Town of Miami Lakes

Storm Water Management Master Plan and Drainage Capital Improvements Program Prepared for:

The Town of Miami Lakes

044533003

January 3, 2003

Kimley-Horn and Associates, Inc.

Town of Miami Lakes
Storm Water Management Master Plan and Drainage Capital Improvements Program

Prepared for:

The Town of Miami Lakes

044533002
January 3, 2003

Kimley-Horn and Associates, Inc.

Kimley-Horn and Associates, Inc.

Table of Contents

Appendices

Kimley-Horn and Associates, Inc.

List of Figures

Kimley-Horn and Associates, Inc.

List of Tables

List of Tables (cont.)

Kimley-Horn and Associates, Inc.

INTRODUCTION

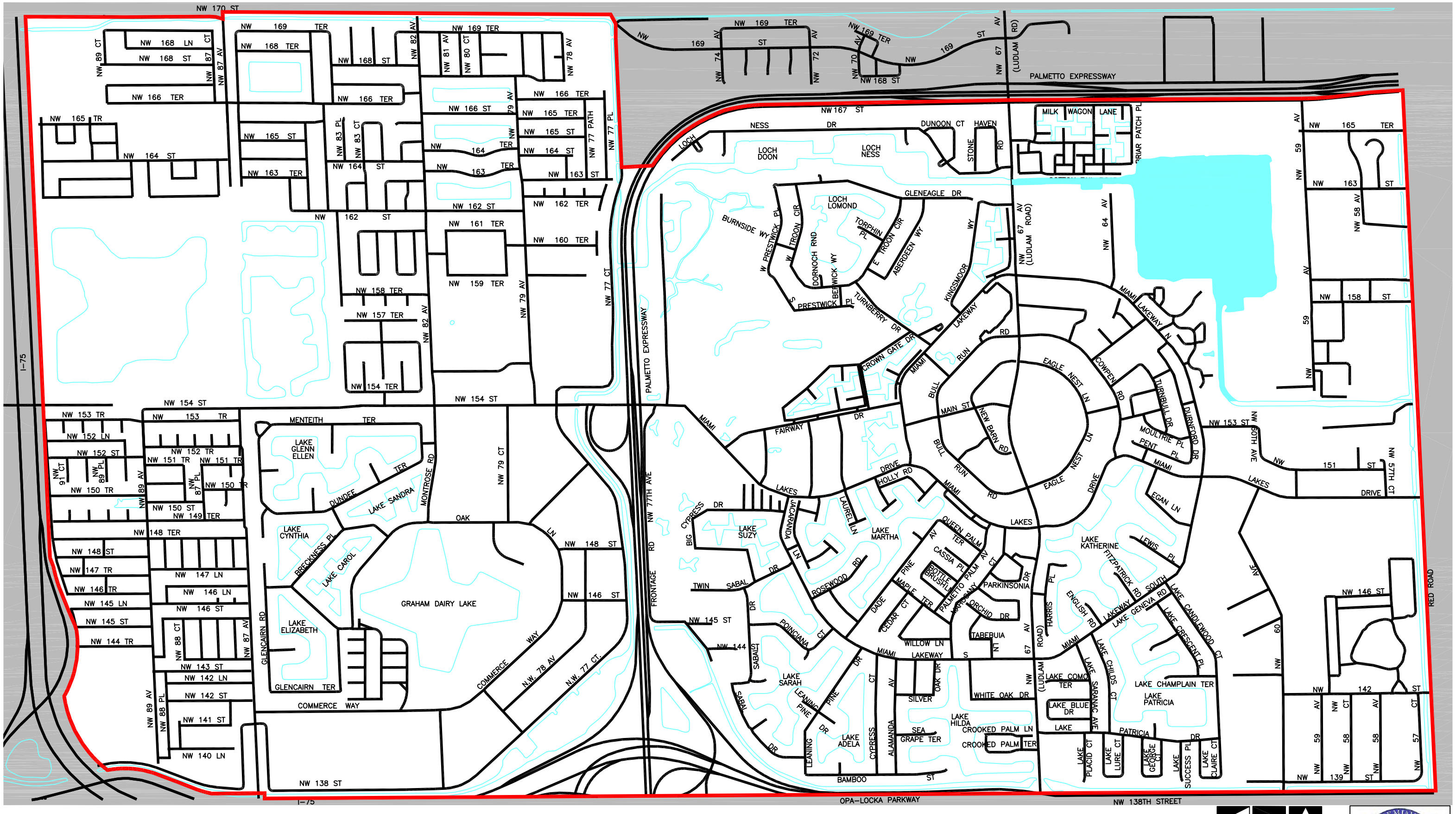
The Town of Miami Lakes was incorporated in December 2000. Miami-Dade County currently operates all storm water management improvements and programs within the Town.

The Town is now in the process of creating a Storm Water Utility to plan, construct, operated and maintain the Storm Water Management System. This will enable the Town to take over the Storm Water Utility ownership and operational responsibilities from Miami-Dade County. Part of the process of creating a Storm Water Utility is to conduct a Storm Water Management Master Plan.

The Town's Storm Water Management Master Plan is being funded by the 2001/2002 legislature General Appropriation Act funds from the Florida Department of Environmental Protection (FDEP) through Special Appropriation 1747A to support the development of Local (Flood) Mitigation Strategies (LMS) in Miami-Dade County. These funds are administered through the South Florida Water Management District (SFWMD) and dispersed and managed at the local level.

As provided for in Chapter 403.0891 F. S., Chapter 24-61 of the Miami-Dade County Code, and to address environmental protection and adequate flood protection, the Town has approved the establishment and implementation of a Storm Water Utility and the development of a Storm Water Management Master Plan (SWMMP).

The Town of Miami Lakes has initiated that program and selected Kimley-Horn and Associates, Inc. (KHA) to provide these services. For a map of the area to be included in the study, see Figure 1.



NORTH

0 600 1200

SCALE AS SHOWN

Figure 1. Town Map

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

BACKGROUND

In 1987, the United States Congress established the Clean Water Act. Section 402 (p) of the Clean Water Act mandated that the Environmental Protection Agency (EPA) formulate a Storm Water permitting program. The EPA promulgated storm water regulations on November 16, 1990, (55 Fed. Reg. 47990) as part of the National Pollutant Discharge Elimination System (NPDES). The Florida Department of Environmental Protection (FDEP) implemented the Municipal Separate Storm Sewer System (MS4) as the stormwater element as authorized under the NPDES program.

In 1992 Miami-Dade County began the development of a County wide stormwater management planning effort which was completed in January 1996. Recently, the Town of Miami Lakes has joined 23 other municipalities as co-permittees with Miami-Dade County under their FDEP Municipal Separate Storm Sewer System (MS4) Permit No. FLS 000003. One condition of the MS4 permit is that the permittee prepare a comprehensive stormwater management program (SWMP).

The Miami-Dade County SWMP addresses runoff from residential and commercial areas, industrial sites, construction sites, and includes a program to eliminate illicit discharges and improper disposal of wastes into the separate storm sewer system. The SWMP contains program elements for each of the following items:

I. Operation and maintenance of structural controls.
II. Control of discharges from areas of new development and significant redevelopment.
III. Operation and maintenance of public streets, roads, and highways.
IV. Ensuring flood control projects consider water quality impacts.
V. Identification, monitoring, and control of discharges from municipal waste treatment, storage or disposal facilities.
VI. Control of pollutants related to application of pesticides, herbicides, and fertilizers.
VII. Implementation of an inspection program to enforce ordinances, which prohibit illicit connections and illegal dumping into the MS4.
VIII. Field screening the MS4 for illicit connections and illegal dumping.
IX. Implementation of standard investigative procedures to identify and terminate sources of illicit connections or discharges.
X. Prevention, containment, and response to spills that may discharge into the MS4.
XI. Limit the infiltration of sanitary seepage into the MS4.
XII. Identification, monitoring and control of discharges from municipal landfills; hazardous waste treatment, storage, disposal and recovery facilities; facilities that are subject to EPCRA Title III, Section 313; and any other industrial or commercial discharge the permittee determines are contributing a substantial pollutant loading to the MS4.
XIII. Control of pollutants in construction site runoff.
XIV. Public education.

The Town of Miami Lakes may consider an agreement to authorize Miami-Dade County to continue to perform some of the above program elements.

ASSESSMENT OF EXISTING DRAINAGE CONDITIONS

Visual Assessment

An assessment of the Storm Water Management System within the Town of Miami Lakes was conducted in three phases. The first phase involved a visual assessment of roadway flooding conditions within the Town.

This assessment was conducted during a rainy period between June 24 and July 11, 2002. Table 1 below details the rainfall for this period. The 3-year return storm event is estimated to be 6-inces in a 24-hour period. The rainfall for any single 24-hour event was less than a 3-year return stom event; however, the 15.68 inches of total rainfall within a 18-day period is very high , even for the typical South Florida rainy season. This provided saturated soils and high ground water tables, which would contribute to higher and longer ponding conditions, which exceed the typical 3-year return storm event. The roadway drainage conditions were assessed within the first 15 to 75 minutes after substantial rainfall events. Areas where stormwater accumulation extended into the roadway travel lanes were noted as flooding areas during this phase of the assessment and can be seen in Figure 2. The deficiencies ranged from roadside flooding that extended into the road for a period of a few hours after a major rainfall event to complete flooding of some sections of roadway lasting for several days after a storm. Photos of the drainage deficiencies can be found in Appendix A.

Table 1. Rainfall in Miami, Florida Between June 24, 2002 and July 11, 2002

Date	Rainfall Inches	Equivalent Recurrence
06/24/02	0.41	Less than 3-year storm
06/25/02	0.03	Less than 3-year storm
06/26/02	4.18	Less than 3-year storm
06/27/02	0.01	Less than 3-year storm
06/28/02	T	Less than 3-year storm
06/29/02	T	Less than 3-year storm
06/30/02	0.53	Less than 3-year storm
07/01/02	1.14	Less than 3-year storm
07/02/02	1.39	Less than 3-year storm
07/03/02	0.08	Less than 3-year storm
07/04/02	0.34	Less than 3-year storm
07/05/02	0.26	Less than 3-year storm
07/06/02	0.42	Less than 3-year storm
07/07/02	0.67	Less than 3-year storm
07/08/02	2.86	Less than 3-year storm
07/09/02	0.40	Less than 3-year storm
07/10/02	2.16	Less than 3-year storm
07/11/02	0.80	Less than 3-year storm
Total 18 Days	15.68	High Cummulative Rainfall

Complaint Assessment

The second phase of the assessment included review of drainage complaints filed with Miami-Dade County Environmental Resources Management (DERM), Miami-Dade County Public Works and the Town of Miami Lakes between 1995 and 2002. A summary of the types of complaints reported is included in Table 2. If there was no indication in county Public Works records that the source of a complaint had been mitigated, it was added to Figure 2.

Table 2. Town of Miami Lakes Drainage Complaints Received 1995-2002

Type of Problem	Number of Complaints	Percent of Complaints
Canal blocked	1	0.22%
Canal bank trees need cutting	3	0.67%
Canal bank needs mowing	13	2.92%
Canal needs cleaning	18	4.04%
Storm drain clogged	146	32.81%
Storm drain cleaning	14	3.15%
Storm drain repair	8	1.80%
Storm drain object removal	3	0.67%
Storm drain missing grate	2	0.45%
Storm drain new	3	0.67%
Storm drain inadequate	4	0.90%
Storm drain cover missing	5	1.12%
New drainage installation	1	0.22%
Cave-in next to drain	1	0.22%
Sink hole in ROW	12	2.70%
Sink hole on driving surface	3	0.67%
Small pot hole on driving surface	142	31.91%
Standing water - no drain	6	1.35%
Standing water	13	2.92%
Localized flooding	47	10.56%
Total	**445**	**100.00%**

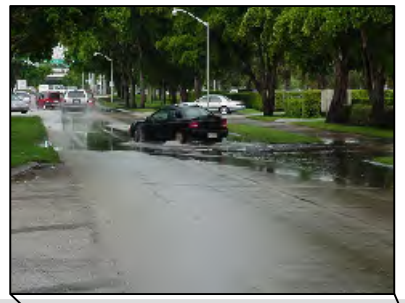
GIS Data Assessment

The third phase of the drainage assessment was an evaluation of drainage structures within the Town. Geographic Information System (GIS) data provided by DERM was used to map the location of the majority of the public drainage structures within the town. Approximately 200 of these structures were chosen for field evaluation. Structures in areas of roadway flooding as noted in the first and second phases of the drainage system evaluation. Additional structures were also evaluated to provide a geographically diverse array of structures. The location of the evaluated structures can be seen in Figure 3.

Study of the GIS data provided by DERM shows that the majority of the drainage systems within the Town consist of two types: exfiltration trench (French drains) and drainage collection systems that discharge to the many lakes within the Town. Exfiltration trench is found predominantly in the newer subdivisions of West Miami Lakes and the downtown area where no lakes were constructed. Drainage collection systems with discharge to the lakes are found in the remainder of the Town. Figure 4 illustrates the type of drainage systems utilized in different sections of the Town. Figure 5 shows the entire drainage system per the GIS information provided by DERM.

Some of the potential causes of roadway flooding were discovered during the drainage structure inventory and are noted below:

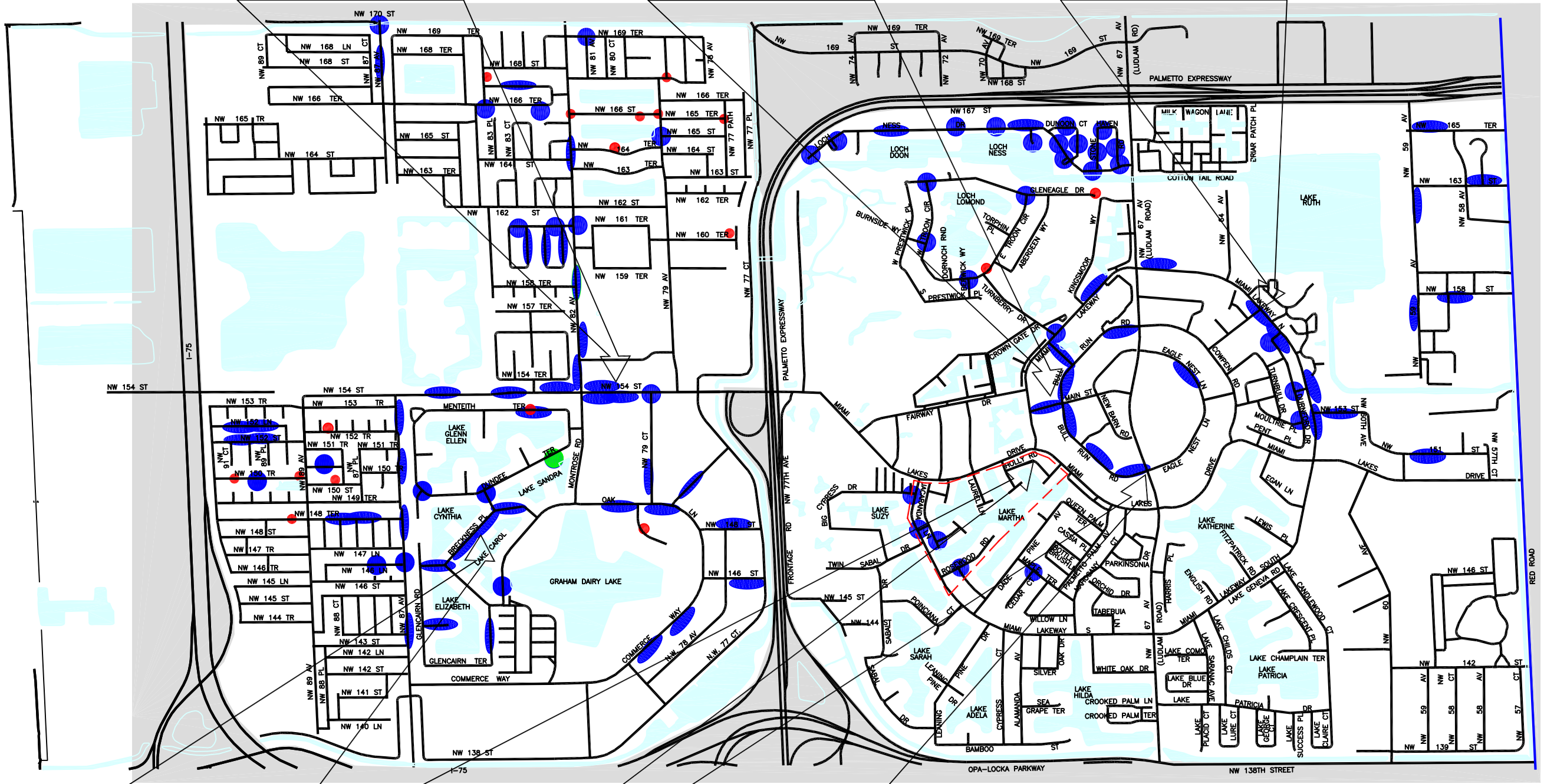
1. *Low areas without positive drainage.* Several of the areas where ponding within the roadway was noted consist of low areas with no drainage structure to convey water away from the roadway. This situation occurs most frequently at residential intersections, but there are some areas along the major roadways where low points without positive drainage exist as well.

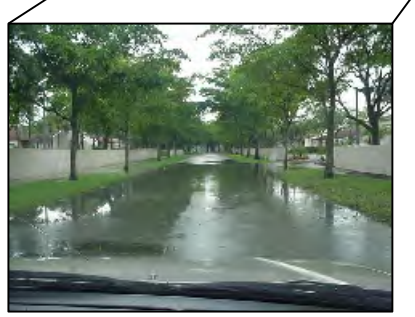


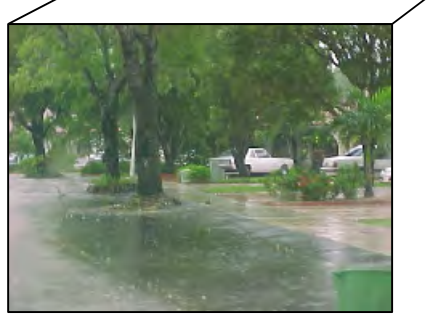
NORTH

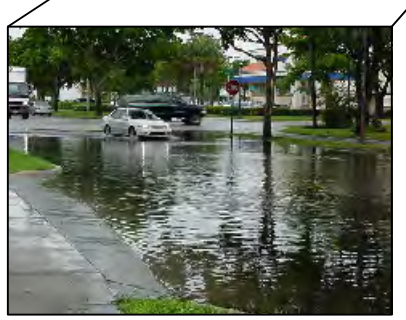
0 800 1600

SCALE AS SHOWN









Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

TOWN OF MIAMI LAKES FLORIDA

LEGEND

OBSERVED DRAINAGE DEFICIENCY

AREA OF PAVED SWALES

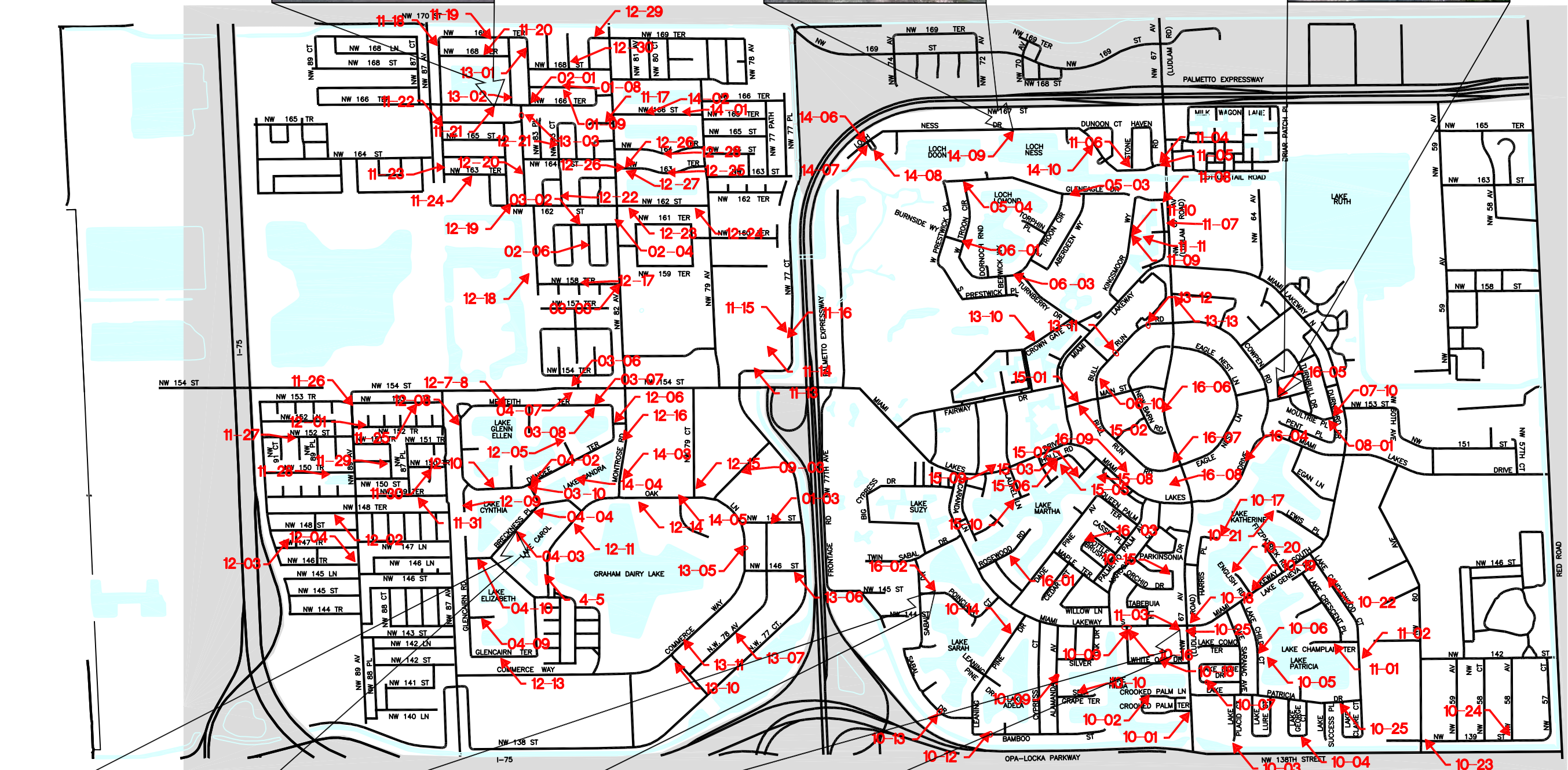
UNRESOLVED DRAINAGE COMPLAINT RECORDED BY MIAMI-DADE DERM OR TOWN OF MIAMI LAKES

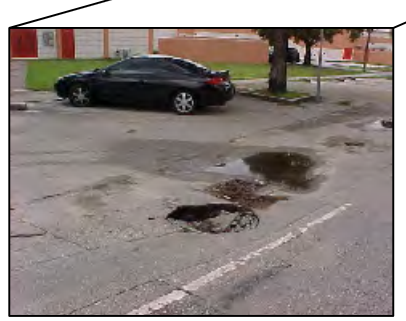
Figure 2. Drainage Deficiencies

NORTH

0 800 1600

SCALE AS SHOWN





Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

TOWN OF MIAMI LAKES FLORIDA

LEGEND

DRAINAGE STRUCTURE LOG SHEET # 10-23

Figure 3. Drainage Structrure Inventory

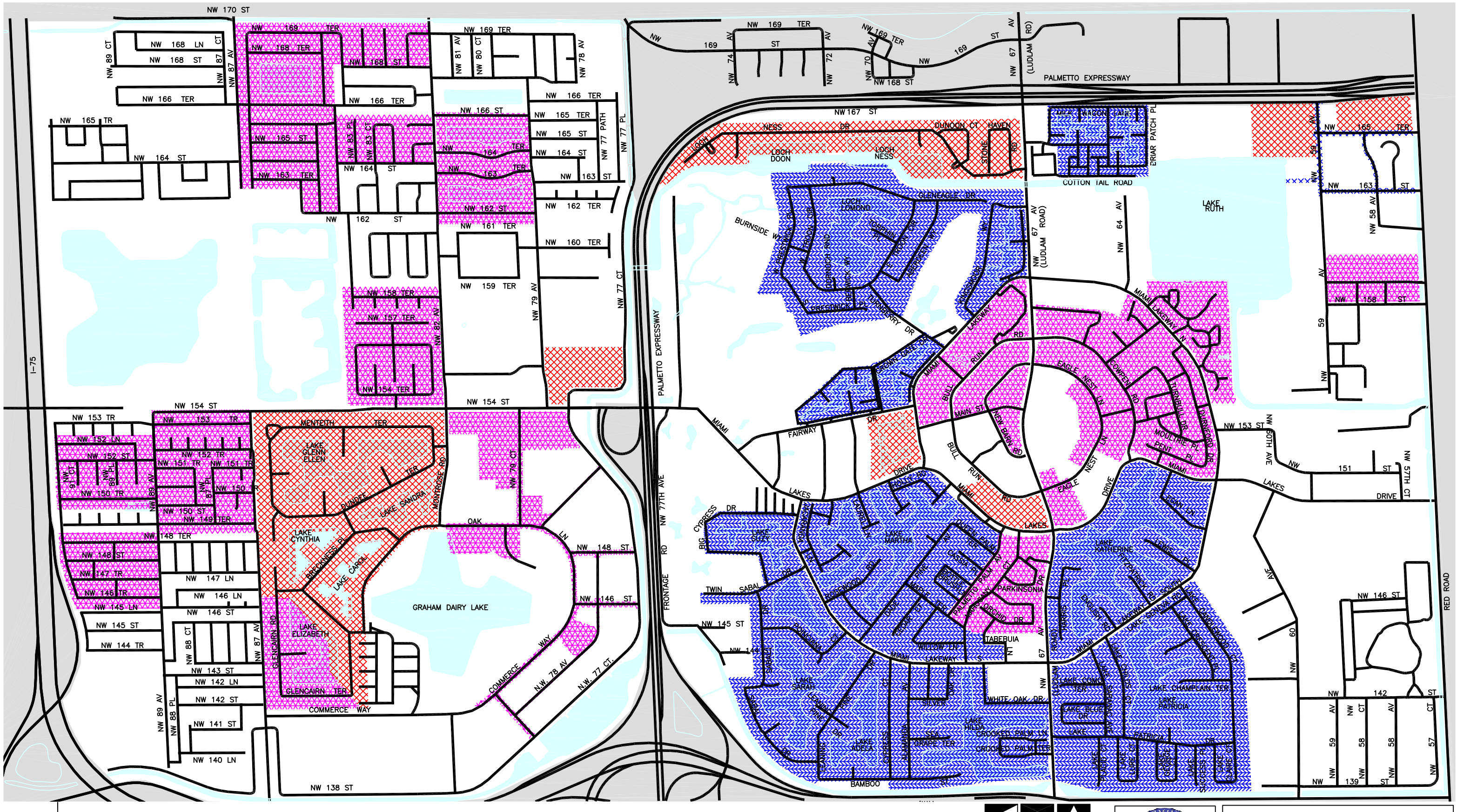
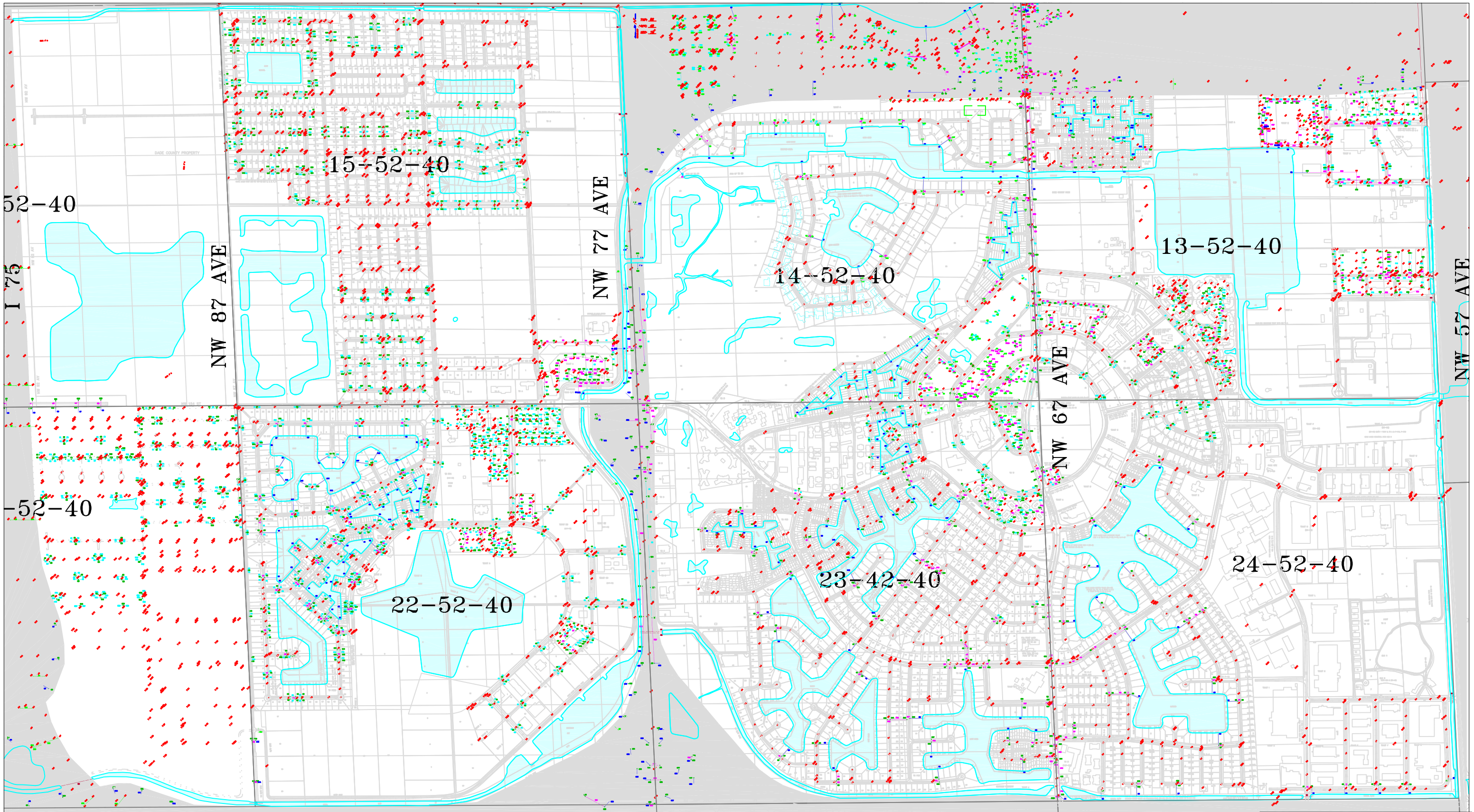


Figure 4. Types of Drainage Systems

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LEGEND
- OUTFALL SYSTEM
- CLOSED SYSTEM (EXFILTRATION)
- COMBINATION SYSTEM (EXFILTRATION / OUTFALL)
- UNDEVELOPED OR UNKNOWN SYSTEM



NORTH

0 600 1200

SCALE AS SHOWN

Figure 5. Drainage System Atlas

Kimley-Horn
and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

TOWN OF MIAMI LAKES FLORIDA

LEGEND

C – CATCH BASIN
M – DRAINAGE MANHOLE
H – PUMP HOUSE
F – FRENCH DRAIN
V – VERTICAL FRENCH DRAIN
P – SOLID PIPE
T – SLAB COVER TRENCH
O – OUTFALL
U – CULVERT
K – ROCK FILLED TRENCH
E – EQUALIZER PIPE
S – HYDRAULIC STRUCTURE
W/ OIL & GREASE INT.

2. *Clogged inlets.* Another common condition found throughout the Town was clogged inlets. This happens when leaves and other debris accumulate on top of the drainage inlet cover, blocking the flow of water into the inlet. Even when leaves were not found to be blocking the drainage inlet cover, often the bottom of the inlet itself was filled with leaves, dirt and other debris.

3. *Blocked or undersized drainage outfalls.* In several areas, the drainage outfalls to the lakes or canals are either too small to handle the drainage needs of the systems they serve or blocked with debris and root growth. This problem is especially prominent in the areas surrounding Lake Carol, Lake Glenn Ellen, Lake Cynthia, Lake Sandra and Lake Elizabeth.

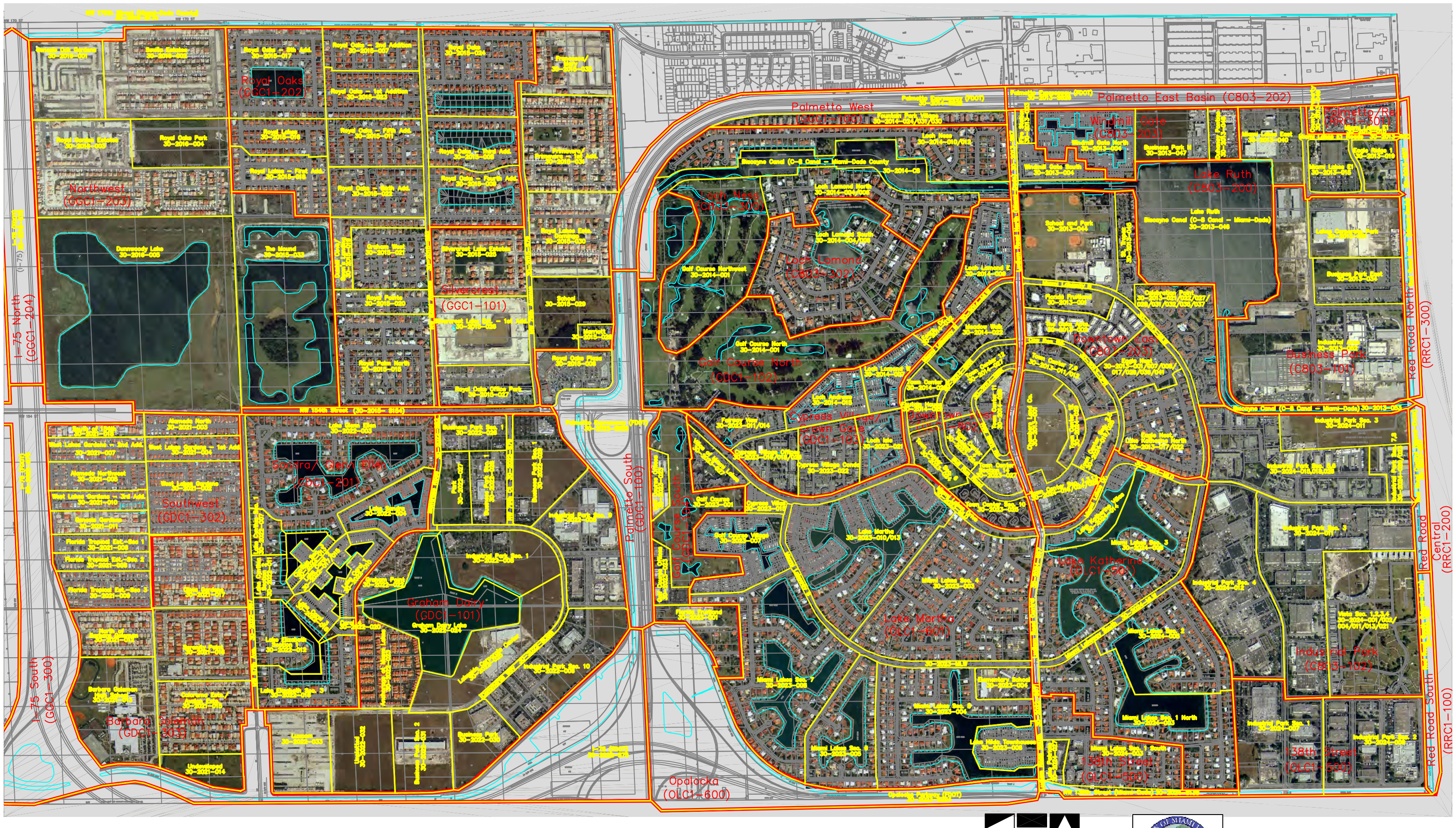
4. *No baffles to protect exfiltration trench from oil and grease deposits.* None of the drainage structures observed contained pollution retardant baffles to prevent the accumulation of grease and oil within the trench. Grease and oil accumulation reduces the drainage effectiveness and lifespan of the exfiltration trench.

Basin Delineation

The Town of Miami Lakes is located in the C-8 Canal Basin within Miami-Dade County. The boundaries of the C-8 Canal Basin have been delineated by the Miami-Dade County Environmental Resources Department (DERM) and the South Florida Water Management District (SFWMD). The C-8 Basin within the Town of Miami Lakes has a northern boundary on NW 170th Street, a western boundary of 107th Avenue, and a southern boundary of NW 138th street. The C-8 extends beyond the Town limits, eastward to NE 6th Avenue. As part of the Miami-Dade County Stormwater Master Plan process, DERM divided the C-8 Biscayne Canal Basin into Drainage Basins based on topography, land use and drainage characteristics. The Town of Miami Lakes adopted the boundaries and numbering system for approximately thirty Miami-Dade County drainage Basins that are located within the Town and designated them as the Town Basins. The County designated the Drainage Basins by assigning a four to nine alpha/numeric character prefix to each Basin. The two to three character prefix indicates the basin drains into the C-8 canal on to a secondary canal. In addition, each Basin was given a name based on a major feature contained within the Basin such as a lake or roadway.

The Basins were then further sub-divided based on the development or drainage pattern. The drainage areas that were originally designed to work as one system were grouped together to form Sub-basins within the Town Basins. The Sub-basins were numbered according to Miami-Dade numbering of the subdivisions or major roadways located within them. Each Sub-basin was also given a name consistent with a sub-division, roadway or water body located within it. While the exact boundaries of the Sub-basins could not be precisely determined without topographic survey information, the information contained in the GIS mapping and drainage infrastructure database provided by DERM was sufficient to determine the approximate boundaries needed for the development of a Stormwater Management Master Plan.

The location and boundaries of the Basins and Sub-basins within the Town of Miami Lakes can be seen in Figure 6. Table 3 provides a list of the Basins and Sub-basins.



NORTH

0 600 1200

Figure 6. Basin Delineation

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LEGEND

Basin Boundary	
Sub-basin Boundary	
Basin Name	Basin Name
Sub-Basin Name	Sub-Basin Name

Table 3. Town of Miami Lakes Drainage Basin List

Miami-Dade County Drainage Basin Name (County Basin Number)	Town of Miami Lakes Drainage Sub-basin	Town Basin Number
NORTHWEST	Genesis Oak Gardens	30-2016-001
(GGC1-203)	Sevilla Estates	30-2016-002
	Royal Garden Estates	30-2016-003
	Royal Oaks Park	30-2016-004
	Dunwoody Lake	30-2016-005
	The Mound	30-2015-033
ROYAL OAKS	Royal Oaks - 8th Add.	30-2015-017
(GGC1-202)	Royal Lakes	30-2015-016
	Royal Oaks - 2nd Addition	30-2015-007
	Royal Oaks - 1st Addition	30-2015-023
	Royal Oaks - Fifth Add.	30-2015-011
	Royal Oaks - Sixth Add.	30-2015-022
	Dunhill Cove/Swan's Landing	30-2015-019
	Graham West	30-2015-021
	Royal Palm North	30-2015-015
	Royal Oaks	30-2015-024
	Royal Oaks - Third Add.	30-2015-008
	Royal Oaks - Fourth Add.	30-2015-009
	NW 82nd Avenue	30-2015-S82
	Royal Lakes - First Add.	30-2015-018
	Royal Pointe	30-2015-020
I-75 NORTH	I-75 (FDOT)	30-2016-S75
(GGC1-204)		
PALMETTO SOUTH	Palmetto Expressway (FDOT)	30-2022-S826
(GDC1-100)	Royal Oaks Plaza	30-2015-006
OPALOCKA	Opalocka Parkway(FDOT)	30-2023-S294
(OLC1-600)		
I-75 SOUTH	I-75 (FDOT)	30-2022-S75
(GGC1-300)		
PALMETTO WEST	Pametto Expressway (FDOT)	30-2014-S826
(GGC1-100)	Fountain Park Village	30-2014-024/031/030
PALMETTO EAST BASIN	Pametto Expressway (FDOT)	30-2013-S826
(C803-202)		
SILVERCREST	Silvercrest Lake Estates	30-2015-025
(GGC1-101)	Silvercrest Lake Estates 1st Add.	30-2015-026
	Royal Oaks Office Park	30-2015-027
	Francesca/Mary	30-2015-032
	Primavera/Primavera - 1st Add.	30-2015-031
	Royal Lakes Ests. Domingo	30-2015-030
	School	30-2015-006
	Marriott	30-2015-028
	NW 79th Avenue	30-2015-S79
SOUTHWEST	South of 154th	30-2021-018
(GDC1-302	West Lakes Gardens - 2nd Add.	30-2021-007
	Aldmeda Northwest	30-2021-005
	West Lakes Gardens - 3rd Add.	30-2021-010
	Genesis Gardens	30-2021-011
	Florida Tropical Est. - Sec. 1	30-2021-006
	Florida Tropical Est. - Sec. 2	30-2021-008
	Florida Tropical Est. - Sec. 3	30-2021-009
	Aldmeda North	30-2021-003
	West Lakes Gardens - 1st Add.	30-2021-004
	West Lakes Gardens	30-2021-002

Miami-Dade County Drainage Basin Name (County Basin Number)	Town of Miami Lakes Drainage Sub-basin	Town Basin Number
BARBARA GOLEMAN (GDC1-303)	North of Barbara Goleman	30-2021-012
	Barbara Goleman High School	30-2021-013
	Olivia Gardens	30-2021-017
	Serenity Point	30-2021-016
	Colorama Ests./ Avalon Ests.	30-2021-015
	Undeveloped	30-2021-014
SANDRA/GLENN ELLEN (GDC1-201)	Lake Glenn Ellen	30-2022-003
	Lake Sandra	30-2022-004
	Lake Cynthia Sec. 1	30-2022-007
	Lake Cynthia Sec. 2	30-2022-011
	Lake Cynthia Sec. 3	30-2022-013
	Lake Carol Sec. 1	30-2022-010
	Lake Carol Sec. 2	30-2022-015/017
	Lake Carol Sec. 3	30-2022-018
	Lake Carol Sec. 4	30-2022-020
	Lake Elizabeth Sec. 1	30-2022-012
	Lake Elizabeth Sec. 3	30-2022-016
GRAHAM DAIRY (GDC1-101)	Business Park Sec. 1	30-2022-026
	Business Park Sec. 1	30-2022-028
	Business Park Sec. 1	30-2022-029
	Park	30-2022-027
	Montrose Road	30-2022-S82
	NW 79th Court	30-2022-S79
	Industrial Park Sec. 9	30-2022-005
	Industrial Park Sec. 1	30-2022-008
	Graham Point	30-2022-022
	Anchorage at Miami Lakes	30-2022-023
	Graham Dairy Lake	30-2022-024
	Lakeside Corporate Center	30-2022-025
	Commerce Way	30-2022-SCOM
	Industrial Park Sec. 10	30-2022-006
	Business Park	30-2022-030
	Business Park Sec. 2	30-2022-031
	Unplatted	30-2022-032
	Luxcom	30-2022-033
	NW 154th Street	30-2015-S154
LOCH NESS (C803-300)	Loch Ness	30-2014-010/012
	Biscayne Canal (C8 Canal)	30-2014-C8
	Loch Lomond North	30-2014-004/006
	Golf Course Northwest	30-2014-001
GOLF COURSE NORTH (GDC1-102)	Golf Course North	30-2014-001
GOLF COURSE SOUTH (GDC1-104)	Golf Course	30-2023-001
	Golf Course Offices 1	30-2023-023
	Golf Course Offices 2	30-2023-023
	Florida Fruitland	30-2023-001
LOCH LOMOND (C803-302)	Loch Lomond South	30-2014-004/006
CYPRESS VILLAGE/ CROWN GATE (GDC1-103)	Loch Lomond E	30-2014-009
	Fearn Drive	30-2014-032
	Loch Lomond W	30-2014-007
	Loch Andrews	30-2014-015
	Fairway View	30-2023-011/014
	Cypress Village Offices	30-2023-016/018/026
	Cypress Village Condo	30-2023-022
	Loch Isle	30-2023-021

Miami-Dade County Drainage Basin Name (County Basin Number)	Town of Miami Lakes Drainage Sub-basin	Town Basin Number
DOWNTOWN WEST	Miami Lakeway N	30-2014-MLW
(OLC1-802)	Meadow Walk	30-2014-022
	Town Center	30-2014-020
	Bull Run Road	30-2014-BRR
	Town Center 12	30-2014-027
	Fountain House	30-2014-029
	New Barn Road	30-2014-NBR
	Town Center 11	30-2014-026
	Town Center Section 4	30-2023-024
	Town Center Section 6	30-2023-024
	Town Center Section 10	30-2023-025
	Town Center Section 14	30-2023-027
LAKE MARTHA	Miami Lakes Drive	30-2023-MLD
(OLC1-601)	Villas of Miami Lakes	30-2023-027
	Cypress Villas	30-2023-015
	Golf Course Village	30-2023-007
	Lake Martha	30-2023-010/013
	Miami Lakes Section 4	30-2023-003
	Miami Lakeway S	30-2023-MLW
	Miami Lakes Section 7	30-2023-008
	Miami Lakes Section 6	30-2023-005
	Miami Lakes Section 5	30-2023-004
	Elementary School	30-2023-004
	Lake Hilda Townhouses	30-2023-006
LAKE KATHERINE	Miami Lakes Drive	30-2024-MLD
(OLC1-501)	Ludlam Road Central	30-2024-S67
	Lake Katherine Villas	30-2024-014
	Miami Lakes Section 3	30-2024-008
	Miami Lakeway South	30-2024-MLW
	Miami Lakes Section 2	30-2024-005
	Miami Lakes Section 1 North	30-2024-003
DOWNTOWN EAST	School & Park	30-2013-044
(C803-203)	St. Tropez	30-2013-045
	Miami Lakeway N	30-2013-MLW
	Florida Fruitland	30-2013-001
	Celebration Point	30-2013-021/022/027/028/031/032/035/037
	The Oaks Apts.	30-2013-002
	Eagle Nest	30-2013-001/007/008/017/026/036/041
	Cow Pen Road	30-2013-CPR
	Town Center 7 & 9	30-2013-011/012
	Chambers Land Co.	30-2013-001
	Town Center 1E	30-2024-029
	Town Center Section 2 & 5	30-2024-019/025
	Eagle Nest Lake Katherine North	30-2013-017/022
	Town Center section 1, 3, & 13	30-2024-016/024/028
WINDMILL GATE	Windmill Gate North	30-2013-004
(C803-203)	Business Park N	30-2013-047
	Duhaney Pontiac	30-2013-048
PALMETTO / RED	County Property	30-2013-049
(RRC1-301)	Miami Lakes E1	30-2013-015
LAKE RUTH	Lake Ruth (C-8 Canal)	30-2013-046
(C803-200)	Fire Station	30-2013-003
	Windmill Gate South	30-2013-004
	Miami Lakes East	30-2013-0400
	Miami Lakes E1 Roads	30-2013-050
	Miami Lakes E1	30-2013-015
	Eagle Ridge 1	30-2013-019

Miami-Dade County Drainage Basin Name (County Basin Number)	Town of Miami Lakes Drainage Sub-basin	Town Basin Number
	Ludlam Road North	30-2013-S67
BUSINESS PARK (C803-101)	Industrial Area	30-2013-052
	Lakes Corporate Park	30-2013-051
	Business Park East	30-2013-034
	Biscayne C-8 Canal	30-2013-053
INDUSTRIAL PARK (C803-102)	Industrial Park Section 3	30-2024-011
	Industrial Park Section 5 & 6	30-2024-015/018/026
	Industrial Park Section 7 & 8	30-2024-020/023
	Industrial Park Section 4	30-2024-012
	Industrial Park Section 3	30-2024-011
	Vista Section 1, 2, 3, & 4	30-2024-001/002/004/011/013/021
138 STREET (OLC1-500)	Industrial Park Section 1	30-2024-007
	Industrial Park Section 2	30-2024-009
	Ludlam South	30-2022-S67
	Lake Patricia	30-2024-027
	Miami Lakes Section 1 South	30-2024-003
	NW 138th Street (Miami-Dade)	30-2024-S138
RED ROAD NORTH (RRC1-300)	Red Road North	30-2013-S57
RED ROAD CENTRAL (RRC1-200)	Red Road Central	30-2013-S57
RED ROAD SOUTH (RRC1-100)	Red Road South	30-2024-S57

Basin Prioritization

As an ongoing part of operating the storm water utility, the Town will continually monitor storm water conditions throughout the Town. As part of this study, sixteen basins were selected as a priority for more detailed analysis. The development of the priority sub-basins was based on several factors including:

1. Magnitude of observed flooding
2. Flood complaint records
3. Town Input
4. Condition of existing roadways
5. Proximity to other priority sub-basins
6. Relative traffic volumes on the affected roadways

Flood mitigation plans for the priority areas are likely to consist of one or more of the following:

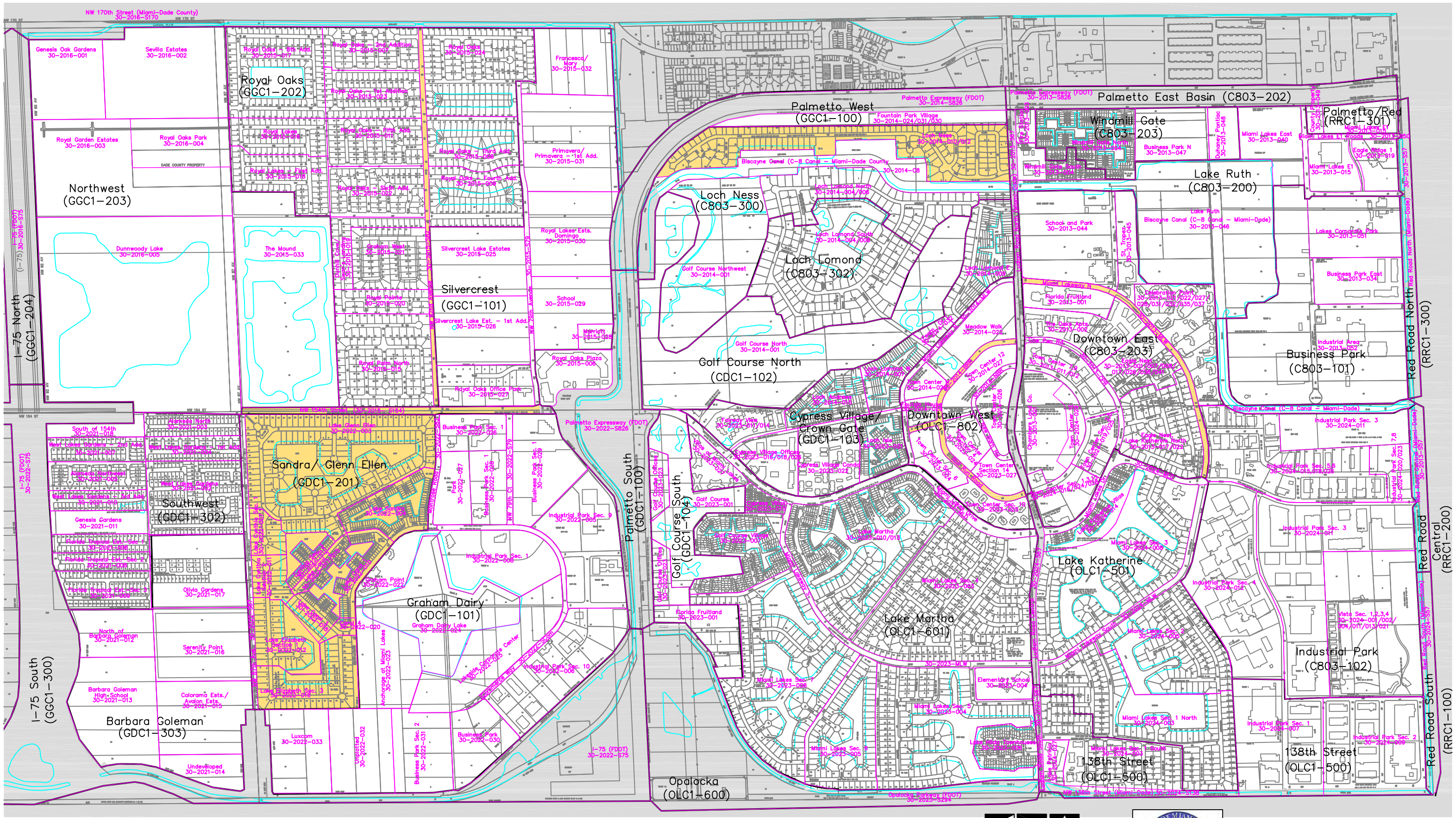
1. Constructing additional catchbasins and drainage system connectors or exfiltration trench for low paints without positive drainage.
2. Increasing drainage capacity by adding exfiltration trench or increasing the size of existing pipes. Exfiltration trench consists of a perforated pipe placed underground and surrounded with gravel. The gravel is wrapped in a porous textile cloth that allows water to gradually seap into the surrounding soil. Exfiltration trench is commonly referred to as a French Drain. It provides underground water storage in the pores between the gravel. Increased pipe size can allow for greater capacity in the movement of water from one place to another (i.e. from the road to the lake).
3. Installing exfiltration trench were none currently exists to provide pre-treatment prior to discharge into lakes. Pretreatment improves the water quality of stormwater runoffs from raid and other areas. The filtration provided by the gravel and geotextile in an exfiltration can remove pollutants before the water is allowed to discharge onto a body of water. Federal, State and county resolutions require this pre-treatment.
4. Installing storm water injection wells to provide increased discharge capacity to the drainage systems. An injection well uses the principle of hydraulic head to inject water deep into the ground. They can be use in areas where discharge to a lake would be implemented.
5. Increased maintenance within the sub-basin. This is a likely recommendation for all areas, but especially those where grates were observed to be covered with leaves, catchbasins were full of dirt, leaves, and debris, swales were overgrown and /or damage to pipes and exfiltration trench was observed.
6. Adding baffles and sumps in catchbasins to protect exfiltration trench from oil and gr deposits and excess debris and sediment. Oil and grease deposits can block the pores in the gravel and geotextile in an exfiltration trench decreasing the seepage of water out of the trench and into the surrounding soil. Debris and sediment can also block these pores over time. Baffles protect the trench from oil and grease by forcing water to go under them before entering the pipe. Since oil and grease float the are prevented from entering the pipe. This depression provides an area where debris and sediment can settle and accommodate instead of entering the pipe system.
7. Limited regrading of roadways to promote flow to existing drainage structures. This is a recommendation that would apply to areas where the roadway has deteirorated or where “birdbaths” (minor low spots) have occurred. The roadway would be “evened out” to eliminated such birdbaths.
8. Increasing pervious areas within the right-of-way. Pervious area is land that is not covered with pavement, concrete or other surfaces that prevent rainfall from soaking into the ground. The opposite of pervious areas is impervious area. Increasing pervious area while decreasing

impervious area allows more rainfall to soak directly into the ground. The increase in pervious areas provide minor reduction in runoff and is typically considered in areas designated for major drainage improvements on pavement resurfacing. This is a likely recommendation in areas where the right-of-way contains more pavement than is necessary for roadways, parking and sidewalks.

Based on the review of the drainage deficiencies shown in Figure 2 and input of the Town Council and Staff, sixteen Drainage Sub-basins were selected as a priority for more detailed analysis. The sixteen Sub-basins in no particular order include:

1. Loch Ness, 30-2014-010/012
2. Lake Glenn Ellen, 30-2022-003
3. Lake Sandra, 30-2022-004
4. Lake Cynthia Section 1, 30-2022-007
5. Lake Cynthia Section 2, 30-2022-011
6. Lake Cynthia Section 3, 30-2022-013
7. Lake Carol Section 1, 30-2022-010
8. Lake Carol Section 2, 30-2022-015/017
9. Lake Carol Section 3, 30-2022-018
10. Lake Carol Section 4, 30-2022-020
11. Lake Elizabeth Section 1, 30-2022-012
12. Lake Elizabeth Section 3, 30-2022-016
13. Bull Run Road, 30-2014-BRR
14. Miami Lakeway N, 30-2013-MLW
15. NW 154th Street, 30-2015-S154
16. NW 82nd Avenue, 30-2015-S82

The location of these priority Sub-basins can be seen in Figure 7.



0 600 1200

SCALE AS SHOWN

Figure 7. Priority Sub-basins

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LEGEND

- Basin Boundary
- Sub-basin Boundary
- Basin Name
- Sub-Basin Name
- Priority Sub-basin

DRAINAGE BASIN ANALYSIS

Methodology

Based on the observed flooding, complaintism road conditions and other parameters noted above, the Town selected sixteen sub-basins for a more in depth study.

Data Collection

The readily available data was collected for each basin from aerial photos, DERM GIS data, Building department records, tax information and site observations. Based on this data the information for roadway elevations, pipe sizes, drainage structure locations and inverts, mean water elevations were approximated for each basin. If finish floor elevations were not available from published data the height above the adjacent road was approximated from site elevations.

The land use and the amount of paved area (impervious area) are also a factor in estimating the Storm Water surface runoff during storm events. Based on the tax information, zoning maps and a detail study of the aerial photographs typical residential developments within the town were analyzed. For each type of development estimates were made for the average land area per unit, average building area, average impervious and average pervious area per unit. Approximately 150 single family detached units, 130 attached townhouse units and 5 multi-family developments were analyzed. The study showed the average impervious areas for each type of residential development within the Town to be 1,100 square feet per multi-family unit, 2,600 square feet per attached single family unit and 4,400 square feet per detached single family unit.

Computer Modeling

Utilizing the data obtained above a computer model of each sub-basin was made to assimulate the land uses, Storm Water runoff characteristics, the existing Storm Water infrastructure, general terrain elevations, and the receiving waters. The existing conditions data was utilized with the South Florida Water Management District "Routing Model Cascade 2001" version 1.0 dated August 2001 to provide a computer model of the storm flood routing for each sub-basin. The maximum flood stage produced by four different design storm events was modeled and the results of these calculations are outlined on the graphics for each basin. The four design storm events were:

- the 5-year 24-hour storm,
- the 10-year 24-hour storm,
- the 25-year 72-hour storm and
- the 100-year 72-hour storm.

The year refers to the frequency in which a rainfall event of that magnitude can be expected to return. The hours are the duration of the model storm events from the start of the rainfall event to the end of the rainfall.

In addition to the flood routing analysis each sub-basin was analyzed for water quality pretreatment capacity. SFWMD and DERM require Storm Water runoff to be pretreated to minimize pollution prior to discharging into the Waters of the State. Typically the water quality pretreatment in the Town of Miami Lakes is provided by exfiltration (perforated pipe in rock trench or French drain) trench or swale detention. The existing pretreatment capacities for each sub-basin were estimated from the available data and compared with the required volumes.

Permitting Requirements

On October 4, 2002 Kimley-Horn and Associates meet with J. M. (Manny) Tobon, P.E., Chief of the Water Control Section Water Management Division and Camilo P. Ignacio of Miami-Dade County Department of Environmental Resources Management (DERM). The meeting was to provide a general overview of the Town of Miami Lake's existing drainage systems and typical Capital Improvement Projects, which may be implemented in the next five years. DERM indicated that existing roadway storm water improvement projects would be required to have or provide one-half inch of water quality pretreatment prior to discharging into Lakes and would be permitted by a DERM Class II permit. The roadways proposed for storm water improvement projects should also provide "Best Management Practices" (i.e., pollution retardant baffles, inlet sumps) for the existing system prior to discharging into the Lakes.

Projects discharging directly into the C-8 Canal are permitted by South Florida Water Management District (SFWMD) Environmental Resource Permit (ERP) and also require water quality pretreatment.

Each of the priority basins was analyzed to determine the hydraulic capacity of the existing drainage system. This analysis was conducted by modeling each system with the Cascade 2001 drainage program utilizing data that was collected as part of this study. Information such as the roadway elevations, pervious areas, finished floor elevations, pipe sizes, and mean water elevations were used in the calculations. The maximum flood stage produced by four different storm events was modeled and the results of these calculations are outlined on the graphics for each basin. The four storm events were the 5-year 24-hour storm, the 10-year 24-hour storm, the 25-year 72-hour storm and the 100-year 72-hour storm. The year refers to the frequency in which a rainfall event of the various magnitudes can be expected. The hours are the duration of the model storm events.

After the existing system was modeled, drainage improvements were proposed for each system that was identified as deficient in drainage discharge capabilities. Conceptual improvements were developed for each priority drainage sub-basin and the system was modeled with the improvements to ensure that the performance goals were being met.

Each sub-basin was analyzed for stormwater quantity capacity and water quality pretreatment requirements. The existing drainage sub-basin characteristics were established based on the readily available aerial photos, DERM GIS data, building department and tax information and site observations. The existing residential area developments within the Town were analyzed to estimate the average land area per unit, average building area, average impervious and average pervious area per unit. Approximately 150 single family detached units, 130 attached townhouse units and 5 multi-family developments were analyzed. The study showed the average impervious areas for each type of residential development within the Town to be 1,100 square feet per multi-family unit, 2,600 square feet per attached single family unit and 4,400 square feet per detached single family unit.

Based on this methodology, the drainage sub-basin areas, land uses and impervious areas were estimated for each sub-basin. Then, hydraulic analyses of the Storm Water runoff volumes were made for the 5, 10, 25, and 100-year design storm events. The existing storm water infrastructure system information was obtained from the DERM GIS data and was hydraulically evaluated for the 5 and 10 year design storm events. The road right-of-way areas and impervious area were estimated to evaluate the water quality pretreatment requirements.

On October 4, 2002 Kimley-Horn and Associates meet with J. M. (Manny) Tobon, P.E., Chief of the Water Control Section Water Management Division and Camilo P. Ignacio of Miami-Dade County Department of Environmental Resources Management (DERM). The meeting was to provide a general overview of the Town of Miami Lake's existing drainage systems and typical Capital Improvement Projects, which may be implemented in the next five years. DERM indicated that existing roadway storm water improvement projects would be required to have or provide one-half inch of water quality pretreatment prior to discharging into Lakes and would be permitted by a DERM Class II permit. The roadways proposed for storm water improvement projects should also provide "Best Management Practices" (i.e., pollution retardant baffles, inlet sumps) for the existing system prior to discharging into the Lakes.

Projects discharging directly into the C-8 Canal are permitted by South Florida Water Management District (SFWMD) Environmental Resource Permit (ERP) and also require water quality pretreatment.

Performance Goals

In order to measure the performance of each drainage sub-basin based on the results of the detailed analysis described above, performance goals had to be identified. The drainage basins were evaluated based on the following performance goals:

Water Quality Treatment Performance Goals:

- The drainage basins which discharge into Lakes should have water quality pre-treatment equal to the volume of the first one half inch of runoff. Drainage basins which discharge into the C-8 Biscayne Canal should have water quality pre-treatment equal to the greater volume of the first one half inch of runoff or 2.5 times the percent impervious. This goal ensures that drainage improvements meet Federal, State and County water quality pre-treatment standards.

Water Quantity Performance Goals:

- During the five-year return design storm event, the roadway travel lanes flooding should not exceed the crown of the road. This goal is consistent with the SFWM basis of design criteria; but it is a higher standard than the Miami-Dade County requirement that collector and local streets be passable during the 5-year storm event. According to Miami-Dade County standards “passable” means the depth of flooding should not exceed 8 inches above the crown of road.
- During the ten-year return design storm event, flooding should be below the crown of the roadway. This is a higher standard than the Miami-Dade County requirement that minor arterials (4-lane roads) be passable during the 10-year storm event. According to Miami-Dade County standards the term “passable” means the depth of flooding should not exceed 8 inches above the crown of road.
- During the twenty-five year return storm event, flooding should be less than 12 inches in the roadway travel lanes. Miami-Dade County does not have a requirement for the 25-year storm event.
- During the one hundred-year return storm event, the flooding should be below the building finish floor elevations. This standard is the same as the current Miami-Dade County standard.

The calculations utilized to evaluate the performance goals are based on the readily available information which provide an overview of each area. The overview of each area identifies if the

areas have water quality pretreatment which meet current standard and if the area has a positive outfalls of sufficient size to meet the hydraulic flooding performance goals. This analysis assumes that the runoff from each area has sufficient roadway slopes or storm drainage infrastructure to convey the storm water runoff to the existing outfall structure. Due to the general nature of the study and the limited availability of survey information, the Master Plan does not provide a computer analysis of the effectiveness of storm water conveyance within each drainage sub-basin or sub-basin area. The storm water conveyance deficiencies within each sub-basin were typically identified by the on site observations which were made during significant storm events and the historical complaints of the area.

Based on the analysis of the history of complaints, site observations, hydrologic and hydraulic analysis each of the sub-basin selected for the Capital Improvement Program were evaluated. The following is a detailed summary of the findings, the drainage deficiencies and recommended improvements for each sub-basin.

LOCH NESS SUB-BASIN

Location

The Loch Ness sub-basin is generally located south of the Palmetto Expressway (826), south of Fountain Park Village, north of the C-8 Canal and west of Ludlam Road. The Loch Ness sub-basin is part of the Loch Ness (C803-300) Drainage Basin.

Existing Conditions

Figure 8 shows existing conditions for the Loch Ness sub-basin. The sub-basin consists of approximately 43.2 acres of existing detached single family development with approximately 8,400 linear feet of roadway, including: Dunoon Court, Loch Ness Court, Loch Ness Drive, Loch Ness Lane and Stone Haven Road. The existing roads range in elevation from a low of approximately 5.7 to a high of approximately 7.5 feet. The sub-basin was subdivided into nine areas. Some of these areas have catchbasins, short sections of exfiltration trench, interconnecting culverts and outfalls. The Sub-basin was subdivided into 9 areas. There are three areas (1, 8 & 9) with direct outfalls into the C-8 Biscayne Canal, five areas (2, 3, 4, 5 & 7) with existing outfalls into the Loch Doon and Loch Ness Lakes (widened sections of the C-8 Biscayne Canal). Area 6 does not have an existing outfall. There are a few sections of road that only have catchbasins with short (30 $\pm$ feet) sections of exfiltration trench without any outfall. Stone Haven Road and Dunoon Court are poorly drained roads with flat slopes and no drainage infrastructure.

Performance Goal Analysis

Based on the available information described above calculations were made for each area of the Loch Ness drainage sub-basin to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 5. Loch Ness Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	**No**	Yes	Yes	Yes	Yes	**No***
2	**No**	Yes	Yes	Yes	Yes	**No***
3	**No**	Yes	Yes	Yes	Yes	**No***
4	**No**	Yes	Yes	Yes	Yes	Yes
5	**No**	Yes	Yes	Yes	Yes	**No***
6	**No**	**No**	**No**	**No**	**No**	**No***
7	**No**	Yes	Yes	Yes	Yes	**No***
8	**No**	Yes	Yes	Yes	Yes	Yes
9	**No**	Yes	Yes	Yes	Yes	**No***

*Flooding is occuring these areas because Storm Water runoff is not flowing to the existing catchbasins. The roadways are fairly flat with low spots where water accumulates. The Storm Water model cannot account for the low areas, because topographic survey information showing where they are located is not available.

10/21/02
Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00

Palmetto Expressway (SR826)

Area 7
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day

Area 6
Max. Stage 8.12 5-yr,1-day
Max. Stage 8.29 10-yr,1-day
Max. Stage 9.03 25-yr,3-day
Max. Stage 9.40 100-yr,3-day

Area 4
Max. Stage 6.
Max. Stage 6.
Max. Stage 6.
Max. Stage 6.

Loch Ness Drive
KHA Observed Flooding
Loch Ness Lane
Loch Doon
Area 5
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day
Dunoon Ct.
Loch Ness
Biscayne Canal (C-8 Canal)
Area 8
Max. Stage 5.54 5-yr,1-day
Max. Stage 5.55 10-yr,1-day
Max. Stage 6.01 25-yr,3-day
Max. Stage 6.30 100-yr,3-day
Area 9
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day
Matchline
Matchline

NORTH
0 100 200
SCALE AS SHOWN

Palmetto Expressway (SR826)

Area 4
Max. Stage 6.11 5-yr,1-day
Max. Stage 6.11 10-yr,1-day
Max. Stage 6.13 25-yr,3-day
Max. Stage 6.15 100-yr,3-day

Loch Ness Drive
KHA Observed Flooding
Stonehaven Rd.
Loch Ness Ct.
Dunoon Ct.
Area 5
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day
Loch Ness
Area 3
Max. Stage 6.03 5-yr,1-day
Max. Stage 6.03 10-yr,1-day
Max. Stage 6.42 25-yr,3-day
Max. Stage 6.72 100-yr,3-day
Biscayne Canal (C-8 Canal)
Area 2
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day
Area 1
Max. Stage 2.40 5-yr,1-day
Max. Stage 2.40 10-yr,1-day
Max. Stage 2.40 25-yr,3-day
Max. Stage 2.40 100-yr,3-day
Matchline
Matchline

Figure 8. Loch Ness Sub-Basin (30-2014-010)-Existing

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: There are a few catchbasins that were observed to be filled with debris and sediment such that water flow was blocked or highly restricted. This condition was observed at the catchbasins leading to the outfalls in drainage areas 1, 2, 3 and 9.

Lack of Infrastructure: There are several flat (minimum slopes) stretches of roadway, that do not have any existing storm drainage infrastructure. These area have several low points in the roadway, that were observed to pond during storm events because runoff cannot flow to the existing catchbasins. This condition is found in Stone Haven Road (area 1) and Dunoon Court (area 2) and a few sections (areas 5, 7 and 9) of Loch Ness Drive.

Inadequate Drainage Infrastructure: There are some low points in the roads which have existing catchbasin(s) and short sections of exfiltration trench, but no positive outfall. The capacity and performance of the existing exfiltration (estimated to be 20 to 30 years old) trenches may be reduced due to sedimentation build up in the trenches and perforated pipes. Based on the hydraulic analysis the existing catchbasins and short exfiltration trenches in Area 6 are inadequate. Area 6 is the only area that does not have an existing positive outfall.

Areas 1 and 7 also have some isolated catchbasins with short length of exfiltration trench that are not connected to a positive outfall. Although it is beyond the scope (lack of detail survey data) of the Master Plan to hydraulically evaluate these small isolated areas, the results would be expected to be very similar to basin 6 results and frequent flooding would be expected, as has been observed in these areas.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be of sufficient size and capacity. This assumes that they are free of sediment, debris and structural defects. However, some outfalls were observed to be blocked by debris, sediment or concrete that highly restricts water flow. This condition was observed in drainage areas 1, 3, 7 and 9. The 21-inch diameter culvert outfall in area 3 appears to be restricted with only an 8-inch concrete slot opening. Also, the 21-inch diameter culvert outfall in area 7 appears to be restricted by a concrete block. These restrictions should be removed. Flooding was also observed at the outfall catchbasin in area 2. The outfall culverts should be inspected (tele-video), thoroughly cleaned, flushed and repaired (any structural defects) as necessary.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, culverts and outfalls. Existing catchbasins should be modified or reconstructed as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

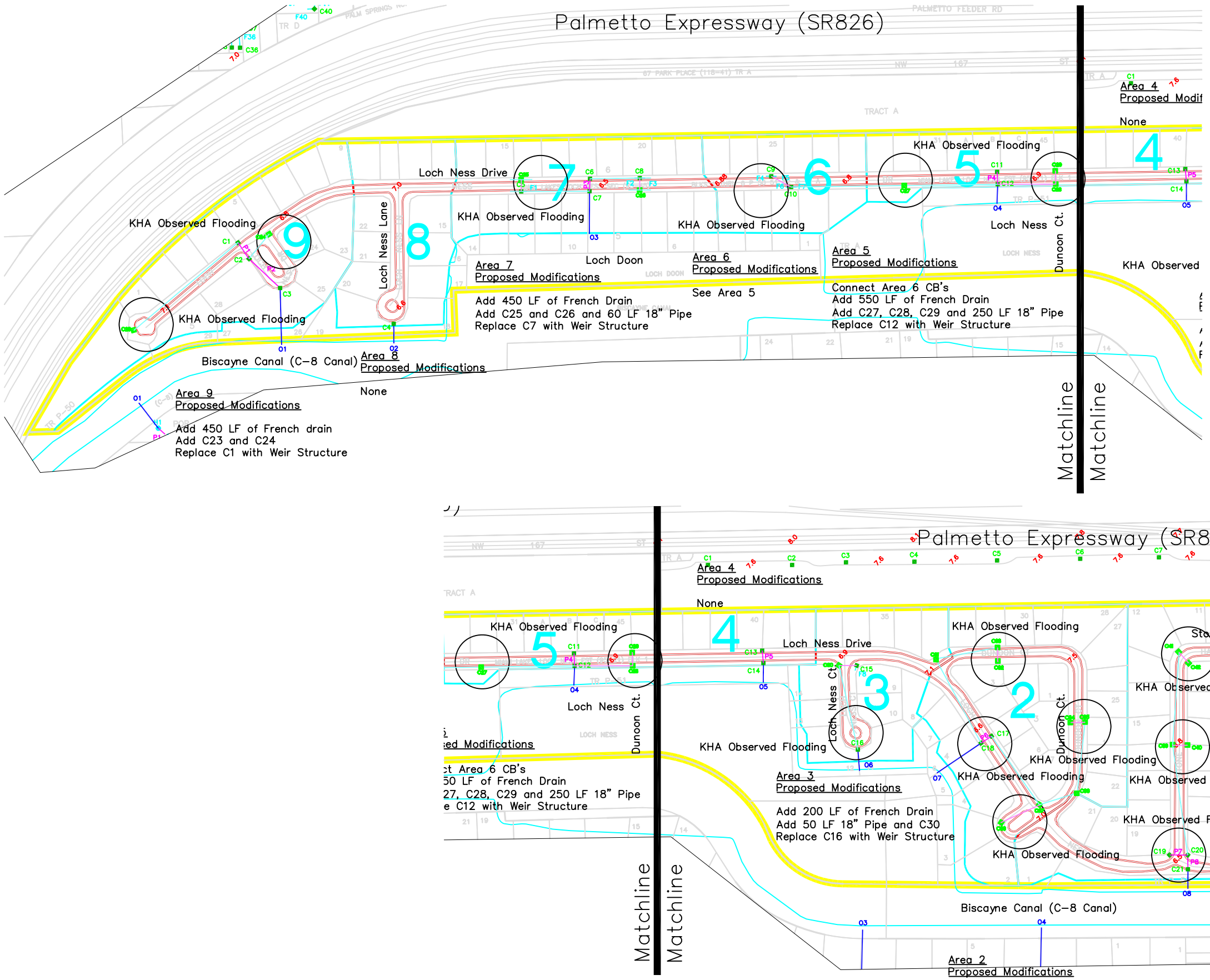
Low Areas Without Drainage: Construct catchbasins at low points with exfiltration trench and connect them to an existing or proposed outfall.

Low Areas With Inadequate Drainage: Construct catchbasins at low points with exfiltration trench and connect them to an existing or proposed outfall. The isolated catchbasins in area 6 should be interconnected with exfiltration trench or culvert to the storm drainage outfall in area 5.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be of sufficient size and capacity, therefore, no improvements are required to the existing outfalls.

An additional outfall is recommended in Basin 1. An additional outfall is a potential alternative for the western end of Loch Ness Drive in area 9. This alternative should be evaluated when detail survey is available during the preliminary design phase.

Figure 9 notes proposed improvements for the Loch Ness sub-basin. These proposed improvements and opinion of probable costs for the Loch Ness sub-basin are summarized in Table 18 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $580,000.



Drawing name: H:\044 Jobs\044533003\CADD\CONCEPT\09LochNessP.dwg lochness Oct 24, 2007 3:33pm by: margaret.mcdermott

No.	REVISIONS	DATE	BY
1	STORMWATER MASTER PLAN UPDATE NO. 1	10/14/05	HLS

SCALE AS NOTED
DESIGNED BY HLS
DRAWN BY HLS
CHECKED BY RRB

Kimley-Horn and Associates, Inc.

5100 N.W. 33rd Avenue, Suite 157, Fort Lauderdale, FL 33309
Phone: (954) 739-2233 Fax: (954) 739-2247
WWW.KIMLEY-HORN.COM CA 00000696

DATE 10/21/02
PROJECT NO. 044533068

Town of Miami Lakes
MIAMI-DADE COUNTY FLORIDA

DESIGN ENGINEER:
FLORIDA REGISTRATION NUMBER:

Figure X. Loch Ness Sub-basin (30-2014-010)

SHEET NUMBER 1 OF 1

LAKE GLENN ELLEN SUB-BASIN

Location

The sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue and west of Montrose Road. The Lake Glenn Ellen sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin.

Existing Conditions

Figure 10 shows existing conditions for the Lake Glenn Ellen sub-basin. The sub-basin consists of approximately 49.1 acres of existing detached single family development with approximately 8,400 linear feet of roadway, including Menteith Terrace, Menteith Place, Dundee Terrace, Glenny terrace, Fintry Place, Garvock Place, Falkirk Place, Dunbarton Place, Dalkeith Place and a portion of Rednock Lane. The existing roads range in elevation from a low of approximately 6.4 to a high of approximately 7.5 feet. The sub-basin was subdivided into 15 areas. There are 19 outfalls into Lake Glenn Ellen. Areas 3, 8, 11, & 14 have two existing outfalls. Typically the low points have catchbasins with short (30 ± feet) sections of exfiltration trench on each side of the road connected to a positive outfall to Lake Glenn Ellen. Typically the exiting outfalls are 8-inch diameter pipes with a raised portion (goose neck) that acts as an overflow weir. The 8-inch outfall pipes are typically located on lot lines between existing houses. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above calculations were made for each area of the Lake Glenn Ellen drainage sub-basin to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 6. Lake Glenn Ellen Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	Yes	Yes	Yes	Yes	**No**
2	Yes	**No**	Yes	Yes	**No**	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	**No**	Yes	**No**	**No**	**No**
5	Yes	**No**	**No**	**No**	**No**	No
6	Yes	**No**	Yes	Yes	**No**	Yes
7	Yes	**No**	Yes	Yes	**No**	**No**
8	Yes	Yes	Yes	Yes	Yes	Yes
9	Yes	Yes	Yes	Yes	Yes	Yes
10	**No**	**No**	Yes	**No**	**No**	**No**
11	Yes	Yes	Yes	Yes	Yes	Yes
12	Yes	**No**	Yes	**No**	**No**	Yes
13	Yes	**No**	**No**	**No**	**No**	**No**
14	Yes	Yes	Yes	Yes	Yes	Yes
15	Yes	**No**	**No**	**No**	**No**	Yes

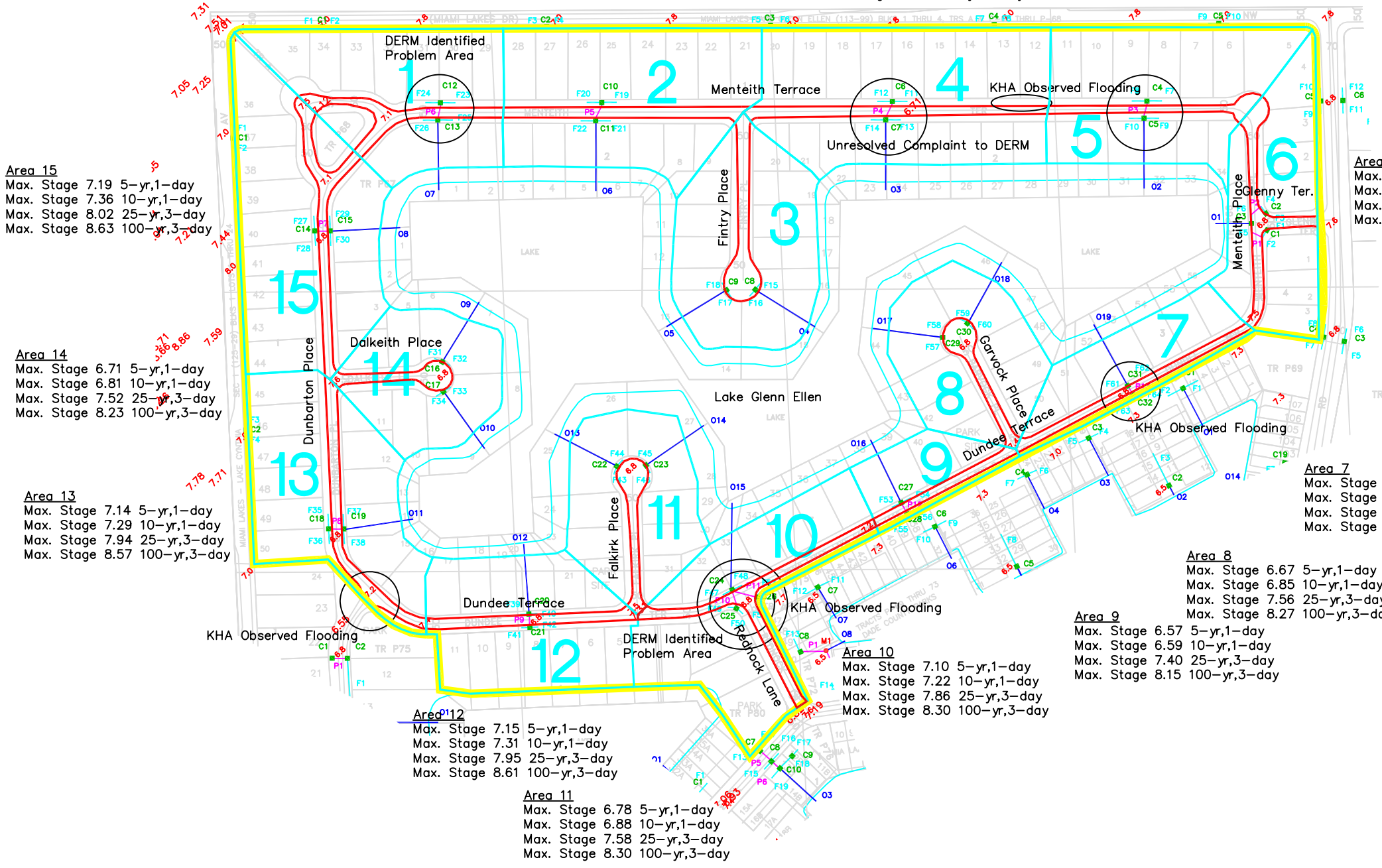
10/16/02

Min. Road Elevation 6.41
Min. CL Road Elevation 6.71
Min. Building FFE 8.21

NORTH

0 150 300

SCALE AS SHOWN



Area 1
Max. Stage 7.10 5-yr,1-day
Max. Stage 7.25 10-yr,1-day
Max. Stage 7.89 25-yr,3-day
Max. Stage 8.54 100-yr,3-day

Area 2
Max. Stage 7.29 5-yr,1-day
Max. Stage 7.41 10-yr,1-day
Max. Stage 8.06 25-yr,3-day
Max. Stage 8.69 100-yr,3-day

Area 3
Max. Stage 6.86 5-yr,1-day
Max. Stage 7.01 10-yr,1-day
Max. Stage 7.63 25-yr,3-day
Max. Stage 8.36 100-yr,3-day

Area 4
Max. Stage 7.27 5-yr,1-day
Max. Stage 7.30 10-yr,1-day
Max. Stage 8.11 25-yr,3-day
Max. Stage 8.62 100-yr,3-day

Area 5
Max. Stage 7.37 5-yr,1-day
Max. Stage 7.56 10-yr,1-day
Max. Stage 8.02 25-yr,3-day
Max. Stage 8.64 100-yr,3-day

Area 6
Max. Stage 7.05 5-yr,1-day
Max. Stage 7.17 10-yr,1-day
Max. Stage 7.37 25-yr,3-day
Max. Stage 9.25 100-yr,3-day

Area 7
Max. Stage 6.88 5-yr,1-day
Max. Stage 7.05 10-yr,1-day
Max. Stage 7.67 25-yr,3-day
Max. Stage 8.41 100-yr,3-day

Area 8
Max. Stage 6.67 5-yr,1-day
Max. Stage 6.85 10-yr,1-day
Max. Stage 7.56 25-yr,3-day
Max. Stage 8.27 100-yr,3-day

Area 9
Max. Stage 6.57 5-yr,1-day
Max. Stage 6.59 10-yr,1-day
Max. Stage 7.40 25-yr,3-day
Max. Stage 8.15 100-yr,3-day

Area 10
Max. Stage 7.10 5-yr,1-day
Max. Stage 7.22 10-yr,1-day
Max. Stage 7.86 25-yr,3-day
Max. Stage 8.30 100-yr,3-day

Area 11
Max. Stage 6.78 5-yr,1-day
Max. Stage 6.88 10-yr,1-day
Max. Stage 7.58 25-yr,3-day
Max. Stage 8.30 100-yr,3-day

Area 12
Max. Stage 7.15 5-yr,1-day
Max. Stage 7.31 10-yr,1-day
Max. Stage 7.95 25-yr,3-day
Max. Stage 8.61 100-yr,3-day

Area 13
Max. Stage 7.14 5-yr,1-day
Max. Stage 7.29 10-yr,1-day
Max. Stage 7.94 25-yr,3-day
Max. Stage 8.57 100-yr,3-day

Area 14
Max. Stage 6.71 5-yr,1-day
Max. Stage 6.81 10-yr,1-day
Max. Stage 7.52 25-yr,3-day
Max. Stage 8.23 100-yr,3-day

Area 15
Max. Stage 7.19 5-yr,1-day
Max. Stage 7.36 10-yr,1-day
Max. Stage 8.02 25-yr,3-day
Max. Stage 8.63 100-yr,3-day

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Figure 10. Glenn Ellen Sub-Basin (30-2022-003) - Existing

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements in all areas except area 10. Except for areas 1, 3, 8, 9, 11, and 14, the existing outfalls for the other areas fail to meet some of the water quantity performance goals, as shown in the preceding chart.

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the performance goals.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfalls: Based on the hydraulic analysis, the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals. The existing outfalls should be replaced with larger outfalls. The final catchbasins prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasin should include a weir, pollution retardant baffle and a sedimentation sump.

Figure 11 notes improvements proposed for the Lake Glenn Ellen sub-basin. These proposed improvements and opinion of probable costs for the Lake Glenn Ellen sub-basin are summarized in Table 19 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $420,000.

01/02/03

Min. Road Elevation 6.41
Min. CL Road Elevation 6.71
Min. Building FFE 8.21

Area 3
Max. Stage 6.86 5–yr,1–day
Max. Stage 7.01 10–yr,1–day
Max. Stage 7.63 25–yr,3–day
Max. Stage 8.36 100–yr,3–day
Proposed Modifications
None

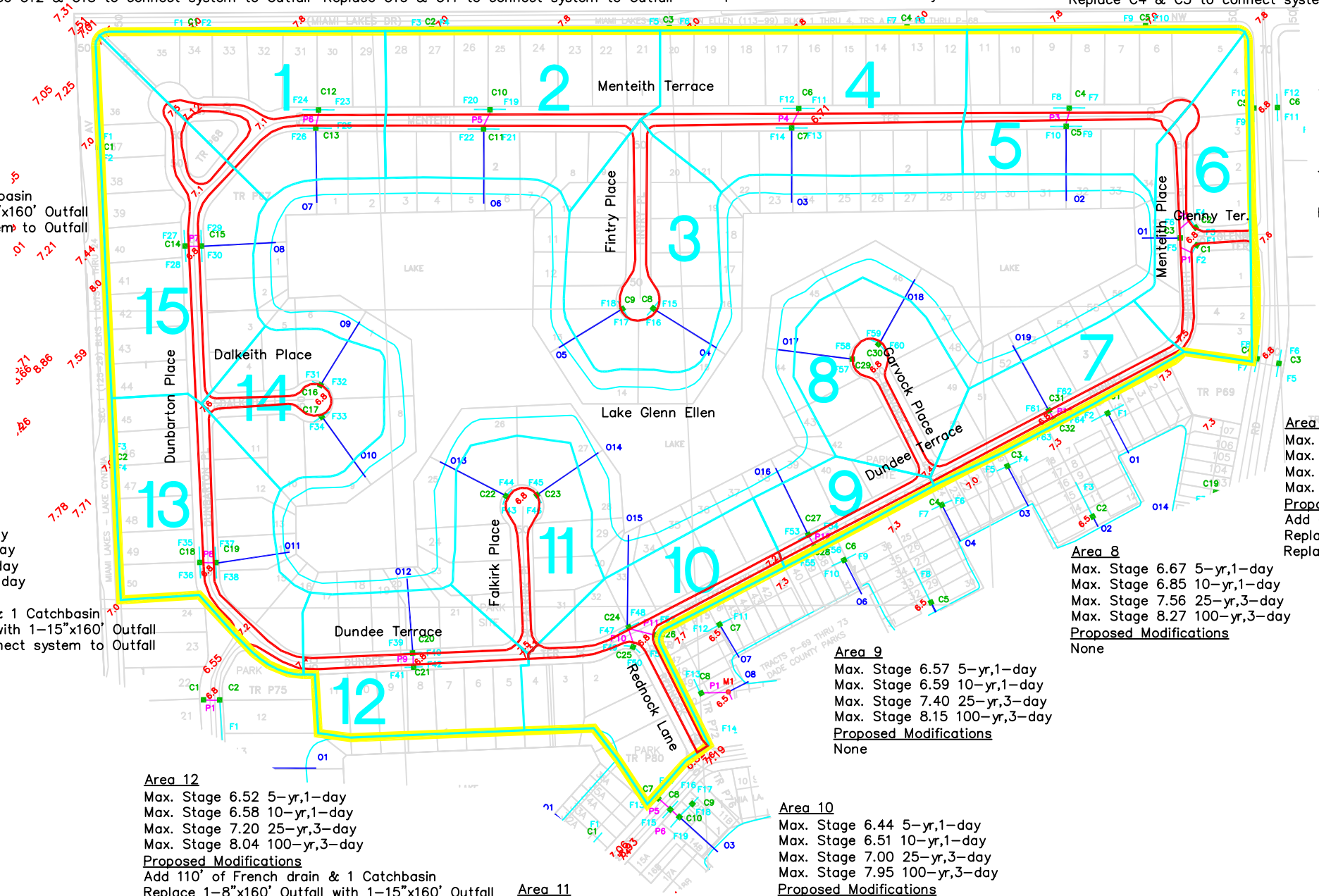
NORTH
0 150 300
SCALE AS SHOWN

Area 1
Max. Stage 7.10 5–yr,1–day
Max. Stage 7.25 10–yr,1–day
Max. Stage 7.89 25–yr,3–day
Max. Stage 8.54 100–yr,3–day
Proposed Modifications
Add 200' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–15"x160' Outfall
Replace C12 & C13 to connect system to Outfall

Area 2
Max. Stage 6.62 5–yr,1–day
Max. Stage 6.71 10–yr,1–day
Max. Stage 7.36 25–yr,3–day
Max. Stage 8.15 100–yr,3–day
Proposed Modifications
Add 150' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–15"x160' Outfall
Replace C10 & C11 to connect system to Outfall

Area 4
Max. Stage 6.45 5–yr,1–day
Max. Stage 6.54 10–yr,1–day
Max. Stage 6.79 25–yr,3–day
Max. Stage 7.10 100–yr,3–day
Proposed Modifications
Add 330' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–18"x160' Outfall
Replace C6 & C7 to connect system to Outfall

Area 5
Max. Stage 6.54 5–yr,1–day
Max. Stage 6.60 10–yr,1–day
Max. Stage 7.07 25–yr,3–day
Max. Stage 7.95 100–yr,3–day
Proposed Modifications
Add 35' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–18"x160' Outfall
Replace C4 & C5 to connect system to Outfall



Area 6
Max. Stage 6.53 5–yr,1–day
Max. Stage 6.60 10–yr,1–day
Max. Stage 7.03 25–yr,3–day
Max. Stage 7.98 100–yr,3–day
Proposed Modifications
Add 145' of French drain & 1 Catchbasin
Replace 1–8"x80' Outfall with 1–15"x80' Outfall
Replace C1, C2 & C3 to connect system to Outfall

Area 15
Max. Stage 6.54 5–yr,1–day
Max. Stage 6.62 10–yr,1–day
Max. Stage 7.14 25–yr,3–day
Max. Stage 7.97 100–yr,3–day
Proposed Modifications
Add 140' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–18"x160' Outfall
Replace C14 & C15 to connect system to Outfall

Area 14
Max. Stage 6.71 5–yr,1–day
Max. Stage 6.81 10–yr,1–day
Max. Stage 7.52 25–yr,3–day
Max. Stage 8.23 100–yr,3–day
Proposed Modifications
None

Area 13
Max. Stage 6.54 5–yr,1–day
Max. Stage 6.62 10–yr,1–day
Max. Stage 7.27 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Add 120' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–15"x160' Outfall
Replace C18 & C19 to connect system to Outfall

Area 7
Max. Stage 6.23 5–yr,1–day
Max. Stage 6.33 10–yr,1–day
Max. Stage 6.94 25–yr,3–day
Max. Stage 7.95 100–yr,3–day
Proposed Modifications
Add 65' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–15"x160' Outfall
Replace C31 & C32 to connect system to Outfall

Area 8
Max. Stage 6.67 5–yr,1–day
Max. Stage 6.85 10–yr,1–day
Max. Stage 7.56 25–yr,3–day
Max. Stage 8.27 100–yr,3–day
Proposed Modifications
None

Area 9
Max. Stage 6.57 5–yr,1–day
Max. Stage 6.59 10–yr,1–day
Max. Stage 7.40 25–yr,3–day
Max. Stage 8.15 100–yr,3–day
Proposed Modifications
None

Area 12
Max. Stage 6.52 5–yr,1–day
Max. Stage 6.58 10–yr,1–day
Max. Stage 7.20 25–yr,3–day
Max. Stage 8.04 100–yr,3–day
Proposed Modifications
Add 110' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–15"x160' Outfall
Replace C20 & C21 to connect system to Outfall

Area 11
Max. Stage 6.78 5–yr,1–day
Max. Stage 6.88 10–yr,1–day
Max. Stage 7.58 25–yr,3–day
Max. Stage 8.30 100–yr,3–day
Proposed Modifications
None

Area 10
Max. Stage 6.44 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 7.95 100–yr,3–day
Proposed Modifications
Add 210' of French drain & 1 Catchbasin
Replace 1–8"x160' Outfall with 1–18"x160' Outfall
Replace C24, C25 & C26 to connect system to Outfall

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Figure 11. Glenn Ellen Sub-Basin (30-2022-003) - Proposed

LAKE SANDRA SUB-BASIN

Location

The sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue and west of Montrose Road. Lake Sandra is adjacent to and southeast of Lake Glenn Ellen. Lake Sandra is located south of Dundee Terrace, north west of Rednock Lane, north of Balgowen Road and west of Montrose Road. The Lake Sandra sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin.

Existing Conditions

Figure 12 shows existing conditions for the Lake Sandra sub-basin. The sub-basin consists of approximately 11.2 acres of residential townhouse development with approximately 600 linear feet of public roadway, including a portion of Balgowan Road. The majority of the paved area within this sub-basin consists of driveways and parking spaces for the development surrounding Lake Sandra. The existing roads range in elevation from a low of approximately 6.4 to a high of approximately 7.5 feet. The sub-basin was subdivided into 14 areas. Each area has an existing outfall into Lake Sandra. Typically, the low points have catchbasins with short (30 $\pm$ feet) sections of exfiltration trench on each side of the road connected to a positive outfall to Lake Sandra. Typically, the existing outfalls are 8-inch diameter pipes with a raised portion (gooseneck) that acts as an overflow weir. The 8-inch outfall pipes are typically located on lot lines between existing buildings. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

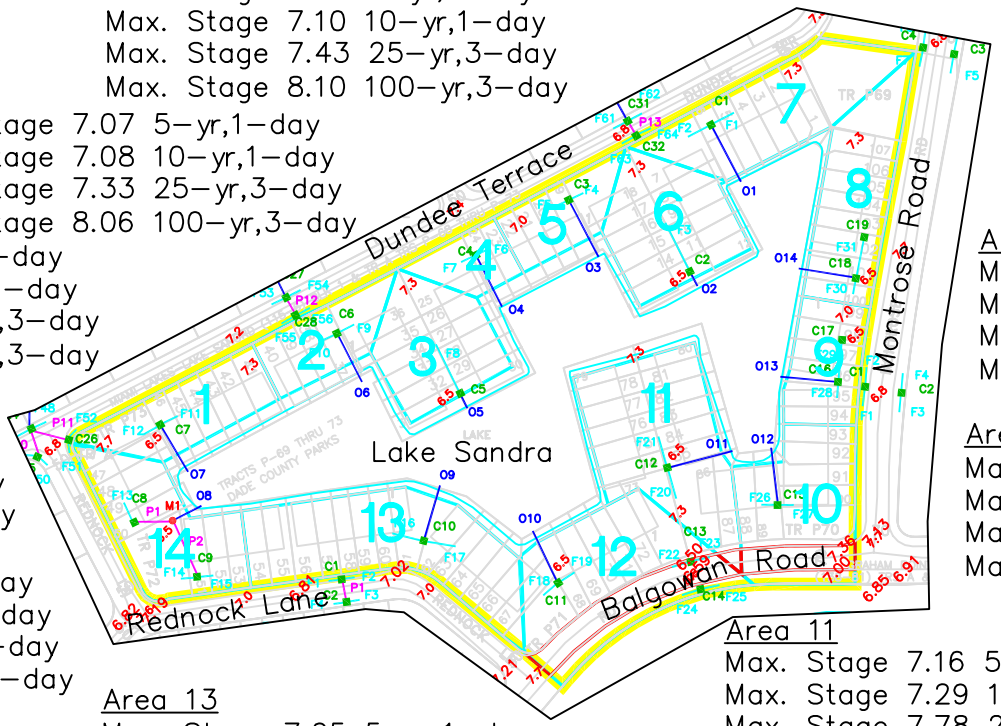
Performance Goal Analysis

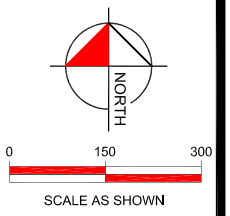
Based on the available information described above, calculations were made for each area of the Lake Sandra drainage sub-basin to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 7. Lake Sandra Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	**No**	Yes	Yes	Yes	Yes
2	Yes	**No**	Yes	Yes	Yes	Yes
3	Yes	**No**	Yes	Yes	Yes	Yes
4	Yes	**No**	Yes	Yes	Yes	Yes
5	Yes	**No**	Yes	Yes	Yes	Yes
6	Yes	Yes	Yes	Yes	Yes	Yes
7	Yes	**No**	Yes	Yes	Yes	Yes
8	Yes	**No**	Yes	Yes	Yes	Yes
9	Yes	**No**	Yes	Yes	Yes	Yes
10	**No**	**No**	Yes	Yes	Yes	Yes
11	Yes	**No**	Yes	Yes	**No**	Yes
12	Yes	**No**	Yes	Yes	Yes	Yes
13	Yes	**No**	Yes	Yes	**No**	Yes
14	Yes	Yes	Yes	Yes	Yes	Yes

Road Elevation 6.50
CL Road Elevation 6.80
Building FFE 8.00





Area 1
Max. Stage 7.01 5-yr,1-day
Max. Stage 7.03 10-yr,1-day
Max. Stage 7.53 25-yr,3-day
Max. Stage 8.20 100-yr,3-day

Area 2
Max. Stage 7.02 5-yr,1-day
Max. Stage 7.06 10-yr,1-day
Max. Stage 7.48 25-yr,3-day
Max. Stage 8.12 100-yr,3-day

Area 3
Max. Stage 7.02 5-yr,1-day
Max. Stage 7.06 10-yr,1-day
Max. Stage 7.34 100-yr,3-day
Max. Stage 8.06 100-yr,3-day

Area 4
Max. Stage 7.07 5-yr,1-day
Max. Stage 7.08 10-yr,1-day
Max. Stage 7.33 25-yr,3-day
Max. Stage 8.06 100-yr,3-day

Area 5
Max. Stage 7.06 5-yr,1-day
Max. Stage 7.10 10-yr,1-day
Max. Stage 7.43 25-yr,3-day
Max. Stage 8.10 100-yr,3-day

Area 6
Max. Stage 6.83 5-yr,1-day
Max. Stage 6.83 10-yr,1-day
Max. Stage 7.29 25-yr,3-day
Max. Stage 8.17 100-yr,3-day

Area 7
Max. Stage 6.89 5-yr,1-day
Max. Stage 7.04 10-yr,1-day
Max. Stage 7.62 25-yr,3-day
Max. Stage 8.29 100-yr,3-day

Area 8
Max. Stage 6.89 5-yr,1-day
Max. Stage 7.16 10-yr,1-day
Max. Stage 7.62 25-yr,3-day
Max. Stage 8.30 100-yr,3-day

Area 9
Max. Stage 7.00 5-yr,1-day
Max. Stage 7.04 10-yr,1-day
Max. Stage 7.47 25-yr,3-day
Max. Stage 8.15 100-yr,3-day

Area 10
Max. Stage 7.04 5-yr,1-day
Max. Stage 7.13 10-yr,1-day
Max. Stage 7.53 25-yr,3-day
Max. Stage 8.16 100-yr,3-day

Area 11
Max. Stage 7.16 5-yr,1-day
Max. Stage 7.29 10-yr,1-day
Max. Stage 7.78 25-yr,3-day
Max. Stage 8.46 100-yr,3-day

Area 12
Max. Stage 7.04 5-yr,1-day
Max. Stage 7.12 10-yr,1-day
Max. Stage 7.54 25-yr,3-day
Max. Stage 8.18 100-yr,3-day

Area 13
Max. Stage 7.05 5-yr,1-day
Max. Stage 7.21 10-yr,1-day
Max. Stage 7.71 25-yr,3-day
Max. Stage 8.45 100-yr,3-day

Area 14
Max. Stage 6.95 5-yr,1-day
Max. Stage 6.87 10-yr,1-day
Max. Stage 7.48 25-yr,3-day
Max. Stage 8.19 100-yr,3-day

10/16/02

Figure 12. Lake Sandra - Existing Sub-Basin (30-2022-004)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements in all area except area 10. The existing outfalls fail to meet the water quantity performance goals for the 5-year storm in all areas except 6 and 14. The existing outfalls meet goals for the 25-year storm in all areas. The existing outfalls fail to meet goals for the 100-year storm in areas 11 and 13.

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Water Quality Deficiencies: Area 10 does not have sufficient length of exfiltration trench to meet the water quality goals.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the majority of the performance goals.

Recommended Drainage Improvements

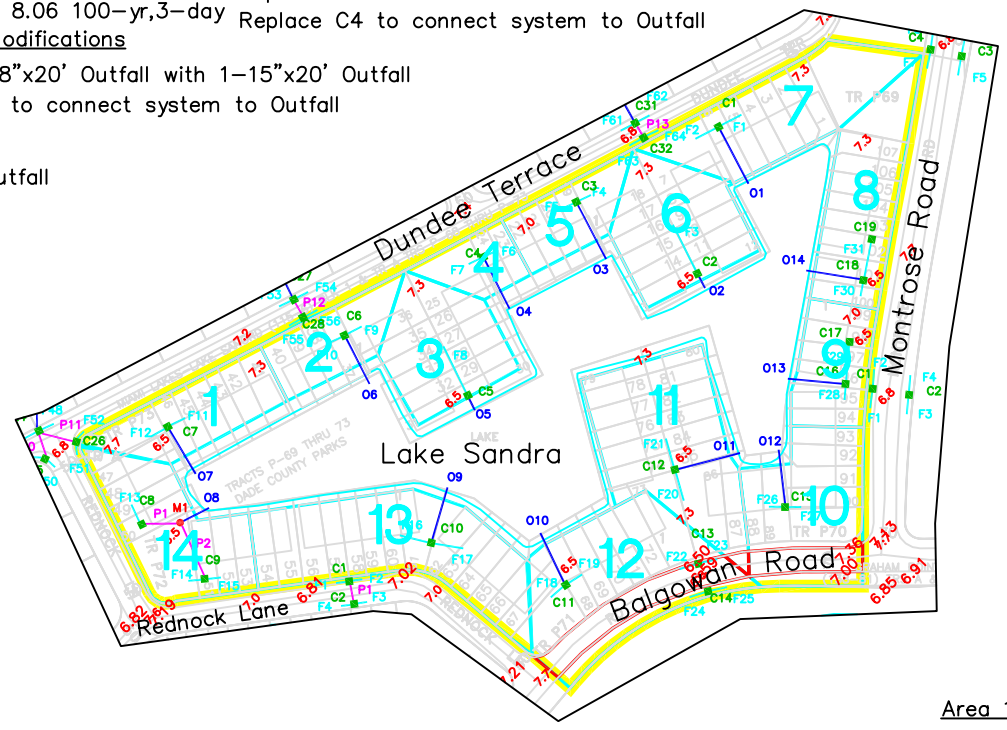
Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Water Quality Deficiencies: Construct additional catchbasins and exfiltration trench and connect to the existing outfall in area 10 to meet the water quality requirements.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals. The existing outfalls should be replaced with longer outfalls. The final catchbasins prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasin should include a weir, pollution retardant baffle and a sedimentation sump.

Figure 13 notes proposed improvements for the Lake Sandra sub-basin. These proposed improvements and opinion of probable costs for the Lake Sandra sub-basin are summarized in Table 20 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $240,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.00



Area 1
Max. Stage 6.52 5–yr,1–day
Max. Stage 6.52 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C7 to connect system to Outfall

Area 2
Max. Stage 6.53 5–yr,1–day
Max. Stage 6.53 10–yr,1–day
Max. Stage 7.01 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C6 to connect system to Outfall

Area 3
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x20' Outfall with 1–15"x20' Outfall
Replace C4 to connect system to Outfall

Area 4
Max. Stage 6.55 5–yr,1–day
Max. Stage 6.55 10–yr,1–day
Max. Stage 7.01 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x115' Outfall with 1–115"x20' Outfall
Replace C4 to connect system to Outfall

Area 5
Max. Stage 6.55 5–yr,1–day
Max. Stage 6.55 10–yr,1–day
Max. Stage 7.01 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C3 to connect system to Outfall

Area 6
Max. Stage 6.83 5–yr,1–day
Max. Stage 6.83 10–yr,1–day
Max. Stage 7.29 25–yr,3–day
Max. Stage 8.17 100–yr,3–day
Proposed Modifications
None

Area 7
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C1 to connect system to Outfall

Area 8
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C18 to connect system to Outfall

Area 9
Max. Stage 6.52 5–yr,1–day
Max. Stage 6.52 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C16 to connect system to Outfall

Area 10
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.00 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Add 240' of French drain
Add 2 CB's in Balgowan Road
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C15 to connect system to Outfall

Area 11
Max. Stage 6.54 5–yr,1–day
Max. Stage 6.61 10–yr,1–day
Max. Stage 7.08 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C12 to connect system to Outfall

Area 12
Max. Stage 6.52 5–yr,1–day
Max. Stage 6.57 10–yr,1–day
Max. Stage 7.03 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Add 325' of French drain
Add 2 CB's in Balgowan Road
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C11 to connect system to Outfall

Area 13
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.56 10–yr,1–day
Max. Stage 7.02 25–yr,3–day
Max. Stage 8.06 100–yr,3–day
Proposed Modifications
Replace 1–8"x110' Outfall with 1–15"x110' Outfall
Replace C10 to connect system to Outfall

Area 14
Max. Stage 6.75 5–yr,1–day
Max. Stage 6.87 10–yr,1–day
Max. Stage 7.48 25–yr,3–day
Max. Stage 8.19 100–yr,3–day
Proposed Modifications
None

NORTH
0 150 300
SCALE AS SHOWN

10/16/02

Figure 13. Lake Sandra - Proposed Sub-Basin (30-2022-004)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CYNTHIA SECTION 1 SUB-BASIN

Location

The Lake Cynthia Section 1 sub-basin is generally located south of NW 154th Street, south of Lake Glenn Ellen, east of NW 87th Avenue and west of Lake Carol and Balgowan Road. The Lake Cynthia Section 1 sub-basin is part of the Sandra/Glenn GDC1-201 Drainage Basin. There are three Lake Cynthia sub-basins, including Sections 1, 2 & 3. Section 1 is located in the northwest portion of Lake Cynthia.

Existing Conditions

Figure 14 shows existing conditions for the Lake Cynthia Section 1 sub-basin. The sub-basin consists of approximately 4.9 acres of existing detached single family development with approximately 400 linear feet of Dunbarton Place roadway. The existing road ranges in elevation from a low of approximately 6.5 to a high of approximately 7.2 feet. The roadway has existing catchbasins, exfiltration trench, interconnecting culverts and one outfall into Lake Cynthia. The existing outfall is an 8-inch diameter pipe with a raised portion (goose neck) that acts as an overflow weir. The 8-inch outfall pipe is located on the lot line between existing houses. The status of drainage easement ownership for the outfall must be verified. If a drainage easement does not presently exist, it may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above calculations were made for the Lake Cynthia Section 1 drainage sub-basin to compare the existing conditions with the above stated performance goals. The detail summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 8. Lake Cynthia Section 1 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	**No**	**No**	**No**	**No**	**No**

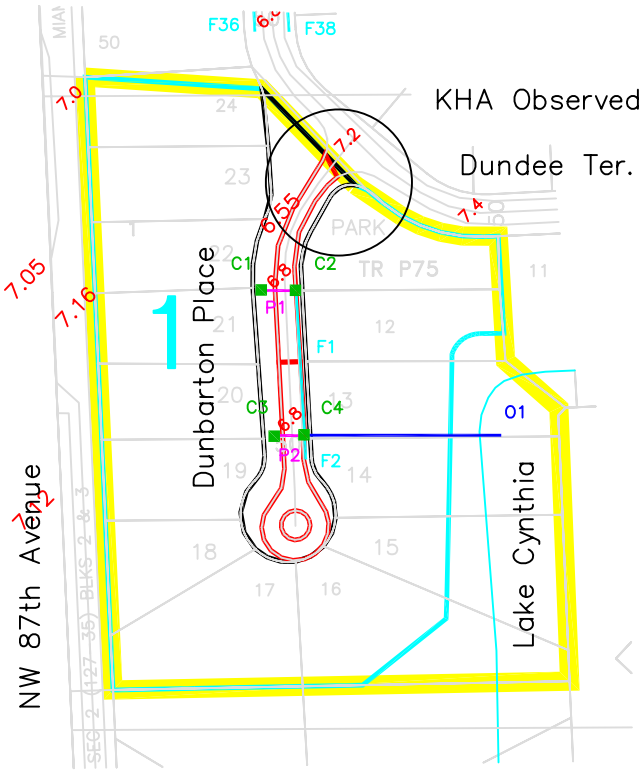
The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfall fails to meet the water quantity performance goals for the 5, 10, 25 and 100-year storm events.

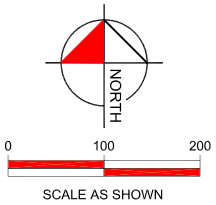
Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch outfall the culvert and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfall appears to be undersized and does not have sufficient capacity to meet the performance goals.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30





Area 1
Max. Stage 7.36 5-yr,1-day
Max. Stage 7.52 10-yr,1-day
Max. Stage 8.01 25-yr,3-day
Max. Stage 8.47 100-yr,3-day

10/16/02

Figure 14. Lake Cynthia Section 1 - Existing Drainage Sub-Basin (30-2022-007)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

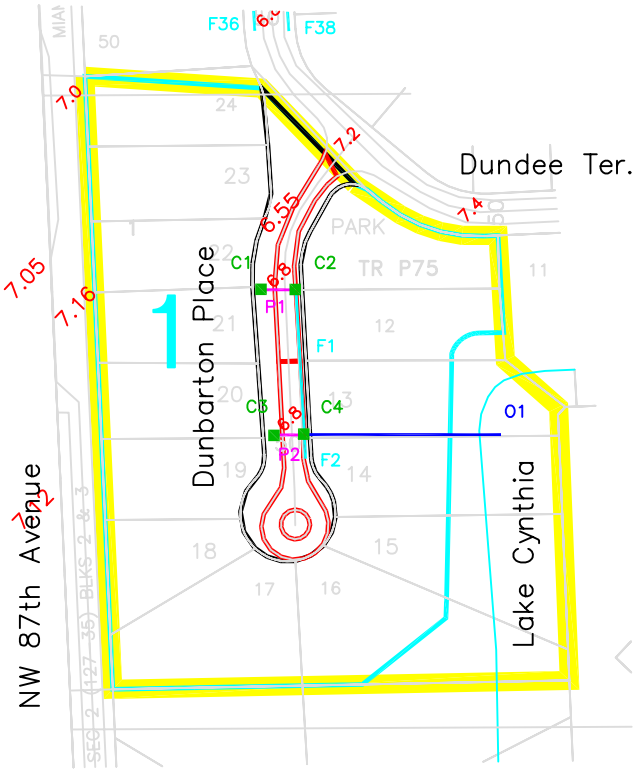
Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfall: Based on the hydraulic analysis the existing outfall appears to be undersized and does not have sufficient capacity to meet the performance goals. The existing outfall should be replaced with an 18-inch outfall. The final catchbasin prior to the oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasin should include a weir, pollution retardant baffle and a sedimentation sump.

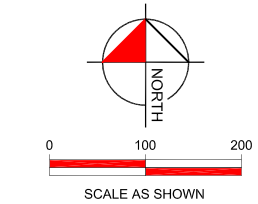
Figure 15 notes improvements proposed for the Lake Cynthia Section 1 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Cynthia Section 1 sub-basin are summarized in Table 21 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $40,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30



Area 1
Max. Stage 6.50 5-yr,1-day
Max. Stage 6.55 10-yr,1-day
Max. Stage 6.91 25-yr,3-day
Max. Stage 8.02 100-yr,3-day

Proposed Modifications
Replace 1-8"x200' Outfall with 2-18"x200' Outfalls
Replace C1, C2, C3 & C4 to protect French drain with sump and baffles



10/16/02

Figure 15. Lake Cynthia Section 1 - Proposed Drainage Sub-Basin (30-2022-007)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CYNTHIA SECTION 2 SUB-BASIN

Location

The Lake Cynthia Section 2 sub-basin is generally located south of NW 154th Street, south of Lake Glenn Ellen, east of NW 87th Avenue and west of Lake Carol and Balgowan Road. The Lake Cynthia Section 2 sub-basin is part of the Sandra/Glenn GDC1-201 Drainage Basin. There are three Lake Cynthia sub-basins, including Sections 1, 2 & 3. Section 2 is located in the southwest portion of Lake Cynthia.

Existing Conditions

Figure 16 shows existing conditions for the Lake Cynthia Section 2 sub-basin. The sub-basin consists of approximately 5.5 acres of detached single family development with approximately 300 linear feet of Breckness Place and 400 linear feet of Glencairn Road. The existing road ranges in elevation from a low of approximately 6.5 to a high of approximately 7.5 feet. The roadway has existing catchbasins, exfiltration trench, interconnecting culverts and two outfalls into Lake Cynthia. The Lake Cynthia Section 2 sub-basin is divided into two areas. Typically, the existing outfalls are 8-inch diameter pipes with a raised portion (goose neck) which acts as an overflow weir. The 8-inch outfall pipes are typically located on lot lines between existing houses or through parks. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above, calculations were made for the Lake Cynthia Section 2 drainage sub-basin areas to compare the existing conditions with the previously stated performance goals. The detail summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

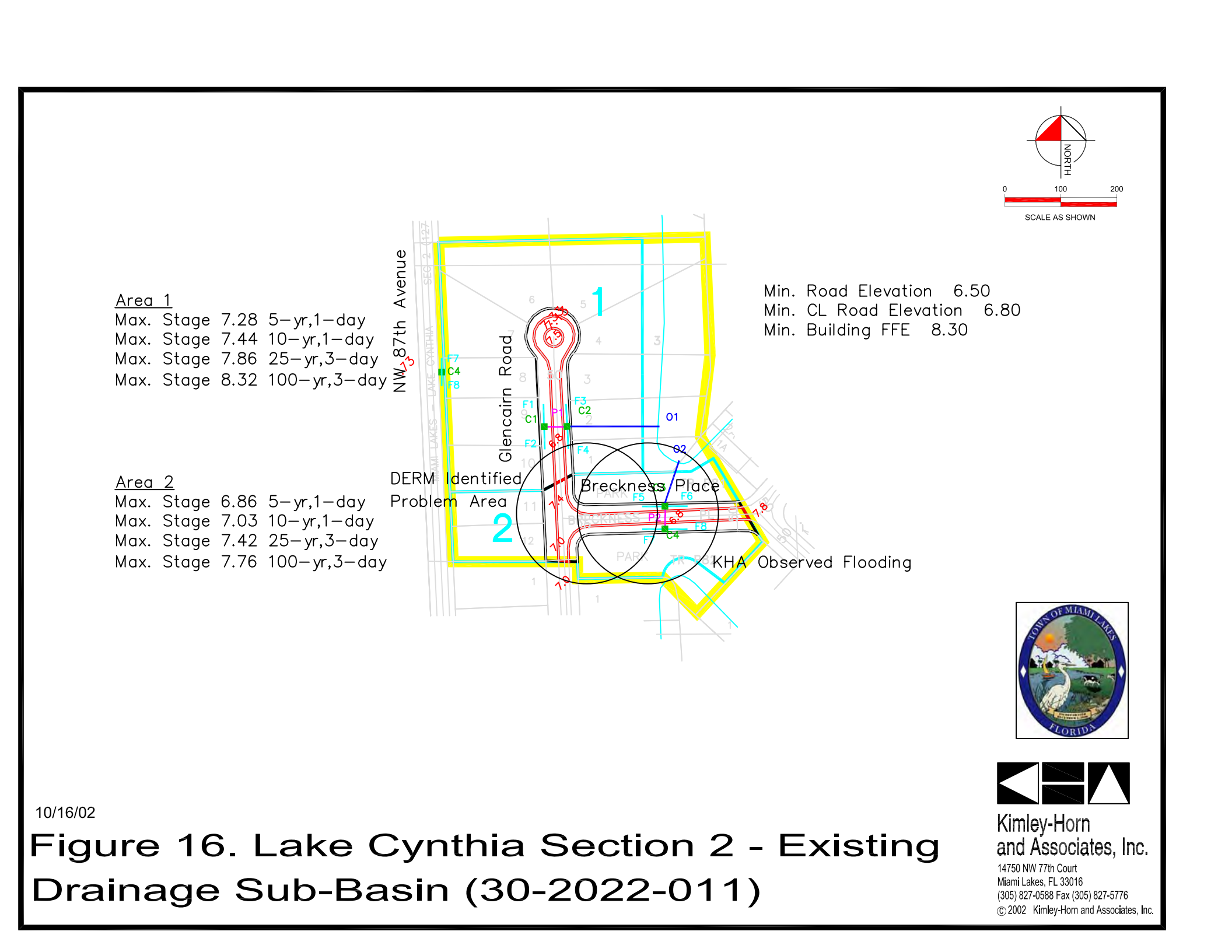
Table 9. Lake Cynthia Section 2 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	**No**	Yes	**No**	**No**	**No**
2	Yes	**No**	Yes	Yes	Yes	**No**

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfall in area 1 fails to meet the water quantity performance goals for the 5, 25 and 100-year storm events. The existing outfall in area 2 fails to meet the water quantity performance goals for the 5-year storm event.

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance may is recommended for the existing system.


NORTH
0
100
200
SCALE AS SHOWN
Area 1
Max. Stage 7.28 5-yr,1-day
Max. Stage 7.44 10-yr,1-day
Max. Stage 7.86 25-yr,3-day
Max. Stage 8.32 100-yr,3-day
Area 2
Max. Stage 6.86 5-yr,1-day
Max. Stage 7.03 10-yr,1-day
Max. Stage 7.42 25-yr,3-day
Max. Stage 7.76 100-yr,3-day
NW 87th Avenue
Glencairn Road
Breckness Place
DERM Identified Problem Area
1
2
F1
F2
F3
F4
F5
F6
F7
F8
C1
C2
C4
P1
P2
O1
O2
KHA Observed Flooding
Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30
10/16/02
Figure 16. Lake Cynthia Section 2 - Existing Drainage Sub-Basin (30-2022-011)
Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776
© 2002 Kimley-Horn and Associates, Inc.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the performance goals.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfall: Based on the hydraulic analysis the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals. The outfalls should be replaced with larger outfalls. The final catchbasin prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump.

Figure 17 notes proposed improvements for the Lake Cynthia Section 2 sub-basin. These proposed improvements and opinion of probable costs for the Lake Cynthia Section 2 sub-basin are summarized in Table 22 in the Capital Improvements Program section of this report. The total budget for the improvements is $40,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30

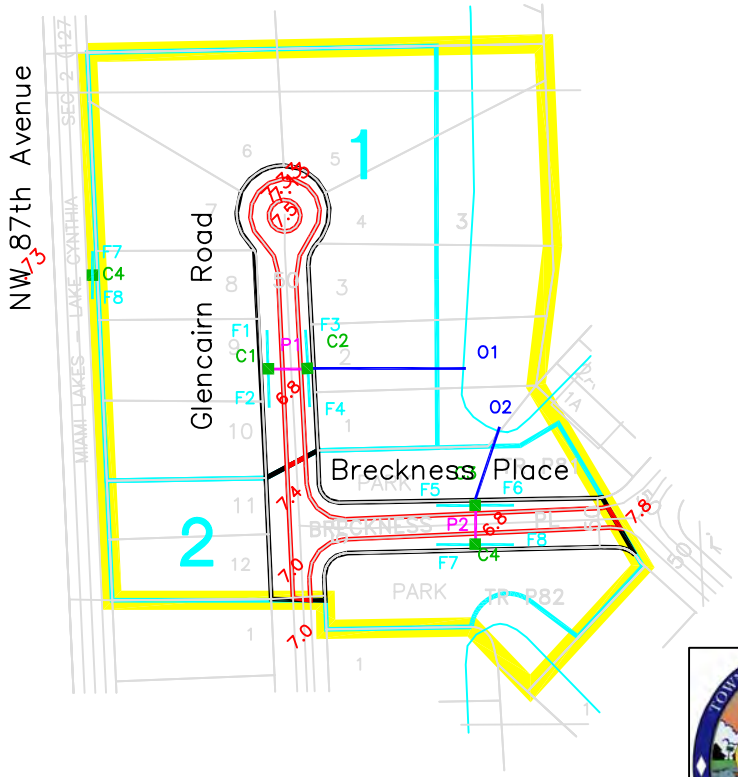
NORTH

0 100 200

SCALE AS SHOWN

Area 1
Max. Stage 6.50 5-yr,1-day
Max. Stage 6.55 10-yr,1-day
Max. Stage 6.91 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Replace 1-8"x160' Outfall with 2-15"X160' Outfalls
Replace C1 & C2 to protect French drain with sump & baffles

Area 2
Max. Stage 6.50 5-yr,1-day
Max. Stage 6.54 10-yr,1-day
Max. Stage 6.91 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Replace 1-8"x80' Outfall with 1-15"x80' Outfall
Replace C3 & C4 to protect French drain with sump & baffles



10/16/02

Figure 17. Lake Cynthia Section 2 - Proposed Drainage Sub-Basin (30-2022-011)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CYNTHIA SECTION 3 SUB-BASIN

Location

The Lake Cynthia Section 3 sub-basin is generally located south of NW 154th Street, south of Lake Glenn Ellen, east of NW 87th Avenue and west of Lake Carol and Balgowan Road. The Lake Cynthia Section 3 sub-basin is part of the Sandra/Glenn GDC1-201 Drainage Basin. There are three Lake Cynthia sub-basins, including Sections 1, 2 & 3. Section 3 is located in the southeast portion of Lake Cynthia.

Existing Conditions

Figure 18 shows existing conditions for the Lake Cynthia Section 3 sub-basin. The sub-basin consists of approximately 3.2 acres of residential townhouse development with frontage on approximately 900 linear feet of Breckness Place. The existing road ranges in elevation from a low of approximately 6.5 to a high of approximately 7.8 feet. The roadway has exiting catchbasins, exfiltration trench, interconnecting culverts and three existing outfalls into Lake Carol. The townhouse parking area and development has three existing outfalls into Lake Cynthia.

The Lake Cynthia Section 3 sub-basin is divided into three areas. Typically the exiting outfalls are 8-inch diameter pipes with a raised portion (goose neck) which acts as an overflow weir. The 8-inch outfall pipes are typically located on lot lines between existing buildings. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above calculations were made for the Lake Cynthia Section 3 drainage sub-basin areas to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following chart table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 10. Lake Cynthia Section 3 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	**No**	**No**	Yes	Yes	**No**
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	**No**	Yes	Yes	Yes	Yes

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfall in area 1 fails to meet the water quantity performance goals for the 5, and 10-year storm events. The existing outfall in area 3 fails to meet the water quantity performance goals for the 5-year storm event.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30

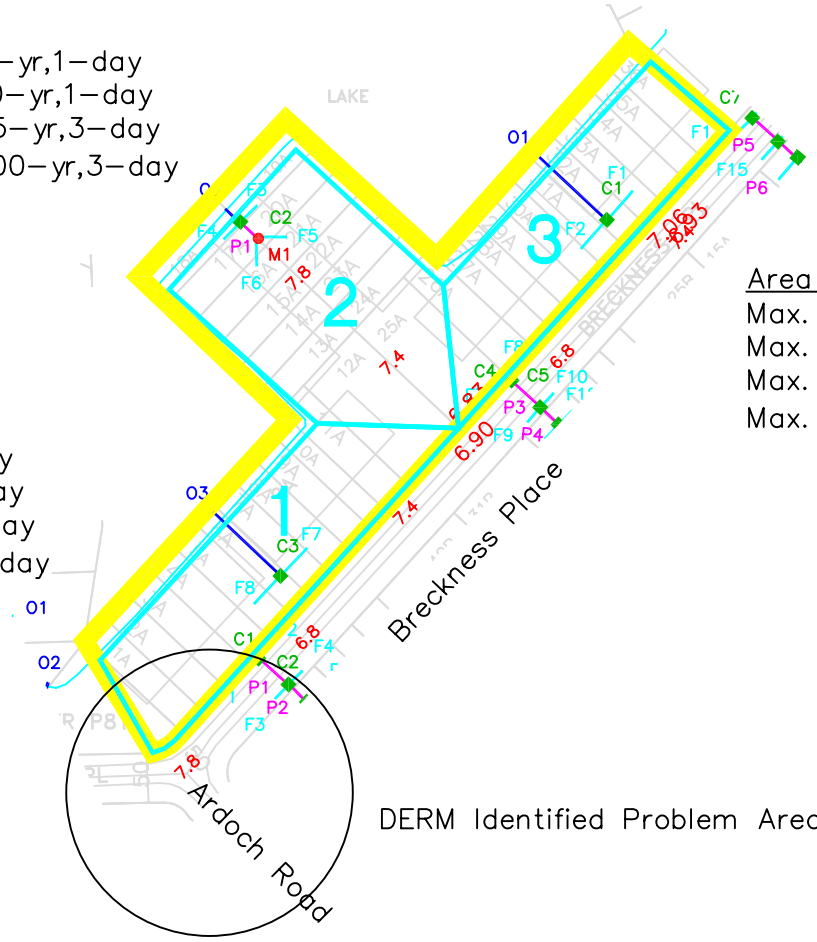
KHA Observed Flooding along entire length of Breckness Place

NORTH
0 100 200
SCALE AS SHOWN

Area 2
Max. Stage 6.57 5-yr,1-day
Max. Stage 6.71 10-yr,1-day
Max. Stage 7.18 25-yr,3-day
Max. Stage 7.76 100-yr,3-day

Area 3
Max. Stage 6.71 5-yr,1-day
Max. Stage 6.82 10-yr,1-day
Max. Stage 7.10 25-yr,3-day
Max. Stage 7.76 100-yr,3-day

Area 1
Max. Stage 6.78 5-yr,1-day
Max. Stage 6.91 10-yr,1-day
Max. Stage 7.22 25-yr,3-day
Max. Stage 7.76 100-yr,3-day



10/16/02

Figure 18. Lake Cynthia Section 3 - Existing Drainage Sub-Basin (30-2022-013)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be adequate and have sufficient capacity to meet the performance goals.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts.

Undersized Outfalls: None.

Lake Cynthia and Lake Carol Outfall Modifications: None

Figure 19 notes proposed improvements for the Lake Cynthia Section 3 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Cynthia Section 3 sub-basin are summarized in Table 23 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $0.

Area 2

Max. Stage 6.57 5-yr,1-day

Max. Stage 6.71 10-yr,1-day

Max. Stage 7.18 25-yr,3-day

Max. Stage 7.76 100-yr,3-day

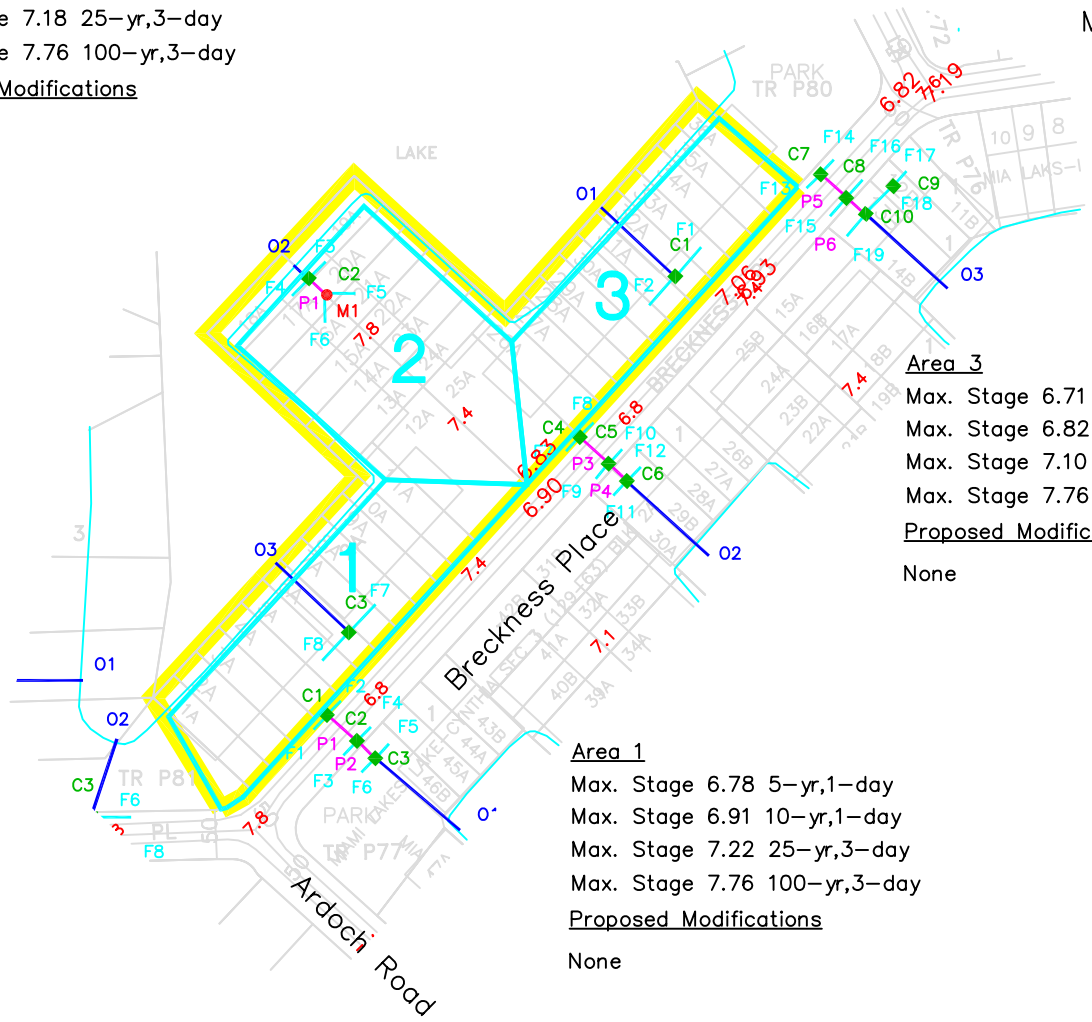
Proposed Modifications

None

Min. Road Elevation 6.25

Min. CL Road Elevation 6.80

Min. Building FFE 8.30



Area 3

Max. Stage 6.71 5-yr,1-day

Max. Stage 6.82 10-yr,1-day

Max. Stage 7.10 25-yr,3-day

Max. Stage 7.76 100-yr,3-day

Proposed Modifications

None

Area 1

Max. Stage 6.78 5-yr,1-day

Max. Stage 6.91 10-yr,1-day

Max. Stage 7.22 25-yr,3-day

Max. Stage 7.76 100-yr,3-day

Proposed Modifications

None

10/16/02

Figure 19. Lake Cynthia Section 3-Proposed Drainage Sub-Basin (30-2022-013)

Kimley-Horn and Associates, Inc.

14750 NW 77th Court

Miami Lakes, FL 33016

(305) 827-0588 Fax (305) 827-5776

LAKE CAROL SECTION 1 SUB-BASIN

Location

The Lake Carol Section 1 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, southwest of Lake Sandra, southeast of Lake Cynthia, northeast of Lake Elizabeth and west of Balgowan Road. The Lake Carol Section 1 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. There are four Lake Carol sub-basins, including Section 1, 2, 3 & 4. Section 1 is located on the east side of Lake Carol. Section 1 is divided into six drainage areas.

Existing Conditions

Figure 20 shows existing conditions for the Lake Carol Section 1 sub-basin. The sub-basin consists of approximately 8.0 acres of existing residential townhouse development along approximately 1250 linear feet of Balgowan Road and 700 linear feet of Rednock Lane. The existing roads range in elevation from a low of approximately 6.5 to a high of approximately 7.6 feet. The roadway and townhouse parking areas have existing catchbasins, exfiltration trench, interconnecting culverts and six existing outfalls into Lake Carol.

The Lake Carol Section 1 sub-basin is divided into six areas. Typically, the existing outfalls vary in size from 8 to 18-inch diameter pipes with a raised portion (goose neck) which acts as an overflow weir. The 8-inch outfall pipes are typically located between existing townhouses. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above calculations were made for the Lake Carol Section 1 drainage sub-basin areas to compare the existing conditions with the above stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

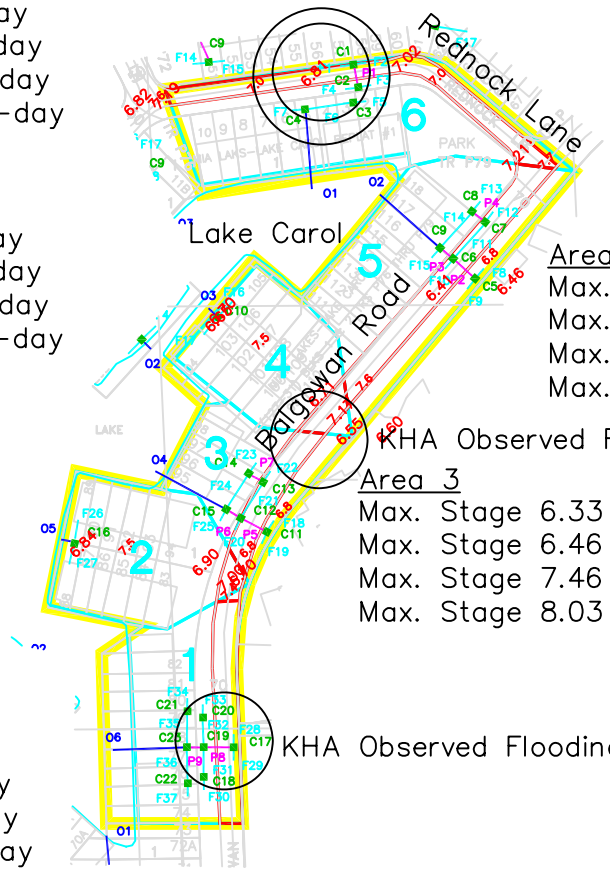
Table 11. Lake Carol Section 1 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	Yes	Yes	Yes	Yes	**No**
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	**No**
4	Yes	Yes	Yes	Yes	Yes	**No**
5	Yes	Yes	Yes	Yes	Yes	**No**
6	Yes	Yes	Yes	Yes	Yes	**No**

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfalls also meet the water quantity performance goals. Flooding and complaints were observed in Areas 1, 3, 4, 5 and 6.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30

DERM Identified
Problem Area
KHA Observed Flooding



NORTH
0 150 300
SCALE AS SHOWN

Area 6
Max. Stage 6.57 5-yr,1-day
Max. Stage 6.64 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 4
Max. Stage 6.51 5-yr,1-day
Max. Stage 6.56 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 5
Max. Stage 6.58 5-yr,1-day
Max. Stage 6.65 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

KHA Observed Flooding

Area 2
Max. Stage 6.66 5-yr,1-day
Max. Stage 6.91 10-yr,1-day
Max. Stage 7.53 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 3
Max. Stage 6.33 5-yr,1-day
Max. Stage 6.46 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 1
Max. Stage 6.53 5-yr,1-day
Max. Stage 6.57 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

KHA Observed Flooding

10/21/02

Figure 20. Lake Carol 1 - Existing Drainage Sub-Basin (30-2022-010)

Kimley-Horn
and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch to 18-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the performance goals.

Recommended Drainage Improvements

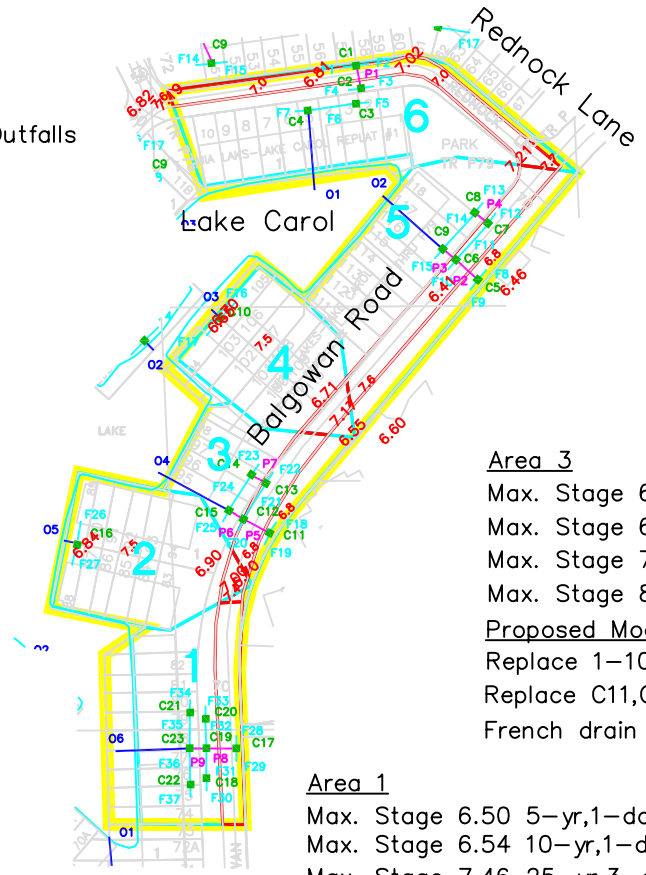
Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals. The existing outfalls should be replaced with six larger outfalls. The final catchbasin prior to each outfall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump.

Existing Infrastructure Modifications: Additional exfiltration trench is recommended in Areas 1, 5 and 6 to provide additional storage capacity for the system. New catchbasins or manholes will be required at the far end of the new exfiltration trench for maintenance purposes.

Figure 21 notes improvements proposed for the Lake Carol Section 1 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Carol Section 1 sub-basin are summarized in Table 24 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $200,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30



NORTH
0 100 200
SCALE AS SHOWN

Area 6
Max. Stage 6.50 5–yr,1–day
Max. Stage 6.55 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Add 150' of French drain & 1 CB
Replace 1–12"x125' Outfall with 2–18"x125' Outfalls
Replace C1,C2,C3 & C4 to protect
French drain with sump & baffles

Area 4
Max. Stage 6.41 5–yr,1–day
Max. Stage 6.51 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
None

Area 2
Max. Stage 6.43 5–yr,1–day
Max. Stage 6.54 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
None

Area 5
Max. Stage 6.50 5–yr,1–day
Max. Stage 6.55 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Add 145' of French drain
Replace 1–18"x125' Outfall with 2–18"x125' Outfalls
Replace C5,C6,C7,C8 & C9 to to protect
French drain with sump & baffles

Area 3
Max. Stage 6.35 5–yr,1–day
Max. Stage 6.46 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Replace 1–10"x120' Outfall with 2–15"x120' Outfalls
Replace C11,C12,C13,C14 & C15 to protect
French drain with sump & baffles

Area 1
Max. Stage 6.50 5–yr,1–day
Max. Stage 6.54 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Add 30' of French drain
Replace 1–12"x115' Outfall with 2–15"x115' Outfalls
Replace C17,C18,C19,C20,C21,C22 & C23
to protect French drain with sump & baffles

01/02/03

Figure 21. Lake Carol 1 - Proposed Drainage Sub-Basin (30-2022-010)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CAROL SECTION 2 SUB-BASIN

Location

The Lake Carol Section 2 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, southwest of Lake Sandra, southeast of Lake Cynthia, , northeast of Lake Elizabeth and west of Balgowan Road. The Lake Carol Section 2 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. There are four Lake Carol sub-basins, including Section 1, 2, 3 & 4. Section 2 is located on the northwest side of Lake Carol. Section 2 is divided into five drainage areas.

Existing Conditions

Figure 22 shows existing conditions for the Lake Carol Section 2 sub-basin. The sub-basin consists of approximately 5.0 acres of residential townhouse development along approximately 1250 linear feet of Breckness Place. The existing roads range in elevation from a low of approximately 6.5 to a high of approximately 7.6 feet. The roadway and townhouse parking areas have existing catchbasins, exfiltration trench, interconnecting culverts and five existing outfalls into Lake Carol.

The Lake Carol Section 2 sub-basin is divided into five areas. Typically, the exiting outfalls vary in size from 8 to 12-inch diameter pipes with a raised portion (goose neck) which acts as an overflow weir. The outfall pipes are typically located between existing townhouses. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

Based on the available information described above, calculations were made for the Lake Carol Section 2 drainage sub-basin areas to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (not) meet the performance goals.

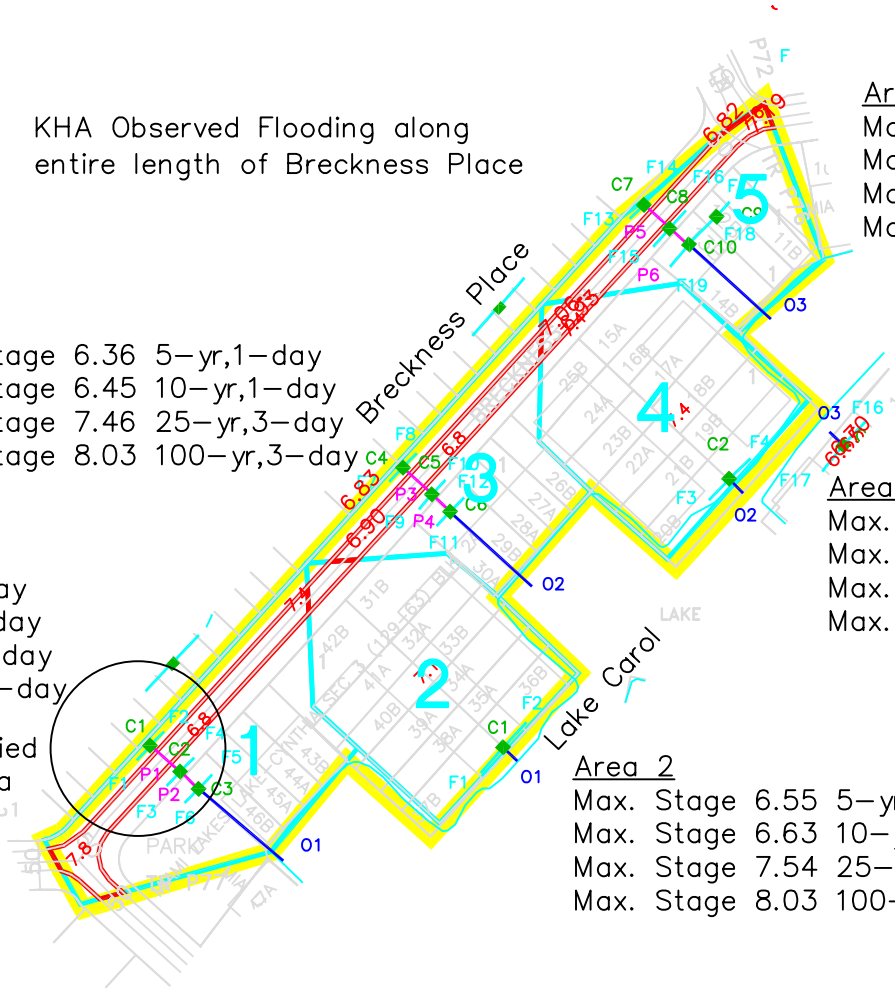
Table 12. Lake Carol Section 2 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or complaints
1	Yes	Yes	Yes	Yes	Yes	**No**
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	**No**
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	**No**

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfalls also meet the water quantity performance goals. Complaints and flooding were observed in areas 1, 3 and 5.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30

KHA Observed Flooding along entire length of Breckness Place



Area 1
Max. Stage 6.81 5-yr,1-day
Max. Stage 7.01 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

DERM Identified Problem Area

Area 2
Max. Stage 6.55 5-yr,1-day
Max. Stage 6.63 10-yr,1-day
Max. Stage 7.54 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 3
Max. Stage 6.36 5-yr,1-day
Max. Stage 6.45 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 4
Max. Stage 6.52 5-yr,1-day
Max. Stage 6.57 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 5
Max. Stage 6.42 5-yr,1-day
Max. Stage 6.56 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

NORTH

0 100 200
SCALE AS SHOWN

10/21/02

Figure 22. Lake Carol 2 - Existing Drainage Sub-Basin (30-2022-017)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch to 18-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be undersized and does not have sufficient capacity to meet the performance goals.

Lake Capacity: Lake Carol does not have the capacity to contain the 100-year storm and maintain a level below the finish floor elevation of the lowest houses surrounding the lake.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

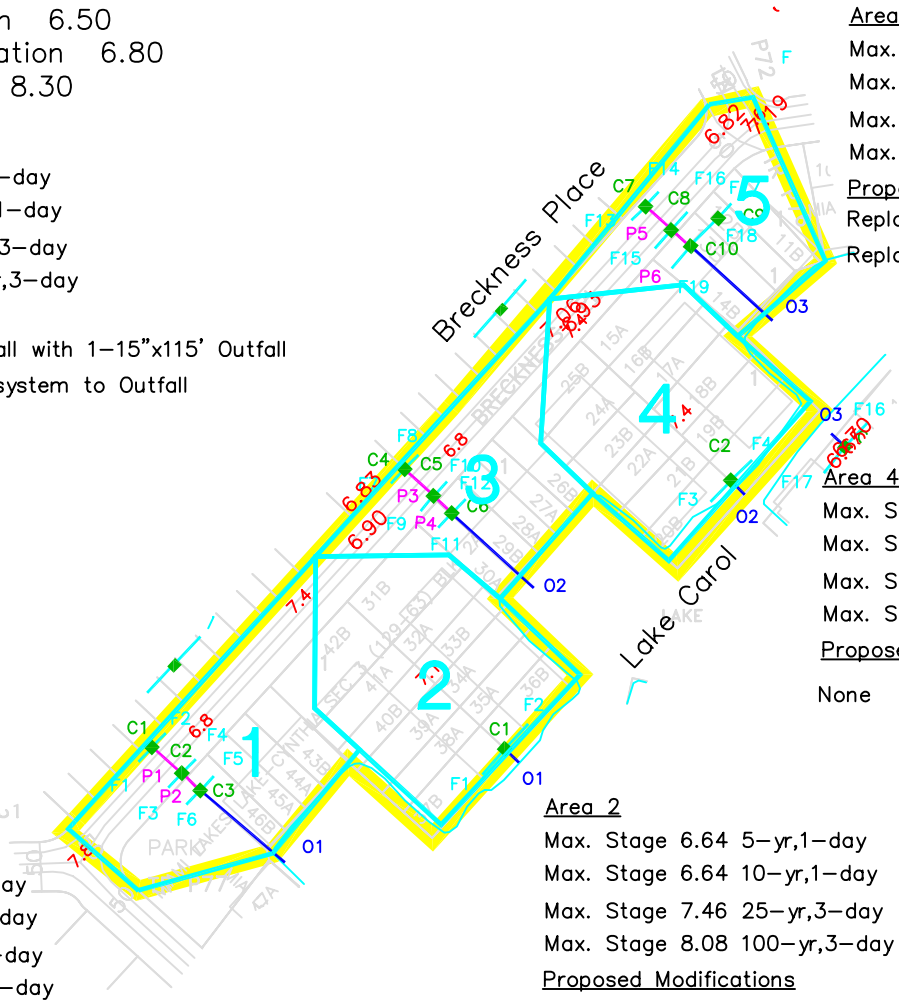
Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the performance goals. The existing outfalls should be replaced with larger outfalls. The final catchbasin prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump.

Existing Infrastructure Modifications: Additional exfiltration trench is recommended in Areas 1, 5, and 6 to provide additional storage capacity for the system. New catchbasins or manholes will be required at the far end of the new exfiltration trench for maintenance purposes.

Figure 23 notes proposed improvements for the Lake Carol Section 2 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Carol Section 2 sub-basin are summarized in Table 25 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $40,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30

Area 3
Max. Stage 6.53 5-yr,1-day
Max. Stage 6.59 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.08 100-yr,3-day
Proposed Modifications
Replace 1-12"x115' Outfall with 1-15"x115' Outfall
Replace C6 to connect system to Outfall



Area 5
Max. Stage 6.47 5-yr,1-day
Max. Stage 6.54 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.08 100-yr,3-day
Proposed Modifications
Replace 1-8"x115' Outfall with 1-15"x115' Outfall
Replace C9 & C10 to connect system to Outfall

NORTH
0 100 200
SCALE AS SHOWN

Area 4
Max. Stage 6.52 5-yr,1-day
Max. Stage 6.52 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.08 100-yr,3-day
Proposed Modifications
None

Area 1
Max. Stage 6.59 5-yr,1-day
Max. Stage 6.69 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.08 100-yr,3-day
Proposed Modifications
Replace 1-8"x115' Outfall with 1-15"x115' Outfall
Replace C3 to connect system to Outfall

Area 2
Max. Stage 6.64 5-yr,1-day
Max. Stage 6.64 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.08 100-yr,3-day
Proposed Modifications
None

01/02/03

Figure 23. Lake Carol 2 - Proposed Drainage Sub-Basin (30-2022-017)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CAROL SECTION 3 SUB-BASIN

Location

The Lake Carol Section 3 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, southwest of Lake Sandra, southeast of Lake Cynthia, , northeast of Lake Elizabeth and west of Balgowan Road. The Lake Carol Section 3 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. There are four Lake Carol sub-basins, including Section 1, 2, 3, & 4. Section 3 is located on the southwest side of Lake Carol. Section 3 is divided into three drainage areas.

Existing Conditions

Figure 24 shows existing conditions for the Lake Carol Section 3 sub-basin. The sub-basin consists of approximately 6.5 acres of residential townhouse development along approximately 700 linear feet of Ardoch Road. The existing roads range in elevation from a low of approximately 6.5 to a high of approximately 7.6 feet. The roadway and townhouse parking areas have exiting catchbasins, exfiltration trench, interconnecting culverts and three existing outfalls into Lake Carol.

The Lake Carol Section 3 sub-basin is divided into six areas. Typically the exiting outfalls vary in size from 8 15-inch diameter pipes with a raised portion (goose neck) which acts as an overflow weir. The 8-inch outfall pipes are typically located on lot lines between existing townhouses. The status of drainage easements for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

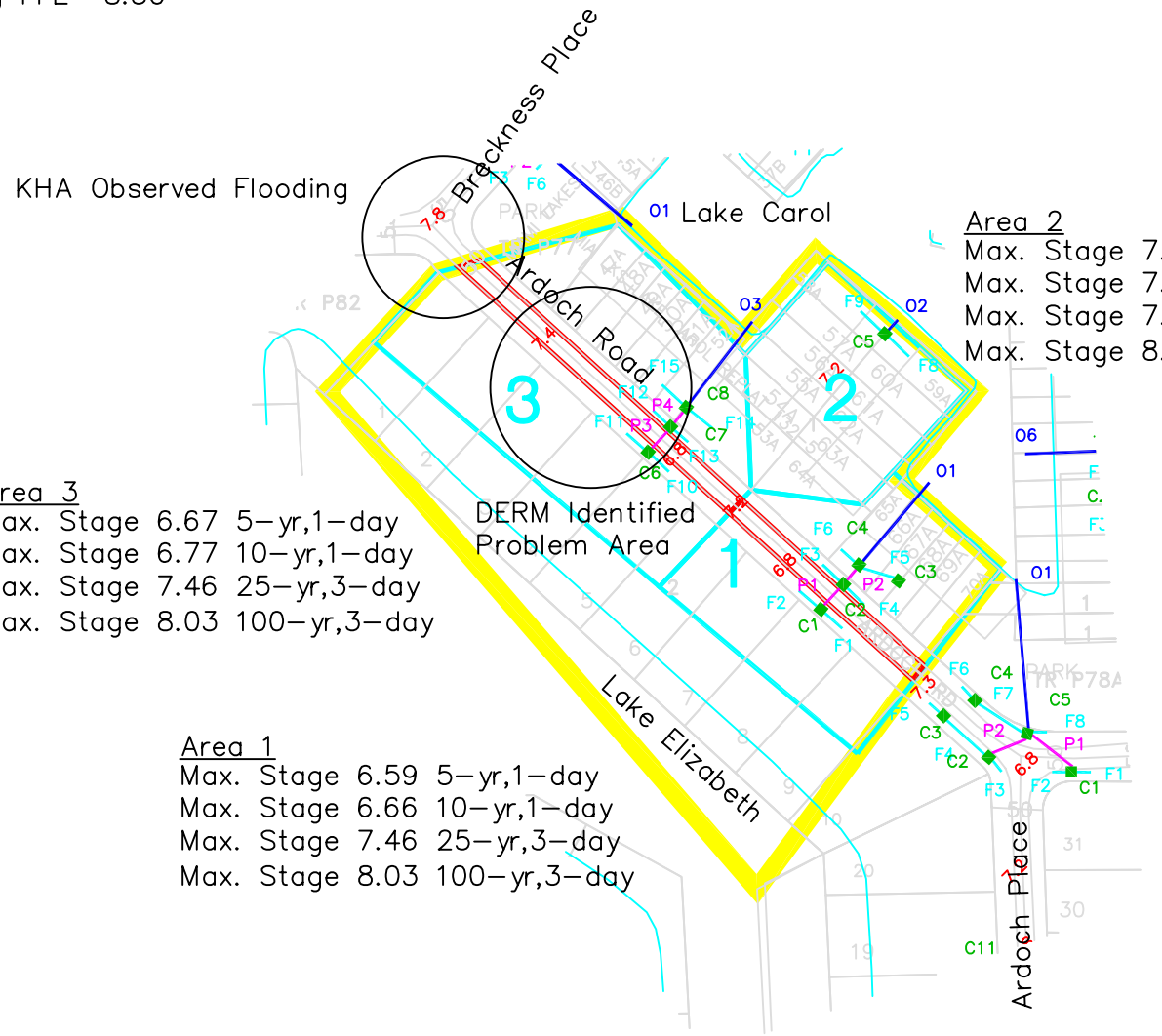
Based on the available information described above calculations were made for the Lake Carol Section 3 drainage sub-basin areas to compare the existing conditions with the above stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that meet the goals (yes) and those that do not (no).

Table 13. Lake Carol Section 3 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	**No**	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	**No**

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfall in area 2 fails to meet the water quantity performance goal. Complaints and flooding were observed in area 3.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30



Area 2
Max. Stage 7.01 5-yr,1-day
Max. Stage 7.11 10-yr,1-day
Max. Stage 7.60 25-yr,3-day
Max. Stage 8.11 100-yr,3-day

Area 3
Max. Stage 6.67 5-yr,1-day
Max. Stage 6.77 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

Area 1
Max. Stage 6.59 5-yr,1-day
Max. Stage 6.66 10-yr,1-day
Max. Stage 7.46 25-yr,3-day
Max. Stage 8.03 100-yr,3-day

NORTH
0 100 200
SCALE AS SHOWN

10/22/02

Figure 24. Lake Carol 3 - Existing Drainage Sub-Basin (30-2022-018)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: Due to the small existing 8-inch to 15-inch outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals.

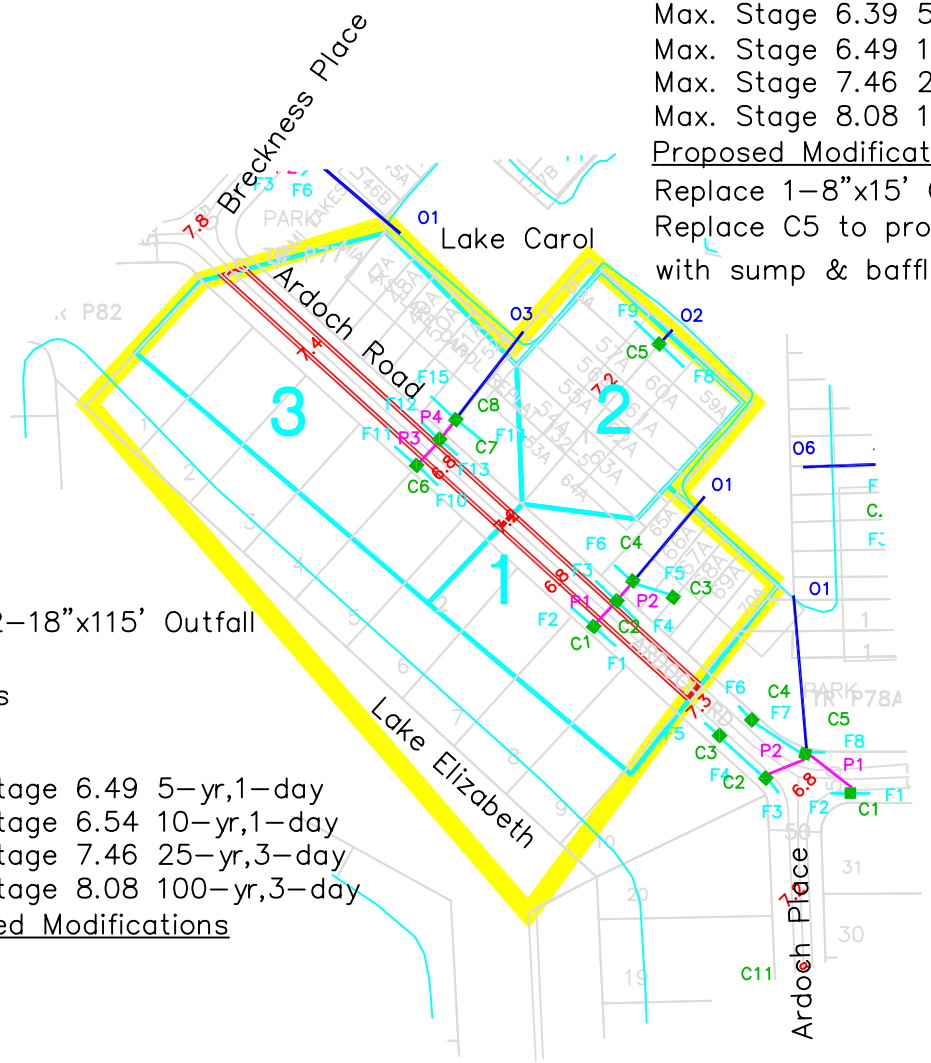
Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and do not have sufficient capacity to meet the performance goals. The existing outfalls should be replaced with larger outfalls. The final catchbasin prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump.

Figure 25 notes improvements proposed for the Lake Carol Section 3 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Carol Section 3 sub-basin are summarized in Table 26 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $40,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30



Area 3
Max. Stage 6.52 5–yr,1–day
Max. Stage 6.60 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Replace 1–12"x115' Outfall with 2–18"x115' Outfall
Replace C6,C7 & C8 to protect
French Drain with sump & baffles

Area 1
Max. Stage 6.49 5–yr,1–day
Max. Stage 6.54 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
None

Area 2
Max. Stage 6.39 5–yr,1–day
Max. Stage 6.49 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day
Proposed Modifications
Replace 1–8"x15' Outfall with 2–15"x15' Outfall
Replace C5 to protect French drain
with sump & baffles

NORTH
0 100 200
SCALE AS SHOWN

01/02/03

Figure 25. Lake Carol 3 - Proposed Drainage Sub-Basin (30-2022-018)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE CAROL SECTION 4 SUB-BASIN

Location

The Lake Carol Section 4 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, southwest of Lake Sandra, southeast of Lake Cynthia, northeast of Lake Elizabeth and west of Balgowan Road. The Lake Carol Section 2 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. There are four Lake Carol sub-basins, including Section 1, 2, 3, & 4. Section 4 is located on the northwest side of Lake Carol. Section 4 is includes one drainage area.

Existing Conditions

Figure 26 shows existing conditions for the Lake Carol Section 4 sub-basin. The sub-basin consists of approximately 1.9 acres of residential townhouse and single-family development along approximately 550 linear feet of roadway at the intersection of Ardoch Place, Ardoch Road and Balgowan Road. The existing roads range in elevation from a low of approximately 6.5 to a high of approximately 7.6 feet. The roadway has existing catchbasins, exfiltration trench, interconnecting culverts and one existing outfall into Lake Carol.

The Lake Carol Section 4 sub-basin includes one area. The exiting outfall is a 12-inch diameter pipe with a raised portion (goose neck) that acts as an overflow weir. The 12-inch outfall pipes extends from the roadway to the lake through a park. The status of drainage easement ownership for the outfalls must be verified. If drainage easements do not presently exist, they may have to be obtained. The ownership of the Lake and drainage rights should also be verified.

Performance Goal Analysis

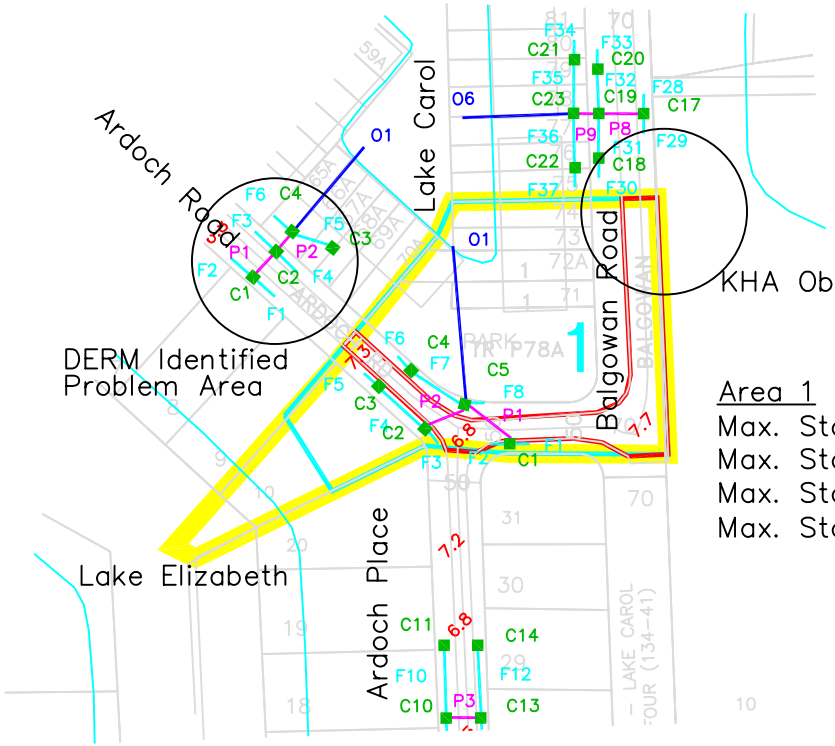
Based on the available information described above calculations were made for the Lake Coral Section 4 drainage sub-basin areas to compare the existing conditions with the above stated performance goals. The detail summary of the calculated values is shown in Appendix C. The following table highlights the performance goals that the areas meets (yes) and does not meet (no).

Table 14. Lake Carol Section 4 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	Yes	Yes	Yes	Yes	**No**

The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements. The existing outfall in area 1 meets the water quantity performance goals. Complaints and flooding were observed in area 1.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30



10/22/02

Figure 26. Lake Carol 4 - Existing Drainage Sub-Basin (30-2022-020)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Storm Drainage Deficiencies

Maintenance: Due to the small existing 12-inch outfall the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be under sized and does not have sufficient capacity to meet the performance goals.

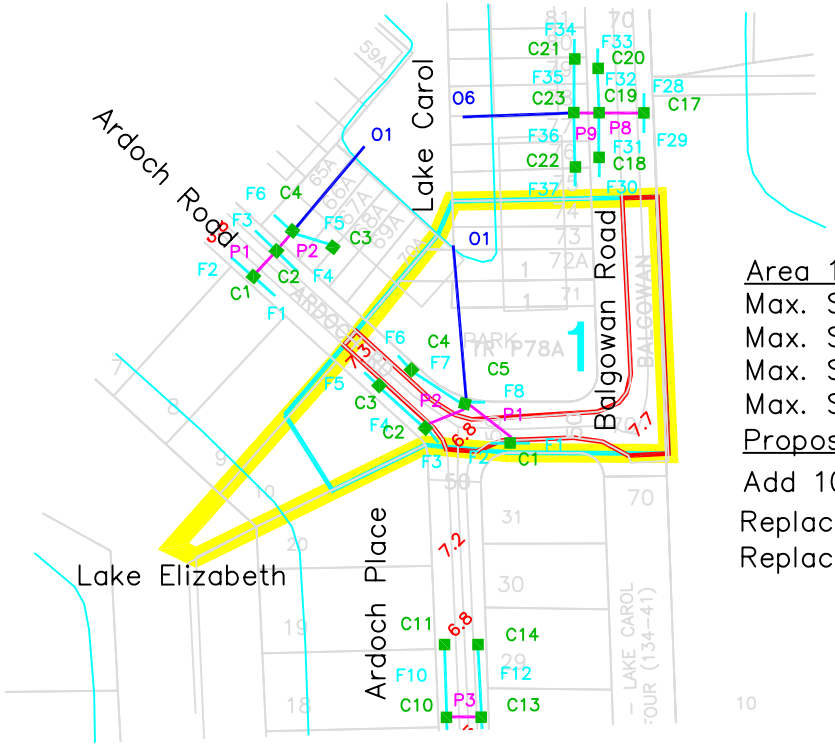
Recommended Drainage Improvements

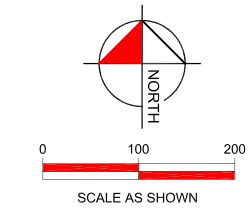
Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Undersized Outfalls: Based on the hydraulic analysis the existing outfalls appear to be undersized and do not have sufficient capacity to meet the performance goals. The existing outfall should be replaced with two larger outfalls. The final catchbasin prior to each oufall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump.

Figure 27 notes improvements proposed for the Lake Carol Section 4 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Carol Section 4 sub-basin are summarized in Table 27 in the Capital Improvements Program section of this report. The total budget for the proposed improvements is $50,000.

Min. Road Elevation 6.50
Min. CL Road Elevation 6.80
Min. Building FFE 8.30





Area 1
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.53 10–yr,1–day
Max. Stage 7.46 25–yr,3–day
Max. Stage 8.08 100–yr,3–day

Proposed Modifications

Add 100' of French drain
Replace 1–12"x155' Outfall with 2–18"x155' Outfalls
Replace C1,C2,C3,C4 & C5 to protect French drain with sump & baffles

10/22/02

Figure 27. Lake Carol 4 - Proposed Drainage Sub-Basin (30-2022-020)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE ELIZABETH SECTION 1 SUB-BASIN

Location

The Lake Elizabeth Section 1 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, south of Lake Cynthia, southwest of Lake Carol and west of Balgowan Road. The Lake Elizabeth Section 1 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. Two Lake Elizabeth sub-basins include Sections 1 & 3. Section 1 is located on the west side of Lake Elizabeth. Section 1 is divided into three drainage areas.

Existing Conditions

Figure 28 shows existing conditions for the Lake Elizabeth Section 1 Sub-basin. The sub-basin consists of approximately 9.7 acres of single family residential development along approximately 1350 linear feet of Glencairn Road. The existing roads range in elevation from a low of approximately 6.2 to a high of approximately 7.4 feet. The roadway has existing catchbasins, exfiltration trench, interconnecting culverts and no existing outfalls into Lake Elizabeth. The Lake Elizabeth Section 1 sub-basin is divided into three areas.

Performance Goal Analysis

Based on the available information described above calculations were made for the Lake Elizabeth Section 1 drainage sub-basin areas to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 15. Lake Elizabeth Section 1 Sub-basin – Performance Goal Analysis for Existing Conditions

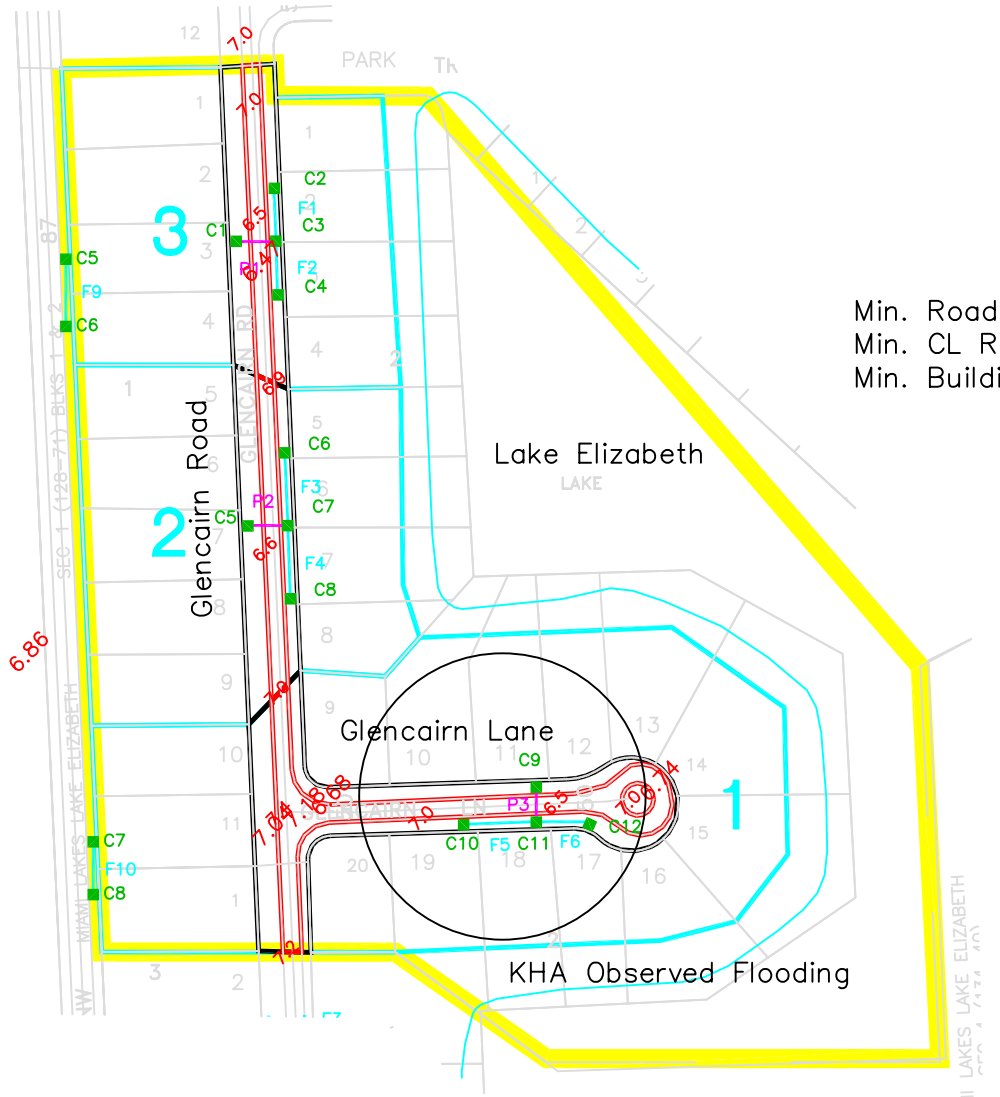
Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	**No**	**No**	**No**	**No**	**No**	**No**
2	Yes	**No**	**No**	**No**	**No**	Yes
3	Yes	**No**	**No**	**No**	**No**	Yes

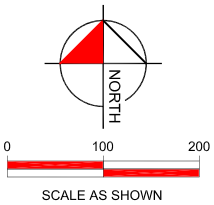
The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements in areas 2 and 3, but not in area 1. The lack of existing outfalls to provide positive drainage means that areas 1, 2, and 3 fail to meet water quality performance goals for the 5, 10, 25 and 100-year storm events.

Storm Drainage Deficiencies

Maintenance: Due to the lack of outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted.
Frequent maintenance is required for the existing system.

Lack of Outfalls: Based on hydraulic analysis the system does not have sufficient capacity to meet the performance goals without positive outfalls to the Lake.





Area 3
Max. Stage 7.64 5-yr,1-day
Max. Stage 7.82 10-yr,1-day
Max. Stage 8.65 25-yr,3-day
Max. Stage 9.08 100-yr,3-day

Area 2
Max. Stage 7.43 5-yr,1-day
Max. Stage 7.87 10-yr,1-day
Max. Stage 8.69 25-yr,3-day
Max. Stage 9.12 100-yr,3-day

Area 1
Max. Stage 7.71 5-yr,1-day
Max. Stage 7.89 10-yr,1-day
Max. Stage 8.68 25-yr,3-day
Max. Stage 9.11 100-yr,3-day

Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00

10/15/02

Figure 28. Lake Elizabeth Section 1-Existing Drainage Sub-Basin (30-2022-012)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Lack of Outfalls: Based on the hydraulic analysis the existing system appears not have sufficient capacity to meet the performance goals. Outfall pipes should be added to provide positive drainage from each area to Lake Elizabeth. The final catchbasin prior to each outfall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump. Easements for the proposed outfalls will need to be obtained. The ownership of the Lake and drainage rights should also be verified.

Existing Infrastructure Modifications: Additional exfiltration trench is proposed to be added in area 1 to meet water quality standards. The exfiltration trench will require manholes or catchbasins at regular intervals to facilitate maintenance.

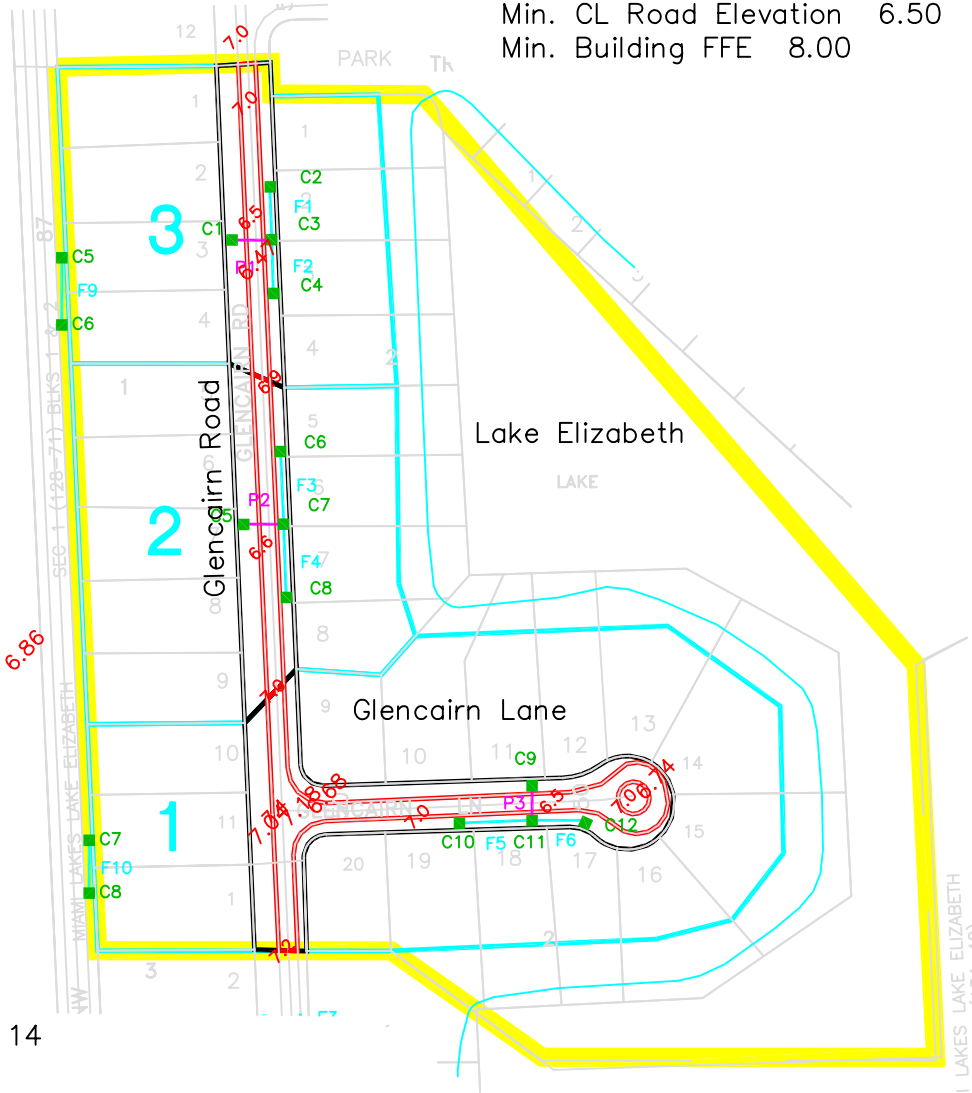
Figure 29 notes proposed improvements for the Lake Elizabeth Section 1 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Elizabeth Section 1 sub-basin are summarized in Table 28 in the Capital Improvements Program section of this report. The total budget for the project is $240,000.

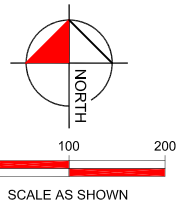
Area 3
Max. Stage 6.19 5-yr,1-day
Max. Stage 6.36 10-yr,1-day
Max. Stage 6.91 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 20' of French drain
Add 1-18"x200' Outfall between lots 3 & 4
Replace C4 to connect system to Outfall

Area 2
Max. Stage 6.30 5-yr,1-day
Max. Stage 6.38 10-yr,1-day
Max. Stage 6.90 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 1-15"x200' Outfall between lots 5 & 6
Replace C8 to connect system to Outfall

Area 1
Max. Stage 6.17 5-yr,1-day
Max. Stage 6.26 10-yr,1-day
Max. Stage 6.91 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 1180' of French drain and 3 CB's
Add 2-15"x220' Outfalls between lots 13 & 14
Add new CB to connect system to Outfalls
Replace C12 to connect system to Outfalls

Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00





10/15/02

Figure 29. Lake Elizabeth Section 1-Proposed Drainage Sub-Basin (30-2022-012)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

LAKE ELIZABETH SECTION 3 SUB-BASIN

Location

The Lake Elizabeth Section 3 sub-basin is generally located south of NW 154th Street, east of NW 87th Avenue, south of Lake Cynthia, southwest of Lake Carol and west of Balgowan Road. The Lake Elizabeth Section 1 sub-basin is part of the Sandra/Glenn (GDC1-201) Drainage Basin. Two Lake Elizabeth sub-basins include Sections 1 & 3. Section 3 is located on the south side of Lake Elizabeth. Section 3 is divided into three drainage areas.

Existing Conditions

Figure 30 shows existing conditions for the Lake Elizabeth Section 1 sub-basin. The sub-basin consists of approximately 16.5 acres of single family residential development along approximately 1600 linear feet of Glencairn Road, Glencairn Terrace and Ardoch Place. The existing roads range in elevation from a low of approximately 6.2 to a high of approximately 7.5 feet. The roadway has existing catchbasins, exfiltration trench, interconnecting culverts and no existing outfalls into Lake Elizabeth. The Lake Elizabeth Section 1 sub-basin is divided into three areas.

Performance Goal Analysis

Based on the available information described above, calculations were made for the Lake Elizabeth Section 1 drainage sub-basin areas to compare the existing conditions with the previously stated performance goals. The detailed summary of the calculated values is shown in Appendix C. The following table highlights the areas that do (yes) and do not (no) meet the performance goals.

Table 16. Lake Elizabeth Section 3 Sub-basin – Performance Goal Analysis for Existing Conditions

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	**No**	**No**	**No**	**No**	Yes
2	Yes	**No**	**No**	**No**	**No**	Yes
3	Yes	**No**	**No**	**No**	**No**	**No**

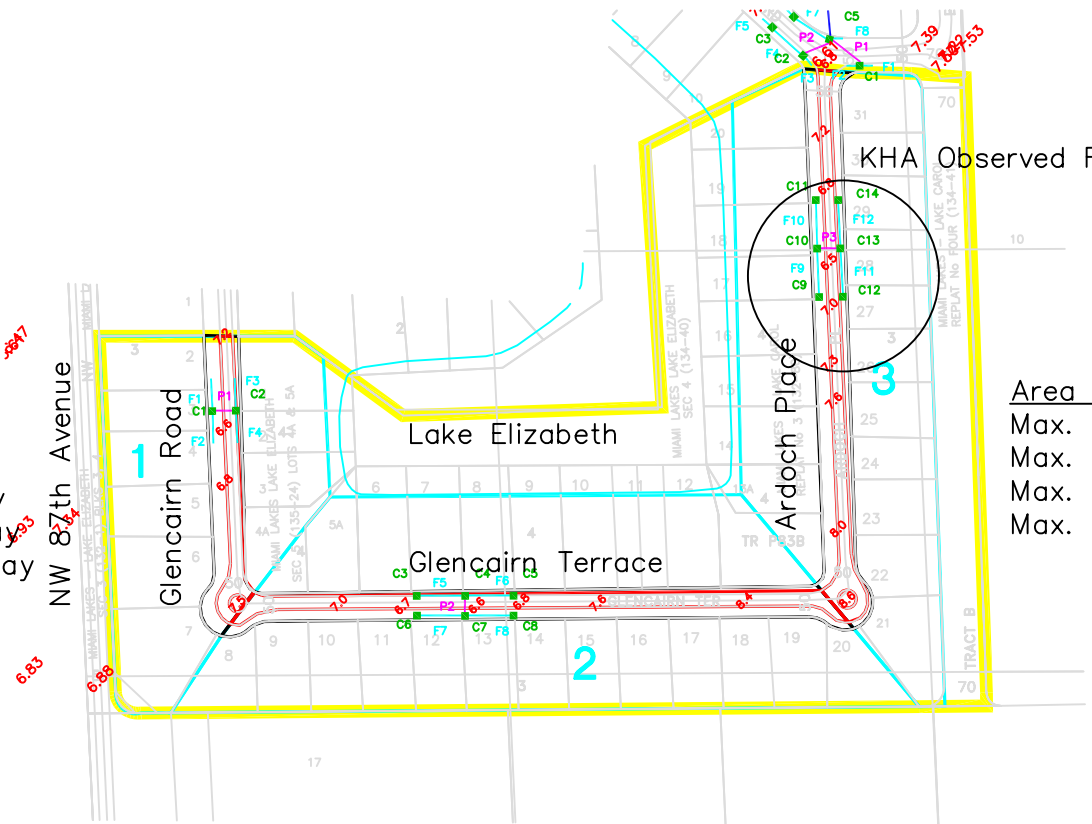
The existing exfiltration trench drainage system, if properly maintained, meets the water quality requirements in areas 1, 2 and 3. The lack of existing outfalls to provide positive drainage means that areas 1, 2, and 3 fail to meet water quality performance goals for the 5, 10, 25, and 100-year storm events.

Storm Drainage Deficiencies

Maintenance: Due to the lack of outfalls the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted.
Frequent maintenance is required for the existing system.

Lack of Outfalls: Based on hydraulic analysis the system does not have sufficient capacity to meet the performance goals without positive outfalls to the Lake.

Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00



NORTH
0 150 300
SCALE AS SHOWN

Area 1
Max. Stage 7.62 5-yr,1-day
Max. Stage 8.11 10-yr,1-day
Max. Stage 8.60 25-yr,3-day
Max. Stage 9.05 100-yr,3-day

Area 2
Max. Stage 7.66 5-yr,1-day
Max. Stage 7.84 10-yr,1-day
Max. Stage 8.66 25-yr,3-day
Max. Stage 9.09 100-yr,3-day

Area 3
Max. Stage 7.31 5-yr,1-day
Max. Stage 7.52 10-yr,1-day
Max. Stage 8.43 25-yr,3-day
Max. Stage 8.89 100-yr,3-day

10/16/02

Figure 30. Lake Elizabeth Section 3 - Existing Drainage Sub-Basin (30-2022-016)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from catchbasins, exfiltration trench and culverts. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls.

Lack of Outfalls: Based on the hydraulic analysis, the existing system appears not have sufficient capacity to meet the performance goals. Outfall pipes should be added to provide positive drainage from each area to Lake Elizabeth. The final catchbasin prior to each outfall into the lake should be replaced with a control structure catchbasin. The control structure catchbasins should include a weir, pollution retardant baffle and a sedimentation sump. Easements for the proposed outfalls will need to be obtained. The ownership of the Lake and drainage rights should also be verified.

Existing Infrastructure Modifications: The proposed outfall for area 2 is recommended to be located in the park at the corner of Glencairn Terrace and Ardoch Road. Additional pipe and drainage infrastructure will be required to connect the proposed outfall to the existing system in area 2.

Figure 31 notes improvements proposed for the Lake Elizabeth Section 3 sub-basin. These proposed improvements and the opinion of probable costs for the Lake Elizabeth Section 3 sub-basin are summarized in Table 29 in the Capital Improvements Program section of this report. The total budget for the project is $150,000.

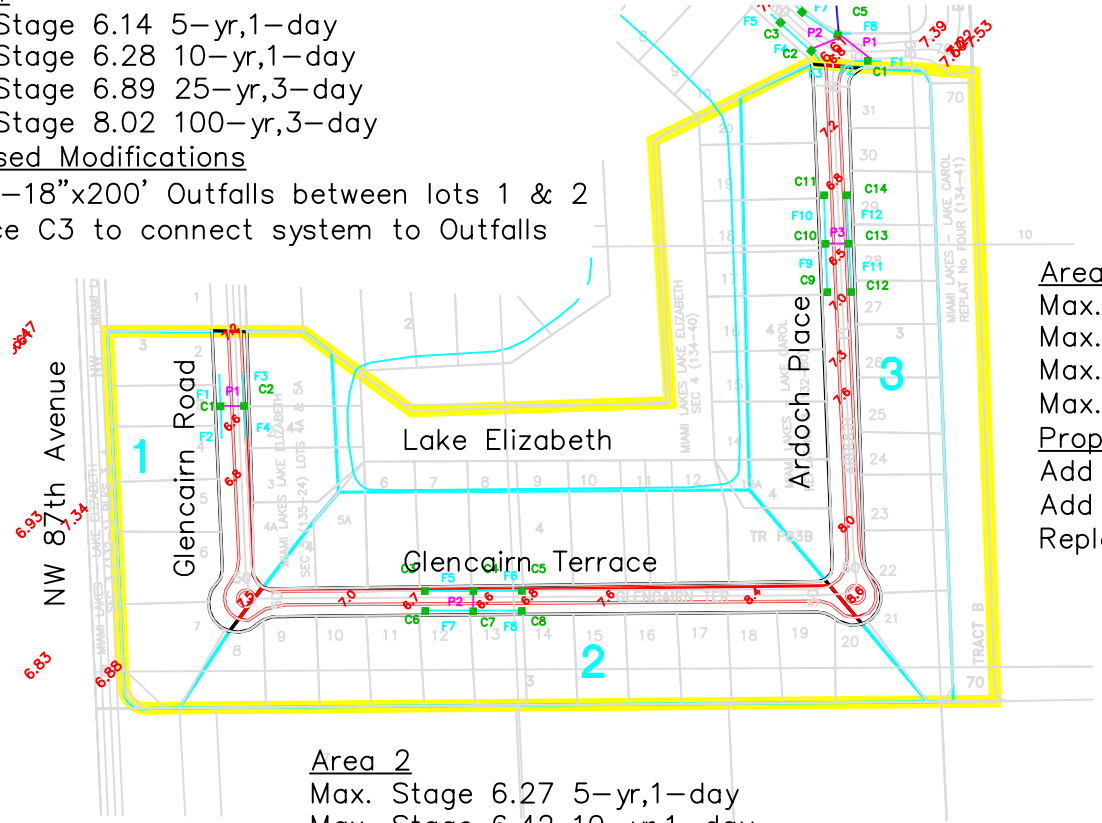
Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00

NORTH

0 100 200

SCALE AS SHOWN

Area 1
Max. Stage 6.14 5-yr,1-day
Max. Stage 6.28 10-yr,1-day
Max. Stage 6.89 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 2-18"x200' Outfalls between lots 1 & 2
Replace C3 to connect system to Outfalls



Area 3
Max. Stage 6.25 5-yr,1-day
Max. Stage 6.37 10-yr,1-day
Max. Stage 6.90 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 30' of French drain
Add 1-18"x200' Outfall between lots 18 & 19
Replace C11 to connect system to Outfalls

Area 2
Max. Stage 6.27 5-yr,1-day
Max. Stage 6.42 10-yr,1-day
Max. Stage 6.90 25-yr,3-day
Max. Stage 8.02 100-yr,3-day
Proposed Modifications
Add 520' of French drain
Add 1-15"x350' and 1-18"x350' Outfall through TR P83B
Add 2 new CB's to connect system to Outfalls
Replace C8 to connect system to Outfalls

10/16/02

Figure 31. Lake Elizabeth Section 3-Proposed Drainage Sub-Basin (30-2022-016)

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

BULL RUN SUB-BASIN

Location

The Bull Run sub-basin is generally located west of Ludlam Road, in the west section of the Miami Lakes downtown area. Bull Run provides access to the Town Center area, the Fountain House Development, the Meadow Walk Development, and a 2.2-acre Town Park. The Bull Run sub-basin is part of the Downtown West (OLC1-802) Drainage Basin. Bull Run sub-basin is divided into nine drainage areas.

Existing Conditions

Figure 32 shows existing conditions for the Bull Run Sub-basin. The sub-basin consists of approximately 3,500 linear feet of Bull Run Road and 400 linear feet of Main Street. It includes approximately 6.5 acres of road right-of-way and a 2.2 acre Town Park. The existing roads range in elevation from a low of approximately 6.2 to a high of approximately 7.5 feet. The Bull Run sub-basin is divided into ten areas. The availability of information on the existing roadway and storm drainage system is very limited. Plans could not be located within the Town or County records. From site observations the roadway areas appear to have existing catchbasins and may have some existing exfiltration trench. There is no evidence of any existing outfalls or existing drainage wells.

Performance Goal Analysis

Due to the lack of available information on the existing Bull Run storm drainage system, a computation for the comparison of the existing conditions with the above stated performance goals can not be made. However, based on the extent of the observed ponding (see Figure 2), it appears that many of the performance goals are not met in the Bull Run sub-basin.

Storm Drainage Deficiencies

Maintenance: Due to the lack of an apparent outfall and the age of the existing system, the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is required for the existing system.

Lack of Infrastructure: There are several areas with low points in the roadway, which frequently pond during storm events due to a lack of a positive outfall or drainage system.

Inadequate Drainage Infrastructure: There are some low points in the roads which have existing catchbasin(s) and may have short sections of exfiltration trench, but no positive outfall. The capacity and performance of the existing exfiltration (estimated to be 20 to 30 year old) trenches may be reduced due to sedimentation build up in the rock trenches and perforated pipes. Based on the observed ponding the existing catchbasins and short exfiltration trenches are inadequate.

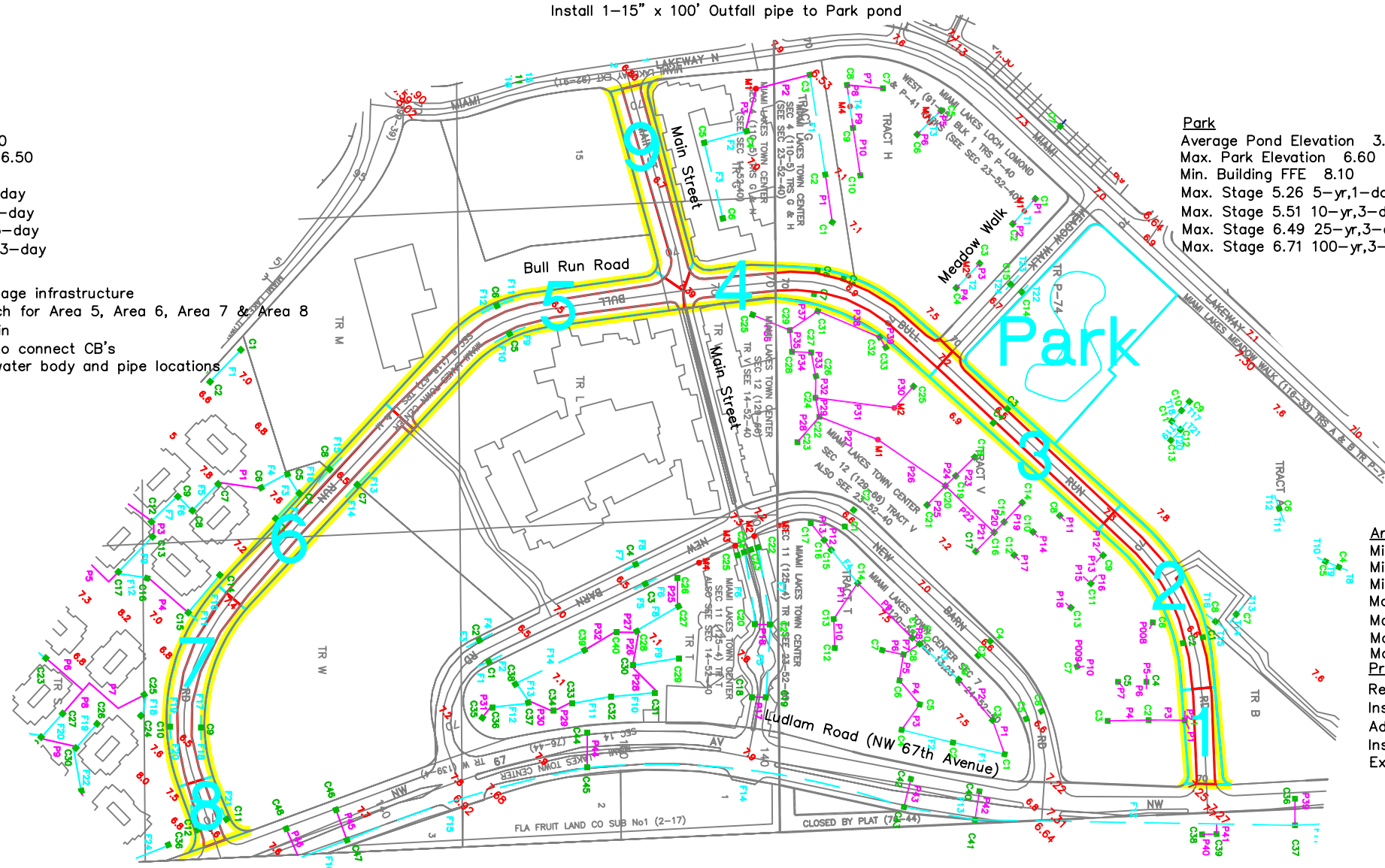
10/22/02

Areas 3, 4 & 9
Min. Road Elevation 6.30
Min. CL Road Elevation 6.60
Min. Building FFE 8.10
Max. Stage 6.18 5–yr,1–day
Max. Stage 6.28 10–yr,1–day
Max. Stage 6.64 100–yr,3–day
Max. Stage 6.84 100–yr,3–day

Proposed Modifications
Remove all existing drainage infrastructure
Install 2 new CB's in Area 9, 2 new CB's in Area 4, & 2 new CB's in Area 3
Add 640' of French drain
Install 390' of 18" Pipe to connect CB's
Install 1 Manhole to connect Area 9 to Area 4
Install 1–15" x 100' Outfall pipe to Park pond

Areas 5, 6, 7 & 8
Min. Road Elevation 6.20
Min. CL Road Elevation 6.50
Min. Building FFE 8.00
Max. Stage 6.51 5–yr,1–day
Max. Stage 6.55 10–yr,1–day
Max. Stage 6.73 25–yr,3–day
Max. Stage 6.92 100–yr,3–day

Proposed Modifications
Remove all existing drainage infrastructure
Install 2 new CB's in each for Area 5, Area 6, Area 7 & Area 8
Add 1630' of French drain
Install 120' of 18" Pipe to connect CB's
Explore possible outfall water body and pipe locations



Park
Average Pond Elevation 3.50
Max. Park Elevation 6.60
Min. Building FFE 8.10
Max. Stage 5.26 5–yr,1–day
Max. Stage 5.51 10–yr,3–day
Max. Stage 6.49 25–yr,3–day
Max. Stage 6.71 100–yr,3–day

Areas 1 & 2
Min. Road Elevation 6.30
Min. CL Road Elevation 6.60
Min. Building FFE 8.10
Max. Stage 6.32 5–yr,1–day
Max. Stage 6.38 10–yr,1–day
Max. Stage 6.55 25–yr,3–day
Max. Stage 6.67 100–yr,3–day

Proposed Modifications
Remove all existing drainage infrastructure
Install 2 new CB's in Area 1 and 2 new CB's in Area 2
Add 350' of French drain
Install 60' of 18" Pipe to connect CB's
Explore possible outfall water body and pipe locations

NORTH
0 150 300
SCALE AS SHOWN

Kimley-Horn
and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Figure 32. Bull Run Road Sub-Basin (30-2014-BRR) - Proposed

Lack of Outfalls or Drainage Wells: Based on the observed ponding the existing drainage system appears to be undersized and does not have sufficient capacity to meet the performance goals. Drainage wells may be required.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from any catchbasins to remain. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls. Inspect any existing culverts or exfiltration trench to determine if they can be cleaned, or if they will have to be replaced.

Existing Infrastructure Modifications: Additional catchbasins/manholes, culverts and exfiltration trench are recommended to be constructed to interconnect the catchbasins.

Lack of Outfalls: Based on the observed ponding the existing drainage system appears to be undersized and does not appear to have sufficient capacity to meet the performance goals. Exfiltration trench is recommended to provide positive drainage. In order to meet the water quantity performance goals, outfall pipes are recommended to provide positive drainage. Location of these outfall water bodies and pipes will need to be explored during the design phase. At this time, drainage easements and access do not currently exist. Easements for the proposed outfall pipes will also need to be obtained. The final catchbasin prior to each outfall should be a control structure catchbasin with a weir, pollution retardant baffle and a sedimentation sump.

Figure 32 notes proposed improvements proposed for the Bull Run sub-basin. These proposed improvements and the opinion of probable costs for the Bull Run sub-basin are summarized in Table 30 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $460,000.

MIAMI LAKEWAY SUB-BASIN

Location

The Miami Lakeway sub-basin is generally located east of Ludlam Road, in the northeast section of the Miami Lakes downtown area. Miami Lakeway provides access to the Middle School and Optimist Park, St. Tropez, Celebration Point, Oaks Apartments, and Eagle Nest Developments. The Miami Lakeway sub-basin is part of the Downtown East (C803-203) Drainage Basin. The Miami Lakeway sub-basin is divided into six drainage areas.

Existing Conditions

Figure 33 shows existing conditions for the Miami Lakeway Sub-basin. The sub-basin consists of approximately 5,000 linear feet of Miami Lakeway North roadway. It includes approximately 6.3 acres of road right-of-way. The existing road range in elevation from a low of approximately 5.9 acres to a high of approximately 7.6 feet.

The Miami Lakeway sub-basin is divided into six areas. The availability of information on the existing roadway and storm drainage system is very limited. Plans could not be located in the Town or County records. From site observations the roadway areas appear to have existing catchbasins and may have some existing exfiltration trench. There is no evidence of any existing outfalls or existing drainage wells.

Performance Goal Analysis

Due to the lack of available information on the existing Miami Lakeway storm drainage system, a computation for the comparison of the existing conditions with the above stated performance goals can not be made. However, based on the extent of the observed ponding (see Figure 2), it appears that many of the performance goals are not met in the Miami Lakeway sub-basin.

Storm Drainage Deficiencies

Maintenance: Due to the lack of an apparent outfall and the age of the existing system, the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Lack of Infrastructure: There are several area with low points in the roadway, which frequently pond during storm events due to a lack of a positive outfall or drainage system.

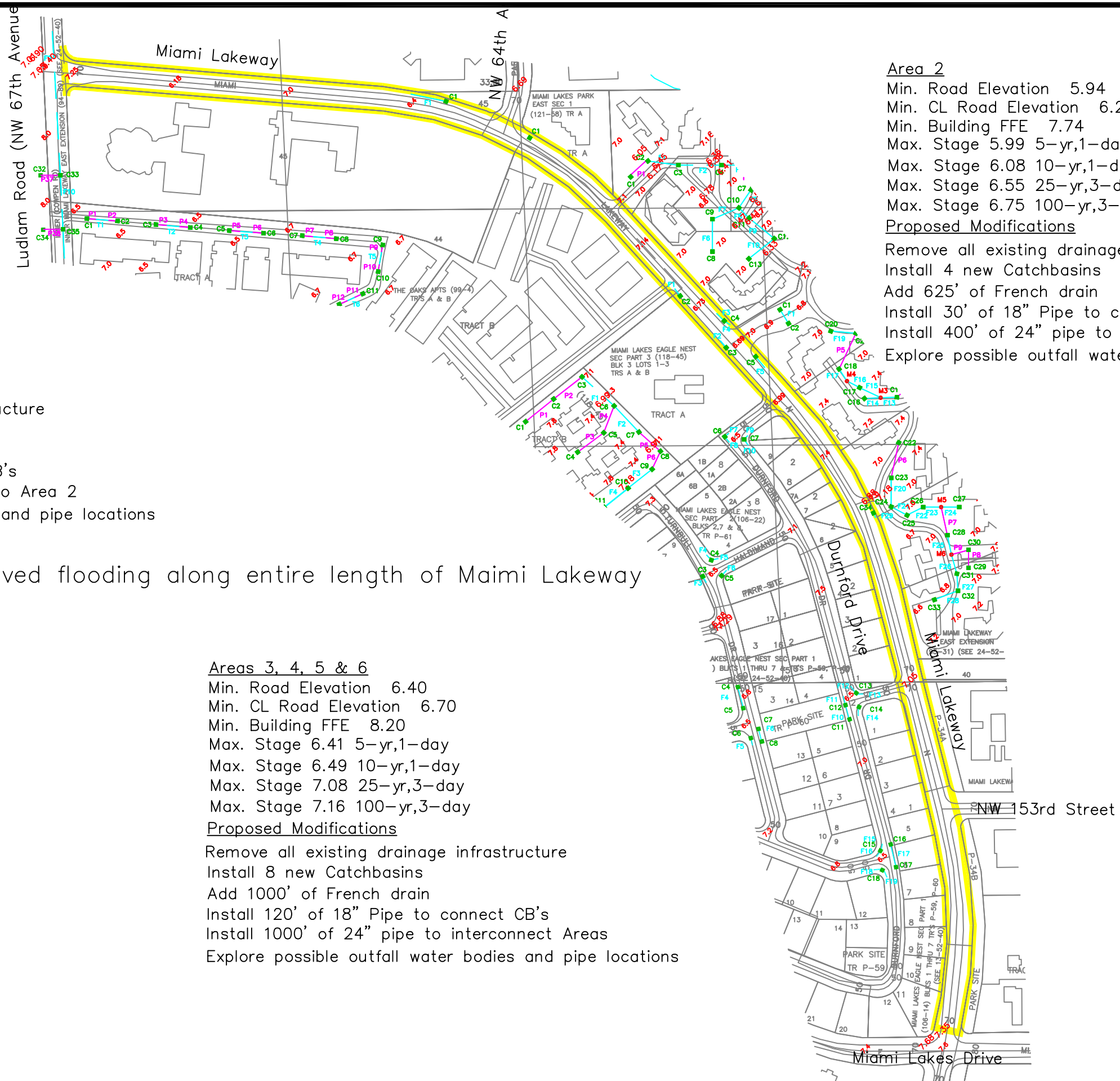
Inadequate Drainage Infrastructure: There are some low points in the roads which have existing catchbasin(s) and may have short sections of exfiltration trench, but no positive outfall. The capacity and performance of the existing exfiltration (estimated to be 20 to 30 year old trenches) may be reduced due to sedimentation build up in the rock trenches and perforated pipes. Based on the observed ponding the existing catchbasins and short exfiltration trenches are inadequate.

Lack of Outfalls or Drainage Wells: Based on the obsevered ponding the existing drainage system appears to be undersized and does not have sufficient capacity to meet the performance goals. Drainage wells or outfalls may be required.

01/02/03

ea 1
n. Road Elevation 5.88
n. CL Road Elevation 6.18
n. Building FFE 7.68
ax. Stage 6.18 5–yr,1–day
ax. Stage 6.38 10–yr,1–day
ax. Stage 6.64 25–yr,3–day
ax. Stage 6.84 100–yr,3–day
oposed Modifications
move all existing drainage infrastructure
stall 2 new Catchbasins
d 330' of French drain
stall 30' of 18" Pipe to connect CB's
stall 300' of 24" pipe to connect to Area 2
plore possible outfall water bodies and pipe locations

KHA observed flooding along entire length of Maimi Lakeway



Area 2
Min. Road Elevation 5.94
Min. CL Road Elevation 6.24
Min. Building FFE 7.74
Max. Stage 5.99 5–yr,1–day
Max. Stage 6.08 10–yr,1–day
Max. Stage 6.55 25–yr,3–day
Max. Stage 6.75 100–yr,3–day
Proposed Modifications
Remove all existing drainage infrastructure
Install 4 new Catchbasins
Add 625' of French drain
Install 30' of 18" Pipe to connect CB's
Install 400' of 24" pipe to connect to Area 3
Explore possible outfall water bodies and pipe locations

Areas 3, 4, 5 & 6
Min. Road Elevation 6.40
Min. CL Road Elevation 6.70
Min. Building FFE 8.20
Max. Stage 6.41 5–yr,1–day
Max. Stage 6.49 10–yr,1–day
Max. Stage 7.08 25–yr,3–day
Max. Stage 7.16 100–yr,3–day
Proposed Modifications
Remove all existing drainage infrastructure
Install 8 new Catchbasins
Add 1000' of French drain
Install 120' of 18" Pipe to connect CB's
Install 1000' of 24" pipe to interconnect Areas
Explore possible outfall water bodies and pipe locations

Figure 33. Miami Lakeway Sub-Basin (30-2013-MLW) - Proposed

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from any catchbasins to remain. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls. Inspect any existing culverts or exfiltration trench to determine if they can be cleaned, or if they will have to be replaced.

Existing Infrastructure Modifications: Additional catchbasins/manholes, culverts and exfiltration trench are recommended to be constructed to interconnect the catchbasins.

Lack of Outfalls: Based on the observed ponding, the existing drainage system appears to be under sized and does not appear to have sufficient capacity to meet the performance goals. Exfiltration trench is recommended to provide positive drainage. In order to meet the water quantity performance goals, outfall pipes are recommended to provide positive drainage. Location of these outfall water bodies and pipes will need to be explored during the design phase. At this time, drainage easements and access do not currently exist. Easements for the proposed outfall pipes will also need to be obtained. The final catchbasin prior to each outfall should be a control structure catchbasin with a weir, pollution retardant baffle and a sedimentation sump.

Figure 33 notes proposed improvements proposed for the Miami Lakeway sub-basin. These proposed improvements and opinion of probable costs for the Miami Lakeway sub-basin are summarized in Table 31 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $590,000.

NW 154th STREET SUB-BASIN

Location

The NW 154th Street sub-basin is generally located west of the Palmetto and east of NW 82nd Avenue. NW 154th Street provides access to the western half of the Town. The NW 154th Street sub-basin is part of the Graham Dairy (GDC1-101), Sandra/Glenn (GDC1-201) and Royal Oaks (GGC1-202) Drainage Basins. NW 154th Street sub-basin is divided into six drainage areas.

Existing Conditions

Figure 34 shows existing conditions for the NW 154th Street Sub-basin. The sub-basin consists of approximately 3,100 linear feet of four-lane divided roadway. It includes approximately 6.9 acres of road right-of-way. The existing roads range in elevation from a low of approximately 6.3 to a high of approximately 7.8 feet.

The NW 154th Street sub-basin is divided into six areas. The availability of information on the existing roadway and storm drainage system is very limited. Plans could not be located in the Town or County records. From site observations the roadway areas appear to have existing catchbasins and may have some existing exfiltration trench. There is no evidence of any existing outfalls or existing drainage wells.

Performance Goal Analysis

Due to the lack of available information on the existing NW 154th Street storm drainage system, a computation for the comparison of the existing conditions with the above stated performance goals can not be made. However, based on the extent of the observed ponding (see Figure 2), it appears that many of the performance goals are not met in the NW 154th Street sub-basin.

Storm Drainage Deficiencies

Maintenance: Due to the lack of an apparent outfall and the age of the existing system, the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Lack of Infrastructure: There are several areas with low points in the roadway, which frequently pond during storm events due to a lack of a positive outfall or drainage system.

Inadequate Drainage Infrastructure: There are some low points in the roads which have existing catchbasins and may have short sections of exfiltration trench but no positive outfall. The capacity and performance of the existing exfiltration (estimated to be 20 to 30 year old) trenches may be reduced due to sedimentation build up in the rock trenches and perforated pipes. Based on the observed ponding, the existing catchbasins and short exfiltration trenches are inadequate.

Lack of Outfalls or Drainage Wells: Based on the obsevered ponding, the existing drainage system appears to be undersized and does not have sufficient capacity to meet the performance goals.

Insert Figure 34 here.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from any catchbasins to remain. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls. Inspect any existing culverts or exfiltration trench to determine if they can be cleaned, or if they will have to be replaced.

Existing Infrastructure Modifications: Additional catchbasins/manholes, culverts and exfiltration trench are recommended to be constructed to interconnect the catchbasins.

Lack of Outfalls: Based on the observed ponding, the existing drainage system appears to be undersized and does not appear to have sufficient capacity to meet the performance goals. The Exfiltration trench is recommended to provide positive drainage. In order to meet the water quantity performance goals, outfall pipes are recommended to provide positive drainage. Location of these outfall water bodies and pipes will need to be explored during the design phase. At this time, drainage easements and access do not currently exist. Easements for the proposed outfall pipes will also need to be obtained. The final catchbasin prior to each outfall should be a control structure catchbasin with a weir, pollution retardant baffle and a sedimentation sump.

Figure 34 notes proposed improvements for the NW 154th Street sub-basin. These proposed improvements and opinion of probable costs for the NW 154th Street sub-basin are summarized in Table 32 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $570,000.

NW 82nd AVENUE SUB-BASIN

Location

The NW 82nd Avenue sub-basin is generally located north of NW 154th Street and south of NW 170 Street. NW 82nd Avenue provides access to the northwest portion of the Town. The NW 82nd Avenue sub-basin is part of the Royal Oaks GGC1-202 County Drainage Basin. NW 82nd Avenue sub-basin is divided into eleven drainage areas.

Existing Conditions

Figure 35 shows existing conditions for the NW 82nd Avenue sub-basin. The sub-basin consists of approximately 5,100 linear feet of NW 82nd Avenue. It includes approximately 7.9 acres of road right-of-way. The existing roads range in elevation from a low approximately 6.0 to a high of approximately 7.7 feet.

The NW 82nd Avenue sub-basin is divided into eleven areas. The availability of information on the existing roadway and storm drainage system is limited. Plans could not be located in the Town or County records. From site observations the roadway areas appear to have exiting catchbasins and may have some existing exfiltration trench. There is no evidence of any existing outfalls or existing drainage wells.

Performance Goal Analysis

Due to the lack of available information on the existing NW 82nd Avenue storm drainage system, a computation for the comparison of the existing conditions with the above stated performance goals can not be made. However, based on the extent of the observed ponding (see Figure 2), it appears that many of the performance goals are not met in the NW 82nd Avenue sub-basin.

Storm Drainage Deficiencies

Maintenance: Due to the lack of an apparent outfall and the age of the existing system, the culverts and catchbasins may frequently clog with debris and sediment such that water flow is blocked or highly restricted. Frequent maintenance is recommended for the existing system.

Lack of Infrastructure: There are several areas with low points in the roadway, which frequently pond during storm events due to a lack of a positive outfall or drainage system.

Inadequate Drainage Infrastructure: There are some low points in the roads which have existing catchbasin(s) and may have short sections of exfiltration trench, but no positive outfall. The capacity and performance of the existing exfiltration (estimated to be 20 to 30 year old) trenches may be reduced due to sedimentation build up in the rock trenches and perforated pipes. Based on the observed ponding, the existing catchbasins and short exfiltration trenches are inadequate.

Lack of Outfalls or Drainage Wells: Based on the obsevered ponding the existing drainage system appears to be undersized and does not have sufficient capacity to meet the performance goals.

Recommended Drainage Improvements

Maintenance: Clean and flush all sediment and debris from any catchbasins to remain. Modify or reconstruct existing catchbasins as required to provide sediment traps (sumps) and pollution retardant baffles to protect the exfiltration trench and outfalls. Inspect any existing culverts or exfiltration trench to determine if they can be cleaned, or if they will have to be replaced.

Existing Infrastructure Modifications: Additional catchbasins/manholes, culverts and exfiltration trench are recommended to be constructed to interconnect the catchbasins.

Lack of Outfalls: Based on the observed ponding the existing drainage system appears to be under sized and does not appear to have sufficient capacity to meet the performance goals. The Exfiltration trench is recommended to provide positive drainage. In order to meet the water quantity performance goals, outfall pipes are recommended to provide positive drainage. Location of these outfall water bodies and pipes will need to be explored during the design phase. At this time, drainage easements and access do not currently exist. Easements for the proposed outfall pipes will also need to be obtained. The final catchbasin prior to each outfall should be a control structure catchbasin with a weir, pollution retardant baffle and a sedimentation sump.

Figure 35 notes improvements proposed for the NW 82nd Avenue sub-basin. These proposed improvements and the opinion of probable costs for the NW 82nd Avenue sub-basin are summarized in Table 33 in the Capital Improvements Program section of this report. The total budget for the recommended improvements is $630,000.

Insert Figure 35 here.

CAPITAL IMPROVEMENT PROGRAM

Background

KHA prepared this five-year Capitol Improvement Program (CIP) for Storm Water improvements to prioritize and set the budgets required to plan, construct, operate and maintain the Town's Storm Water Management Program. The CIP is a budgetary tool and is intended to provide an order of magnitude for the Town's yearly funding for the implementation of the proposed Storm Water utility.

The proposed five year capital improvement plan is based on the findings of the assessment of existing drainage conditions within the town and the detailed analysis of the sixteen drainage sub-basins which where identified as priority basins. Two components of the capital improvement plan where identified. These are the operation and maintenance component and the capital improvements component.

The operation and maintenance component is based on the general assessment of the existing drainage conditions within the Town limits. The recommended operation and maintenance procedures were identified. The preliminary budget estimates are based on the implementation of these procedures over the next five years.

The Capital Improvement component is based on the findings of the analysis of the sixteen priority sub-basins. Recommended improvements to achieve the stated performance goals were identified for each sub-basin. The recommended improvements where quantified based on the available data and preliminary opinions of probable costs (preliminary budgets) where prepared for each sub-basin. Based on the preliminary budgets, the priority sub-basin improvements were grouped and phased to provide the proposed five-year capital improvement program.

The following is a detailed explanation and summary of each component of the five-year Capital Improvement Program.

Operation and Maintenance Plan

The intent of the operation and maintenance plan is to maintain the integrity of the Storm Water system. This is accomplished by maintaining the existing Storm Water system to provide the level of service that as it was originally designed. To achieve this goal, periodic observations, routine maintenance, and general improvements are required. This section of the overall report is not intended to provide a complete operation and maintenance manual, but to provide some of the key components and allow sufficient budget to implement these items.

Street Sweeping

The Town should invest resources in street sweeping. This activity cleans intake structures, reduces debris deposition within the pipe network, and contributes to the aesthetics of the Town. Generally, street sweeping is a positive maintenance activity that provides measurable benefits. Because pollutants such as hydrocarbons and metals adhere to dirt particles, removing this dirt from the street system will remove the pollutants before they are allowed to discharge into the Town's Lakes.

Catchbasin Maintenance

Catchbasin maintenance is a two-step process. This task includes cleaning the external grate to permit stormwater to enter the system and removing sand, silt and debris from the sedimentation chamber of the intake structure. The catchbasins will be cleaned using mechanical and manual methods. In the majority of cases, catchbasins will be cleaned/maintained in response to observations following significant rain events. Upon making such observations, the Town should evaluate the general area and perform the required maintenance on the inlets and pipes within a sub-basin. Under normal conditions, catchbasin maintenance is recommended every 12 months. However, because of foliage and other debris entering the system, the Town should consider conducting catchbasin maintenance more frequently in some areas.

Pipe Flushing

Pipe flushing is typically performed in conjunction with catchbasin cleaning and is usually contracted out on an as-needed basis. During this activity, a high-pressure water hose is inserted into the pipe network. This process flushes debris into the catchbasin where it can then be removed. Pipe flushing is recommended to be performed every five years.

Swale Mowing

Grassed swales and landscaped medians play an important role stormwater disposal. Consistent mowing of such features promotes stormwater retention and efficient percolation. The Town maintains swales and medians within public roadways and parking lots. Individual business owners and residents are mandated through local codes to maintain their facilities. This activity should continue on a scheduled basis.

Minor Repairs and Improvements

The final task conducted to maintain the stormwater collection system is routine improvements and repairs. This task covers a significant spectrum of activities ranging from the repair of collapsed pipes and manholes to the replacements of catchbasin grates. Maintenance activities are performed in response to an immediate problem using the best methods available. These tasks often can not be foreseen or scheduled.

Operation and Maintenance Costs

The following table from the DERM Stormwater Master Plan summarizes the unit costs for maintenance activities and is based on costs from the Miami-Dade County Department of Public Works operational data.

Activity	Unit Cost	Frequency
Pipe Flushing	$12/LF	Once/5-years
Exfiltration Trench Cleaning	$10/LF	Once/5-years
Catchbasin and Manhole Cleaning	$190 Per Basin	Once/2-years

Visual observations made at the time of this report have indicated that the maintenance of the Town's stormwater system has not been performed on a consistent basis or recently. This lack of maintenance is leading to numerous areas of nuisance flooding and has also resulted in several of the existing drainage systems failing.

In order to overcome the existing deficient maintenance activities, an aggressive maintenance program should be initiated immediately to clean the entire Town's system. The initial maintenance activities should be prioritized based upon the areas observed to have flooding problems. We have identified the budget to complete the maintenance activities throughout the Town within a five- (5) year period.

As the maintenance activities are initiated, we recommend that a basic database utilizing the GIS information that has been collected be utilized for the tracking and scheduling of the maintenance activities. This process will result in a method of identifying the date and time that a system was last maintained and will also provide a tool to identify the next scheduled maintenance.

There are two items noted in the budget to provide personnel to oversee the operation and maintenance of the stormwater system. These items are: "Professional Services" and "Stormwater Utility Administration". The Professional Services item will include the preparation and oversight of contracting services such as pipe and inlet cleaning and street sweeping. The Stormwater Utility Administration item includes general administration, clerical support, program planning and public awareness.

Drainage Capital Projects

The Capital Improvement Program (CIP) is based on the findings of the analysis of the sixteen priority sub-basins. Recommended improvements to achieve the stated performance goals were identified for each basin. The recommended improvements were quantified based on the available data and preliminary opinions of probable costs (preliminary budgets) were prepared for each basin. Prior to each individual project being implemented, professional services such as surveying, engineering, and permitting will be required and are included within the budgets. The budget figures were developed by reviewing recent costs from similar projects. The CIP budgets are based on 2002 dollars.

The following assumptions have been made in the formulation of the budgets for the drainage improvements:

1. The budgets include the recommended improvements identified in the analysis of the sixteen priority sub-basins.
2. Projects were grouped by sub-basin.
3. The budgets include restoration of the roadway impacted by the proposed trenching, but do not include any additional roadway resurfacing.
4. The budgets do not include any costs of obtaining drainage or construction easements.
5. The budgets include a 10% allowance for mobilization and maintenance of traffic for each project.
6. The budgets include a 20% contingency for each project.
7. The budgets include a 15% allowance for surveying, engineering, permitting, and limited construction phase assistance (site observations).
8. The budgets do not include any landscape costs for improvements or restoration.

The budgetary numbers are an opinion of probable construction costs in the current marketplace. Unit pricing for similar projects constructed under the FEMA/ DORM program in Miami-Dade County was used as the basis for the construction budget**.** Based on the preliminary budgets, the priority sub-basin proposed improvements were grouped and phased to provide the alternative five-year and ten-year capital improvement programs.

Table 17. Basin Prioritization Matrix

Priority Ranking	Area	Hydraulic Analysis	Observed Flooding	Complaints	Roadway Condition	Traffic Volumes	Total Score
1	NW 82nd Avenue	5	3	5	5	5	**23**
2	NW 154th Street	5	4	1	5	5	**20**
3	Lake Glenn Ellen	4	2	5	4	1	**16**
4	Lake Cynthia Section 1	5	5	1	4	1	**16**
5	Lake Cynthia Section 2	5	5	1	4	1	**16**
6	Miami Lakeway	5	4	1	3	3	**16**
7	Bull Run	5	4	1	1	3	**14**
8	Lake Elizabeth Section 1	5	2	1	4	1	**13**
9	Lake Elizabeth Section 3	5	2	1	4	1	**13**
10	Lake Carol Section 2	1	5	1	4	1	**12**
11	Lake Carol Section 4	1	5	1	4	1	**12**
12	Lake Sandra	4	1	1	4	1	**11**
13	Loch Ness	2	4	1	2	1	**10**
14	Lake Carol Section 3	2	2	1	4	1	**10**
15	Lake Carol Section 1	1	2	1	4	1	**9**
16	Lake Cynthia Section 3	1	1	1	4	1	**8**

Table 17 shows the priority ranking for the capital improvement projects. Each project was given a score between 1 and 5 in each of the five categories: hydraulic analysis, observed flooding, complaints, roadway condition and traffic volumes. The scores were then totaled and the projects were ranked from highest to lowest. The basis for the category scores is detailed below.

Hydraulic Analysis

1 All water quantity performance goals met by existing conditions
2 Water quantity performance goals failed in less than 1/3 of drainage areas in sub-basin
3 Water quantity performance goals failed in1/3 to 1/2 of drainage areas in sub-basin
4 Water quantity performance goals failed in1/2 to all but one of the drainage areas in sub-basin
5 Water quantity performance goals failed in all of the drainage areas in the sub-basin

Observed Flooding

1 No flooding observed in sub-basin
2 Roadway flooding observed in less than 1/3 of drainage areas within sub-basin
3 Roadway flooding observed in 1/3 to 1/2 of drainage areas within sub-basin
4 Roadway flooding observed in 1/2 to all but one of the drainage areas within sub-basin'
5 Roadway flooding observed in all of the drainage areas within sub-basin

Complaints

1 No complaints recorded
2 Complaints recorded for less than 1/3 of drainage areas within sub-basin
3 Complaints recorded for 1/3 to 1/2 of drainage areas within sub-basin
4 Complaints recorded for 1/2 to all but one of drainage areas within sub-basin
5 Complaints recorded for all drainage areas within the sub-basin

Roadway Condition

1 Roadway rated as Fair 5 in Roadway CIP
2 Roadway rated as Fair 3 in Roadway CIP
3 Roadway rated as Fair 2 in Roadway CIP
4 Roadway rated as Fair 1 in Roadway CIP
5 Roadway rated as Poor in Roadway CIP

The proposed CIP summary and schedule of work is contained in Table 18. Figure 36 shows the effect that the proposed projects would have on observed flooding areas and complaint areas throughout the Town. Table 19-34 detail the budgets for the recommended drainage improvements for each sub-basin based on the analysis described in the preceding sections of this report. Table 35 details the operations and maintenance budget. The projects are recommended to be coordinated with the roadway CIP project scheduling to insure that the drainage improvements are complete before or at the same time as the roadway improvements in the same area. This will require some adjustment to the roadway CIP schedule.

Figure 36. Drainage Improvements

NORTH

0 300 600

Kimley-Horn and Associates, Inc.
14750 NW 77th Court
Miami Lakes, FL 33016
(305) 827-0588 Fax (305) 827-5776

TOWN OF MIAMI LAKES FLORIDA

LEGEND

- OBSERVED DRAINAGE DEFICIENCY OR COMPLAINT TO BE ELIMINATED BY TOWN PROJECT
- OBSERVED DRAINAGE DEFICIENCY OR COMPLAINT TO BE ELIMINATED BY COUNTY PROJECT
- UNRESOLVED OBSERVED DRAINAGE DEFICIENCY
- UNRESOLVED DRAINAGE COMPLAINT RECORDED BY MIAMI-DADE DERM OR TOWN OF MIAMI LAKES

Table 18A. Drainage Capital Improvements Program Summary - Alternate A

PROJECT	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	PROGRAM TOTAL
Loch Ness									$640,000		$640,000
Lake Glenn Ellen				$380,000							$380,000
Lake Cynthia Section 1				$40,000							$40,000
Lake Cynthia Section 2				$40,000							$40,000
Lake Cynthia Section 3										$0	$0
Lake Carol Section 1										$100,000	$100,000
Lake Carol Section 2								$50,000			$50,000
Lake Carol Section 3								$60,000			$60,000
Lake Carol Section 4										$50,000	$50,000
Lake Sandra								$220,000			$220,000
Lake Elizabeth Section 1							$240,000				$240,000
Lake Elizabeth Section 3							$150,000				$150,000
Bull Run						$570,000					$570,000
Miami Lakeway					$740,000						$740,000
NW 154th Street			$740,000								$740,000
NW 82nd Avenue	$520,000	$520,000									$1,040,000
Annual Operations and Maintenance	$524,000	$524,000	$524,000	$524,000	$524,000	$524,000	$524,000	$524,000	$524,000	$524,000	$5,240,000
TOTAL	**$1,044,000**	**$1,044,000**	**$1,264,000**	**$984,000**	**$1,264,000**	**$1,094,000**	**$914,000**	**$854,000**	**$1,164,000**	**$674,000**	**$10,300,000**

Approximate number of ERU's	13,900
Total Cost per ERU per month	$6.18

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 18B. Drainage Capital Improvements Program Summary - Alternate B

PROJECT	FY 03	FY 04	FY 05	FY 06	FY 07	PROGRAM TOTAL
Loch Ness					$640,000	$640,000
Lake Glenn Ellen		$380,000				$380,000
Lake Cynthia Section 1			$40,000			$40,000
Lake Cynthia Section 2			$40,000			$40,000
Lake Cynthia Section 3					$0	$0
Lake Carol Section 1					$100,000	$100,000
Lake Carol Section 2				$50,000		$50,000
Lake Carol Section 3					$60,000	$60,000
Lake Carol Section 4				$50,000		$50,000
Lake Sandra					$220,000	$220,000
Lake Elizabeth Section 1				$240,000		$240,000
Lake Elizabeth Section 3				$150,000		$150,000
Bull Run				$570,000		$570,000
Miami Lakeway			$740,000			$740,000
NW 154th Street		$740,000				$740,000
NW 82nd Avenue	$1,040,000					$1,040,000
Annual Operations and Maintenance	$524,000	$524,000	$524,000	$524,000	$524,000	$2,620,000
TOTAL	**$1,564,000**	**$1,644,000**	**$1,344,000**	**$1,584,000**	**$1,544,000**	**$7,680,000**

Approximate number of ERU's	13,900
Total Cost per ERU per month	$9.21

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 19. Loch Ness Sub-Basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	42,600	**$43,000**
Remove Existing Structure	13	Ea.	220	**$3,000**
Remove Drainage Pipe	70	L.F.	5	**$0**
Inlet Pavement	290	S.Y.	21	**$6,000**
Swale Inlet (P-10)	26	Ea.	2,400	**$62,000**
Manhole (P-7T)	1	Ea.	1,816	**$2,000**
18" Diameter Storm Sewer PEP	1,310	L.F.	31	**$41,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	3,270	L.F.	60	**$196,000**
Pollution Retardant Baffle	26	Ea.	232	**$6,000**
Roadway Restoration	6,107	S.Y.	18	**$110,000**
Utility Adjustments	1	W.O.	21,300	**$21,000**
Professional Services	1	W.O.	63,900	**$64,000**
Contingency	1	W.O.	85,200	**$85,000**
TOTAL				**$640,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 20. Lake Glenn Ellen Drainage Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	25,100	**$25,000**
Remove Existing Structure	21	Ea.	220	**$5,000**
Remove Drainage Pipe	1,440	L.F.	5	**$7,000**
Inlet Pavement	350	S.Y.	21	**$7,000**
Swale Inlet (P-10)	31	Ea.	2,400	**$74,000**
15" Diameter Storm Sewer PEP	800	L.F.	28	**$22,000**
18" Diameter Storm Sewer PEP	640	L.F.	31	**$20,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	1,305	L.F.	60	**$78,000**
Pollution Retardant Baffle	31	Ea.	232	**$7,000**
Roadway Restoration	1,740	S.Y.	18	**$31,000**
Utility Adjustments	1	W.O.	12,550	**$13,000**
Professional Services	1	W.O.	37,650	**$38,000**
Contingency	1	W.O.	50,200	**$50,000**
TOTAL				**$380,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 22. Lake Cynthia Section 1 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	2,800	**$3,000**
Remove Existing Structure	4	Ea.	220	**$1,000**
Remove Drainage Pipe	200	L.F.	5	**$1,000**
Inlet Pavement	44	S.Y.	21	**$1,000**
Swale Inlet (J-10)	1	Ea.	3,614	**$4,000**
Swale Inlet (P-10)	3	Ea.	2,400	**$7,000**
18" Diameter Storm Sewer PEP	400	L.F.	31	**$12,000**
Pollution Retardant Baffle	4	Ea.	232	**$1,000**
Roadway Restoration	44	S.Y.	18	**$1,000**
Utility Adjustments	1	W.O.	1,400	**$1,000**
Professional Services	1	W.O.	4,200	**$4,000**
Contingency	1	W.O.	5,600	**$6,000**
TOTAL				**$40,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 23. Lake Cynthia Section 2 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	2,700	**$3,000**
Remove Existing Structure	4	Ea.	220	**$1,000**
Remove Drainage Pipe	240	L.F.	5	**$1,000**
Inlet Pavement	44	S.Y.	21	**$1,000**
Swale Inlet (J-10)	1	Ea.	3,614	**$4,000**
Swale Inlet (P-10)	3	Ea.	2,400	**$7,000**
15" Diameter Storm Sewer PEP	400	L.F.	28	**$11,000**
Pollution Retardant Baffle	4	Ea.	232	**$1,000**
Roadway Restoration	44	S.Y.	18	**$1,000**
Utility Adjustments	1	W.O.	1,350	**$1,000**
Professional Services	1	W.O.	4,050	**$4,000**
Contingency	1	W.O.	5,400	**$5,000**
TOTAL				**$40,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 24. Lake Cynthia Section 3 Sub-Basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	0	W.O.	0	**$0**
Remove Existing Structure	0	Ea.	220	**$0**
Remove Drainage Pipe	0	L.F.	5	**$0**
Inlet Pavement	0	S.Y.	21	**$0**
Swale Inlet (P-10)	0	Ea.	2,400	**$0**
Manhole (P-7T)	0	Ea.	1,816	**$0**
15" Diameter Storm Sewer PEP	0	L.F.	28	**$0**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	0	L.F.	60	**$0**
Pollution Retardant Baffle	0	Ea.	232	**$0**
Roadway Restoration	0	S.Y.	18	**$0**
Utility Adjustments	0	W.O.	0	**$0**
Professional Services	0	W.O.	0	**$0**
Contingency	0	W.O.	0	**$0**
TOTAL				**$0**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 25. Lake Carol Section 1 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	6,800	**$7,000**
Remove Existing Structure	11	Ea.	220	**$2,000**
Remove Drainage Pipe	240	L.F.	5	**$1,000**
Inlet Pavement	120	S.Y.	21	**$2,000**
Curb Inlet (P-6)	7	Ea.	2,550	**$18,000**
Swale Inlet (J-10)	3	Ea.	3,614	**$11,000**
Swale Inlet (P-10)	1	Ea.	2,400	**$2,000**
15" Diameter Storm Sewer PEP	230	L.F.	28	**$6,000**
18" Diameter Storm Sewer PEP	250	L.F.	31	**$8,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	180	L.F.	60	**$11,000**
Pollution Retardant Baffle	11	Ea.	232	**$3,000**
Roadway Restoration	240	S.Y.	18	**$4,000**
Utility Adjustments	1	W.O.	3,400	**$3,000**
Professional Services	1	W.O.	10,200	**$10,000**
Contingency	1	W.O.	13,600	**$14,000**
TOTAL				**$100,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 26. Lake Carol Section 2 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	3,300	**$3,000**
Remove Existing Structure	6	Ea.	220	**$1,000**
Remove Drainage Pipe	465	L.F.	5	**$2,000**
Inlet Pavement	70	S.Y.	21	**$1,000**
Swale Inlet (J-10)	1	Ea.	3,614	**$4,000**
Swale Inlet (P-10)	5	Ea.	2,400	**$12,000**
15" Diameter Storm Sewer PEP	405	L.F.	28	**$11,000**
Pollution Retardant Baffle	6	Ea.	232	**$1,000**
Roadway Restoration	70	S.Y.	18	**$1,000**
Utility Adjustments	1	W.O.	1,650	**$2,000**
Professional Services	1	W.O.	4,950	**$5,000**
Contingency	1	W.O.	6,600	**$7,000**
TOTAL				**$50,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 27. Lake Carol Section 3 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	4,200	**$4,000**
Remove Existing Structure	7	Ea.	220	**$2,000**
Remove Drainage Pipe	130	L.F.	5	**$1,000**
Inlet Pavement	80	S.Y.	21	**$2,000**
Swale Inlet (J-10)	2	Ea.	3,614	**$7,000**
Swale Inlet (P-10)	5	Ea.	2,400	**$12,000**
18" Diameter Storm Sewer PEP	460	L.F.	31	**$14,000**
Pollution Retardant Baffle	7	Ea.	232	**$2,000**
Roadway Restoration	90	S.Y.	18	**$2,000**
Utility Adjustments	1	W.O.	2,100	**$2,000**
Professional Services	1	W.O.	6,300	**$6,000**
Contingency	1	W.O.	8,400	**$8,000**
TOTAL				**$60,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 28. Lake Carol Section 4 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	3,500	**$4,000**
Remove Existing Structure	5	Ea.	220	**$1,000**
Remove Drainage Pipe	155	L.F.	5	**$1,000**
Inlet Pavement	60	S.Y.	21	**$1,000**
Swale Inlet (J-10)	1	Ea.	3,614	**$4,000**
Swale Inlet (P-10)	4	Ea.	2,400	**$10,000**
18" Diameter Storm Sewer PEP	310	L.F.	31	**$10,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	100	L.F.	60	**$6,000**
Pollution Retardant Baffle	5	Ea.	232	**$1,000**
Roadway Restoration	60	S.Y.	18	**$1,000**
Utility Adjustments	1	W.O.	1,750	**$2,000**
Professional Services	1	W.O.	5,250	**$5,000**
Contingency	1	W.O.	7,000	**$7,000**
TOTAL				**$50,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 21. Lake Sandra Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	14,900	**$15,000**
Remove Existing Structure	17	Ea.	220	**$4,000**
Remove Drainage Pipe	1,120	L.F.	5	**$6,000**
Inlet Pavement	190	S.Y.	21	**$4,000**
Curb Inlet (P-6)	4	Ea.	2,550	**$10,000**
Swale Inlet (P-10)	17	Ea.	2,400	**$41,000**
15" Diameter Storm Sewer PEP	1,120	L.F.	28	**$31,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	565	L.F.	60	**$34,000**
Pollution Retardant Baffle	21	Ea.	232	**$5,000**
Roadway Restoration	760	S.Y.	18	**$14,000**
Utility Adjustments	1	W.O.	7,450	**$7,000**
Professional Services	1	W.O.	22,350	**$22,000**
Contingency	1	W.O.	29,800	**$30,000**
TOTAL				**$220,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 29. Lake Elizabeth Section 1 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	15,700	**$16,000**
Remove Existing Structure	3	Ea.	220	**$1,000**
Inlet Pavement	670	S.Y.	21	**$14,000**
Swale Inlet (J-10)	1	Ea.	3,614	**$4,000**
Swale Inlet (P-10)	5	Ea.	2,400	**$12,000**
15" Diameter Storm Sewer PEP	640	L.F.	28	**$18,000**
18" Diameter Storm Sewer PEP	200	L.F.	31	**$6,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	1,200	L.F.	60	**$72,000**
Pollution Retardant Baffle	6	Ea.	232	**$1,000**
Roadway Restoration	1,600	S.Y.	18	**$29,000**
Utility Adjustments	1	W.O.	7,850	**$8,000**
Professional Services	1	W.O.	23,550	**$24,000**
Contingency	1	W.O.	31,400	**$31,000**
TOTAL				**$240,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 30. Lake Elizabeth Section 3 Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	10,200	**$10,000**
Remove Existing Structure	3	Ea.	220	**$1,000**
Inlet Pavement	60	S.Y.	21	**$1,000**
Swale Inlet (J-10)	2	Ea.	3,614	**$7,000**
Swale Inlet (P-10)	3	Ea.	2,400	**$7,000**
15" Diameter Storm Sewer PEP	350	L.F.	28	**$10,000**
18" Diameter Storm Sewer PEP	950	L.F.	31	**$29,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	550	L.F.	60	**$33,000**
Pollution Retardant Baffle	5	Ea.	232	**$1,000**
Roadway Restoration	740	S.Y.	18	**$13,000**
Utility Adjustments	1	W.O.	5,100	**$5,000**
Professional Services	1	W.O.	15,300	**$15,000**
Contingency	1	W.O.	20,400	**$20,000**
TOTAL				**$150,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 34. NW 82nd Avenue Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	69,200	**$69,000**
Remove Existing Structure	22	Ea.	220	**$5,000**
Remove Drainage Pipe	2,200	L.F.	5	**$11,000**
Curb Inlet (P-6)	32	Ea.	2,550	**$82,000**
18" Diameter Storm Sewer PEP	330	L.F.	31	**$10,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	1,630	L.F.	60	**$98,000**
Pollution Retardant Baffle	32	Ea.	232	**$7,000**
Roadway Restoration	2,175	S.Y.	18	**$39,000**
Drainage Well	11	Ea.	40,000	**$440,000**
Utility Adjustments	1	W.O.	34,600	**$35,000**
Professional Services	1	W.O.	103,800	**$104,000**
Contingency	1	W.O.	138,400	**$138,000**
TOTAL				**$1,040,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 32. Miami Lakeway Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	49,500	**$50,000**
Remove Existing Structure	14	Ea.	220	**$3,000**
Remove Drainage Pipe	600	L.F.	5	**$3,000**
Curb Inlet (P-6)	14	Ea.	2,550	**$36,000**
Manhole (P-7T)	0	Ea.	1,816	**$0**
18" Diameter Storm Sewer PEP	180	L.F.	31	**$6,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	1,955	L.F.	60	**$117,000**
Pollution Retardant Baffle	14	Ea.	232	**$3,000**
Roadway Restoration	2,607	S.Y.	18	**$47,000**
Drainage Well	7	Ea.	40,000	**$280,000**
Utility Adjustments	1	W.O.	24,750	**$25,000**
Professional Services	1	W.O.	74,250	**$74,000**
Contingency	1	W.O.	99,000	**$99,000**
TOTAL				**$740,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 33. NW 154th Street Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	49,000	**$49,000**
Remove Existing Structure	6	Ea.	220	**$1,000**
Remove Drainage Pipe	360	L.F.	5	**$2,000**
Curb Inlet (P-6)	12	Ea.	2,550	**$31,000**
18" Diameter Storm Sewer PEP	180	L.F.	31	**$6,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	2,470	L.F.	60	**$148,000**
Pollution Retardant Baffle	12	Ea.	232	**$3,000**
Roadway Restoration	3,300	S.Y.	18	**$59,000**
Drainage Well	6	Ea.	40,000	**$240,000**
Utility Adjustments	1	W.O.	24,500	**$25,000**
Professional Services	1	W.O.	73,500	**$74,000**
Contingency	1	W.O.	98,000	**$98,000**
TOTAL				**$740,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 31. Bull Run Sub-basin Capital Improvements

Item	Quantity	Units	Unit Price $	Amount $
Mobilization	1	W.O.	37,900	**$38,000**
Remove Existing Structure	18	Ea.	220	**$4,000**
Remove Drainage Pipe	900	L.F.	5	**$5,000**
Curb Inlet (P-6)	18	Ea.	2,550	**$46,000**
Manhole (P-7T)	1	Ea.	1,816	**$2,000**
18" Diameter Storm Sewer PEP	570	L.F.	31	**$18,000**
French Drain (-8.00 Elev.) - 18" Pipe PPEP	2,620	L.F.	60	**$157,000**
Pollution Retardant Baffle	18	Ea.	232	**$4,000**
Roadway Restoration	3,500	S.Y.	18	**$63,000**
Drainage Well	2	Ea.	40,000	**$80,000**
Utility Adjustments	1	W.O.	18,950	**$19,000**
Professional Services	1	W.O.	56,850	**$57,000**
Contingency	1	W.O.	75,800	**$76,000**
TOTAL				**$570,000**

Notes

1. Easements for outfalls to lakes must be verified and additional easements may be required.
2. Costs do not include inflation or interest costs.
3. Sequence of improvements should be coordinated with roadway CIP.

Table 35A. Annual Operations and Maintenance Budget (Option A)

Item	Quantity	Units	Unit Price ($)	Amount ($)
Clean Catchbasins & Manholes - 1/2 per year	730	Ea.	$190.00	**$139,000**
Pipe Flushing - 1/5 per year	4,720	L.F.	$12.00	**$57,000**
Exfiltration Trench Cleaning - 1/5 per year	11,760	L.F.	$10.00	**$118,000**
Street Sweeping	1	L.S.	$15,000	**$15,000**
NPDES Permit Fees	1	L.S.	$25,000	**$25,000**
Canal Maintenance JPA	1	L.S.	$25,000	**$25,000**
DERM Monitoring	1	L.S.	$15,000	**$15,000**
WASAD Fee Collection	1	L.S.	$25,000	**$25,000**
Professional Services - Engineering and Legal	1	L.S.	$30,000	**$30,000**
Stormwater Utility Administration	1	L.S.	$25,000	**$25,000**
Minor Repairs and Improvements and Contingency	1	L.S.	$50,000	**$50,000**
TOTAL				**$524,000**

Table 35B. Annual Operations and Maintenance Budget (Option B)

Item	Quantity	Units	Unit Price ($)	Amount ($)
Clean Catchbasins & Manholes - 1/2 per year	730	Ea.	$190.00	**$139,000**
Pipe Flushing - 1/5 per year	4,720	L.F.	$12.00	**$57,000**
Exfiltration Trench Cleaning - 1/5 per year	11,760	L.F.	$10.00	**$118,000**
Street Sweeping	1	L.S.	$15,000	**$15,000**
NPDES Permit Fees	1	L.S.	$25,000	**$25,000**
Canal Maintenance JPA	1	L.S.	$25,000	**$25,000**
DERM Monitoring	1	L.S.	$15,000	**$15,000**
WASAD Fee Collection	1	L.S.	$25,000	**$25,000**
Professional Services - Engineering and Legal	1	L.S.	$30,000	**$30,000**
Stormwater Utility Administration	1	L.S.	$25,000	**$25,000**
Matching Funds for Grant Applications	1	L.S.	$150,000	**$150,000**
Minor Repairs and Improvements and Contingency	1	L.S.	$50,000	**$50,000**
TOTAL				**$674,000**

Table 36. Annual Revenue Generated by Various Monthly Stormwater Utility Fees

Present Conditions - Miami-Dade County

Fee	Residential ERU's	Non-residential ERU's	Residential Revenue	Non-Residential Revenue	Total Revenue
$3	8,010	10,660	$288,360	$383,760	$672,120

Proposed Conditions - Town of Miami Lakes

Fee	Residential ERU's	Non-residential ERU's	Residential Revenue	Non-Residential Revenue	Total Revenue
$3	8,010	5,890	$288,360	$212,040	$500,400
$4	8,010	5,890	$384,480	$282,720	$667,200
$5	8,010	5,890	$480,600	$353,400	$834,000
$6	8,010	5,890	$576,720	$424,080	$1,000,800
$7	8,010	5,890	$672,840	$494,760	$1,167,600
$8	8,010	5,890	$768,960	$565,440	$1,334,400
$9	8,010	5,890	$865,080	$636,120	$1,501,200
$10	8,010	5,890	$961,200	$706,800	$1,668,000
$11	8,010	5,890	$1,057,320	$777,480	$1,834,800
$12	8,010	5,890	$1,153,440	$848,160	$2,001,600
$13	8,010	5,890	$1,249,560	$918,840	$2,168,400
$14	8,010	5,890	$1,345,680	$989,520	$2,335,200
$15	8,010	5,890	$1,441,800	$1,060,200	$2,502,000
$16	8,010	5,890	$1,537,920	$1,130,880	$2,668,800