Solving Chronic Flooding in Naples Park

Stormwater Management / Drainage Considerations

INTRODUCTION

The development of the Naples Park began in the 1950s during an era where the subdivision of land in Florida was largely unregulated. Unlike today, there were no county or state regulations to ensure that heavy rains would not flood the lots, or overwhelm or pollute receiving waters.

Because an effective master drainage plan was never designed or built, some parts of Naples Park continue to suffer repeated flooding, even from normal summer rainstorms. From the system that exists today, it appears that the design intent was to rely on a system of roadside ditches located along each of the avenues to collect rainwater from yards and streets and hope that it eventually infiltrated into the ground or flowed to larger deeper ditches located on the back lot lines of 91st/92nd Avenue and along 8th Street. For the westerly portions of Naples Park, the roadside ditches flow toward pipes under Vanderbilt Drive that discharge directly to Vanderbilt Lagoon.

The most visible part of a modern stormwater management system is usually a series of lakes into which stormwater flows before being discharged off-site. However, the lakes are just part of a system that typically consists of three elements; drainage, water quality treatment, and water quantity attenuation:

-The drainage element of a system is designed to provide protection from flooding. The lowest floors of buildings are usually protected from the heaviest storm expected during a 100-year period (usually by elevating the lowest floor), while roads are usually protected from the heaviest storm expected during a 10-year period using a carefully designed internal drainage system.

-The water quality treatment element of a system removes a percentage of pollutants from stormwater runoff, such as oils, greases, eroded soil, general trash, and yard waste. This removal protects downstream waters from unnecessary pollution.

-Water quantity attenuation is provided so that downstream waters receive flows at predevelopment rates; without attenuation, their capacity will be overloaded by the increased rates of runoff rates caused by urbanization.

Attenuation is much less important in the case of Naples Park because receiving waters are tidal in nature and have an enormous capacity to accept heavy volumes of water. However, the other two elements are extremely important for the Naples Park drainage system, but they were only minimally proposed and incompletely implemented during the original development of Naples Park.

Naples Park had unpaved roads for many years. When they were paved, the roads weren't rebuilt. Asphalt was placed on top of the road base to the extent possible, rather than being reconfigured to accommodate a modern drainage system. Thus even today the roads and roadside ditches seem to follow the elevation of the original road base, which generally follows the original topography of the land, rather than being sloped properly to avoid low spots that are virtually guaranteed to flood during heavy rains.

As individual lots were developed, driveways were installed across the ditches, usually with a culvert pipe to allow water to flow under the driveway. Sometimes the entire ditch was filled, usually with a drainage pipe to allow water to flow. In this kind of system, flow can be interrupted by even a single pipe that is too small, damaged, plugged up, or simply installed at the wrong elevation. Given this sequence of events and the relative lack of a master plan to follow, it is not at all surprising that the original drainage system has proven inadequate to support the amount of development that has now arrived in Naples Park.

ENGINEERING STUDY OF NAPLES PARK AREA DRAINAGE SYSTEM

By the 1980s, the drainage problems being experienced today were already apparent. At the urging of Naples Park civic organizations, the Board of County Commissioners in 1987 hired Agnoli, Barber, & Brundage, Inc. to prepare a preliminary engineering study for the entire Naples Park drainage system.

This study was to address the increasing drainage problems throughout Naples Park as well as aesthetic and safety concerns associated with the major open drainage ditches located on 8th Street and the rear lot lines between 91st and 92nd Avenues.

The final report, issued in June 1988, recommended certain improvements classified as "primary" and "secondary" drainage improvements. The primary improvements were related to the major ditches located on 91st/92nd Avenue and 8th Street; the secondary improvements were to be located primarily on the avenues (the smaller roadside ditches and driveway culverts).

Because of the potential environmental impacts, extensive permits are required for all drainage improvements (see Figure 4-1 for a summary of permits for Naples Park).

NAPLES PARK PERMITTING SUMMARY

Florida Department of Environmental Regulation *(now Florida Department of Environmental Protection)*:

Collier County was issued DER Permit #11-1714815 on August 30, 1990, which permitted the filling and piping of the 8th Street and 91st/92nd Avenue ditches. This Permit came with a Special Condition #8 which required Collier County to place a permanent prohibition on the practice of filling the minor roadside swales and replacing with closed drainage and pipes.

This Permit was modified in May 1995, and a new Permit number, 11-2698535, was issued. The purpose of the modification was to change the Permit expiration date from August 30, 1995 to August 30, 2000. All other conditions of the original permit remained in place.

On June 26, 1997, the Permit was modified to permit a pilot swale enclosure project using the cross section contained in Collier County Ord. No. 98-1. This modification was issued Permit # 11-3019365.

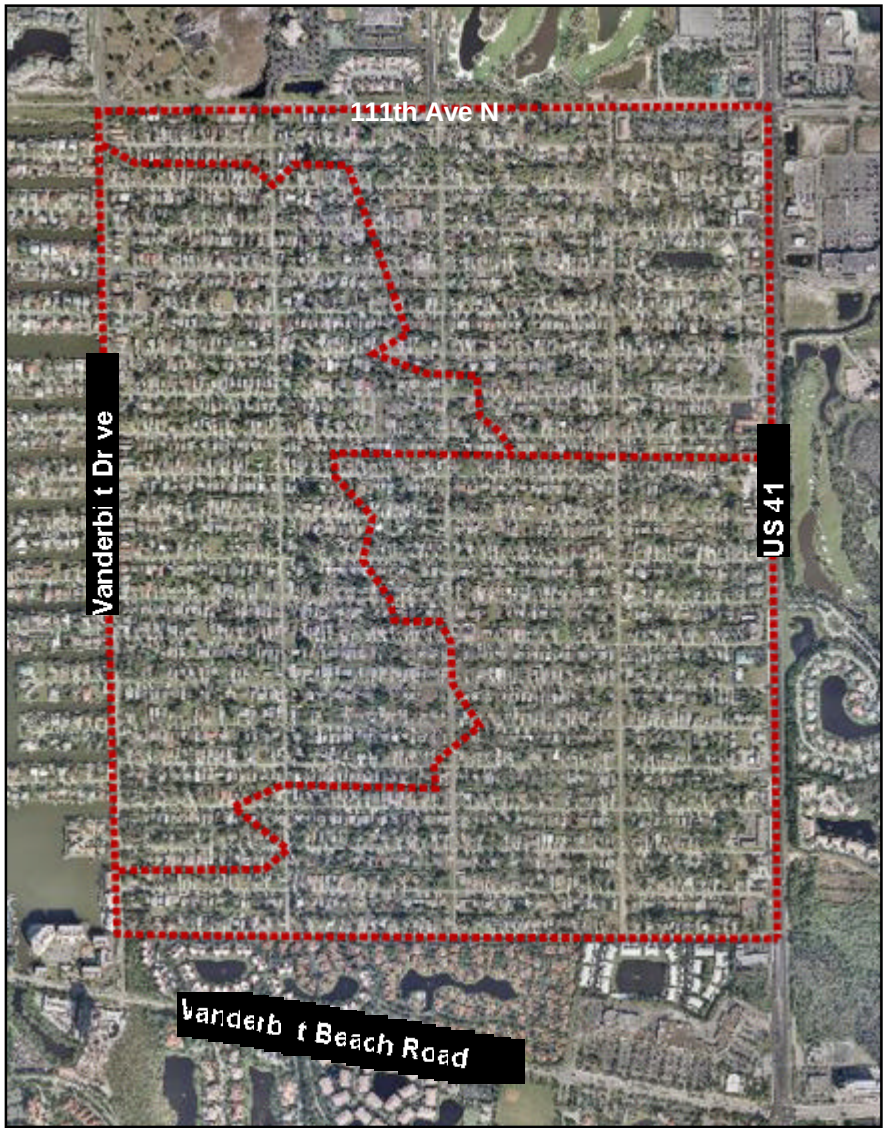
On March 26, 1998, a permit modification was issued (11-0134257-001) which deleted several special conditions required by permit #113019365 dealing with water quality testing. We believe this testing program was discontinued due to no swale enclosures occurring.

The Permit authorizing the work expired on August 30, 2000.

South Florida Water Management District:

The SFWMD issued permit # 11-00573-S on August 10, 1989.

Figure 4-1



The above map displays the three identified drainage areas within the neighborhood.

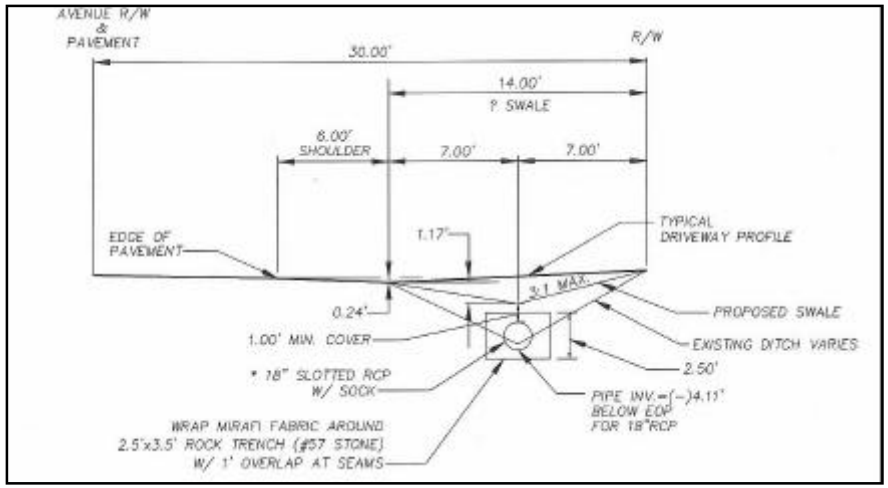
Recommendations, Improvements, and Actions of 1988 Study.

The Study recommended improvements to the Primary and Secondary systems to address adequate drainage and safety concerns. The study identified three major outfalls serving the neighborhood. These are generally comprised of:

1. An area west of 7th Street which drains westerly to the finger canals along Vanderbilt Drive (Vanderbilt Lagoon Basin - 281 acres "),
2. An area east of 7th Street and north of 102nd Avenue which drains northward via an outfall ditch to the Cocohatchee River (North 8th Street Basin - 212 acres "), and
3. An area east of 7th Street and south of 102nd Avenue which drains southerly via a ditch along 8th Street and then westerly between 91st and 92nd Avenue to Vanderbilt Drive where it discharges through twin 30" culverts (South 8th Street Basin - 301 acres ").

The 301-acre area does not include the 101-acre Beach Walk and Pavilion developments which outfall into the South 8th Street Basin. The total area of the three basins is approximately 795 acres.

The recommendations for improvement to the Primary system were implemented in Spring of 1997. The 8th Street ditch was fitted with a closed drainage system of varying size terminating with an 84" round culvert at the north end of the neighborhood (111th Avenue). The flow from this culvert was routed to a new ditch. This required an easement from the Section 21 property owner and the ditch construction upon his property. The new outfall ditch routed flows north to wetlands adjacent to the Cocohatchee River for outfall to tide. This ditch was subsequently replaced with a lake system within the Section 21 golf course. The 91st/92nd Avenue ditch was fitted with a closed drainage system of varying up to 84" in size, terminating at its outfall to Vanderbilt lagoon.



Technical cross-section that is included in County Ordinance No. 98-1 (See drawing enlarged in Appendix C)

The ***Primary System*** consists of the major outfall ditches and culverts.

The ***Secondary System*** consists of roadside swales and driveway culverts within Naples Park.

-As defined in the Drainage Study of Naples Park Area Drainage System, Prepared by Agnoli, Barber, and Brundage, Inc.-

The Primary system was designed exclusively to provide drainage function. It was sized to provide 10-year protection for the roads within Naples Park. The Primary system was not designed for any stormwater attenuation or water quality treatment purposes. The main water quality, and to some minor extent, attenuation components of the system were the existing roadside swale systems in place on the avenues. The roadside swale system did not provide water quality treatment meeting the standards in place at the time, nor currently, but they were thought to provide some treatment and scrubbing effect on the stormwater prior to discharge to the estuarine systems. For this reason, a condition of the original Department of Environmental Regulation (DER) permit for parts of the work required the County to adopt a permanent prohibition to prevent any subsequent filling and piping of the roadside swale system, as was the historic practice to varying degrees throughout the neighborhood.

The Secondary improvements recommended in the report were assumed to require physical improvements to the ditches on about one-third of the length of the avenues. The exact location of those improvements were not identified at that time and no further study has taken place to date. The improvements recommended consisted primarily of culvert replacement and swale grading and shaping, as well as providing for proper hydraulic connections to the Primary system. The Secondary system recommendations did not delete any of the roadside swales, but rather provided the proper capacity within the confines of an open drainage system. As such, the Secondary system modifications proposed were consistent with the terms of the permanent prohibition in place regarding filling of roadside swales and could be implemented as maintenance to the existing system.

Due to public desire and displeasure with the aesthetics and safety of the open swale system, a negotiation with the DER resulted in the design of a replacement special cross section which would allow the swales to be eliminated and replaced with an underground system capable of providing the matching water quality treatment, while at the same time addressing the drainage capacity issue. The special cross section in question was adopted by the Collier County Commission and is included in County Ordinance No. 98-1. (See copy of Special Cross Section in Appendix C) To the best of our knowledge, however, the installation of the special cross section has not been implemented due to its high cost per linear foot and the potential conflict with existing utilities.

Implementation of this cross section would eliminate the roadside swales to a great extent (only a shallow collection swale would remain) and allow for the installation of the community character elements such as street trees and sidewalks.

ADDITIONAL STUDY - NAPLES PARK COMMUNITY PLAN - 2002

A key element identified by the residents during the Naples Park Community Plan conducted in late 2002 was the drainage improvements necessary to prevent the recurrent isolated road flooding along the avenues that occurs in various parts of the neighborhood. Other key elements desired included alterations to make the neighborhood more attractive and pedestrian friendly. The combination of these two factors led to the conclusion that alternatives to enclose the Secondary drainage system throughout the Park should be examined.

Three alternatives were considered by this study, and are described in detail in the following sections. They are:

Alternative A: Completion of the Phase II elements of the Naples Park Drainage Study as stated in the 1988 study *(keeping the existing swales)*;

Alternative B: Completion of the improvements made possible by Collier County Ordinance 98-1 *(replacing the existing swales)*;

Alternative C: Modification to Alternative II, above, implementing new technology *(replacing the existing swales)*.

Alternative A

The first alternative considered was simply to construct the Secondary drainage improvements directed by the 1988 Drainage Study. These improvements consist of regarding swales and replacing damaged and undersized culverts in approximately 1/3 of the Naples Park area. This alternative is the least costly option to address the drainage concerns of the subdivision, but does nothing to advance the other planning directives. A cost opinion of this alternative is presented in Appendix C

This option will NOT enclose the existing open drainage system.

Pro: This alternative is relatively inexpensive and will address the primary concern of providing adequate drainage. The alternative can, most likely, be constructed under the guise of right-of-way maintenance.

Con: The alternative does not permit the installation of the other Community Plan elements.

Alternative B

Next, the alternative involving implementation of the special cross section given in County Ordinance 98-1 was considered. The special cross section included within the ordinance would allow for all of the swales within the project to be enclosed using a "Rock Trench" design incorporating a slotted pipe located under a shallow swale for local drainage purposes. This design meets both needs previously mentioned. It provides for adequate drainage, while allowing the swales to be covered and eliminated to a great extent, and provides an approvable level of stormwater quality treatment. This alternative is by far more expensive than the first option, but achieves all of the desired goals of the Community Plan. A cost opinion of this alternative is presented in Appendix C.

This option WOULD enclose all open swales.

Pro: This alternative achieves all of the elements identified in the Community Plan. The alternative has received agency approval in the past and has been accepted by Collier County approval staff as well.

Con: This alternative is more costly than the alternative A, by an approximate order of magnitude of 10. The alternative may need further review and approval from State agencies.

Alternative C

A third alternative, which is a modification alternative B, replaces the rock trench and perforated pipe with a solid pipe and inlets. Each inlet would be fitted with a pollutant skimmer device. (example shown, right) These devices are relatively new to the field of stormwater treatment and were not available when the initial Naples Park Drainage Study was done. They are most often used in today's designs in projects such as golf course clubhouse parking areas, and have been approved as an alternative to the ½ inch of dry pretreatment required on highly impervious projects or projects with high vehicular use. The "inlet skimmer" devices include a boom of fabric similar to those used in marine fuel spills to absorb floating oils and grease, as well as a sediment basin for suspended solids capture. These boxes do little to remove nutrient loading, however the technology exists to replace the fabric boom with one containing activated charcoal for nutrient capture purposes. These devices are most often used in stormwater retrofit applications. A cost opinion of this alternative is presented in Appendix C.

This option WOULD enclose all open swales.

Pro: This alternative achieves all of the elements identified in the Community Plan, is similar in nature to Alternative B, but represents a small cost savings. The system would be more reliable than Alternative B since all maintenance could be performed without excavation with man labor from ground level.

Con: The alternative is subject to further review and approval from State agencies and may experience resistance for approval. The alternative will require an increased level of maintenance after installation that would tend to erode the potential up front savings over alternative B.

An example of a pollutant skimmer device, which would be used with Alternative C.

Recommendation of Preferred Alternative

The preferred alternative from a long term maintenance, initial cost, and reliability perspective is alternative C, although this alternative will require new regulatory approvals and may not pass the scrutiny of agency review. Alternative B is considered to be a backup strategy in the event that the preferred alternative is not approved.