS re-evaluation of the SWCWP was never begun in 1977-78 when the sponsors of the project lead an advisory group that tried to set priorities for the restudy. There continues to be significant public support, at least from the DARB area, that no additional runoff should be permitted to enter the embayment.

## RECENT FLOODING IN THE WATERSHED

During September and October, 1979, there was some minor flooding in the CPS Watershed. The muck area was flooded to a limited extent but fortunately there were no crops in at the time. Pasture flooding was even more limited with only some lower pastures partially flooded. At Structure No. 1 the slough reached near overflowing conditions and threatened to bypass the structure. Residents of the King's Gate Club Development notified the County and gate openings were increased to alleviate the situation. Bank-full conditions at Structure No. 1 probably resulted from the structure being only partially open, rather than from the magnitude of the runoff. Discharge at the structure is not measured; therefore, the peak flow is unknown as well as the frequency of the runoff event. However, it is estimated to have been less than the MAF event. Soil Conservation Service personnel were surveying along CPS between Structures No. 2 and 3 during this time of maximum runoff. Conditions in that reach of the channel were several feet below bank-full stage (personal communication, District Conservationist, SCS-Sarasota). There were no problems in DARB as a result of this runoff.

An indication of hydrologic conditions in the watershed area during recent years can be gained from a review of the following data on runoff in the adjacent Myakka River Watershed. Since 1966, the MAF on the Myakka River near Sarasota has been exceeded on only one occasion. That was in 1974 when the maximum discharge was 2,860 cfs. Since 1966,

the maximum discharge on the Myakka River at this location has exceeded 2,000 cfs on only two occasions--1968 and 1974 water years. The total runoff for the 1975 water year (October 1, 1974 through September 30, 1975) was the lowest experienced during the nineteen year period, 1960 through 1978. Similar conditions probably existed on other watersheds in the area including CPS. Therefore, since the extremely wet years of 1959 through 1962, the CPS watershed area has experienced a period of low runoff.



## · OPERATIONAL FEATURES OF THE PARTIALLY COMPLETED PROJECT

When discussing the operational features of the partially completed project it should be remembered that the project was not designed to eliminate flooding but to remove excess runoff so that the period of inundation for a ten-year storm would be less than 24 hours. Channels and structures are designed to carry the design storm with a flow line at or near the natural ground line. Spoil openings along channels and at structures permit flows greater than design to spread over the flood plain and to bypass the structures. The structures hold water in the channels during the dry season to prevent excessive lowering of the water table aquifer. The project is designed to increase freshwater runoff from the watershed under storm conditions. But, under normal rainfall conditions runoff from the watershed should be relatively unaffected by the channelization.

Alteration of a structure operation plan cannot affect the hydroperiod because overall storage capacity in the channels is very limited. No operational plan was developed for the structures because there are no operational capabilities as far as holding back floodwaters for later release--the project was designed to remove floodwater.

The basic management plan for the gates in the structures was to operate the gates to provide maximum discharge capacity during flood periods. When the partially completed project first became operational, operation

of the structures depended on affected landowners informing the County when gates needed to be opened or closed. There was no set schedule other than present weather conditions and groundwater conditions.

Operation and maintenance agreements entered into by the County and the SCS specify the following plan of operation for the control gates in Structures No. 1, 2, and 3: The gates are to be operated in such a manner as to obtain maximum outflow up to design discharge capacity during storms and normal rainy season, acts of God excepted. At all other times of the year, the spillways will be operated to provide maximum water control and storage.

The above plan of operation reflects the project design to remove floodwater from the system, and to conserve water during the dry part of the year. In a memorandum dated April 27, 1972 from Jack Zilles District Conservationist, Sarasota to Edward Hoyt, County Administrator, the SCS suggested the following plan of operation:

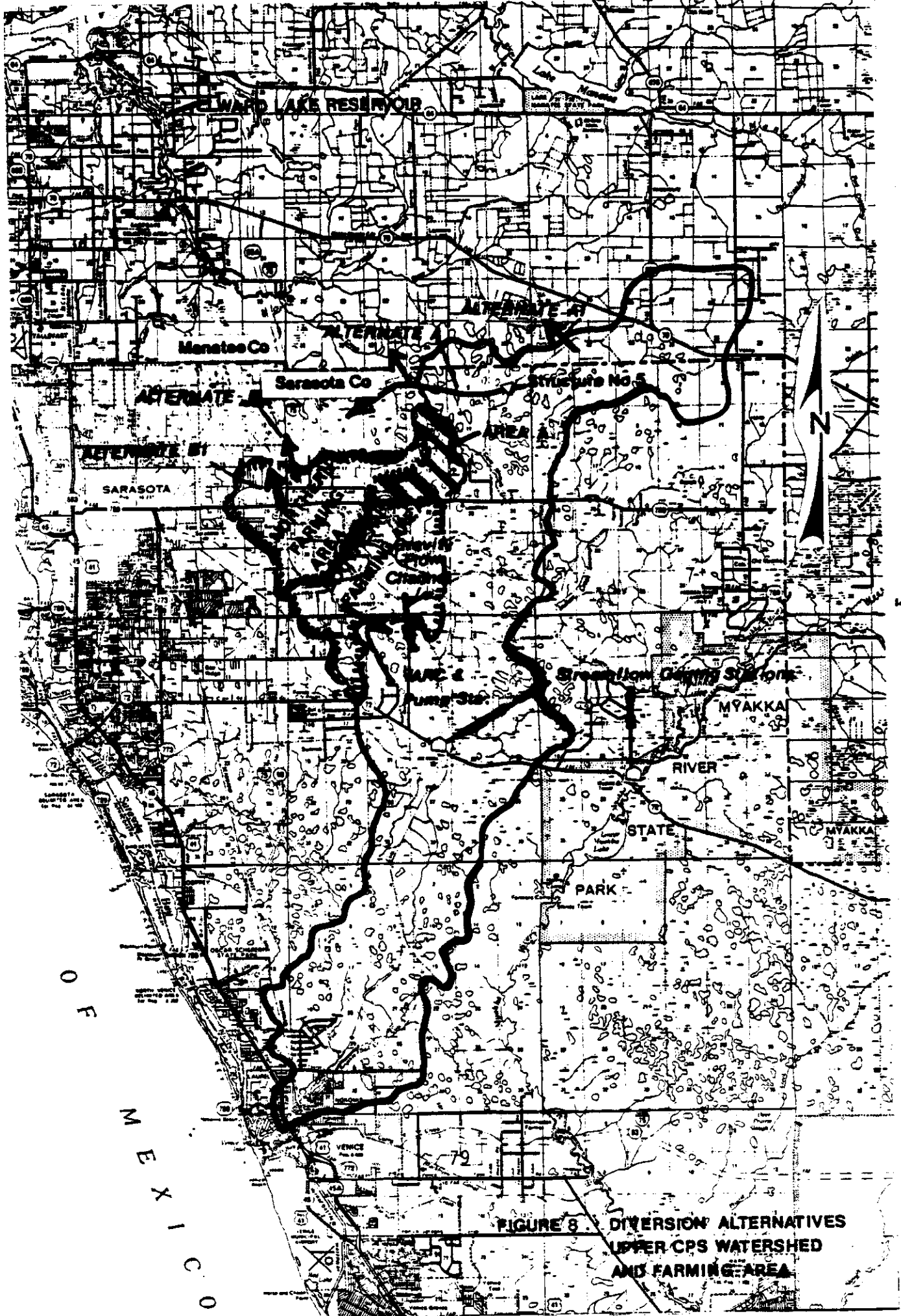
..."Normally the gates should be closed for the eight-month period from October through May unless watershed conditions and weather forecasts indicate otherwise. During a normal year the gates should be opened over a period of 5 to 10 days beginning June 1, or when it is apparent that the rainy season is beginning, and should remain open until October. The purpose of the gradual opening is to slowly lower the water in the channels thus avoiding a sudden surge of outflow. The gates should be closed in October at the end of the rainy season."...

Leaving the control gates open during the rainy season should not result in a wasteful discharge of water. During that time of the year the hydrologic system normally fills to overflowing, and runoff occurs naturally. Although the gates are open, with the structures in-place it may be possible to hold-back more water after flood flow has subsided than could have been held back under pre-SWCWP conditions. This would be possible because crest elevations at the structures are higher than the elevations which existed naturally at those locations. Also, channel slopes are less than pre-project which would tend to counteract the increased cross-sectional areas of the channelized stream.

## PROJECT ALTERNATIVES

Alternative A - A project alternative considered is the diversion of streamflow from the CPS Watershed to the Braden River Watershed. This diversion would increase inflow to the Ward Lake Reservoir on the Braden River and thus increase water availability for public supply. At the same time freshwater inflow to Dona and Robert's Bays (DARB) would be decreased.

The diversion would take place at the approximate site of the originally proposed Structure No. 5 of the SWCWP (see Figure 8). The drainage area at this site is about 16 sqmi. A diversion channel would run westward and generally parallel to land surface contours a distance of from 3.0 to 3.5 mi depending upon which tributary of the Braden River is utilized. Discharge could be to the southern-most tributary (Foley Creek) which would be nearest; however, another project alternative to be discussed subsequently may utilize discharge to that tributary. Therefore, consideration must also be given to extending the diversion channel to the northwest a distance of one mile to discharge to a more northerly tributary (Cooper Creek). The site of the proposed diversion is located in Sarasota County but discharge to the more northerly tributary would require crossing into Manatee County with the diversion channel. Discharge to the southern-most tributary would not require crossing county boundaries.



**FIGURE 8 DIVERSION ALTERNATIVES  
UPPER CPS WATERSHED  
AND FARMING AREA**

Size of the diversion channel would be about the same as that originally proposed downstream of Structure No. 5. Maximum discharge would be 200 cfs, about the same as designed for the SWCWP.

During an average year the maximum annual diversion possible (divert all flow up to design flow whenever possible) is estimated to be on the order of 10-15 mgd (about 15-25 cfs), or about 70 percent of the total average yearly flow at the point of diversion.

The amount of diversion during an average year was arrived at by utilizing streamflow records from the gaging stations on the Myakka River near Sarasota and CPS near Bee Ridge (see Figure 8); and a ratio of drainage areas between the Bee Ridge station and the proposed diversion site on CPS. Comparing the figures for annual runoff at the Myakka River station for the 19-year period, water years 1960 through 1978, the runoff for the 1965 water year was mid-way between the runoff for the average year and the runoff for the mean year for that period of record. Therefore, it was assumed that 1965 was somewhat of an average year with regard to runoff from watersheds in this area.

Streamflow record was available for the station on CPS near Bee Ridge for the 1965 water year. This record was also assumed to reflect somewhat of an average year of runoff, and the data was transferred upstream to the diversion site by a ratio of drainage areas. The capacity of the diversion canal was superimposed on the adjusted daily

streamflow record and the total amount of diversion for the year was computed. This yearly figure was converted to an average daily rate and was assumed to reflect diversion for an average year. When design (SWCWP) flow conditions are occurring in the watershed, the maximum rate of inflow to DARB at Structure No. 1 would be reduced by about 15 percent with a diversion capability of about 200 cfs (about 130 mgd) at the proposed site.

Alternative A-1 - There is another potential diversion site about 1.5 mi upstream from the above site (see Figure 8). This diversion site is in Manatee County and the diversion channel would be totally within Manatee County. The drainage area at this site is about 12 sqmi. The diversion channel would run northwest for a distance of about 1.0 mi and discharge into an unnamed tributary of the Braden River.

The size and capacity of the diversion facility would be somewhat smaller than that for the previously discussed site 1.5 mi downstream because of the smaller drainage area. During an average year the maximum average annual diversion possible at this site is estimated to be on the order of 10 mgd (about 15 cfs) if about 70 percent of the flow is diverted. When design (SWCWP) flow conditions are occurring in the watershed, the maximum rate of inflow to DARB at Structure No. 1 could be reduced by about 10 percent with this diversion facility.

Both the above described diversions would reduce the freshwater inflow to DARB but probably would have only very minimal affect upon the hydroperiod. The affects on DARB of such reductions in flow cannot be forecast because of the lack of baseline data relating the health of DARB to the amount of freshwater inflow. However, Dr. Ross stated in his report, Dona Bay Study, that the only natural force deterring the ultimate fate of Dona Bay--ceasing to be a body of water because of filling as a result of siltation--is the flushing that occurs during peak freshwater runoff periods.

Various diversion rates could be utilized. Two hundred cubic feet per second was chosen because it approximated the original project (SWCWP) design in the area. Neither that rate nor the total amount of flow diverted during an average year utilizing that rate may be realistic or permissable because of the needs of downstream landowners, and/or instream needs in downstream reaches of the CPS Watershed. Further studies would be necessary to establish the most appropriate diversion scheme.

Water quality at the proposed diversion sites should be very similar to water quality in the upstream reaches of the Braden River Watershed.

A project alternative considered is the diversion of streamflow from the farming area which is now a part of the Phillippi Creek Watershed. As was previously mentioned in the Introduction section of this report, the

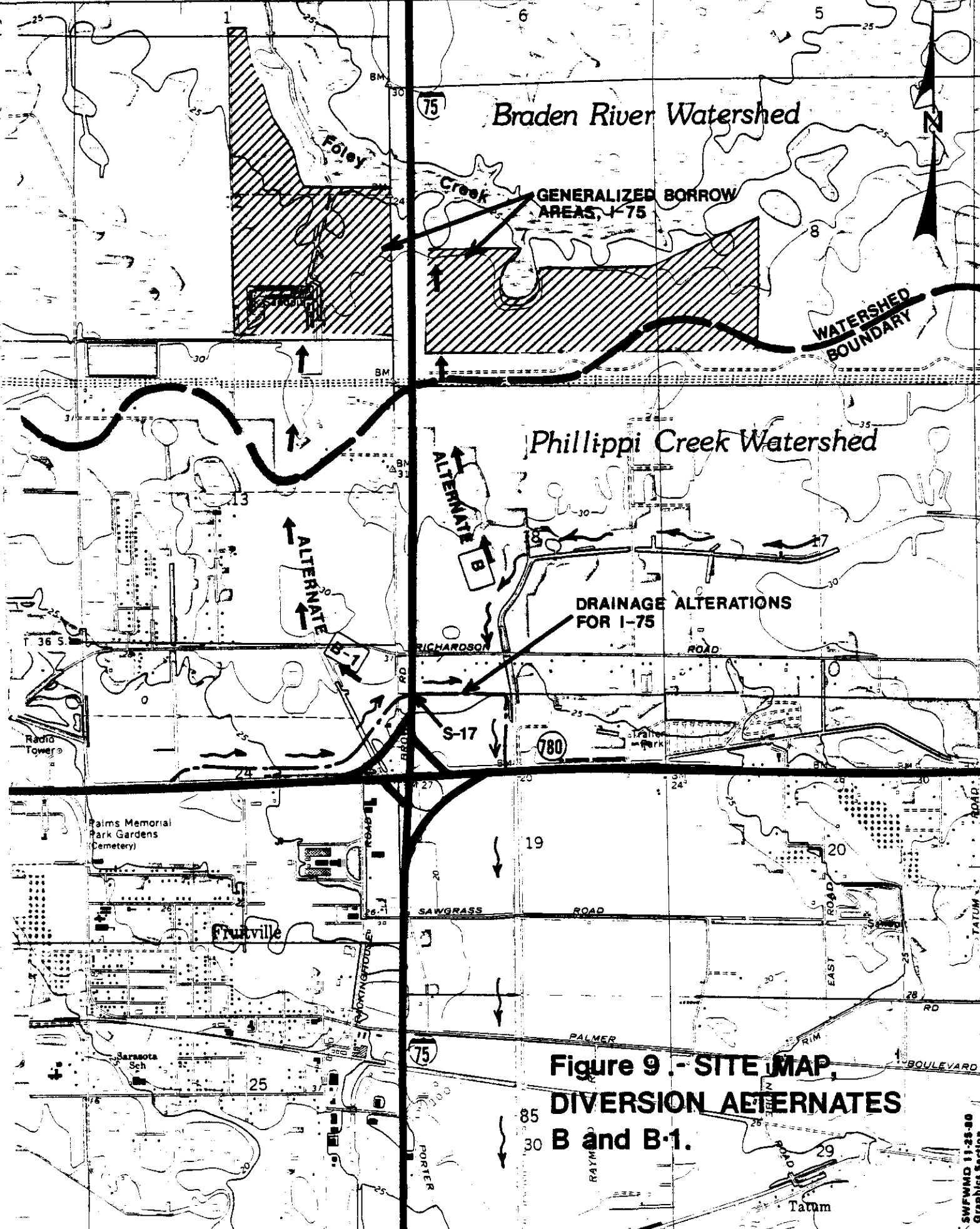


Advisory Committee gave clear direction that no further consideration was to be given to a diversion to CPS as was originally planned in the SWCWP. Neither could increased flow to Phillippi Creek nor any of its tributaries be considered because of current flooding problems along that stream.

Locating a possible diversion route is increasingly difficult because of the encroachment of urbanization into possible channel routes and because of the construction of I-75. The interstate creates a barrier (cost prohibitive as well as physically prohibitive) to man-made drainageways except those which can utilize the openings where major existing drainageways pass through the roadway fill. Fortunately, the hydraulic design of the openings for the major drainageways should be capable of accommodating the additional flow which would need to be diverted to provide the farming area with the degree of flood protection that was originally designed into the SWCWP.

Since neither Phillippi Creek nor CPS could be utilized, the only other possibility is the Braden River Watershed which lies to the north of the farming area. The farming area to be drained by the VARC in the SWCWP included about 23 sqmi. This area is naturally divided into two sub-areas; one to the north including about 7,000 acres and drained by Lateral No. 52; and one to the south including about 7,900 acres and drained by Main Channel No. 1 (see Figure 8).

Alternative B - Flooding in the northern section of the farming area probably could be controlled by managing the inflow to this area in the vicinity of the Fruitville Road (S.R. 780). Some of the inflow probably could be diverted by gravity flow at a site about one-half mile north of Richardson Road (see Figures 8 and 9). The diversion channel would run north for a distance of about one mile crossing the drainage divide to discharge to Foley Creek a tributary of the Braden River. The channel size should be somewhat larger than that originally proposed in the WP upstream of S.R. 780. The design channel capacity should be about 200 cfs. As part of the DOT drainage for I-75 in this vicinity, a stop-log structure has been constructed just upstream of S.R. 780. This structure could be utilized to direct flow to the north via the previously described diversion channel into the Braden River Watershed. The structure may need modification to insure adequate hydraulic head to accomplish the diversion by gravity flow. If diversion cannot be accomplished by gravity flow one of the pumps (pump capacity, 245 cfs) from the originally designed (SWCWP) pump plant on Bee Ridge Road could be relocated to this site. The diversion facility would only be utilized during flood-flows unless diversion for water supply purposes becomes of paramount importance; normal flow would be via the farming area to Phillippi Creek. A control structure would be required on the diversion channel.



**Figure 9 - SITE MAP, DIVERSION ALTERNATES B and B-1.**

Alternative B-1 - An alternate routing was considered for diversion of streamflow from the northern section of the farming area to the Braden River Watershed. The alternative route would begin at the point of inflow to the farming area in the vicinity of S.R. 780 (see Figures 8 and 9). Some existing drainage works for I-75 in this vicinity would be utilized for this diversion. These would include an east-west ditch on the east side of I-75 connecting with a double box culvert (Structure S-17, DOT Drainage Map, Project No. I-75-621-412, Sheet No. 3) under I-75 about 1,400 ft north of S.R. 780. From the west end of the double box culvert a diversion channel would be constructed generally to the north for a distance of about one mile crossing the drainage divide to discharge to Foley Creek. The channel size would be somewhat larger than that originally proposed in the WP upstream of S.R. 780. Design channel capacity should be about 200 cfs. The diversion facility would only be utilized during flood-flows unless diversion for water supply purposes becomes of paramount importance. Normal flow would be via the farming area to Phillippi Creek.

Utilizing the above diversion route to Foley Creek rather than the previously described route on the east side of I-75 would permit crossing of the drainage divide at a somewhat lower elevation than with the easterly route. Diversion via this westerly route probably cannot be accomplished without utilization of one of the pumps from the pump plant on Bee Ridge Road.

Benefits from a diversion from the farming area to the Braden River Watershed would not only be to the farming area. There would be some minimal reduction in flooding on Phillippi Creek, and the water diverted to the Braden River Watershed would eventually reach the Ward Lake Reservoir and be made available for water supply purposes. No estimate of diversion amounts was made because of the lack of streamflow data.

Generally, the water to be diverted from upstream of the farming area should be of good quality. There is only minimal farming in that part of the watershed; however, because of the impact of sub-urbanization in the area, contamination from septic tank systems can be expected. A detailed sampling program would be necessary to make the proper water quality evaluation.

Further evaluation of all the diversion alternatives to the Braden River Watershed should include assessment of the potential for flooding on the Braden River and its tributaries. If the diversions are utilized, consideration should be given to re-directing to the west, runoff from that part of the Phillippi Creek Watershed which lies north of S.R. 780 and which contributes inflow to the southern section of the farming area (see area "A" Figure 8). Thus re-directed, the runoff would eventually reach the previously discussed point of diversion upstream of S.R. 780. This drainage alteration would add runoff from about three square miles

of drainage area to the amount of water available for diversion for water supply purposes. The same amount of runoff would be removed from contributing to flooding problems in the southern part of the farming area. To provide flood control in the southern section of the farming area, the only alternative is an outlet to CPS. Either the previously designed VARC and pump station (SWCWP) or possibly a gravity-flow diversion channel directly south from the farming area to connect with the completed part of the VARC (see Figure 8). This latter possibility had in times past been given some consideration by the SCS (personal communication, SCS).

Primary Project Alternatives - In the following paragraphs, all the previously discussed project alternatives for diverting water to the Braden River Watershed have been combined with possible diversion schemes in the lower CPS Watershed to form three primary project alternatives. The diversion schemes in the lower CPS Watershed would be utilized to divert streamflow to reservoirs for water supply purposes. Before the Advisory Committee directed that no further consideration be given to that part of any project alternative which diverts water from the farming area to CPS, each of these three primary project alternatives satisfied all of the project objectives as outlined in the Introduction section of this report. A conceptual reservoir site at the general location as shown on Page 24 of the Appendix of this report has been utilized in all of the primary project alternatives.

The first of these primary project alternatives, Alternative C, includes a diversion from the farming area to the Braden River and a conceptual reservoir between CPS and the Myakka River (see Figure 10). Diversion to the reservoir for water supply purposes would be from both streams. There would be an overflow-relief channel from the reservoir to the Myakka River. The diversion from the farming area would benefit only the northern section of the farming area. In addition to satisfying all of the project objectives, Alternative C would also provide some minimal reduction in flooding on Phillippi Creek.

The second of these primary project alternatives, Alternative D, included a diversion from the farming area via the pumping station and the VARC, or a gravity-flow diversion channel, and the conceptual reservoir of Alternative C (see Figure 11). In this alternative, the diversion from the farming area would benefit the entire farming area. However, as has previously been stated on several occasions in this report, the Advisory Committee directed that no further consideration be given to any part of a project alternative which would divert water from the farming area to CPS. Therefore, as modified by the Advisory Committee, this second primary project alternative would not satisfy all of the project objectives. Alternative D would not provide any reduction in flooding on Phillippi Creek.

The last of the primary project alternatives, Alternative E, is very similar to Alternative D in that it includes a diversion from the

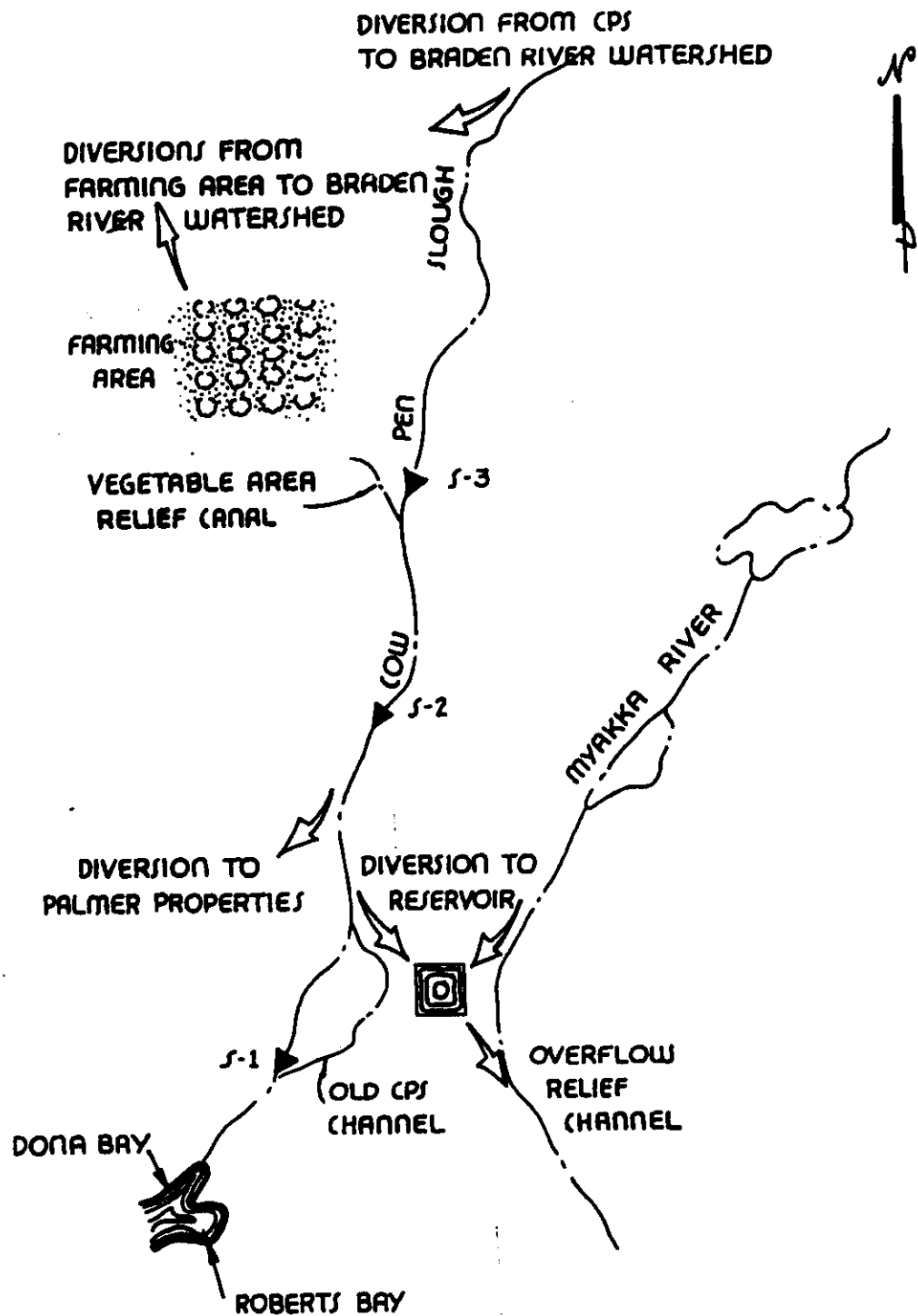


FIGURE 10. - Schematic of Diversion Alternative C



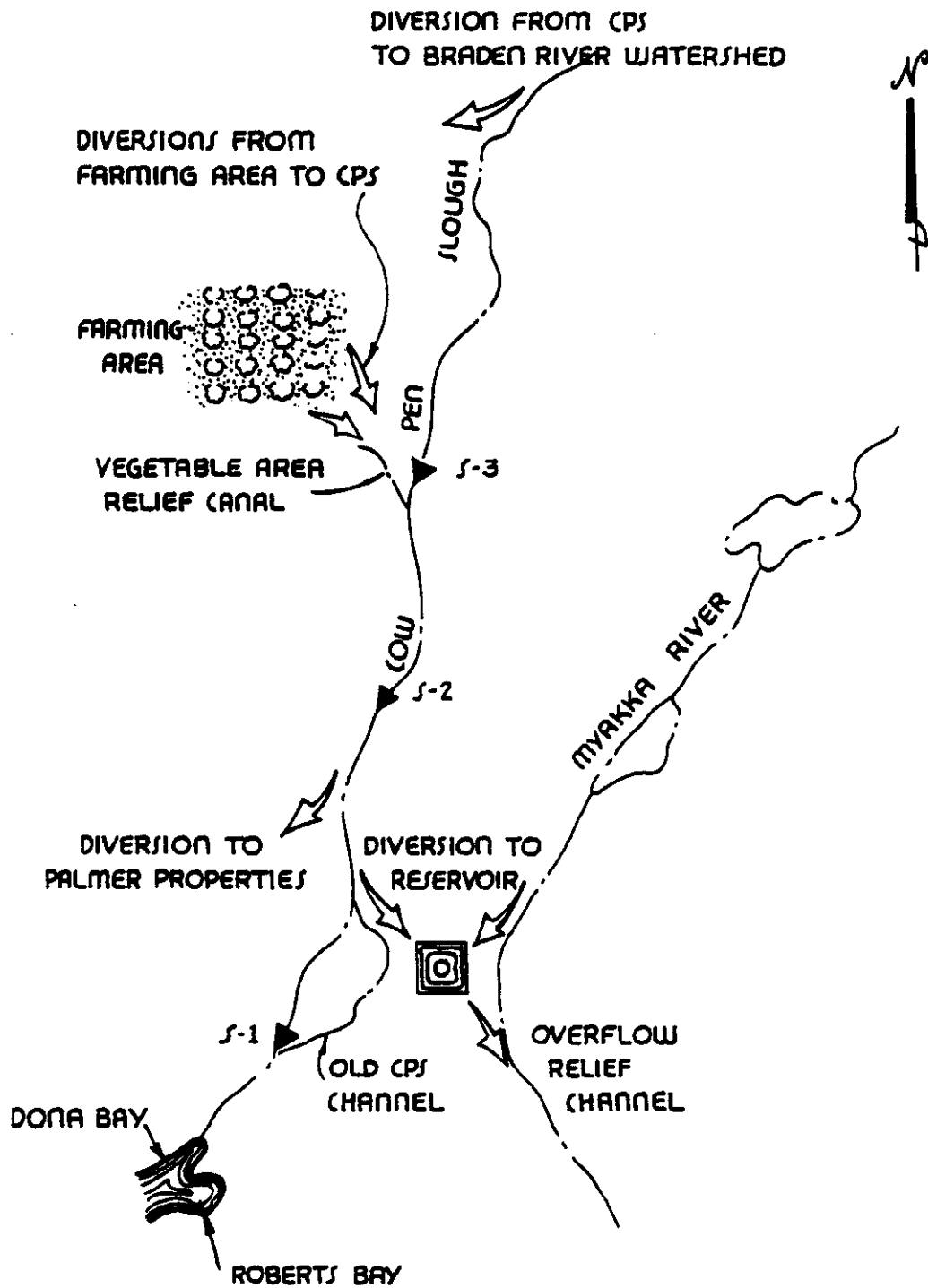


FIGURE 11. -- Schematic of Diversion Alternative D

farming area to CPS and a conceptual reservoir. It differs from Alternative D in that it has no overflow-relief channel to the Myakka River. An overflow-relief channel and an additional diversion from CPS would be directed southward from the reservoir to divert flow to Curry Creek (see Figure 12). As directed by the Advisory Committee, that part of this alternative which diverts water from the farming area to CPS could not be given further consideration. Therefore, this primary project alternative would not satisfy all of the project objectives. Alternative E would not provide any reduction in flooding on Phillippi Creek.

In Alternative E, the re-direction of the overflow-relief channel, and the addition of another diversion channel from CPS was done because diversion to the Myakka River might be prohibited since it is being considered for Wild and Scenic Rivers classification, and to have the capability of diverting more water from CPS than could be routed through the reservoir.

All three of these primary project alternatives could include a diversion of flow from CPS into the water management facilities planned as part of the development of the Palmer Properties. A collection system of tile drains or shallow wells could also be utilized in the vicinity of the reservoir to pump from the shallow aquifer into the reservoir. Such a system of wells or drains could yield a significant amount of water from the shallow aquifer system.

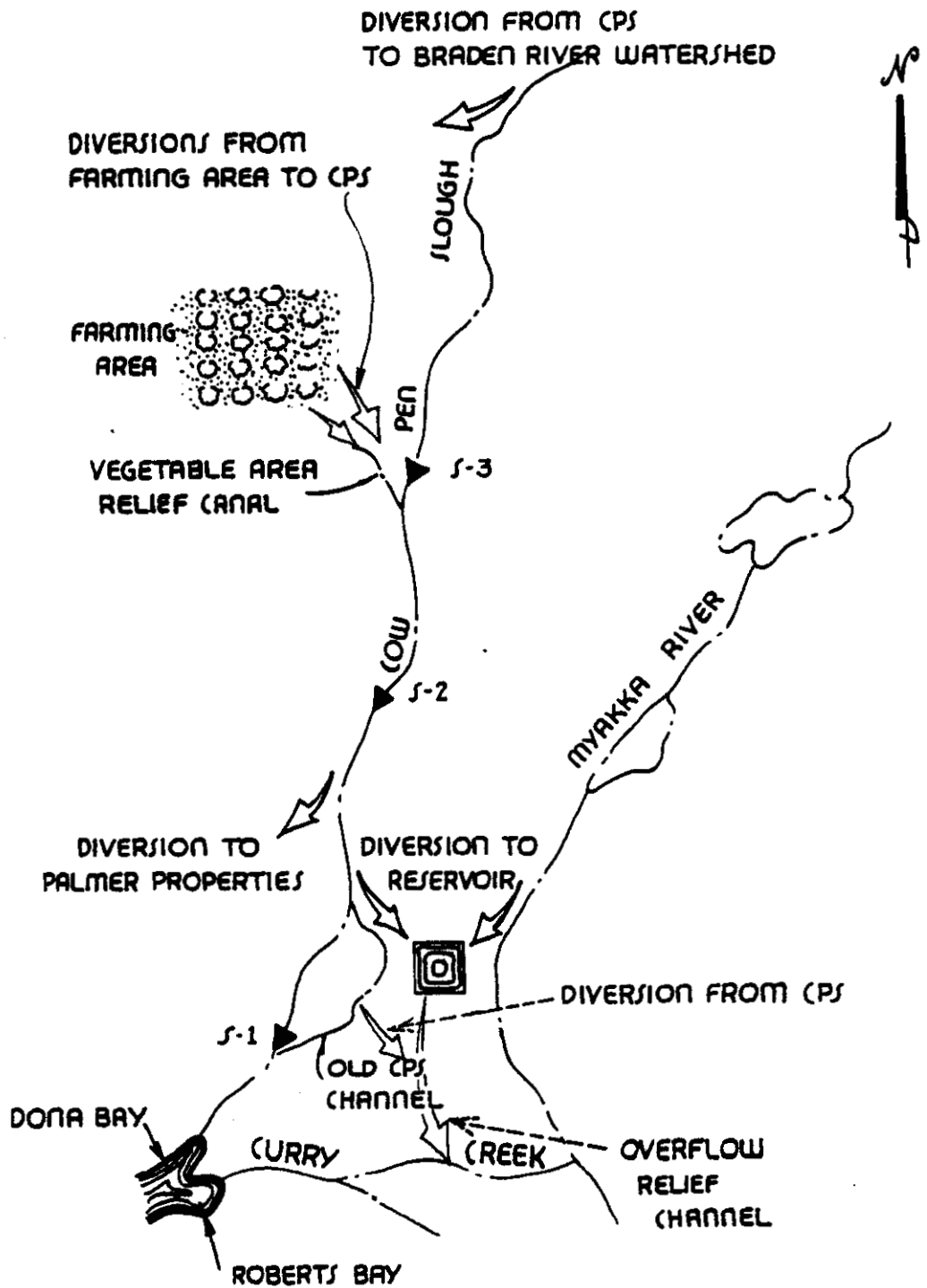


FIGURE 12. -- Schematic of Diversion Alternative E  
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Costs of diversion facilities for the project alternatives A, A-1, B and B-1 were estimated in terms of 1980 dollars by applying the Construction Index to the cost of those elements of the originally proposed works (SWCWP), which with minor modifications could be utilized as diversion facilities. This simplified method of estimating costs was utilized because in this preliminary Staff report the comparative costs of project alternatives will only be presented as order of magnitude costs. Order of magnitude costs of the project alternatives are presented in Table No. 1.

Cost estimates are not included for alternatives C, D, and E because the quantity of water to be diverted to the reservoirs for water supply purposes is not known, and because it has not been determined whether or to what degree the hydroperiod should be adjusted. As was stated earlier, Dr. Ross concluded that the flushing which occurs during freshwater peak inflows is the only natural force deterring the ultimate fate of Dona and Robert's Bays--ceasing to be a body of water.

The diversion schemes utilizing reservoirs have been investigated as part of the Regional Water Supply Program being developed by the SWFWMD--Manasota Basin Board. Utilizing the diversions would increase the water supply potential of the area, but at the same time freshwater inflow to DARB would be decreased. Utilization of the reservoirs would provide some adjustment in the hydroperiod.

TABLE 1: OBJECTIVES SATISFIED BY PROJECT ALTERNATIVES,  
AND ORDER OF MAGNITUDE COSTS OF PROJECT ALTERNATIVES.

Objectives, Phase I Study	Project Alternatives						
	A	A-1	g <sub>B</sub>	g <sub>B-1</sub>	g <sub>C</sub>	D	E
<sup>a</sup> Adjustment of the CPS Hydroperiod	✓	✓			✓	✓	✓
Development of Municipal Water Supply Potential	b✓	b✓	b✓	b✓	c✓	c✓	c✓
<sup>d</sup> Drainage and Flood Control in CPS Watershed							
Flood Control in the Farming Area			e✓	e✓	e✓	f✓	f✓
Resolution and Disposition of SWCWP	✓	✓	✓	✓	✓	✓	✓
<sup>h</sup> Order of Magnitude Costs	1.4	1.0	2.2	2.2	i	i	i

- a - Would provide reduction of inflow to DARB but it has not been determined whether or to what extent the hydroperiod should be adjusted to redress the environmental problems in the embayment.
- b - Diversion would be to the Braden River Watershed.
- c - Diversion would be to the Braden River Watershed and to reservoir between CPS and the Myakka River.
- d - Additional drainage is not warranted and the major flooding problem is that connected with the King's Gate Club Development.
- e - Would provide flood control only in the northern section of farming area.
- f - As modified by the Advisory Committee it would not provide flood control in the farming area.
- g - Would provide some reduction in flooding on Phillippi Creek.
- h - One order of magnitude cost approximately equals \$250,000. Cost includes Engineering, Administration of Contracts, Acquisition of Easements and Rights-of-Way, and Contingencies.
- i - Costs not estimated because quantity of water to be diverted to the reservoirs is not known, and because it has not been determined whether or to what extent the hydroperiod should be adjusted.
- ✓ - Objective satisfied by project alternative.

Detailed evaluation of the alternatives for controlling flooding within the farming area (but not including diversions to CPS) probably could be most expeditiously handled by the SCS since their expertise lies in the area of agricultural water management, and the project would involve a re-evaluation of an existing SCS project within the farming area. Such a project study should include engineering feasibility, environmental impact and benefit/cost analysis.

The SCS has expressed an interest in re-evaluating the project (personal communications) providing that an acceptable project alternative can be agreed upon by the various agencies and groups having interest in the project. Since the biggest area of contention centers on the potential environmental problems in DARB, and since none of the alternatives for diversion from the farming area to the Braden River Watershed would have any affect upon DARB, a re-evaluation by the SCS appears to be the most efficient disposition of that part of the SWCWP which affects the farming area.

Project alternatives for alleviating the flood hazard surrounding the King's Gate Club Development and the King's Gate Travel Trailer Condominium Development (discussed in the section of this report entitled, Changes and Current Needs in the Watershed) will be only briefly mentioned.

The King's Gate Club Development, as the name implies, is a private club, and expenditures of public funds to investigate project alternatives and/or to construct facilities to alleviate the flood hazard surrounding a private club would be highly questionable.

However, some conceptual project alternatives which could be considered for alleviating the flood hazard at the King's Gate Club Development include:

1. Increasing the discharge capacity of the flood control works on CPS.
2. Construction of a perimeter flood-wall and installation of interior pumps.
3. Construction of upstream diversion facilities to divert flood flows to Fox Creek, Salt Creek, Myakka River or Curry Creek.

In regard to the Travel Trailer Condominium development, again with the intent of minimizing expenditures of public funds, a relatively inexpensive solution might be to require installation of a flood-warning system to provide continuous notice of upstream flood conditions which would dictate evacuation.

## CONSULTANT STUDIES

The specific questions directed to the consultants were enumerated in the section of this report entitled, Purpose and Scope. The answers provided by the consultants will not be summarized here, but rather pertinent sections of their reports are included in the Appendix of this report.

The Conclusions section of the report by Smally, Welford & Nalven, Inc., and Russel & Axon, Inc., contains several recommendations which go beyond the questions asked of them. Their discussion reflects upon the many years of experience and the wealth of knowledge which they have accumulated in the watershed area.



## CONCLUSIONS

The conclusions from the Phase I Study are as follows:

1. The Sarasota County Commission has released temporary easements (acquired for construction and maintenance) and spoil easements (acquired for construction) in connection with the VARC which is only partially complete. The Commission stated that, "...the VARC project has been abandoned..."--May 15, 1979.
2. The Sarasota County Commission, and the Sarasota Soil and Water Conservation District have determined that the SWCWP should not be completed as planned because of differences among landowners affected by the watershed channel--May 18, 1979.
3. The muck farming area and Phillippi Creek receive no benefits from the partially completed project (SWCWP).
4. Various agencies and groups having an interest in a revised project (SWCWP) probably will not be able to agree on priorities for a project re-evaluation. There still is strong opposition to additional project work in the watershed, especially from DARBES.
5. The SCS cannot carry out a re-evaluation of the original project (SWCWP) unless a list of project alternatives which address environmental and water management problems in the watershed can be agreed upon by those having an interest in the project.
6. The project (SWCWP) probably will be "closed-out" by mutual agreement between the SCS and the sponsors (Sarasota County and Sarasota Soil and Water Conservation District).

7. There is water supply potential in the watershed areas from surface water sources--report by Hydrosience Research Group, Inc.
8. The County's plan of operation of the structures does not appear to be in agreement with the plan of operation set-forth in the Operation and Maintenance Agreements with the SCS, and may not be the best method of releasing freshwater to the embayment. The County's plan has the potential for requiring the release of large amounts of water at a rapid rate during times of heavy runoff. Gradually releasing freshwater (low rate of discharge) at the beginning of the rainy season may be better (for environmental conditions in the embayment) than holding-back the water for as long as possible before releasing water at a high rate of discharge.
9. The CPS Watershed remains basically agricultural in nature although urban and suburbanization is beginning to impact some areas.
10. The construction of I-75 has not adversely impacted the watersheds; however, when opened it will cause certain parts of the watersheds to develop more rapidly than others.
11. Works of improvement already installed provide adequate drainage for the farming area and pasture areas; however, flooding still is a problem in the farming area.
12. Farming interests believe that the muck lands can be productively farmed for another 5-10 years, and that it would be economically sound to expend money to provide the necessary flood control. However, it probably would be at least five years before a flood control project could be completed.

13. The question of completing flood control works to divert water from the farming area to the Braden River, or works to divert freshwater inflow from DARB is a question of benefit/cost.
14. Some ranchers could benefit from additional project (SWCWP) work while others have adequate drainage. However, it must be remembered that limited pasture inundation is a feature of the original project design.
15. There is a difference of opinion among landowners whether the South Creek Lateral portion of the original project should be built.
16. There are no agricultural related problems in the Manatee County part of the watershed that need addressing by revisions to the original project.
17. To alleviate the flooding threat on Phillippi Creek would require a reduction in flow of 5,000 cfs; or a pumping station seven times the size of the pumping station designed in the original project-- report by Joint Venture Engineers.
18. An evaluation of the flooding potential of the King's Gate Club Development and the King's Gate Travel Trailer Condominium development located near Structure No. 1 indicates that CPS probably will overflow through King's Gate Club even during MAF conditions.
19. The County is confident that, with the exception of some minor flooding in older developments, drainage and flood control in the CPS Watershed can continue to be accomplished through application of Subdivision and Development Regulations.
20. Except in small isolated areas of the watershed, septic tanks are functioning properly. However; they continue to be installed

around embayments such as DARB and are an almost constant source of pollution of the bays (personal communication, County Health Department).

21. The SWCWP was designed as an agricultural water-management project, and although a runoff coefficient was utilized that would allow for some urbanization, the structural measures of the project do not provide the level of protection needed for a moderately to highly urbanized watershed. However, the County is confident that re-zoning of agriculture lands for development purposes can be controlled to a maximum of one dwelling unit per two to five acres, thereby minimizing increased runoff.
22. The two reports from which conclusions have been drawn regarding the impact of CPS on the embayment are of limited value in assessing current environmental conditions in the embayment as related to the SWCWP, because of the lack of pre-project (SWCWP) baseline data and because the reports are 6-7 years old.
23. Other changes in the watershed area may have contributed as much to the environmental problems in the embayment as has the construction and/or operation of CPS.
24. With all of the instability in the embayment area it would be very difficult to identify the major cause or causes of the environmental problems.
25. The most severe water quality problem in the embayment since the project (SWCWP) work was partially completed, occurred in 1972. That problem probably resulted from an influx of freshwater weeds rather than from an influx of freshwater.

26. During recent years many factors which contribute to environmental problems in the embayment have significantly increased.
27. Since the extremely wet years of 1959 through 1962, and since the SWCWP was partially completed, the watershed areas has experienced a period of low runoff. There was some minor flooding in the farming area and some pasture areas in September and October, 1979 during less than MAF conditions.
28. The SWCWP is designed to increase freshwater runoff from the watershed under storm conditions. But, under normal rainfall conditions, runoff from the watershed should be relatively unaffected by existing channelization. Crest elevations at structures are higher than elevations which existed naturally at those locations, and channel slopes are less than pre-project. These design features should tend to counteract the increased cross-sectional area of the channelized stream.
29. There are project alternatives for diverting flood flows from some of the muck farming area, reducing freshwater inflow to DARB, and diverting stream flow into reservoirs and other storage areas for water supply purposes. However, to provide flood control in the southern section of the farming area the only alternative is diversion to CPS.
30. There are project alternatives which could be considered for alleviating the flood hazard at the King's Gate Club Development. However, the expenditures of public funds to investigate project alternatives and/or to construct facilities to alleviate the flood hazard surrounding a private club would be highly questionable.

31. Adjustment of the hydroperiod cannot be accomplished by construction of additional structures or by a specific operational plan for the existing structures. Storage capacity within the channel is too limited. The relief potential of the project lies in allowing adjacent low-lying lands to flood temporarily as was designed in the original project--report by Joint Venture Engineers.

## RECOMMENDATIONS

The recommendations from the Phase I Study are as follows:

1. The original project (SWCWP) should not be completed as planned. The effects on the embayment area from the partially completed project have not been determined, and the results of a benefit/cost analysis probably would not be favorable toward completing the project.
2. The sponsors of the project (SWCWP) should obtain public input regarding modifications to the project. Separate input should be sought regarding diversions from the farming area to the Braden River, and diversions from CPS to the Braden River. The DARBES should not have special interest in the diversions from the farming area to the Braden River since that would have no affect on DARB. However, Manatee County and Braden River interests should have input.

Agricultural interests in the farming area should not have special interests in the diversions from CPS to the Braden River since that would have no affect upon the farming area. However, the DARBES, property owners along the CPS, Manatee County, and Braden River interests should have input.

3. If the sponsors decide to further evaluate modifications to the project (WCWP), the SCS should be requested to evaluate diversion

alternatives from the farming area to the Braden River; however, a preliminary benefit/cost analysis must first be made to determine whether it is feasible to proceed with detailed evaluations of the alternatives. The preliminary evaluations must also consider the economic life of the farming area. None of the diversion alternatives from the farming area to the Braden River will affect DARB.

The diversions from CPS, which would mainly be for water supply purposes probably should be investigated as part of the Regional Water Supply Program being undertaken by the Manasota Basin Board of SWFWMD, and Manatee and Sarasota Counties.

4. Planned repairs to Structure No. 3 probably should be undertaken. Nothing in the Phase I Study indicated that not having the structure operational was critical regarding the proper functioning of the partially completed project. However, as was pointed out in the report by Joint Venture Engineers, putting all the existing structures in good working order would be a constructive step which probably should be undertaken.
5. The required repair and/or maintenance of the project (SWCWP) facilities as detailed in the 1979 SWFWMD investigation (in-house memorandum dated February 9, 1979 from W. F. Sietman to B. R. Laseter) should be accomplished by the County.



6. The operation of the structures should be reviewed by the sponsors and the SCS. Waiting as long as possible before opening the structures may cause the greatest "shock" to the embayment area. It should be emphasized that during design storm conditions there will be inundation of pastures.
7. The water supply potential of surface water sources should receive further investigation, especially in the area of water quality-- report by Hydrosience Research Group, Inc.
8. A study should be conducted in the embayment to document environmental conditions. This should include establishment of the following data stations: A continuous streamflow measuring station on CPS, and periodic streamflow measuring stations on Fox Creek and Salt Creek; and a tidal recording station in the embayment area. Knowledge of tidal fluctuations in the embayment and quantity of freshwater inflow to the embayment would decrease the number of assumptions which would have to be made relative to conditions in the embayment at a particular time during a tidal cycle, and as related to the quantity of freshwater inflow.
9. An evaluation of the flooding potential of the King's Gate Club Development, and the Travel Trailer Condominium development should be made by a competent hydrologic consultant. Residents of these developments should be advised of the flood hazard.

10. Any development adjacent to CPS should be required to have a Flood Plain Study similar to that which was done for Gator Creek Estates.
  
11. Although CPS appears to have been a significant contributor to the environmental problems in DARB steps should be taken to minimize all causative factors which may contribute to those problems. Therefore, the County should develop and implement a plan to accomplish the following objectives, as contained in the Conclusions and Recommendations section of the report by Mote Marine Laboratory (August, 1975). The objectives are: (1) Reduce the rate, amount and duration of impact of freshwater, freshwater weeds, suspended solids and sediment that enters Shakett Creek-Dona Bay; (2) Reduce nutrient and bacterial input into Shakett Creek-Dona Bay from residential areas and help the estuary re-attain some of its ability to stabilize quickly after the normal perturbation of runoff; and (3) Create and maintain a situation whereby the long-term effect of land use changes and management alterations will be more easily discerned.
  
12. The question of channelization in the embayment should receive thorough evaluation. Natural flow restrictions resulting from a build-up of oyster bars at both the railroad bridge and the U.S. 41 bridge should be selectively removed to restore channel conveyance.

13. A plan for eliminating the pollution of the embayment by septic tank systems should be developed and implemented.
14. An effective and continuing aquatic weed control program for CPS should be developed and implemented.
15. Monitoring of the sanitary landfill in the CPS Watershed should continue.
16. Additional drainage of pasture areas is not warranted.

## GLOSSARY OF TERMS AND ABBREVIATIONS

Base flood elevation - The elevation of the 100-year flood. The 100-year flood has been designated at the base flood in Flood Insurance Studies done for the National Flood Insurance Program by the Federal Emergency Management Agency.

Embayment - The inlet of the Gulf of Mexico which receives the fresh-water runoff from a part of the SWCWP area. The streams contributing runoff to the embayment are Curry Creek, Shakett Creek, Fox Creek, Salt Creek and Cow Pen Slough. The term is synonymous with the term Dona and Robert's Bays.

Hydroperiod - The natural periodicity in the fluctuations of water levels in the hydrologic system--surface water and groundwater.

CPS - Cow Pen Slough

CPSWMI - Cow Pen Slough Water Management Investigation

DARB - Dona and Robert's Bays

DARBES - Dona and Robert's Bays Environmental Society, Inc.

HPDD - Hyde Park Drainage District

MAF - Mean Annual Flood

PPDD - Pomello Park Drainage District

SCS - Soil Conservation Service

SFDD - Sarasota Fruitville Drainage District

SSWCD - Sarasota Soil and Water Conservation District

SWCWP - Sarasota West Coast Watershed Project

SWFWMD - Southwest Florida Water Management District

USDA - U.S. Department of Agriculture

WWP - Watershed Work Plan

VARC - Vegetable Area Relief Channel

## SELECTED REFERENCES

- Barnes, H.H., Jr., and H.G. Golden. 1966. Magnitude and Frequency of Floods in the United States - Part 2-B, South Atlantic Slope and Eastern Gulf of Mexico Basins, U.S. Geological Survey Water Supply Paper 1674.
- Corps of Engineers, U.S. Army Jacksonville, Florida, District. May 1973. Flood Plain Information Coastal Areas, Sarasota County, Florida.
- Corps of Engineers, U.S. Army Jacksonville, Florida, District. June 1973. Flood Plain Information South Creek, North Creek, Catfish Creek, Clower Creek, Elligraw Bayou and Matheny Creek, Sarasota County, Florida.
- Hydroscience Research Group. January 1980. Preliminary Evaluation of the Surface-Water Supplies in the Cow Pen Slough Area.
- Leggette, Brashears and Graham. March 1978. Manasota Basin Comprehensive Water Management Plan, Preliminary Hydrogeologic Evaluation of Selected Sites.
- Mote Marine Laboratory. August 1975. The Ecological Status of Dona and Robert's Bays and its Relationship to Cow Pen Slough and Other Possible Perturbations (Final Report).
- Mote Marine Laboratory and Sarasota County Division of Pollution Control. August 1979. Proposed Detailed Sampling Design for Southwest Florida Regional Planning Council.
- Ross, Bernard E. August 1973. Dona Bay Study.
- Sarasota Soil Conservation District, Sarasota County Board of Commissioners, Manatee River Soil Conservation District and U.S. Department of Agriculture, Soil Conservation Service. March 1961. Work Plan for Sarasota West Coast Watershed, Sarasota and Manatee Counties, Florida.
- Seijo, M.A., R.F. Giovannelli and J.F. Turner, Jr. 1979. Regional Flood - Frequency Relations for West-Central Florida, Water-Resources Investigations, Open-File Report 79-1293, U.S. Geological Survey.
- Snelly, Wellford and Nalven - Russel and Axon. June 1977. Manasota Literature Assessment Study June, 1977.
- Snelly, Wellford and Nalven - Russel and Axon. October 1979. Technical Support/Cow Pen Slough Water Management Project, Cow Pen Slough and Phillippi Creek Basins.
- Southwest Florida Regional Planning Council, Plan of Study for the Southwest Florida Regional Planning Council 208 Water Quality Management Plan, Continuing Planning Process. Undated.

APPENDIX

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Excerpts from the report entitled, <u>Technical Support Cow Pen Slough Water Management Project</u> by Smally, Wellford and Nalven, Inc., and Russel and Axon, Inc.	A-14
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DISCUSSION--FLOOD HAZARD  
KING'S GATE CLUB DEVELOPMENT

During the course of the review of the flood hazard surrounding the King's Gate Club Development it was learned that County approval of the development was a very controversial matter. Over two years elapsed from the time the initial plans were submitted in January-February, 1976 until the County granted approval in March, 1978. During that time the County Engineer changed and the developer's Engineer of Record changed three times. Although the correspondence reviewed did not indicate it, apparently approval was granted because of a "legal technicality" connected with designation of the development as a private club. Some aspects of the flood hazard surrounding the development were readily apparent to the County when the development initially came in for approval. Comments regarding the potential flooding problems associated with the development plan were made by both the SCS and the various Departments of County Government.

From the time the initial plans for the development (first named King's Gate Mobile Home Park, and later known as King's Gate North Mobile Home Park) were reviewed by the County until the County approved the development as a non-profit club (named King's Gate Club), various revisions of the initial plans were considered. The correspondence reviewed indicated the revisions considered included the following: filling no-spoil areas along the slough adjacent to the development to prevent the designed

(SWCWP) overflow through the proposed development and around Structure No. 1; designing a bypass channel through the proposed development and around Structure No. 1 to accommodate a 100-year storm; compensating for the loss in flood plain when the approximately 30 percent of the property below the base flood elevation was filled; and, consideration of a major lake outfall to Shakett Creek.

In December, 1977 a petition was filed with the Planning Commission by the owners of the property, requesting that a Special Exception to the zoning regulations be granted to permit the property to be used for a private club. After public hearings before the Planning Commission and the County Commission, the exception was granted on March 7, 1978 (Special Exception Petition No. 661, King's Gate Club). A copy of the "Summary of Action" by the County on the matter indicates that approval with stipulations was recommended by the County Planning Staff, by the County Planning Commission (5/0 Vote), and that approval with stipulations was granted by the Board of County Commissioners by a 4/0 Vote.

The Planning Commission's recommendation for approval of the petition was subject to the following major stipulation in regard to CPS and the SWCWP; that is: that no site modification or construction was to be initiated until the problems associated with the CPS Watershed were resolved to the satisfaction of the County Engineer and the Board of County Commissioners (Report and Recommendation of the Sarasota County Planning Commission January 19, 1978, and excerpt from the minutes,



County Planning Commission, Public Meeting, January 19, 1978). The above statement, "the problems associated with the CPS Watershed" refers to County review comments on some aspects of the development plan which were not resolved at the time of the hearing. These included utilization of spoil areas, construction of buildings and residences in areas designed to flood during high water conditions in the slough, maintenance of the floodwater bypass of Structure No. 1, disposition of designed over-bank flow which would occur through the development, and the need for a complete evaluation of the hydrology of the CPS before any final decision was made on the project (letter dated February 17, 1976 from Richard Balduzzi, District Conservationist, USDA-SCS to Sebastian J. D'Alli, County Engineer, Subject: King's Gate Mobile Home Park; and, Inter Office Memorandum dated March 11, 1976 from Sebastian J. D'Alli to Phil McGuire, Director Planning Department, Subject: Preliminary Plat for King's Gate North Mobile Home Park, North of King's Gate Travel Trailer Condominium, Drawings Nos. 1-6, Revised March 9, 1976, Drainage Calculations March 8, 1976).

At the public hearing before the Planning Commission, some 300 residents of the King's Gate Travel Trailer Condominium petitioned the Commission to approve the special exception for the King's Gate Club Development. Evidently many of these people were prospective residents of the Club Development. Among other things, the petition stated, "We believe that the layout of the park, proposed elevations...are in keeping with good

planning and judgement." Also, there were some 20 letters to the Planning Commission from many of these same people requesting approval of the development.

After the hearing before the Planning Commission a revised preliminary development plan for King's Gate Club was submitted January 26, 1978. The County's comments on this plan eventually became the stipulations which the County Commission attached to its approval of the Special Exception Petition. The stipulations which address SWCWP-CPS, and the flood hazard of the development are as follows:

1. That the "no-spoil area" adjacent to this project and north of Structure No. 1 be enlarged to allow sheet flow during storm conditions and three cul-de-sacs be constructed to conduct this flow into the street system of the development;
2. Pads for the construction of mobile homes are elevated above the maximum storm flood elevation so that only the overflows will affect the street system, recreation area and similar low lying areas;
3. The engineer for this project in his construction plans show a means of lowering the level of lake in order to accommodate storage space;
4. A notice is submitted for the files of the local Civil Defense Authority stating that the roads in King's Gate Club Development are also used for drainage purposes and these roads are the only means of evacuation; and

5. The Civil Defense Authority be advised that this facility should carry a high priority on the evacuation notification procedure chart.

The County's comments on the revised preliminary development plan are set forth in an Inter Office Memorandum dated February 2, 1978 from Charles L. Goode, Transportation, Sarasota County, to Douglas James, Planning Department, Sarasota County; SUBJECT: King's Gate Club--Preliminary Plan. Those comments are repeated herein for the purpose of making a comparative-evaluation of the comments based upon hydrologic information available in the following reports and other sources of data. These data were available to the County and the developer's engineer at the time the developer was seeking County approval.

1. Office Memorandum from D. H. Esry, Party Leader, WMPP, SCS to J. A. Zilles, Work Unit Conservationist, SCS, Sarasota; SUBJECT: Watershed Protection--SWCW; February 16, 1960.
2. Data Sheet, SWCW--Tropical Storm Brenda, Thursday, July 28 to Monday August 1, 1960; Undated.
3. Data Sheet--Urban and Built Up Areas Inside and Outside Phillippi Creek Watershed Sarasota County Florida; Estimated Runoff Figures; Urban and Built Up Areas, Venice Vicinity; Undated.
4. Work Plan for Sarasota West Coast Watershed, Sarasota and Manatee Counties, Florida, USDA-SCS; March 1961.

5. Office Memorandum from H. T. Stanley, Assistant State Conservationist, SCS-Gainesville to A. Jacobsen, Area Conservationist, SCS, Sebring; SUBJECT: WP-PL566, Sarasota West Coast; September 27, 1971.
6. Letter from Jimmy D. Allison, State Design Engineer, SCS, Gainesville to S. M. Hopkins, Assistant Engineer of Drainage, DOT, Tallahassee; RE: SWCWP--Design Data for Areas Where I-75 Crosses Our Constructed or Proposed Improvements. December 29, 1971.
7. Subdivision Regulations, Sarasota County Planning Department May 15, 1973.
8. Dona Bay Study by Bernard E. Ross, Ph.D. August 1, 1973.
9. Bridge Design Data Sheets, Department of Transportation, dated April 25, 1974 and June 6, 1974.
10. Drainage Map, Sheets No. 2 and 3, Project No. 17075-3414, Department of Transportation. Undated.
11. Cow Pen Slough Flood Plain Study, Gator Creek Estates, Smalley Wellford and Nalven, Consulting Engineers. July 12, 1974.
12. Letter/Memorandum from William E. Austin, State Conservationist, SCS, Gainesville to Richard Balduzzi, District Conservationist, SCS, Sarasota; SUBJECT: Sarasota West Coast, Channel and Structure, Design Information. October 6, 1977.
13. Memorandum from SCS, Gainesville to Cyrus Bispham, District Supervisor, Sarasota Soil Conservation District; SUBJECT: Sarasota West Coast Watershed October 6, 1977.

Comments from County Transportation to County Planning on the revised preliminary development plan submitted January 26, 1978 were as follows:

1. The present design proposes that the no-spoil area adjacent to this project and north of Structure No. 1 be enlarged to allow sheet flow type of flows during storm conditions. The design further intends that three cul-de-sacs be constructed to conduct this flow into the street system of the development. The theory of this design is that a storm in excess of the ten-year storm flood will overflow into the development and through the streets in the development to Shakett Creek.
2. Storms of less intensity of the ten-year design for the structure on Cow Pen Slough will have no effect on the development.
3. Pads for the construction of the mobile homes are to be elevated above the maximum storm flood elevation therefore, only the overflows will affect the street system, recreation area, and similar low lying areas.
4. The lake in the development (see Figure 6) is intended to attenuate storm flows of storms of lesser intensity than ten years. It will be necessary for the engineer in his construction plans to show a means of lowering the level of the lake in order to accommodate storage space.
5. Recognizing that the streets in the project will be flooded periodically, albeit infrequently, it is our opinion that the project can be developed without undue harmful effect on the future occupants.

An evaluation of the information available in the previously listed sources of data on the hydrologic setting in the watershed, as it affects the flood hazard of the development was done for the Phase I Study. The following paragraphs describe the flood hazard situation surrounding the development.

The SCS designed the channel of CPS to carry slightly in excess of 1,000 cfs, but because it probably is somewhat overcut it may have a greater capacity. Structure No. 1 is designed to discharge about 1,800 cfs but may discharge as high as 2,200 cfs as water builds-up behind the structure. However, at a discharge of 2,200 cfs through Structure No. 1, bypass of the structure and overflow through the development would be occurring. The MAF at Structure No. 1 is estimated to be about 2,900 cfs (SCS Table dated September 14, 1978). The design highwater and extreme high-water for the 50- and 100-year floods at the I-75 crossing of CPS is 14.4 ft msl (feet, mean sea level) and 15.5 ft msl respectively (DOT design data). These data indicate that CPS will overflow through the King's Gate Club Development even during the MAF, a rather frequently occurring flood, and that during the 50- and 100-year floods the water surface elevation in the slough at the northern end of the development will be about 14 ft msl and 15 ft msl respectively. All floods including and in excess of the MAF will cause overflow (overbank sheet flow) through the development, and the streets in the development will be frequently flooded (see Figures 5 and 6).

The lake in the development will not be effective in attenuating storm flows; even of storms of lesser intensity than ten years. It was designed as part of the drainage system within the development and when empty has about 20 acre feet of storage capacity. Twenty acre feet of storage would only be adequate to store a discharge of 10 cfs lasting for a period of 24 hours.

Quoting from the SWCWP-Watershed Work Plan (pages 20, 30), the project was designed to remove within 24 hours the runoff (5.13 ins) from a 10-year 24 hour rainfall event (8.1 ins). The project was not designed to eliminate flooding but to remove excess runoff so that the period of inundation for a 10-year storm would be less than 24 hours (WWP, pages 21, 31). Even if the project had been completed, there would have been flooding of farming and pasture areas for up to 18 hours and 3 days respectively during minor floods and during design conditions the flooding would have been for 26 hours and 5 days respectively.

A project design that would reduce the discharge from a 10-year design storm event to bankfull discharge would require higher capacity channels and control facilities than the current SWCWP design requires. A project design that would reduce the discharge from a 10-year flood event to bankfull discharge would require still higher capacity facilities. The current SWCWP design probably is insufficient to handle even MAF conditions without overflow of the channel banks. The discharge for a 10-year flood event at Structure No. 1 is estimated to be about 2.5 times greater than the discharge for a MAF (SCS Table dated September 14, 1978).

The development has units adjacent to the left bank of CPS. The County's stipulation regarding enlarging of the no-spoil area on the left bank has been complied with. The spoil bank has been pulled-down for the entire length of the development along CPS. Structure No. 1 of the SWCWP is located about one-third of the distance along the western boundary of the development from south to north--the left bank of CPS. It is an island type structure designed to bypass flow in excess of the design discharge. The left bank overflow (bypass) will pass through the development.

SCS flow data for Structure No. 1 indicates a maximum design flow of about 2,200 cfs. A table entitled "Sarasota West Coast Watershed--Peak Flows Estimated From USGS Water Supply Paper (WSP) No. 1674," dated September 14, 1978, obtained from the SCS, gives the following data for Structure No. 1:

*Mean Annual Storm	2,900 cfs
5-Year Storm	5,200 cfs
10-Year Storm	7,300 cfs
25-Year Storm	9,900 cfs
50-Year Storm	11,800 cfs
100-Year Storm	13,800 cfs

\*NOTE: Wherever the word storm is used in this table it should carry the meaning of flood. WSP-1674 is a report on flood frequency rather than storm frequency.



The above discharges were estimated for then present (1978) conditions in the watershed which were the same as now; 14 miles (mi) of channel improvements installed plus three water control structures (one structure is non-functioning).

Elevations of the mobile home pads in the development are not known at this time. However, County requirements in this area are that they be above 11.0 ft msl which is the base flood level on the Flood Hazard Boundary and Flood Insurance Rate Maps. Design water elevation in CPS at the upstream side of Structure No. 1 is 11.0 ft msl at which elevation design discharge would be 1,036 cfs. The previously mentioned 2,200 cfs discharge through Structure No. 1 would occur at an elevation of approximately 13.5 ft msl as water builds-up behind the structure. However, left-bank overflow in the upstream vicinity of Structure No. 1 now begins at an elevation of approximately 12.5 ft msl. The structure may pass the MAF of 2,900 cfs; however, before that elevation is reached (approximately 15.0 ft msl) bypass of the structure will take place with both banks overflowing.

In the DOT design for the I-75 crossing of CPS just upstream of the northern boundary of the development, three surface drainage routes were utilized to convey flood flow from the watershed (DOT Drainage Maps Sheets No. 2 and 3, Project 17075-3414). The following table lists the drainage routes, the discharge for the 50-year flood ( $Q_{50}$ ), the design high water for the 50-year flood ( $DHW_{50}$ ), the discharge for the 100-year flood ( $Q_{100}$ ), and the extreme high water for the 100-year flood ( $EHW_{100}$ ).

STREAM	Q <sub>50</sub> (cfs)	DHW <sub>50</sub> (ft msl)	Q <sub>100</sub> (cfs)	EHW <sub>100</sub> (ft msl)
Salt Creek	3,040	6.5	3,605	7.0
Cow Pen Slough	1,900	14.4	2,280	15.5
<u>Fox Creek</u>	<u>1,400</u>	<u>12.0</u>	<u>1,680</u>	<u>12.5</u>
Total Flow	6,340		7,565	

The total estimated Q<sub>50</sub> for these streams is 6,340 cfs or (11,800-6,340) 5,460 cfs--46 percent less than the estimated Q<sub>50</sub> from the SCS table. The total estimated Q<sub>100</sub> for these streams is 7,565 cfs or (13,800-7,565) 6,235 cfs--45 percent less than the estimated Q<sub>100</sub> from the SCS table dated September 14, 1978. Another way of saying this is that the SCS flood discharges Q<sub>50</sub>, Q<sub>100</sub> are respectively 86 percent and 82 percent greater than corresponding DOT flood discharges.

Assume for a moment that the DOT design data are correct; certainly, it is conservative in the developer's favor because it does not depict the worst case situation for the development. With a DHW<sub>50</sub> of 14.4 ft msl and an EHW<sub>100</sub> of 15.5 ft msl, and knowing that the left spoil bank along the entire length of the development has been pulled-down; then at elevations of 14.4 ft msl and 15.5 ft msl water will be overtopping the banks and flowing through the development. From looking at the topographic map, it appears that at an elevation of 15.5 ft msl there probably would be overland, sheet-flow with the three streams interconnected. The DOT Bridge Design Data Sheet for Salt Creek mentions such interconnection at flood stages.

Street elevations in the development along the boundary which is common with I-75, range from 13.0 ft msl at the northeast corner to 9.0 ft msl at the southeast corner. These elevations compare to finished grade on I-75 of from 18.5 ft msl to 15.5 ft msl. The previously mentioned cul-de-sacs, which convey structure bypass flow and overflow from CPS to the street system of the development, are at elevations of 12.3 ft msl, and the adjacent roadway elevation is 12.0 ft msl. Overflow in the upstream vicinity of Structure No. 1 begins at an elevation of about 12.5 ft msl. All elevations are referred to msl (information excerpted from the Drainage Plan for King's Gate Club, Sheet 1 of 6, dated May 29, 1978; and, Drainage Map, Sheets No. 2 and 3, Project No. 17075-3414, Department of Transportation, undated).

After reviewing these data (SCS and DOT) as part of the re-evaluation study of the SWCWP (Phase I Study), it seems imperative that the District re-iterate the SCS concern over the potential flood hazard at the King's Gate Club Development as was pointed out at the onset of permitting of this development in a memorandum from the SCS--District Conservationist, Sarasota, to the County Engineer, dated February 17, 1976 "...it is evident that buildings and residences are planned in an area that was designed to flood during high-water conditions in Cow Pen Slough. It is my suggestion that a complete re-evaluation be made of the flows and their effects before disruptive and destructive conditions occur to this development and the Cow Pen Slough Watershed."

TECHNICAL SUPPORT/COW PEN SLOUGH WATER MANAGEMENT PROJECT

WORK ORDER: MANA-7/79-2/J.V.

on

COW PEN SLOUGH AND PHILLIPPI CREEK BASINS

for

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

by

SMALLY, WELLFORD & NALVEN, INC.

&

RUSSELL & AXON, INCORPORATED

October 1979

Project No. 1241-26

**Smally, Wellford & Nalven, Inc.**

CONSULTING ENGINEERS



**Russell & Axon, Incorporated**

CONSULTING ENGINEERS

P. O. BOX 2411 SARASOTA, FLORIDA 33578

October 25, 1979

Southwest Florida Water Management District  
5060 U.S. Highway 41 South  
Brooksville, FL 33512

Attn: Mr. R. V. McLean  
Project Manager  
Project Development Section

Subject: Cow Pen Slough and Phillippi Creek Basins

Your Ref: Technical Support/Cow Pen Slough Water Management Project  
Work Order: Mana-7/79-2/J.V.

Our Ref: 1241-26

Gentlemen:

Your letter dated August 31, 1979 authorized a review of pertinent features of the Cow Pen Slough and Phillippi Creek Basins, characterized by a number of specific questions in the letter. The explicit intent is to limit our analysis to "answers general in nature" relying on existing information without detailed evaluations.

We concur with the wisdom of an updated review like this in order for everyone concerned to get a clearer understanding of where matters stand today. In this way you may put a better handle on the direction to be considered for tomorrow.

The review distills our investigation of the available information. It consists of two parts. The first part is a general outline and the second part is addressed to your enumerated questions. A brief conclusion is included.

#### General Background

Valuable information goes back over fifty years, in bits and pieces, especially as to the Phillippi Creek Basin. It has been helpful for a review of this kind that for many years Smally, Wellford & Nalven represented the old Sarasota-Fruitville Drainage District which later was absorbed by Sarasota County, and for a long period thereafter we continued to be drainage consultants to the County. In addition to studies and projects directly for these public agencies and other services for private clients, we reviewed innumerable plans and studies prepared by other engineering agencies and firms relative to both public works

and private projects. This aspect is pertinent in that the knowledge and experience we have accumulated by being at the crossroads, so to speak, have been brought to bear on the specific reports and key points that will be discussed below.

For a graphical picture of the basins and their relationship, we have prepared three exhibits which are bound in the report.

Exhibit A - This exhibit has been adapted from our prior report covering the coastal basins of Sarasota County. It shows the juxtaposition of Cow Pen Slough and Phillippi Creek Basins.

Exhibit B - This exhibit shows Phillippi Creek basin and was adapted from another prior report.

Exhibit C - This exhibit shows the Cow Pen Slough project as originally presented in 1961, prior to construction.

The most significant reports covering the two basins over the last twenty-odd years have been freshly reviewed and are briefly summarized below. It should be kept in mind that with the number of different investigators involved at various time frames, the parameters and hydrological projections are not always consistent and opinions tend to differ along with evaluations of the effectiveness of such construction as occurred.

#### Prior Reports

Watershed Work Plan, Sarasota West Coast Watershed (Cow Pen Slough Water Management Project) Prepared with the assistance of the Soil Conservation Service of the U.S. Department of Agriculture, 1961. The stated objectives of the project described in the report are:

- A. "to reduce flood damage frequency in the vegetable producing area to about once in 10 years."
- B. "to provide adequate drainage and flood protection in the pasture lands to permit the production of improved pastures in the lower lying areas along the stream channels."

The Cow Pen Slough project was established by the U.S. Department of Agriculture for the benefit of agricultural lands, the requirements of which are not identical to those of more urban areas. It was to have a beneficial effect on Phillippi Creek in that it was intended to divert 735 cubic feet per second of storm water from the upper portion of that basin, which at that time was devoted to agricultural uses, to Cow Pen Slough. This was to be accomplished by the use of the pumping station to be constructed on Bee Ridge Road.

#### Commentary

The canal system has never been completed. The plan called for 21 miles of main channel and two laterals, of which 13 miles of the main channel have

attempt to relate the findings to runoff aspects and storm flows produced by Cow Pen Slough. The team was comprised of specialized ecological scientists and accordingly is heavier on environmental matters than engineering. The findings are clearly engineering-related and this is a valuable contribution toward future conclusions that could embrace all of the complex matters and lead to reasonably satisfactory solutions. The studies identify locally generated adverse effects on the bays from seawalls and septic tanks, but conclude that the greatest contributor is heavy flood flows from Cow Pen Slough, which also carry fresh water weeds and sediments. Flora and fauna have been seriously affected.

The report cautions against further channelizing, including re-routing of any flood water from the Phillippi Creek Basin. In this connection, evidence is adduced of pollutants arising from agricultural operations. The report recommends reduction of siltation, especially from eroding banks, control of weeds and other measures. Tighter regulation of urban development and practices is also advised. Of particular interest to this review are suggestions for what may be summarized as attenuation and impoundment measures along the slough.

Commentary

There has been no implementation of the recommendations in the report, but they include significant findings which should be incorporated in further steps.

Other Water Management Material. As noted in the opening remarks, we have an accumulation of other materials related to this subject, together with corresponding general knowledge and experience. Specifically as to the Cow Pen Slough project, we performed surveys and prepared right-of-way maps. As to the Phillippi Creek Basin, our work for Sarasota County remains the main guideline even though it needs updating in some respects.

Responses to Questions in Letter of August 31, 1979

In responding to your letter dated August 31, 1979, we have attempted to answer the enumerated questions in a manner which we believe will be helpful in planning future steps. For a review like this it is necessary to generalize to a degree. Definitive analysis would require an intensive study well beyond the scope of this one.

1. "How has the flood flow hydroperiod changed from preconstruction to post-construction of the completed works?"

The "time of concentration" for a flood has been cut approximately in half by the construction of the project, meaning that storm water arrives at Dona Bay from the upper reaches of the basin in about half the time. This has changed the ratio of fresh to salt water in Dona Bay.

2. A. "To what extent would flooding be reduced in Phillippi Creek if the existing pumping station were made operational as planned? Use the storm the system was designed for as a reference."

The pumping station was intended to relieve (but not prevent) flooding of agricultural areas in the upper portion of the basin, in keeping with statutory limitations upon the U.S. Department of Agriculture. The greatest effect is in this upstream location, and diminishes downstream through the urbanized areas.

Flooding occurred throughout the Phillippi Basin in the late Fifties and early Sixties. The worst damage occurred in the Oak Shores area at the head of Phillippi Creek itself, where many houses were under five to six feet of water. We have indicated four points on Exhibit B and have estimated a reduction in flow which would relate to flooding for these points. The computation is based on the criteria used in our work prepared for Sarasota County. The percent reductions would be approximately as follows:

<u>Point</u>	<u>Percent Reduction in Flow</u>
Farm Area	27
Cattlemen Road	9
McIntosh Road	8
Oak Shores	7

2. B. "To significantly reduce flooding in the Phillippi Creek Basin, what size pumping station would be required?"

Any major flow reduction would provide significant flood relief within the context of the disastrous 1962 storm, but to really alleviate the threat as much of a reduction as 5,000 cubic feet per second might be required. Directing this large flow (or anything like it) to Cow Pen Slough would greatly aggravate the problems in that basin and ultimately in Dona Bay. A pumping station to handle 5,000 CFS would be very costly to build and operate, with a capacity of about seven times the existing unused one.

In the light of existing conditions, any pumping plans should be considered only within the context of impoundment to attenuate the channel flow rate. The Mote report emphasizes the pollutant problem attendant to flood water from agricultural areas, and impoundment might provide an opportunity for simultaneous pollution abatement.

3. A. "Discuss a possible operation plan that could be established with the existing structures (if all three were in working order) to reduce storm water impacts to Dona Bay."



Putting the existing structures in good working order would be a constructive step which probably should be undertaken. However, in order to reduce storm water impacts on Dona Bay, far more storage than the channel affords would be needed. Such storage might be provided by allowing temporary flooding of low-lying adjacent lands. The original project plan called for "no-spoil" openings in the dikes for the purpose, based on the principle that agricultural lands usually can stand submergence for short periods. It is our understanding that the system has not been operating in this manner.

Impacts due to silting need other measures, especially stabilizing of channel cross sections. It has been clearly established that pollution and floating weed materials must also be considered.

3. B. *"Discuss possible additional protection that could be obtained if some optimum number of structures were added to the system. (Optimum number based on your knowledge of the subject.)"*

Additional structures would add some wedge storage between structures, but the corresponding reduction in storm runoff rates would probably not justify the cost of construction and the operation and maintenance program. Storage capacity within the channel is just too limited to begin with and the relief potential of the project would lie in allowing adjacent low-lying lands to flood temporarily, as noted above. An "optimum number of structures" cannot be determined under present conditions and is probably academic under the circumstances.

### Conclusions

The questions posed by your August 31, 1979 letter are a logical outgrowth of the underlying concerns that have developed over the years. Phillippi Creek's flooding problem has made itself painfully evident in the past, and with few measures for relief, large flood-prone areas will be facing disaster when the weather cycle returns to seasons of heavy rainfall. The basin drained by Cow Pen Slough, on the other hand, is suffering from problems at the Dona Bay outlet, which have worsened due to incomplete project construction. During the years that have elapsed there have been changes not only in the landscape by development and other factors, but perceptions of environmental effects have led to public policy changes involving modified or new approaches.

Having had the opportunity to make this overview under the stimulus of your questions, we have developed the following conclusions which we think are pertinent to the concerns behind them.

- I. Past information and reports are so outdated that they cannot be applied quantitatively to decisions that need to be made for solving the complex and inter-related problems that have been inherited. There exist a lot of sound material

and elements of some of the measures to be taken, which would be helpful for an update. For example, the intensive studies of Phillippi Creek (which remain useful in many ways) allowed for future accelerated runoff resulting from full urbanization. However, subsequent public policy has required attenuation of the rate from new subdivisions.

- II. The flooding of one basin cannot properly be alleviated by transferring excess water to a contiguous basin, if that transfer will aggravate an already overburdened condition in the receiving basin. Activating the existing pumping station in the upper Phillippi Creek Basin would be of insufficient help to the flooding downstream and would add pollutants as well as more water to Cow Pen Slough. Conceivably impoundment in the upper basin of Cow Pen Slough might be used for both aspects, but this concept would need detailed study as only one possibility among a number deserving investigation.
- III. We believe that an updated review of the Phillippi Creek Basin will confirm that its carrying capacity must be increased to the maximum allowed by environmental limitations, for a solution to flooding within economic reason. Essentially, this would mean deepening the channel within its banks and not altering the natural alignment, except possibly in localized situations.
- IV. Impoundment and modifying basin features are not new ideas. The original work for the Sarasota-Fruitville Drainage District incorporated impoundment areas, and the natural boundary of the basin was further to the east, the present "ridge" being a dike that was built half a century ago. Impoundment of low-lying lands was intended to alleviate downstream flooding by Cow Pen Slough. In fact, the main new concern is for environmental effects arising from pollution, siltation and aquatic growths. The leaders of the past were not faced with the population concentrations and other problems brought about in recent times. Impoundment-related measures are the most fruitful, economical approaches to the environmental considerations.

Open land in the lower reaches of Phillippi Creek is not available for impoundment. Impoundment opportunities should be considered elsewhere in the basin, including a fresh look at the concepts covered by our 1966 report on a "Pumped Impoundment System", which would be hampered by subsequent development and higher costs.

The Cow Pen Slough Basin appears to have good potential for impoundment, both upstream and downstream. Transfer of some flood water from the Phillippi Creek Basin could be considered if upstream impoundment were particularly favorable.

- V. A comprehensive study should cover both basins simultaneously, because of their existing interrelationship and potential changes. The areas affected are both overdue for solutions, or at least a rational plan of action for orderly implementation.

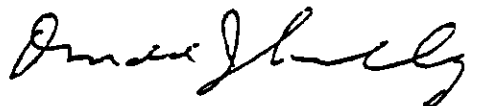
Compartmentalized outlooks should be avoided. Because of federal statutes and policies, the Corps of Engineers could not address itself to agricultural aspects, and the Soil Conservation Service had to focus almost exclusively on agricultural aspects.

Prior reports revealed the disadvantages of this division. This is not to say that the same criteria should apply to urban and agricultural areas. On the contrary, the differences should be recognized. The point is that there are effects of one on the other that need to be accounted for in an overall program.

- VI. Although we have observed that the Cow Pen Slough project structures are not the answer to the current problems, we believe that the project is due for a careful, updated analysis. Improvements are needed. Beyond the structures themselves, an example is a crying need to stabilize banks to greatly reduce siltation. Furthermore, the operating processes of the project need to be looked into carefully. If the originally planned relief by impoundment has been found to be impracticable, it should be recognized, especially in the light of the impoundment study suggested above.
- VII. Whatever other measures are ultimately employed, it should be economically feasible to provide sand traps in the channels so that siltation would be controlled where it can be readily removed. For example, this step could be readily taken in Main A (above the head of Phillippi Creek) and above Dona Bay. Possibly aquatic weed trapping could also be incorporated.
- VIII. Any studies should be in collaboration with qualified environmental specialists. Affordable programs undoubtedly will require some compromises which can best be pointed to by mutual input from the start. Dona Bay would not only be affected by opening the channel but by what happens all the way upstream, including the impoundment features.

We trust that this report will serve your present purpose. We should be pleased to discuss it further if you should so desire.

Yours very truly,



Donald J. Smally, P.E.

For: THE JOINT VENTURE ENGINEERS

DJS:ba

Attachments

PRELIMINARY EVALUATION  
OF THE SURFACE-WATER  
SUPPLIES IN THE  
COW PEN SLOUGH AREA

By  
Leon Scarbrough  
and  
C. F. Hains

Prepared For:  
The Manasota Basin Board  
of the Southwest Florida  
Water Management District

Prepared By:  
Hydroscience Research Group, Inc.  
2928 Franklin Street Suite 3  
Lakeland, Florida 33801

January 1980

## INTRODUCTION

On July 31, 1979, the Southwest Florida Water Management District authorized the firm of Hydrosience Research Group, Inc. to conduct a preliminary evaluation of the surface-water supplies in the Cow Pen Slough Area, Sarasota County, Florida. The results of the preliminary evaluation are contained in this report which is submitted in fulfillment of the agreement between the Southwest Florida Water Management District and Hydrosience Research Group, Inc.

## PURPOSE AND SCOPE

The purpose of this preliminary evaluation was to evaluate the water quality, water quantity, and the potential yield of water from Cow Pen Slough, Phillippi Creek, and the Myakka River, under a given set of variable limiting factors. The scope of work included the collection and evaluation of all existing and available data on water quality and water quantity of the selected streams, and the evaluation of appropriate methods of diverting and capturing large amounts of water for future use.

The recent and present rate of urban and agricultural growth in Sarasota County within and adjacent to the Basins of Cow Pen Slough, Phillippi Creek, and the Myakka River has dictated the need for new water supplies as well as flood control measures to meet the future needs of the county. Information and data provided in this report gives a preliminary evaluation of the surface-water potential and methods of possible development of selected streams to determine the availability of possible future water supplies and, in turn, solve the flooding problems.

The purpose and scope of this preliminary evaluation is enhanced by the long-term data available on both water quality and water quantity parameters of the three streams. The possibilities of producing a new water supply needed for future development and, by doing so, alleviating potential flooding problems, makes the area of study a unique setting in surface-water hydrology.

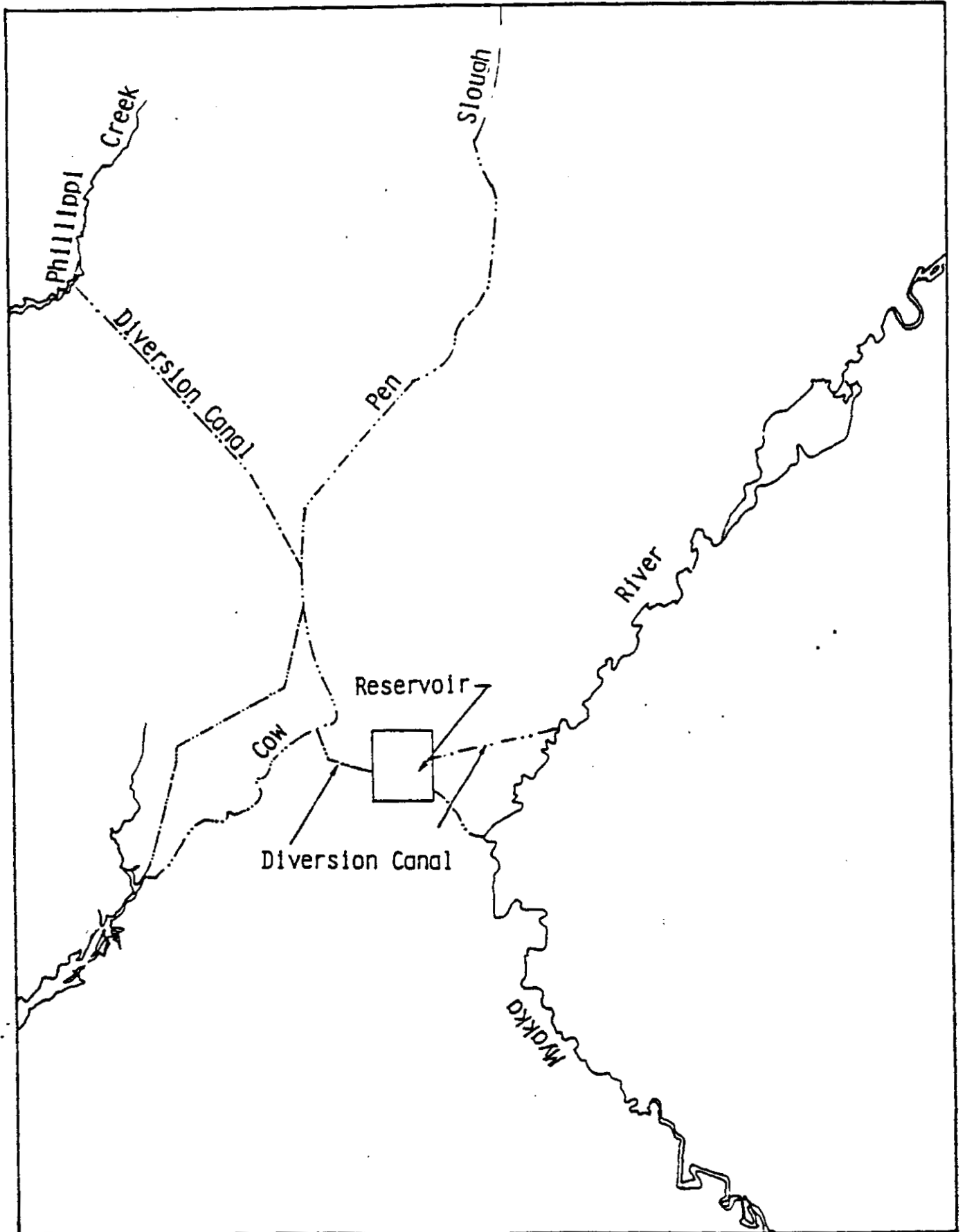


FIGURE 11 SCHEMATIC OF STREAMS AND PROPOSED RESERVOIR SITE

each basin in order to obtain hourly rainfall records, as well as gaged daily discharges for use in a rainfall / run-off model similar to the Stanford Watershed or Georgia Tech rainfall / run-off models. It is not believed, however, that much improvement would be obtained in the long-term figures of water availability in these streams.

If diversion is not to be made at exactly the points where the daily discharge records have been collected, it is possible to transfer these figures, adjusted for the size of the basin at any point of development, to other diversion points. Lacking the exact locations of where pumping stations might be placed, the water availability data was developed for the gaging station sites.

The computations of yields for any of the three streams pumped separately or for the whole development channelled into a single off-channel reservoir made certain assumptions that may be pursued to greater detail in a later phase of the study. All variations of pump capacities on each stream, all reservoir sizes, and all possible sizes of the pumps required for delivering the water to be used at the various water plants could not possibly be considered, but it is believed enough choices of each variant was considered that the feasibility of future development can be ascertained and further studies considered.

## CONCLUSIONS AND RECOMMENDATIONS

### Water Quality

From the existing U.S.G.S. water quality data, the waters of Cow Pen Slough and Phillippi Creek, together or independently, appear to be of suitable quality for use as a water supply. The existing data on parameters that could be problems such as color, pH, etc., are treatable.

A more detailed sampling program, along with concurrent discharges, is highly recommended before any new development is initiated. The sampling

program should include trace elements, nutrient loading, coliform bacteria, toxins, and viruses, because of the potential influence of sewage discharges and sanitary landfills in the area of both streams. The Myakka River does have water quality problems. An example is that all of the trace inorganics exceed Drinking Water Standards, and the treatment to bring these elements within the Standards could be very difficult.

A detailed sampling program to further study trace inorganics, Nitrates, and Fluorides, is needed to complete a water quality evaluation of the Myakka. It is also recommended that trace elements along with concurrent discharges be sampled to determine if the problems are as great as indicated by this preliminary study, and if so, can the problems be solved?

#### Water Quantity

##### Cow Pen Slough and Phillippi Creek:

The evaluation of Cow Pen Slough and Phillippi Creek as potential water supply sources required the development of statistics based on actual, extended, or transferred data. These data show the two streams to certainly be qualified as potential sources for surface-water supply development, especially during the wet season (June through December).

##### Myakka River:

The larger of the three streams can be used as a supplementary source of water for off-stream storage during the periods when Cow Pen Slough and Phillippi Creek cannot support the reservoir. The mixing and dilution of the three streams will help solve minor water quality problems. The Myakka River could possibly act as the receiver stream for flood control measures in the total proposed system, as shown in Figure 11. The existing water quantity data indicates the Myakka, as a single source, could support an off-stream reservoir.



## Diversion and Storage

The variables included in this preliminary study (as shown in Figure 11 and Tables 13A - 13F), are assumed to give a base for computations. The assumptions were made from basic surface-water hydrology background and meetings with the District Staff. The preliminary data, using the assumptions, is of course, extreme in some cases to look for possible faults in the development approach. The system, as outlined in this report, is feasible by using both Cow Pen Slough and Phillippi Creek and supplementing the supply with the Myakka River, to supply the storage reservoir. A portion of the potential flooding problems associated with the two smaller streams can be solved by the diversion and storage system because the Myakka River can handle the overflow at peak flood periods.

It is recommended that if future studies are carried out, the needs for water use in the area of development should be the base for design criteria; for example, the exact size of a reservoir needed to supply the needs of the area will dictate pump sizes, diversion canal sizes, and the control structure needed to handle peak flood events.

This preliminary report deals with a potential water supply system, using Cow Pen Slough, Phillippi Creek, and the Myakka River, because of flood problems on the two smaller streams. In the future, evaluations should be made and considered on the following:

- 1) A Cow Pen Slough - Myakka River Reservoir
- 2) A Myakka River Reservoir
- 3) A combination of Cow Pen Slough and Phillippi Creek

The possibilities of combinations that are feasible are great because these preliminary studies indicate that a considerable amount of water is available and may be developed from surface streams in the Manasota Basin. Also, any water developed will require certain treatment, as is expected for any surface-water use. Therefore, the best combination for future study would be a management decision and depend on needs, economics, (treatment of waters and construction costs) and long-term feasibility.

TABLE NO. 13 WATER AVAILABLE FOR USE FROM OFF-CHANNEL RESERVOIR WITH VARIED FIGURES FOR STORAGE, ALLOWABLE DIVERSION, DIVERSION PUMP CAPACITY, AND USE:

13A Reservoir Storage Capacity, 500 CFS-Days

DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	7.75	8.76	9.19	12.1	15.0	16.0	19.5	28.7	32.2
100	7.75	8.76	9.19	12.1	15.0	16.0	19.8	28.9	32.4
200	7.75	8.76	9.19	12.1	15.0	16.0	19.8	28.9	32.4
500	7.75	8.76	9.19	12.1	15.0	16.0	19.8	28.9	32.4

13B Reservoir Storage Capacity, 1,000 CFS-Days

DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	8.67	9.40	9.71	13.7	16.2	17.2	20.3	30.5	34.0
100	8.67	9.40	9.71	13.7	16.2	17.2	21.2	30.8	34.3
200	8.67	9.40	9.71	13.7	16.2	17.2	21.2	30.8	34.3
500	8.67	9.40	9.71	13.7	16.2	17.2	21.2	30.8	34.3

\* For this preliminary analysis the allowable diversion in percent of flow is considered the same for all three streams (Cow Pen Slough, Phillippi Creek and Myakka River). Also for this preliminary analysis the pump capacity to be installed at all three streams will be the same.

TABLE NO. 13 (Continued). WATER AVAILABLE FOR USE FROM OFF-CHANNEL RESERVOIR WITH VARIED FIGURES FOR STORAGE, ALLOWABLE DIVERSION, DIVERSION PUMP CAPACITY, AND USE:

13C Reservoir Storage Capacity, 2,000 CFS-Days

DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	9.75	10.0	10.0	15.7	17.9	18.6	21.7	33.2	36.9
100	9.75	10.0	10.0	15.8	17.9	18.6	22.9	34.0	37.3
200	9.75	10.0	10.0	15.8	17.9	18.6	23.3	34.1	37.4
500	9.75	10.0	10.0	15.8	17.9	18.6	23.3	34.1	37.4

13D Reservoir Storage Capacity, 5,000 CFS-Days

DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	10.0	10.0	10.0	18.7	20.0	20.0	22.4	37.5	42.1
100	10.0	10.0	10.0	19.1	20.0	20.0	26.2	40.4	43.3
200	10.0	10.0	10.0	19.3	20.0	20.0	27.0	40.7	43.3
500	10.0	10.0	10.0	19.3	20.0	20.0	27.1	40.7	43.3

\* For this preliminary analysis the allowable diversion in percent of flow is considered the same for all three streams (Cow Pen Slough, Phillippi Creek, and Myakka River). Also for this preliminary analysis the pump capacity to be installed at all three streams will be the same.

TABLE NO. 13 (Continued). WATER AVAILABLE FOR USE FROM OFF-CHANNEL RESERVOIR WITH VARIED FIGURES FOR STORAGE, ALLOWABLE DIVERSION, DIVERSION PUMP CAPACITY, AND USE:

13E Reservoir Storage Capacity, 10,000 CFS-Days

DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	10.0	10.0	10.0	19.9	20.0	20.0	22.4	39.4	45.9
100	10.0	10.0	10.0	20.0	20.0	20.0	27.9	46.0	48.6
200	10.0	10.0	10.0	20.0	20.0	20.0	30.3	47.1	48.7
500	10.0	10.0	10.0	20.0	20.0	20.0	30.8	47.4	48.7

13F Reservoir Storage Capacity, 15,000 CFS-Days

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DEMAND RATE Diversion Pump Capacity in CFS *	10 CFS			20 CFS			50 CFS		
	Allowable Diversion *			Allowable Diversion *			Allowable Diversion *		
	10%	30%	50%	10%	30%	50%	10%	30%	50%
50	10.0	10.0	10.0	19.9	20.0	20.0	22.4	39.7	47.3
100	10.0	10.0	10.0	20.0	20.0	20.0	27.9	48.5	49.8
200	10.0	10.0	10.0	20.0	20.0	20.0	31.2	49.3	49.8
500	10.0	10.0	10.0	20.0	20.0	20.0	32.0	49.5	49.8

\* For this preliminary analysis the allowable diversion in percent of flow is considered the same for all three streams (Cow Pen Slough, Phillippi Creek, and Myakka River). Also for this preliminary analysis the pump capacity to be installed at all three streams will be the same.