Lake Minnehaha Stormwater Improvement Study

Prepared For:

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&

Lake County Water Authority
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CITY OF CLERMONT

LCWA
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WATER AUTHORITY

Prepared by:

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▲ ENGINEERS
▲ SURVEYORS
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Table of Contents

Section 1
Introduction

Farner, Barley & Associates, Inc., has been retained to provide engineering services to the City of Clermont for the project titled "Lake Minnehaha Stormwater Improvement Study". The Study is the result of a Joint Participation Agreement (JPA) between the City of Clermont and the Lake County Water Authority. The purpose of the Study is to identify the drainage basins discharging into Lake Minnehaha which are located within the Corporate Limits of the City of Clermont and provide recommendations for potential stormwater treatment options. More specifically, the scope of the Study includes the following:

- Conduct extensive site visits to identify and catalogue all existing stormwater discharges into Lake Minnehaha from within the City of Clermont corporate limits.
- Coordinate with City of Clermont staff to identify existing stormwater piping locations and sizes.
- Catalogue, both graphically and verbally, the locations, sizes and conditions of all stormwater collection and conveyance facilities located within the City of Clermont which discharge directly to Lake Minnehaha.
- Utilize available topographic and aerial maps to determine approximate drainage sub-basins and related areas contributing stormwater runoff into Lake Minnehaha.
- Identify potential properties available within drainage sub-basins for potential stormwater retention/detention areas for stormwater treatment.
- Identify potential locations for pipe end stormwater treatment structures.
- Identify observed operation and maintenance problems observed during the course of the site visits.
- Prepare this written report summarizing the findings of the Study.

Section 2
Description of Study Area

The Study area for the Lake Minnehaha Stormwater Improvement Study includes all areas lying within the City of Clermont Corporate Limits which discharge stormwater directly into Lake Minnehaha. In order to conduct the Study, Farner, Barley & Associates, Inc., utilized 2004 Lake County Aerial Photographs and USGS Quad Maps with topography. Sheet 2 of the enclosed plan set depicts the overall Study area, including drainage sub-basins and approximate locations of structures and stormwater pipes. Based upon the USGS topographic maps, the total drainage area discharging directly into Lake Minnehaha is approximately 222 acres (note, this does not include additional areas discharging into Lake Minnehaha through Lake Winona. A discussion of the Lake Winona drainage basin can be found in the report titled Lake Winona Stormwater Improvement Study). This overall drainage area has been subdivided into twenty-two (22) drainage sub-basins, corresponding to existing drainage discharge points into Lake Minnehaha. Within the 222 acre study area, we identified a total of 67 existing stormwater structures. These included a vast array of drainage structures, including ditch bottom inlets, curb inlets, storm manholes and hand formed stormwater inlets. The drainage improvements exist within both City of Clermont and Lake County road rights-of-way. In addition, based upon research of plats within the study area, it appears that the vast majority of stormwater discharge piping is not located within public easements, but rather on private property.

Estimated Rates of Runoff

Farner, Barley & Associates, Inc., conducted an analysis of impervious area percentages on several sample sub-basins and has determined that the average impervious area within each sub-basin is approximately 30%. Table 2-1 summarizes the anticipated runoff rates per drainage basin during the standard 10 year/24 hour design storm utilized for sizing stormwater conveyance systems. Tables 2-2 through 2-23 illustrate the runoff time of concentration calculations per sub-basin. Peak rates of runoff through the existing basins range in flow from approximately 6 cfs to approximately 111 cfs.

Topography within Study Area

Topography within the study area ranges from low elevations adjacent to Lake Minnehaha of approximately 100' NGVD to high elevations exceeding 200' NGVD. Ground slopes vary greatly, with slopes in excess of 8% visible to the north of Lake Minnehaha, with much more gradual slopes found at the western end of the study area close to Lake Minnehaha.

Soils within Study Area

Soils within the study area consist of several soils types, as identified on the Lake County SCS Soil Survey Report. Soils located within the study area include:

SCS Map Symbol	Soil Name	SCS Soil Type
Am	Anclote, Myakka & Felda Soils, Depressional	B/D
AtB	Astatula Sands, 0-5% slopes	A
AtD	Astatula Sands, 5-12% slopes	A
LaB	Lake Sands, 0-5% slopes	A
LaD	Lake Sands, 5-12% slopes	A
Fm	Fill Material	D

As can be seen from the attached SCS Soils Map, the majority of the study area consists of SCS Type A soils.

Description of Existing Facilities

As stated above, there are a total of 67 city owned stormwater structures discharging untreated stormwater runoff into Lake Minnehaha, including ditch bottom inlets, curb inlets, storm manholes, hand formed inlets and outlet structures. There are a total of 26 separate untreated discharge points into the Lake within the 22 drainage sub-basins. Aerial Photography Sheets 2 through 14 depict the locations, types and conditions of the existing drainage structures. Table 2-24 provides information on each of the structures, including structure number, location, type, depth and physical condition. Many of the structures are in a state of disrepair and require maintenance or replacement.

Pipes within the study area consist of reinforced concrete pipe, corrugated metal pipe, vitrified clay pipe and PVC pipe. Pipe sizes range from 10" diameter to 24" diameter. Please note that information contained herein with regards to inlet and pipe types and conditions are based solely on visual inspection, not as-built drawings. Some inlets could not be fully accessed due to stuck grates, and many of the inlets were partially or totally full of debris, making inspection difficult.

Section 3
Recommendations

Based upon the availability of land within each drainage sub-basin, different treatment options are available for stormwater discharge points. In some cases, vacant land appears to be available for construction of retention ponds. However, in most cases, no vacant land is available for construction of ponds. While it may be possible for the City to acquire existing developed properties within the study area through the Eminent Domain process, this alternative is both costly and politically unpopular. However, this option does exist within all sub-basins contained in this study. In those cases where no vacant land exists, the most likely method of stormwater treatment is pipe end treatment. Several options exist for pipe end treatment, including baffle boxes and vortex separators.

Where land is available for construction of stormwater retention ponds, in most cases, the most efficient form of pond would be an offline dry retention pond. An offline pond receives stormwater runoff via diversion from a stormwater structure with an interior diversion weir. Stormwater is diverted into the pond until the elevation within the pond reaches the required treatment volume, which matches the elevation of the weir within the stormwater structure. Once the water level reaches this point, additional flow through the pipe network continues past the pond and towards its ultimate discharge point. Due to the capture of larger volumes of stormwater runoff, it is anticipated that stormwater retention ponds would provide the highest level of treatment of all options considered. However, due to the cost of land acquisition and the work associated with their construction, their cost is highest.

One type of pipe end treatment is a baffle box. Baffle boxes are structures which consist of several interior chambers (similar to a septic tank) which trap settleable solids such as grit and sand. Generally, baffle boxes are equipped with varying sizes of screens for the capture of floatable solids. Finally, inclusion of oil and grease capturing sorbent materials suspended within the boxes completes the treatment process. In order to assure that the hydraulic gradient is not measurably increased upstream, two safeguards are included in their design. The baffle walls within the boxes are constructed at or below the invert of the inlet pipe. In addition, the screens are suspended in such a way as to swing out of the flow path in the event that they become clogged. Maintenance of these structures generally consists of regular cleaning following rainfall events. Frequency of cleaning will depend greatly on the size of the drainage sub-basin and frequency and intensity of the rainfall events. Cleaning of the sediment in the baffle boxes is generally accomplished with a vacuum truck, while the screens are best cleaned by hand. Appendix A Includes information regarding different types of baffle boxes commercially available.

Finally, vortex separators are another type of pipe end treatment. Several types of vortex separators are commercially available for this purpose. Generally, vortex separators consist of a round chamber with the inlet pipe offset in the structure so that flow entering the chamber flows in a circular manner, or vortex. The vortex motion assists in forcing settleable solids into the bottom of the chamber for capture and removal. Floatable solids are trapped by different means, depending on the brand of separator specified. Oil, grease and other hydrocarbons are also trapped within the chamber via slightly differing methods depending on the brand of separator specified. Appendix B Includes information from a couple of different vortex separator manufacturers.

In addition to treatment of stormwater, education of the public is an important component of improving water quality. It appears from site visits that informational signage was installed on some of the inlets within the study area warning the public that the inlets flow to the lake. However, it was apparent that many signs had either broken or fallen off of the structures. Included in Appendix C is some product information on stormwater structure marking products which are durable and inform the public of the discharge of stormwater into the lake.

Due to differing conditions within each sub-basin, we have identified the most feasible method of stormwater treatment based upon availability of land, etc. In the cases where vacant properties are available, we have included property record cards from the Lake County Property Appraisers Office with information on the property owners, etc. These property record cards are numbered corresponding to the drawings and can be found in Appendix D. Recommendations for each Sub-Basin are found below:

Sub-Basin 1 (Structures D-1 and D-2)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-2 and the discharge point.

Sub-Basin 2 (Structures D-3 and D-4)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-4 and the discharge point.

Sub-Basin 3 (Structures D-5, D-6, D-7 and D-8)

Several options exist for treatment of stormwater from within this sub-basin. First, it should be noted that 12th Street have a pavement surface which is approximately forty-five feet wide. It would be very feasible to remove approximately twenty-one feet of pavement in the middle of this roadway and create a grassed median. This median could be constructed with a series of linear ponds for treatment of stormwater runoff from the roadway surface of 12th Street. Second, these structures are adjacent to a park which is owned by the City of Clermont (Property Record Card #1). A portion of this park could be utilized for stormwater treatment via a retention or wet detention pond. Third, a vacant lot exists to the east of these stormwater structures which could also be utilized for a stormwater retention pond (Property Record Card #2) and another vacant lot exists north on Harbor Lane which could be utilized for a retention pond (Property Record Card #3). Finally, pipe end treatment structures could be utilized for stormwater treatment within this basin. Due to the size of the drainage sub-basin and the existence of City owned property, the park area would be ideal for the construction of a stormwater treatment pond.

Sub-Basin 4 (Structures D-9, D-10 and D-11)

Two options exist for treatment of stormwater from within this sub-basin. A vacant lot exists to the east of these stormwater structures, adjacent to the canal, which could be utilized for a stormwater retention pond (Property Record Card #4). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 5 (Structures D-12, D-13 and D-14)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-12 and the discharge point.

Sub-Basin 6 (Structure D-15 and D-15A)

A few options exist for treatment of stormwater from within this sub-basin. A vacant lot exists on the west side of Settle Street across from Structure D-15A which could be utilized for a stormwater retention pond (Property Record Card #5). Another vacant lot exists to the northeast of stormwater Structure D-15, adjacent to the canal, which could be utilized for a stormwater retention pond (Property Record Card #6). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 7 (Structures D-16 and D-17)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-17 and the discharge point.

Sub-Basin 8 (Structures D-18 and D-19)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-19 and the discharge point.

Sub-Basin 9 (Structure D-20)

Due to the location of this structure, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-20 and the discharge point.

Sub-Basin 10 (Structures D-21 and D-22)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-22 and the discharge point.

Sub-Basin 11 (Structure D-23)

Three options exist for treatment of stormwater from within this sub-basin. A vacant lot exists to the north of this stormwater structure, on 2nd Street, which could be utilized for an offline stormwater retention pond (Property Record Card #7). A second vacant lot exists to the east of this stormwater structure, on Lakeshore Drive, which could also be utilized for an offline stormwater retention pond (Property Record Card #8). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 12 (Structures D-24, D-25 and D-26)

Three options exist for treatment of stormwater from within this sub-basin. Two vacant lots exist to the north of these stormwater structures, on 1st Street, which could be utilized for an offline stormwater retention pond (Property Record Cards #9 & #10). A second vacant lot exists to the west of these stormwater structures, on Lakeshore Drive, which could also be utilized for an offline stormwater retention pond (Property Record Card #8). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 13 (Structure D-27)

Due to the location of this structure, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-27 and the discharge point.

Sub-Basin 14 (Structures D-28, D-29 and D-30, D-31 and D-32)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-32 and the discharge point.

Sub-Basin 15 (Structures D-33, D-34 and D-35, D-36, D-37, D-37A and D-38)

Due to the location of these structures, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. Two treatment structures would be constructed, one between Structure D-37 and the discharge point, and the other between Structure D-38 and the discharge point.

Sub-Basin 16 (Structure D-39)

Due to the location of this structure, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-39 and the discharge point.

Sub-Basin 17 (Structures D-40, D-41, D-42, D-43, D-44 and D-45)

Two options exist for treatment of stormwater from within this sub-basin. A vacant lot exists to the north of these stormwater structures, on Anderson Street, which could be utilized for an offline stormwater retention pond to treat stormwater runoff entering Structures D-40 to D-43 (Property Record Card #11). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin. Due to the location of Structures D-44 and D-45, only a pipe end treatment structure would be feasible for this location.

Sub-Basin 18 (Structures D-46, D-47, D-48, D-49, and D-50)

Two options exist for treatment of stormwater from within this sub-basin. A vacant lot exists to the north of these stormwater structures, on Disston Avenue, which could be utilized for an offline stormwater retention pond to treat stormwater runoff (Property Record Card #12). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 19 (Structure D-51)

Due to the location of this structure, surrounded by developed areas, construction of a retention pond is not feasible. Therefore, construction of a pipe end treatment structure is the most feasible form of stormwater treatment. This treatment structure would be constructed between Structure D-51 and the discharge point.

Sub-Basin 20 (Structures D-52 through D-59)

Two options exist for treatment of stormwater from within this sub-basin. A vacant parcel of land exists to the north of these stormwater structures, on Lakeshore Drive, which could be utilized for an offline stormwater retention pond to treat stormwater runoff (Property Record Card #13). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 21 (Structure D-60)

Two options exist for treatment of stormwater from within this sub-basin. A vacant parcel of private park land exists to the west of this stormwater structure, on Lakeshore Drive, which could be utilized for a stormwater retention pond to treat stormwater runoff (Property Record Card #14). In addition, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Sub-Basin 22 (Structures D-61 through D-67)

Several options exist for treatment of stormwater from within this sub-basin. A vacant parcel of land exists to the east of these stormwater structures, on the corner of Brogden Drive and Lakeshore Drive, which could be utilized for an offline stormwater retention pond to treat stormwater runoff (Property Record Card #15). A second vacant parcel exists east of Structure D-66 which could be utilized for an offline stormwater retention pond (Property Record Card #16). Finally, a pipe end treatment structure could be utilized for stormwater treatment within this basin.

Section 4
Cost Estimates

We have prepared cost estimates for several treatment options detailed within the Study. Tables 4-1 through 4-5 detail the estimated costs for construction of a single stormwater treatment device within an individual sub-basin. It is important to note, however, that some of the costs documented (i.e. mobilization, survey, etc) would be significantly lower were a stormwater improvement project to be undertaken which incorporated several improvements within several sub-basins under one contract. The types of stormwater improvements for which we provided cost estimates include:

- Custom Designed and Built Baffle Box
- Suntree Technologies Baffle Box
- Vortechnics Vortex Separator
- Stormceptor Vortex Separator
- Dry Retention Pond

Costs for these improvements range from a low of approximately $60,000.00 for a Suntree Technologies Baffle Box to a high of approximately $130,000.00 for a dry retention pond. Please note, however, that these cost estimates do not include the cost of land acquisition or the acquisition of easements for construction of these improvements.

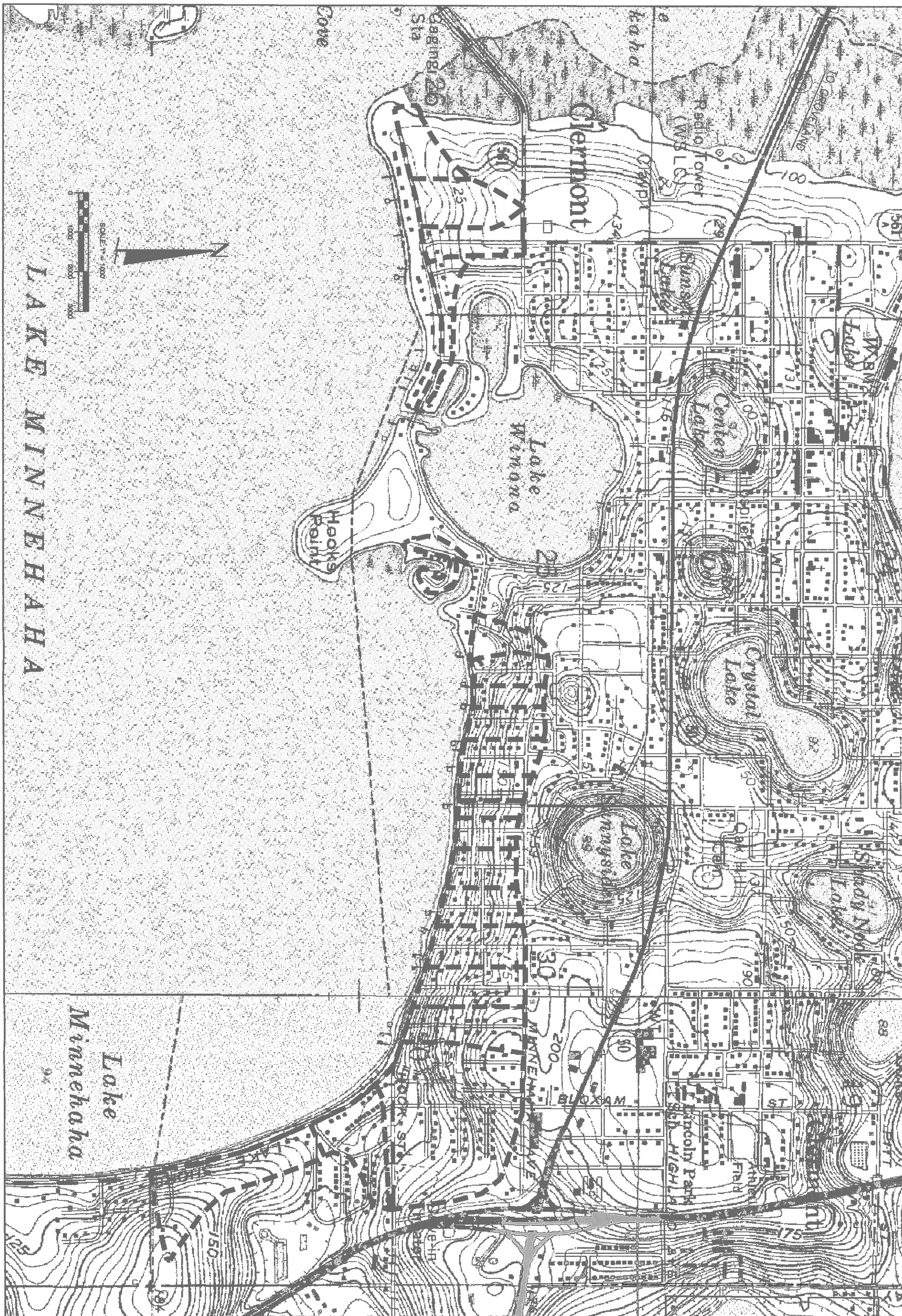
It is anticipated that funds to construct these improvements could come from a variety of funding sources, including grants from the Lake County Water Authority and/or the St. Johns River Water Management District. In addition, stormwater fees collected by the City of Clermont could be a potential funding source for stormwater quality improvements such as these. One final solution for financing of stormwater improvement projects would be an assessment of property owners whose property discharges within each drainage sub-basin.

Section 5
Summary

Farner, Barley & Associates, Inc., conducted this Study under contract with the City of Clermont, in association with the Lake County Water Authority. As requested, we conducted extensive visits to the field to verify existing conditions of the stormwater system and to familiarize ourselves with the study area. Visits to the study area revealed the potential for some conventional stormwater treatment possibilities (retention ponds), as well as some newer, inline stormwater treatment possibilities (baffle boxes and vortex separators). Based upon our study, we would recommend that the City pursue obtaining vacant properties within the study area for construction of stormwater treatment systems in areas where this potential exists. In other, more tightly constrained areas, we would recommend that the City pursue the design and construction of pipe-end treatment technologies, such as baffle boxes or vortex separators. In all cases, it will be necessary to either obtain land, or obtain easements, for the construction of these stormwater improvements.

Pursuing elimination of the numerous untreated stormwater discharges into Lake Minnehaha is a positive first step in making a commitment to the future water quality and associated quality of life for residents of the City of Clermont.

Figures



LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

USGS MAP
CLERMONT EAST AND WEST

CITY OF CLERMONT

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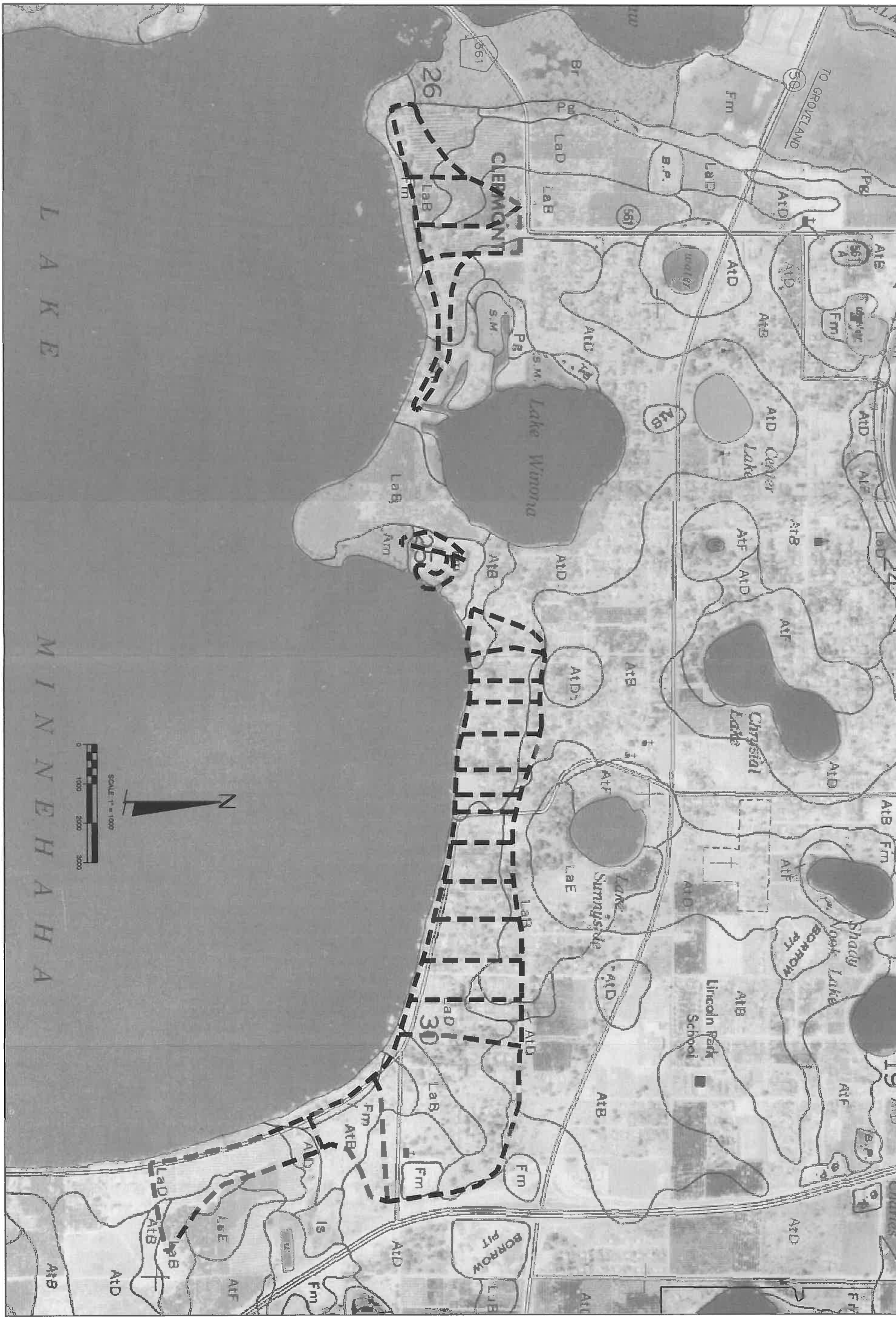
DATE DECEMBER 4, 2004

FIGURE 1

JOB NO. 03004004



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DATE DECEMBER 6, 2004

FIGURE 2

JOB NO. 03004.006

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CITY OF CLERMONT

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

SOILS MAP
LAKE COUNTY SHEET 59

DATE	REVISION

Tables

Drainage Sub-Basin Runoff

Sub-Basin No.	Area (ac.)	Average % Impervious	Runoff Coefficient "C"	Intensity (in/hr)	Runoff Rate "Q" (cfs)
1	7.36	30	0.445	5.05	16.54
2	11.75	30	0.445	4.5	23.53
3	8.80	30	0.445	4.4	17.23
4	6.73	30	0.445	4.9	14.67
5	2.22	30	0.445	6.15	6.08
6	1.83	30	0.445	6.9	5.62
7	6.00	30	0.445	6	16.02
8	6.23	30	0.445	5.8	16.08
9	4.15	30	0.445	5.6	10.34
10	6.64	30	0.445	5.4	15.96
11	7.73	30	0.445	5.4	18.58
12	4.69	30	0.445	5.6	11.69
13	2.98	30	0.445	5.8	7.69
14	5.15	30	0.445	5.8	13.29
15	7.10	30	0.445	5.8	18.33
16	8.15	30	0.445	5.9	21.40
17	10.56	30	0.445	5.5	25.85
18	11.62	30	0.445	4.8	24.82
19	12.77	30	0.445	4.55	25.86
20	54.90	30	0.445	4.55	111.16
21	13.15	30	0.445	5.4	31.60
22	21.31	30	0.445	5.3	50.26
Total	**221.82**				**502.58**

Notes:

1. Average Impervious Percentage Per Basin averaged via random sample of sub-basins
2. Runoff Coefficient based upon Pervious "C" value of 0.25 and Impervious "C" value of 0.90
3. Based upon 10 yr/24 hr storm event with 7.3 in/hr base intensity.

Table 2-1

Time of Concentration Calculations

Basin I.D.: Basin 1

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0367
6	Travel Time,	T_t	hr	0.37

$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	750
9	Watercourse Slope,	s	ft/ft	0.024
10	Average Velocity (from reference graph)	V	ft/s	2.5
11	Travel Time,	T_t	hr	0.08

$T_t = L / (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.45**
		min	**27.24**

Time of Concentration Calculations

Basin I.D.: Basin 2

Sheet Flow

1 Surface Description:			Dense Grasses
2 Mannings Roughness Coefficient,	n		0.24
3 Flow Length (total < 300 ft),	L	ft	300
4 Two-Year, 24-Hour rainfall,	P_2	in	4.7
5 Land Slope,	s	ft/ft	0.0167
6 Travel Time,	T_t	hr	0.51

$T_t = [\,0.007\,(nL)^{0.8}\,] / [\,P_2^{0.5}\,s^{0.4}\,]$

Shallow Flow

7 Surface Description: (paved or unpaved)			Unpaved
8 Flow Length,	L	ft	850
9 Watercourse Slope,	s	ft/ft	4.35
10 Average Velocity (from reference graph)	V	ft/s	3.4
11 Travel Time,	T_t	hr	0.07

$T_t = L / (3{,}600\ V)$

Channel Flow

12 Cross Sectional Fow Area,	A	ft^2	
13 Wetted Perimeter,	P_w	ft	
14 Hydraulic Radius,	R_H	ft	
15 Channel Slope,	s	ft/ft	
16 Mannings Roughness Coefficient,	n		
17 Velocity, (based on Mannings)	V	ft/s	
18 Flow Length,	L	ft	
19 Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.58**
		min	**34.64**

Table 2-3

Time of Concentration Calculations

Basin I.D.: Basin 3

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0167
6	Travel Time,	T_t	hr	0.51

$$T_t = [\,0.007\,(nL)^{0.8}\,] / [\,P_2^{0.5}\,s^{0.4}\,]$$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	850
9	Watercourse Slope,	s	ft/ft	0.0388
10	Average Velocity (from reference graph)	V	ft/s	2.5
11	Travel Time,	T_t	hr	0.09

$$T_t = L / (3{,}600\ V)$$

Channel Flow

12	Cross Sectional Flow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$$

$$T_t = L / (3{,}600\ V)$$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.60**
		min	**36.14**

Table 2-4

Time of Concentration Calculations

Basin I.D.: Basin 4

Sheet Flow

1 Surface Description:			Dense Grasses
2 Mannings Roughness Coefficient,	n		0.24
3 Flow Length (total < 300 ft),	L	ft	300
4 Two-Year, 24-Hour rainfall,	P_2	in	4.7
5 Land Slope,	s	ft/ft	0.0267
6 Travel Time,	T_t	hr	0.42

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7 Surface Description: (paved or unpaved)			Unpaved
8 Flow Length,	L	ft	750
9 Watercourse Slope,	s	ft/ft	0.04
10 Average Velocity (from reference graph)	V	ft/s	3.2
11 Travel Time,	T_t	hr	0.07

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12 Cross Sectional Fow Area,	A	ft^2	
13 Wetted Perimeter,	P_w	ft	
14 Hydraulic Radius,	R_H	ft	
15 Channel Slope,	s	ft/ft	
16 Mannings Roughness Coefficient,	n		
17 Velocity, (based on Mannings)	V	ft/s	
18 Flow Length,	L	ft	
19 Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.49**
		min	**29.17**

Table 2-5

Time of Concentration Calculations

Basin I.D.: Basin 5

Sheet Flow

1 Surface Description:			Dense Grasses
2 Mannings Roughness Coefficient,	n		0.24
3 Flow Length (total < 300 ft),	L	ft	150
4 Two-Year, 24-Hour rainfall,	P_2	in	4.7
5 Land Slope,	s	ft/ft	0.02
6 Travel Time,	T_t	hr	0.27

$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7 Surface Description: (paved or unpaved)			
8 Flow Length,	L	ft	
9 Watercourse Slope,	s	ft/ft	
10 Average Velocity (from reference graph)	V	ft/s	
11 Travel Time,	T_t	hr	0.00

$T_t = L / (3{,}600\ V)$

Channel Flow

12 Cross Sectional Fow Area,	A	ft^2	
13 Wetted Perimeter,	P_w	ft	
14 Hydraulic Radius,	R_H	ft	
15 Channel Slope,	s	ft/ft	
16 Mannings Roughness Coefficient,	n		
17 Velocity, (based on Mannings)	V	ft/s	
18 Flow Length,	L	ft	
19 Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.27**
		min	**16.29**

Time of Concentration Calculations

Basin I.D.: Basin 6

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	100
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.02
6	Travel Time,	T_t	hr	0.20

$T_t = [\,0.007\,(nL)^{0.8}\,] / [\,P_2^{0.5}\,s^{0.4}\,]$

Shallow Flow

7	Surface Description: (paved or unpaved)			
8	Flow Length,	L	ft	
9	Watercourse Slope,	s	ft/ft	
10	Average Velocity (from reference graph)	V	ft/s	
11	Travel Time,	T_t	hr	0.00

$T_t = L / (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.20**
		min	**11.77**

Table 2-7

Time of Concentration Calculations

Basin I.D.: Basin 7

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.09
6	Travel Time,	T_t	hr	0.26

$$T_t = [\, 0.007\, (nL)^{0.8}\,] \,/\, [\, P_2^{0.5}\, s^{0.4}\,]$$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	200
9	Watercourse Slope,	s	ft/ft	0.015
10	Average Velocity (from reference graph)	V	ft/s	2
11	Travel Time,	T_t	hr	0.03

$$T_t = L \,/\, (3{,}600\, V)$$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$$V = (1.486\, R_H^{2/3}\, s^{1/2}) \,/\, n$$
$$T_t = L \,/\, (3{,}600\, V)$$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.29**
		min	**17.20**

Time of Concentration Calculations

Basin I.D.: Basin 8

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0667
6	Travel Time,	T_t	hr	0.29

$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	450
9	Watercourse Slope,	s	ft/ft	7.11
10	Average Velocity (from reference graph)	V	ft/s	4.4
11	Travel Time,	T_t	hr	0.03

$T_t = L / (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.32**
		min	**19.22**

Table 2-9

Time of Concentration Calculations

Basin I.D.: Basin 9

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.05
6	Travel Time,	T_t	hr	0.33

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	450
9	Watercourse Slope,	s	ft/ft	0.0933
10	Average Velocity (from reference graph)	V	ft/s	5
11	Travel Time,	T_t	hr	0.03

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.35**
		min	**21.16**

Table 2-10

Time of Concentration Calculations

Basin I.D.: Basin 10

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.04
6	Travel Time,	T_t	hr	0.36

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	550
9	Watercourse Slope,	s	ft/ft	0.0854
10	Average Velocity (from reference graph)	V	ft/s	4.7
11	Travel Time,	T_t	hr	0.03

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.39**
		min	**23.44**

Table 2-11

Time of Concentration Calculations

Basin I.D.: Basin 11

Sheet Flow

		Symbol	Units	Value
1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.04
6	Travel Time,	T_t	hr	0.36

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

		Symbol	Units	Value
7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	550
9	Watercourse Slope,	s	ft/ft	0.0854
10	Average Velocity (from reference graph)	V	ft/s	4.7
11	Travel Time,	T_t	hr	0.03

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

		Symbol	Units	Value
12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

	Symbol	Units	Value
Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.39**
		min	**23.44**

Table 2-12

Time of Concentration Calculations

Basin I.D.: Basin 12

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.05
6	Travel Time,	T_t	hr	0.33

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	450
9	Watercourse Slope,	s	ft/ft	0.0778
10	Average Velocity (from reference graph)	V	ft/s	4.5
11	Travel Time,	T_t	hr	0.03

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.36**
		min	**21.32**

Table 2-13

Time of Concentration Calculations

Basin I.D.: Basin 13

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0667
6	Travel Time,	T_t	hr	0.29

$T_t = [\, 0.007\,(nL)^{0.8}\,] \,/\, [\, P_2^{0.5}\, s^{0.4}\,]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	350
9	Watercourse Slope,	s	ft/ft	0.0857
10	Average Velocity (from reference graph)	V	ft/s	4.7
11	Travel Time,	T_t	hr	0.02

$T_t = L \,/\, (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) \,/\, n$

$T_t = L \,/\, (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.31**
		min	**18.76**

Table 2-14

Time of Concentration Calculations

Basin I.D.: Basin 14

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.06
6	Travel Time,	T_t	hr	0.30

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	300
9	Watercourse Slope,	s	ft/ft	0.1
10	Average Velocity (from reference graph)	V	ft/s	5.1
11	Travel Time,	T_t	hr	0.02

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.32**
		min	**19.25**

Table 2-15

Time of Concentration Calculations

Basin I.D.: Basin 15

Sheet Flow

		Symbol	Unit	Value
1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0667
6	Travel Time,	T_t	hr	0.29

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

		Symbol	Unit	Value
7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	400
9	Watercourse Slope,	s	ft/ft	0.0875
10	Average Velocity (from reference graph)	V	ft/s	4.9
11	Travel Time,	T_t	hr	0.02

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

		Symbol	Unit	Value
12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

	Symbol	Unit	Value
Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.31**
		min	**18.88**

Table 2-16

Time of Concentration Calculations

Basin I.D.: Basin 16

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0833
6	Travel Time,	T_t	hr	0.27

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	550
9	Watercourse Slope,	s	ft/ft	0.0764
10	Average Velocity (from reference graph)	V	ft/s	4.5
11	Travel Time,	T_t	hr	0.03

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.30**
		min	**18.06**

Table 2-17

Time of Concentration Calculations

Basin I.D.: Basin 17

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.05
6	Travel Time,	T_t	hr	0.33

$T_t = [\,0.007\,(nL)^{0.8}\,] / [\,P_2^{0.5}\,s^{0.4}\,]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	700
9	Watercourse Slope,	s	ft/ft	0.0786
10	Average Velocity (from reference graph)	V	ft/s	4.6
11	Travel Time,	T_t	hr	0.04

$T_t = L / (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.37**
		min	**22.19**

Table 2-18

Time of Concentration Calculations

Basin I.D.: Basin 18

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0233
6	Travel Time,	T_t	hr	0.44

$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	850
9	Watercourse Slope,	s	ft/ft	0.0882
10	Average Velocity (from reference graph)	V	ft/s	4.9
11	Travel Time,	T_t	hr	0.05

$T_t = L / (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$

$T_t = L / (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.49**
		min	**29.57**

Time of Concentration Calculations

Basin I.D.: Basin 19

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0167
6	Travel Time,	T_t	hr	0.51

$$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	950
9	Watercourse Slope,	s	ft/ft	0.0947
10	Average Velocity (from reference graph)	V	ft/s	5
11	Travel Time,	T_t	hr	0.05

$$T_t = L / (3{,}600\ V)$$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$$

$$T_t = L / (3{,}600\ V)$$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.56**
		min	**33.64**

Table 2-20

Time of Concentration Calculations

Basin I.D.: Basin 20

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.0167
6	Travel Time,	T_t	hr	0.51

$T_t = [\, 0.007\,(nL)^{0.8}\,] \,/\, [\, P_2^{0.5}\, s^{0.4}\,]$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	1050
9	Watercourse Slope,	s	ft/ft	0.0905
10	Average Velocity (from reference graph)	V	ft/s	4.9
11	Travel Time,	T_t	hr	0.06

$T_t = L \,/\, (3{,}600\ V)$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\, R_H^{2/3}\, s^{1/2}) \,/\, n$

$T_t = L \,/\, (3{,}600\ V)$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.57**
		min	**34.05**

Table 2-21

Time of Concentration Calculations

Basin I.D.: Basin 21

Sheet Flow

1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.05
6	Travel Time,	T_t	hr	0.33

$$T_t = [\ 0.007\ (nL)^{0.8}\ ] / [\ P_2^{0.5}\ s^{0.4}\ ]$$

Shallow Flow

7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	350
9	Watercourse Slope,	s	ft/ft	0.0143
10	Average Velocity (from reference graph)	V	ft/s	1.9
11	Travel Time,	T_t	hr	0.05

$$T_t = L / (3{,}600\ V)$$

Channel Flow

12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$$V = (1.486\ R_H^{2/3}\ s^{1/2}) / n$$
$$T_t = L / (3{,}600\ V)$$

Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.38**
		min	**22.73**

Table 2-22

Time of Concentration Calculations

Basin I.D.: Basin 22

Sheet Flow

		Symbol	Units	Value
1	Surface Description:			Dense Grasses
2	Mannings Roughness Coefficient,	n		0.24
3	Flow Length (total < 300 ft),	L	ft	300
4	Two-Year, 24-Hour rainfall,	P_2	in	4.7
5	Land Slope,	s	ft/ft	0.04
6	Travel Time,	T_t	hr	0.36

$T_t = [\ 0.007\ (nL)^{0.8}\ ]\ /\ [\ P_2^{0.5}\ s^{0.4}\ ]$

Shallow Flow

		Symbol	Units	Value
7	Surface Description: (paved or unpaved)			Unpaved
8	Flow Length,	L	ft	500
9	Watercourse Slope,	s	ft/ft	0.034
10	Average Velocity (from reference graph)	V	ft/s	3
11	Travel Time,	T_t	hr	0.05

$T_t = L\ /\ (3{,}600\ V)$

Channel Flow

		Symbol	Units	Value
12	Cross Sectional Fow Area,	A	ft^2	
13	Wetted Perimeter,	P_w	ft	
14	Hydraulic Radius,	R_H	ft	
15	Channel Slope,	s	ft/ft	
16	Mannings Roughness Coefficient,	n		
17	Velocity, (based on Mannings)	V	ft/s	
18	Flow Length,	L	ft	
19	Travel Time,	T_t	hr	0.00

$V = (1.486\ R_H^{2/3}\ s^{1/2})\ /\ n$

$T_t = L\ /\ (3{,}600\ V)$

	Symbol	Units	Value
Time of Concentration, $T_c = S\ T_t$	T_c	hr	**0.40**
		min	**24.27**

Table 2-23

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-1	BOX INLET FULL OF WATER 18X12 RCP TO NORTH INSIDE TOP OF PIPE 14" FROM TOP OF GRATE	GRATE: 48"X30"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-2	BOX INLET FULL OF WATER 18X12 RCP TO SOUTH	GRATE: 48"X30"	
D-3	CURB INLET 10" SOUTH	INVERT NOT ACCESSIBLE	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-4	CURB INLET 10" NORTH 12" SOUTH NOTE: FULL OF DEBRIS	INVERT:-15.5"	
D-5	CURB INLET 18" SOUTH NOTE: HAS SCREEN INSIDE OF IT	INVERT: -48"	Retention Pond in Park, Pipe End Treatment (Baffle Box, Vortex Separator, etc.), or Median Swales on 12th Street. Also Potential Pond on vacant lot located between Rosewood Avenue and Johnson Drive
D-6	CURB INLET 18" NORTH RCP 18" SOUTH RCP	INVERT: -48"	
D-7	CATCH BASIN 12" RCP SOUTH	GRATE: 18"X28" INVERT: -27"	
D-8	BOX INLET 12" RCP NORTH 12" RCP SOUTH	GRATE: 18"X32" INVERT: -27"	
D-9	CURB INLET 18" RCP SOUTH	INVERT: -42"	Retention Pond in vacant lot adjacent to canal, or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-10	CURB INLET 18" RCP NORTH	INVERT: -42"	
D-11	MAN HOLE 18" RCP NORTH 18" RCP EAST 18" RCP SOUTH	INVERT: -53"	

Table 2-24

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-12 *	BOX INLET 24" EAST OF CANAL 24" WEST TO POND	INVERT: -47"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-13	RETENTION POND OVERFLOW STRUCTURE		
D-14 *	CURB INLET 12" SOUTH 12" WEST NOTE: PVC PIPE RUN INSIDE 12" PIPE RUN TO WEST	INVERT: -18"	
D-15	BOX INLET 10" SOUTH WEST	GRATE: 18"X14" INVERT: -20"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-15A	BOX INLET 12" EAST	GRATE: 18"X14" INVERT: -18"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-16	CURB INLET 18" SOUTH	NOTE: NEED HELP WITH GRATE	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-17	CURB INLET 18" NORTH 24" SOUTH	NOTE: NEED HELP WITH GRATE	
D-18	CURB INLET PIPE WEST, UNKNOWN SIZE	INVERT: -26:EOP	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-19	CURB INLET PIPE EAST, UNKNOWN SIZE 24" SOUTH	INVERT: -22"EOP GRADE: -35"	
D-20	CURB INLET 12" SOUTH	INVERT: -35"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-21	CATCH BASIN 12" SOUTH RCP	INVERT: -37"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-22	CURB INLET 12" NORTH 18" SOUTH	INVERT: -62"	

Table 2-24

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-23	CURB INLET 12" SOUTH 18"X18" BOX NOTE: ROOTS IN BOX AND PIPE	INVERT: -57"	Retention Pond in vacant lot on 2nd Street or Lakeshore Drive, or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-24	CATCH BASIN 12" EAST NOTE: CURB BROKEN	INVERT: -26"	Retention Pond in either vacant lot on 1st Street or vacant lot on Lakeshore Drive, or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-25	CATCH BASIN 12" WEST 14" SOUTH	INVERT: -25" INVERT: -42.5"	
D-26	CURB INLET 14" NORTH 14" SOUTH 18"X18" BOX	INVERT: -78.5"	
D-27	CURB INLET 12" CMP 18"X18" BOX	INVERT: -52.5"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-28	CATCH BASIN NOTE: COMPLETELY FULL OF DIRT	INVERT: -26.5"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-29	CATCH BASIN 12" RCP SOUTH	INVERT: -40"	
D-30	CATCH BASIN NOTE: HALF FULL OF DIRT 12" RCP SOUTH	INVERT: -24"	
D-31	CATCH BASIN 12" RCP SOUTH	INVERT: -26"	
D-32	CURB INLET 12" NORTH 12" SOUTH 18"X18" BOX NOTE: ROOTS IN BOX	INVERT: -71.5"	

Table 2-24

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-33	CATCH BASIN 12" RCP SOUTHEAST	INVERT: -21.5"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-34	CATCH BASIN 12" RCP SOUTHWEST	INVERT: -23"	
D-35	CATCH BASIN 12" RCP SOUTHEAST	INVERT: -24"	
D-36	CATCH BASIN 12" RCP SOUTHWEST	INVERT: -24"	
D-37	CURB INLET 12" RCP NORTH 12" RCP SOUTH	INVERT: -66"	
D-37A	MANHOLE NOTE: COVERED WITH ASPHALT		
D-38	CURB INLET 12" RCP SOUTH	INVERT: -64.8"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-39	CURB INLET 18" CMP 18"X24" BOX	INVERT: -66.5"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-40	CATCH BASIN 12" RCP SOUTHEAST	INVERT: -21.5"	Retention Pond in vacant lot on Anderson Street or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-41	CATCH BASIN 12" RCP SOUTHWEST	INVERT: -23"	
D-42	CATCH BASIN 12" RCP SOUTHEAST	INVERT: -25"	
D-43	CATCH BASIN 12" RCP SOUTHWEST	INVERT: -25"	
D-44	CATCH BASIN 30" DIP SOUTH 48"X9" BOX	INVERT: -41"	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-45	ENDWALL WITH PIPE GOING THROUGH		

Table 2-24

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-46	CURB INLET 15" RCP SOUTHEAST 24"X24" BOX	INVERT: -57"	Retention Pond in vacant lot on Disston Avenue or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-47	CURB INLET 15" RCP NORTHEAST 15" RCP SOUTH	INVERT: -58.5"	
D-48	CURB INLET 15"RCP NORTH 15" RCP SOUTH 15" RCP WEST	INVERT: -57"	
D-49	CURB INLET 15" RCP EAST	INVERT: -58"	
D-50	CURB INLET 15" RCP NORTH 15" CMP SOUTH 15" RCP SOUTH	INVERT: -66"	
D-51	CURB INLET 18" CMP NOTE: THROAT NEEDS TO BE CLEANED OF GRASS	INVERT: -30" EOP INVERT: -42" EOP	Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-52	BOX INLET 42"x24" CMP NORTH 42"x24" CMP SOUTH	INVERT: TOP -51" INVERT: EOP -43"	Retention Pond in vacant lot on Lakeshore Drive or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-53	CURB INLET 36"x24" CMP WEST 42"x24" CMP SOUTH	INVERT: -36"	
D-54	CURB INLET 36"x24" CMP EAST 36"x24" CMP WEST	INVERT: -36"	
D-55	DIVERSION MANHOLE 36"x24" CMP EAST 36"x24" CMP WEST	INVERT: -36"	

Table 2-24

CITY OF CLERMONT
LAKE MINNEHAHA STRUCTURE TABLE

STRUCTURE NO.	STRUCTURE TYPE	GRATE / INVERT	TREATMENT OPTIONS
D-56	CURB INLET 24" CMP EAST 36"x24" CMP WEST	INVERT: -36"	(continued) Retention Pond in vacant lot on Lakeshore Drive or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-57	BOX INLET 18" CMP EAST 24" CMP WEST	INVERT: -39"	
D-58	CURB INLET 18" CMP EAST 24" CMP WEST	INVERT: -30"	
D-59	BOX INLET 18" CMP WEST	INVERT: -30"	
D-60	BOX INLET 12" OR 18" PIPE NOTE: INLET AND SWALE NEEDS TO BE CLEANED	GRATE: 28"X35"	Retention Pond in Park on Lakeshore Drive or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-61	BOX INLET 24" SOUTH	GRATE: 36"X28" INVERT: -58"	Retention Pond in vacant lot on Lakeshore Drive or Pipe End Treatment (Baffle Box, Vortex Separator, etc.)
D-62	BOX INLET 24" NORTH 24" SOUTH	GRATE: 36"X28" INVERT: -73.5"	
D-63	BOX INLET 24"CMP NORTH 24" SOUTH	GRATE: 53"X35" INVERT: -55" INVERT: -79"	
D-64	BOX INLET 24" NORTH 24" SOUTH 24" WEST	GRATE: 53"X35" INVERT: -68"+/- INVERT: 42" INVERT: -44"	
D-65	CHANNEL BOX NOTE: FULL OF DEBRIS		
D-66	BOX INLET 24" NORTH 24" SOUTH	GRATE: 53"X55" INVERT: -36" INVERT: -36" NOTE: GRATE BENT	
D-67	BOX INLET 24" NORTH NOTE: HALF FULL OF DEBRIS	INVERT: -30"	

Table 2-24

City of Clermont
Lake Minnehaha Stormwater Study
Cost Estimate, Custom Baffle Box

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$5,000.00	$5,000.00
2	Clear & Grub	1	LS	$2,500.00	$2,500.00
3	Final Grading	1,000	SY	$2.00	$2,000.00
4	Custom Baffle Box, Complete	1	LS	$20,000.00	$20,000.00
5	18" RCP Discharge Pipe	50	LF	$30.00	$1,500.00
6	18" Mitered End Section	1	EA	$1,000.00	$1,000.00
7	Demolition of Exist. Improvements	1	LS	$5,000.00	$5,000.00
8	Restoration	1	LS	$2,000.00	$2,000.00
9	Sod	1,000	SY	$3.50	$3,500.00
10	Floating Turbidity Barrier	50	LF	$15.00	$750.00
11	Silt Fence	100	LF	$3.00	$300.00
12	Survey/As-Builts	1	LS	$2,500.00	$2,500.00
	Subtotal				**$46,050.00**
	Engineering/Surveying				$10,000.00
	Subtotal				**$56,050.00**
	Contingency @ 10%				$5,605.00
	Estimated Total				$61,655.00

Notes:
1. Does not include land cost, cost of easements, etc.
2. Actual costs will vary depending on basin area, basin impervious area, pipe sizes, depth to water table, location of existing improvements, etc.

Table 4-1

City of Clermont
Lake Minnehaha Stormwater Study
Cost Estimate, Suntree Baffle Box

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$5,000.00	$5,000.00
2	Clear & Grub	1	LS	$2,500.00	$2,500.00
3	Final Grading	1,000	SY	$2.00	$2,000.00
4	Suntree Baffle Box, Complete	1	LS	$17,000.00	$17,000.00
5	18" RCP Discharge Pipe	50	LF	$30.00	$1,500.00
6	18" Mitered End Section	1	EA	$1,000.00	$1,000.00
7	Demolition of Exist. Improvements	1	LS	$5,000.00	$5,000.00
8	Restoration	1	LS	$2,000.00	$2,000.00
9	Sod	1,000	SY	$3.50	$3,500.00
10	Floating Turbidity Barrier	50	LF	$15.00	$750.00
11	Silt Fence	100	LF	$3.00	$300.00
12	Survey/As-Builts	1	LS	$2,500.00	$2,500.00
	Subtotal				**$43,050.00**
	Engineering/Surveying				$10,000.00
	Subtotal				**$53,050.00**
	Contingency @ 10%				$5,305.00
	Estimated Total				$58,355.00

Notes:
1. Does not include land cost, cost of easements, etc.
2. Actual costs will vary depending on basin area, basin impervious area, pipe sizes, depth to water table, location of existing improvements, etc.

Table 4-2

City of Clermont
Lake Minnehaha Stormwater Study
Cost Estimate, Vortechnics Separator

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$5,000.00	$5,000.00
2	Clear & Grub	1	LS	$2,500.00	$2,500.00
3	Final Grading	1,000	SY	$2.00	$2,000.00
4	Vortechnics Vortex Separator	1	LS	$19,000.00	$19,000.00
5	18" RCP Discharge Pipe	50	LF	$30.00	$1,500.00
6	18" Mitered End Section	1	EA	$1,000.00	$1,000.00
7	Demolition of Exist. Improvements	1	LS	$5,000.00	$5,000.00
8	Restoration	1	LS	$2,000.00	$2,000.00
9	Sod	1,000	SY	$3.50	$3,500.00
10	Floating Turbidity Barrier	50	LF	$15.00	$750.00
11	Silt Fence	100	LF	$3.00	$300.00
12	Survey/As-Builts	1	LS	$2,500.00	$2,500.00
	Subtotal				**$45,050.00**
	Engineering/Surveying				$10,000.00
	Subtotal				**$55,050.00**
	Contingency @ 10%				$5,505.00
	Estimated Total				$60,555.00

Notes:
1. Does not include land cost, cost of easements, etc.
2. Actual costs will vary depending on basin area, basin impervious area, pipe sizes, depth to water table, location of existing improvements, etc.

Table 4-3

City of Clermont
Lake Minnehaha Stormwater Study
Cost Estimate, Stormceptor Separator

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$5,000.00	$5,000.00
2	Clear & Grub	1	LS	$2,500.00	$2,500.00
3	Final Grading	1,000	SY	$2.00	$2,000.00
4	Stormceptor Vortex Separator	1	LS	$20,000.00	$20,000.00
5	18" RCP Discharge Pipe	50	LF	$30.00	$1,500.00
6	18" Mitered End Section	1	EA	$1,000.00	$1,000.00
7	Demolition of Exist. Improvements	1	LS	$5,000.00	$5,000.00
8	Restoration	1	LS	$2,000.00	$2,000.00
9	Sod	1,000	SY	$3.50	$3,500.00
10	Floating Turbidity Barrier	50	LF	$15.00	$750.00
11	Silt Fence	100	LF	$3.00	$300.00
12	Survey/As-Builts	1	LS	$2,500.00	$2,500.00
	Subtotal				**$46,050.00**
	Engineering/Surveying				$10,000.00
	Subtotal				**$56,050.00**
	Contingency @ 10%				$5,605.00
	Estimated Total				$61,655.00

Notes:
1. Does not include land cost, cost of easements, etc.
2. Actual costs will vary depending on basin area, basin impervious area, pipe sizes, depth to water table, location of existing improvements, etc.

Table 4-4

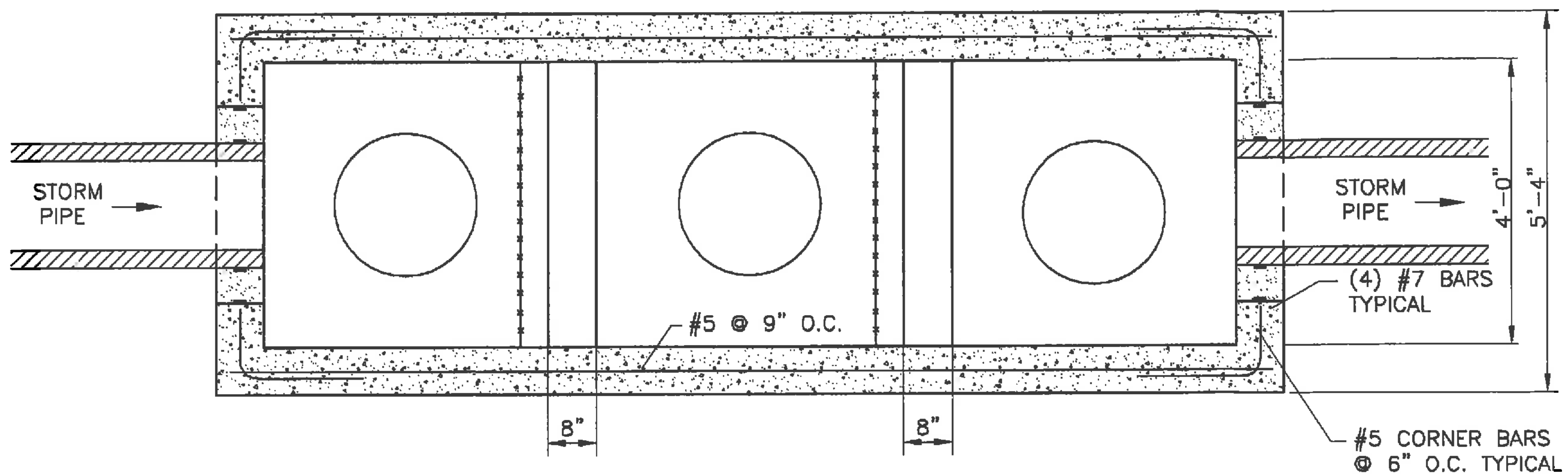
City of Clermont
Lake Minnehaha Stormwater Study
Cost Estimate, Offline Retention Pond

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$15,000.00	$15,000.00
2	Clear & Grub	1	LS	$10,000.00	$10,000.00
3	Final Grading, Cut and Haul	1,300	CY	$5.00	$6,500.00
4	Curb Inlet	2	EA	$3,000.00	$6,000.00
5	18" RCP Inlet & Discharge Pipe	100	LF	$30.00	$3,000.00
6	18" Mitered End Section	1	EA	$1,000.00	$1,000.00
7	Outfall Structure w/skimmer	1	EA	$3,500.00	$3,500.00
8	Demolition of Exist. Improvements	1	LS	$10,000.00	$10,000.00
9		1	LS	$7,500.00	$7,500.00
10	Sod	8,000	SY	$3.50	$28,000.00
11	Silt Fence	300	LF	$3.00	$900.00
12	Survey/As-Builts	1	LS	$5,000.00	$5,000.00
	Subtotal				**$96,400.00**
	Engineering/Surveying				$20,000.00
	Subtotal				**$116,400.00**
	Contingency @ 10%				$11,640.00
	Estimated Total				$128,040.00

Notes:
1. Does not include land cost, cost of easements, etc.
2. Actual costs will vary depending on basin area, basin impervious area, pipe sizes, depth to water table, location of existing improvements, etc.
3. Assumes retention pond is adjacent to existing stormwater system. Additional offsite piping may be necessary dependent on basin in question.

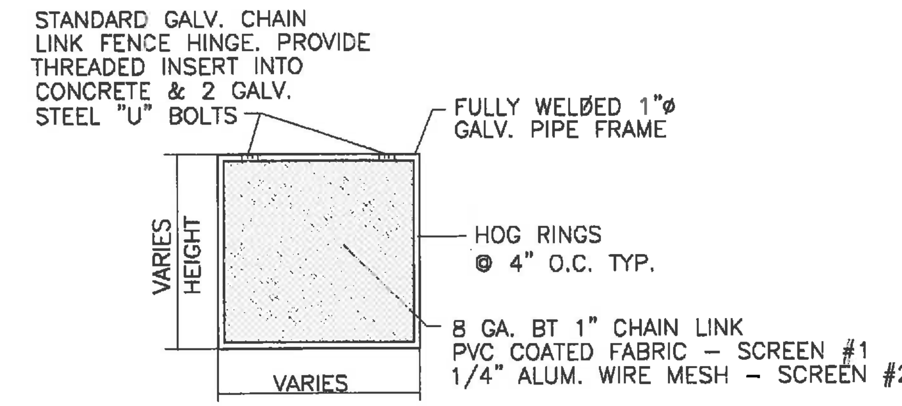
Table 4-5

Appendix A
Baffle Box Examples



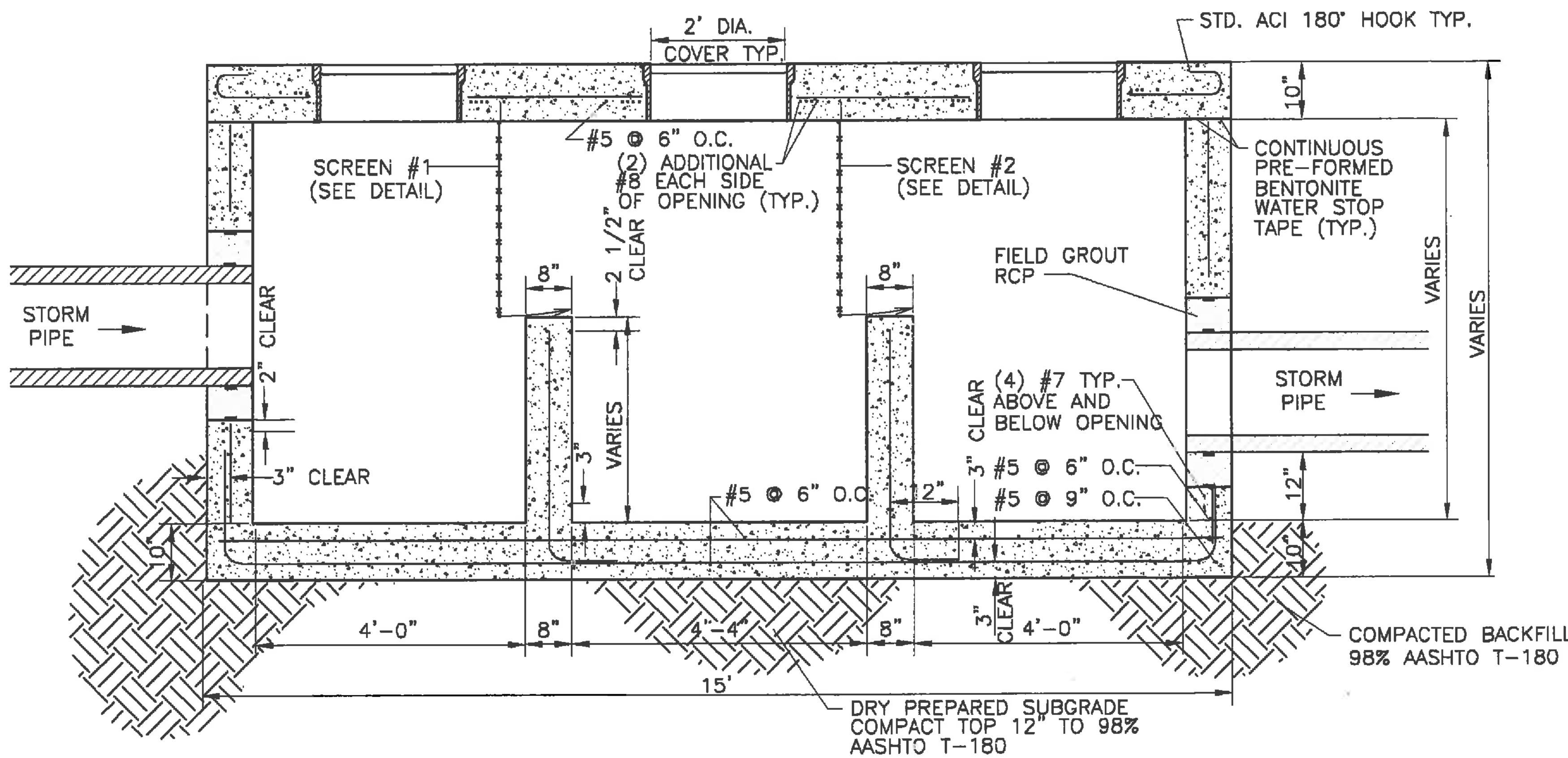
MODIFIED STORM BAFFLE BOX
TOP VIEW

N.T.S.



MODIFIED STORM BAFFLE BOX
SCREEN BAFFLE DETAIL

N.T.S.



MODIFIED STORM BAFFLE BOX
SECTION

N.T.S.

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

BAFFLE BOX DETAIL

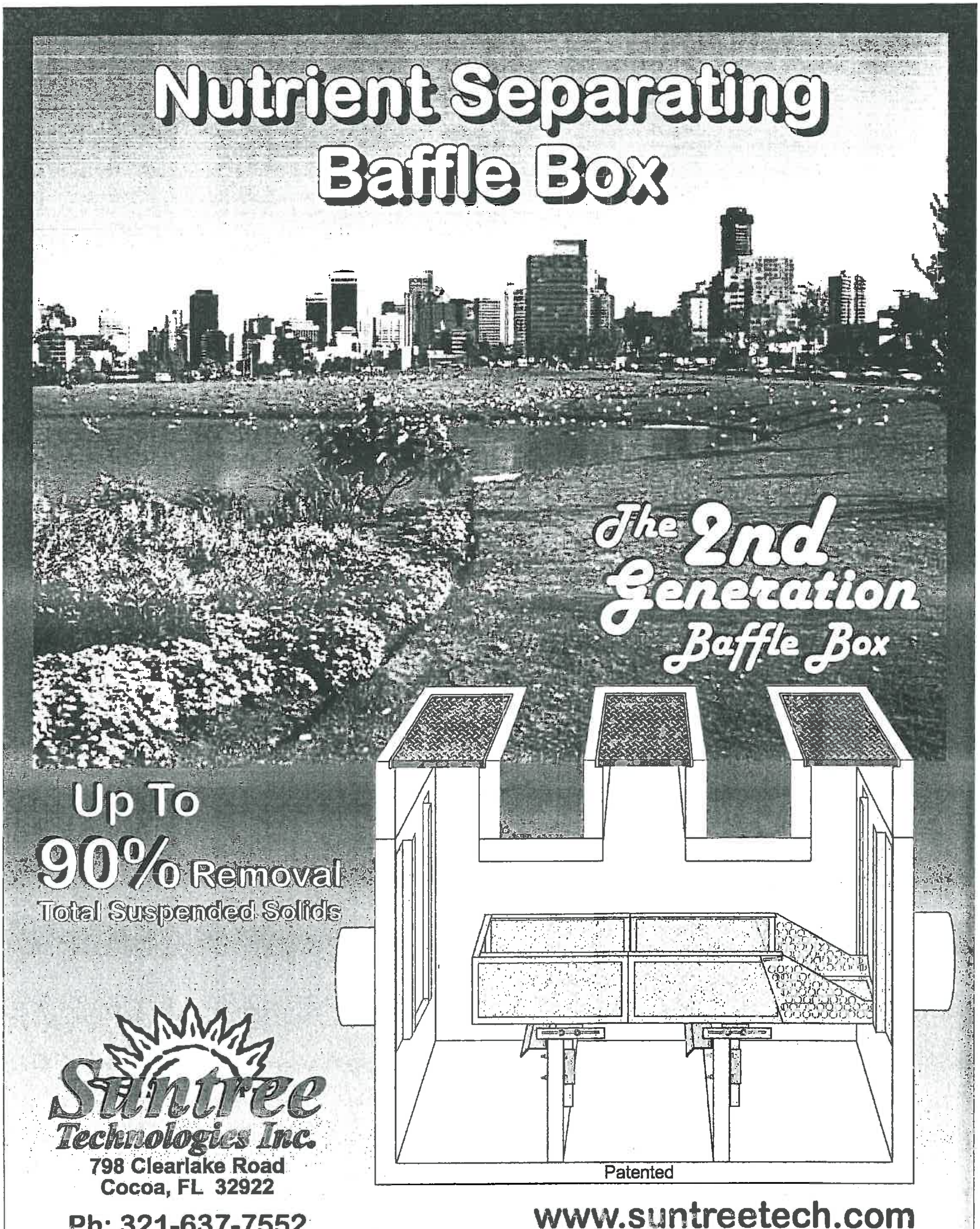
CITY OF CLERMONT

FARNER BARLEY AND ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS

Robert A. Ern, Jr., PE
Registered Eng 54018

DATE: DECEMBER 6, 2004

DETAIL 1


Nutrient Separating
Baffle Box
The 2nd Generation Baffle Box
Up To
90% Removal
Total Suspended Solids
Suntree Technologies Inc.
798 Clearlake Road
Cocoa, FL 32922
Ph: 321-637-7552
Patented
www.suntreetech.com

Nutrient Separating Baffle Box

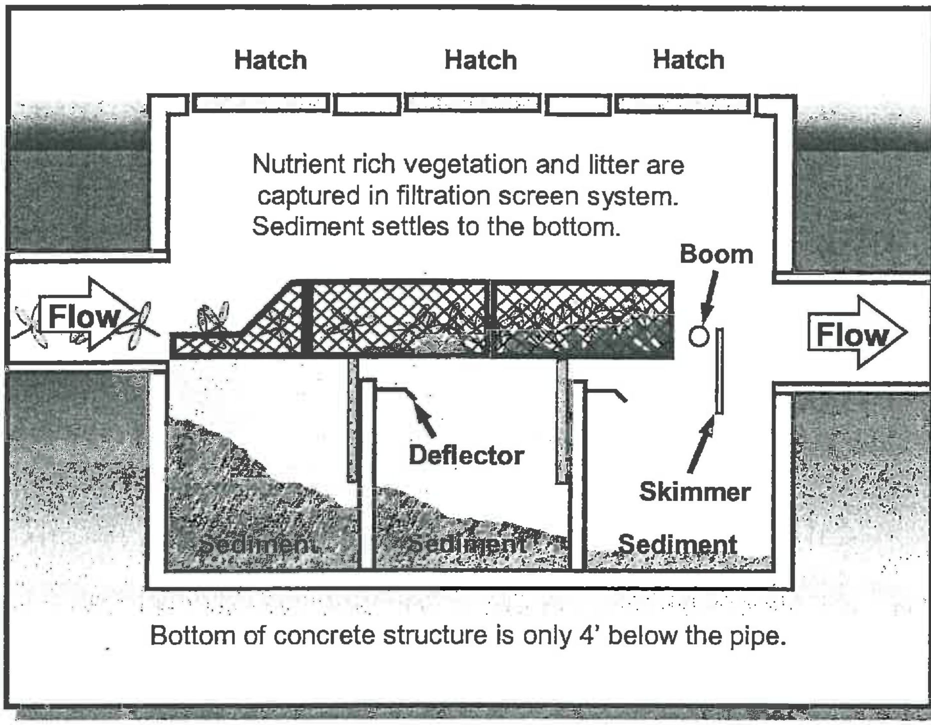
Functional Description

During The Storm Event

The inflow pipe is the same size as the outflow.

Turbulence defectors prevent captured sediment from re-suspending.

Hydrocarbons collect in front of skimmer and are absorbed by Storm Boom.



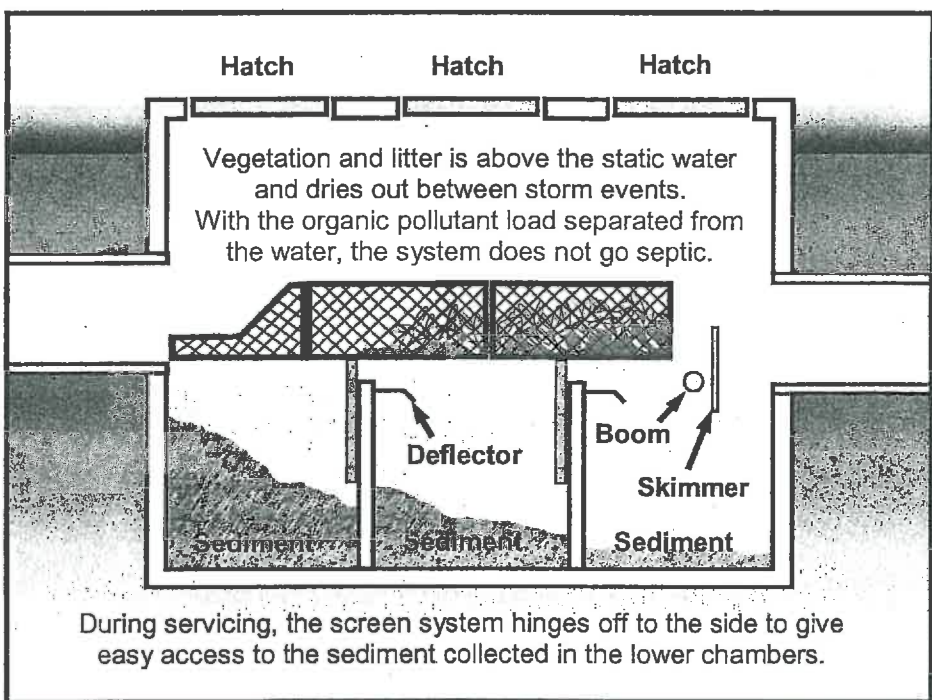
Patented

The System Stays Healthy!

After The Storm Event

Nutrient pollutant load is not lost to static water and flushed out at the next storm event.

Separating organic matter from the static water prevents bacterial buildup.



No Chance For A Bacterial Discharge!

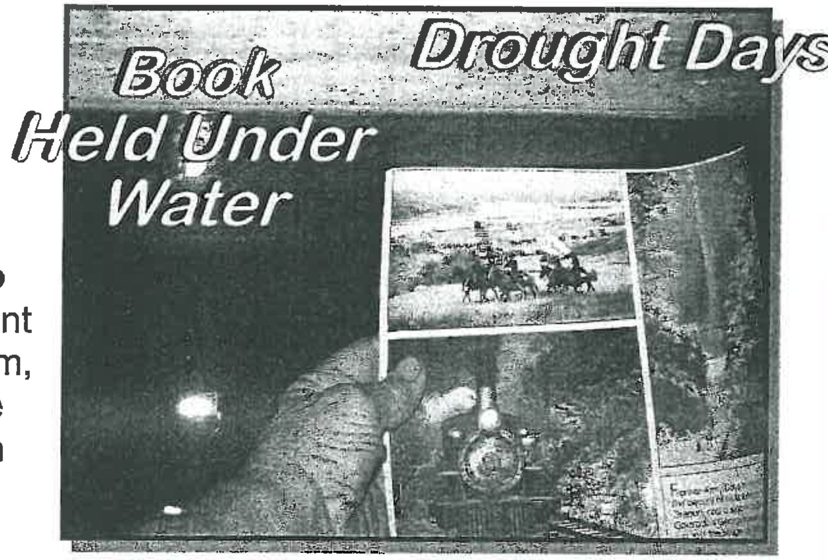
Nutrient Separating Baffle Box

Captured Debris

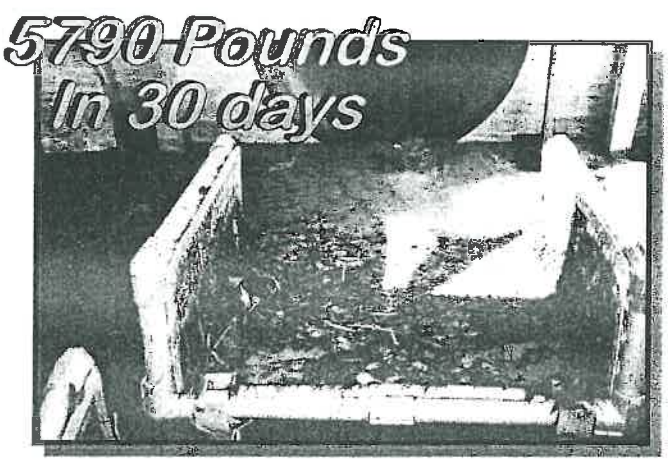
Not All Stormwater Systems Are Created Equal

To the right is a photo of the back page of a road atlas being held 10" underwater in a *Nutrient Separating Baffle Box.*

After a couple of months with no rain, the water still has no smell and is clear. The sediment can be clearly seen on the bottom, and small fish and critters have established a happy and health ecosystem within the structure.



If you are reluctant to touch the water in your stormwater filtration system because it septic, then you have a problem because the next storm event will flush out your system into the environment.



To the left is a view of 5790 pounds of sediment collected in a Nutrient *Separating Baffle Box* just 30 days after installation.

To the right is a view of foliage and litter collected within the screen system of a *Nutrient Separating Baffle Box.*

Sizing The Nutrient Separating Baffle Box

Because the entire flow is always treated and head loss is so minimal, determining the appropriate size of *Nutrient Separating Baffle Box* for a project is more often an element of pipe size than flow rate.

Model #	Inside Width	Inside Length	Standard Height *	Recommended Pipe Sizes
NSBB 4-6	4'	6'	6'	8" to 18"
NSBB 4-8	4'	8'	7'	12" to 18"
NSBB 5-10	5'	10'	7'	12" to 30"
NSBB 6-12	6'	12'	7'	18" to 36"
NSBB 8-12	8'	12'	8'	36" to 48"
NSBB 8-14	8'	14'	8'	40" to 54"
NSBB 10-14	10'	14'	8'	48" to 72"

Custom sizes are available. ***Height can vary as needed**

Please Call Suntree For Assistance Or Advice

- **Because water flow is <u>not</u> ducted off line for treatment, head loss is minimal and comparable to a large square catchbasin. Because of this, existing stormwater systems can be retrofitted with a Nutrient Separating Baffle Box, without compromising the original design specifications of the existing stormwater system.**

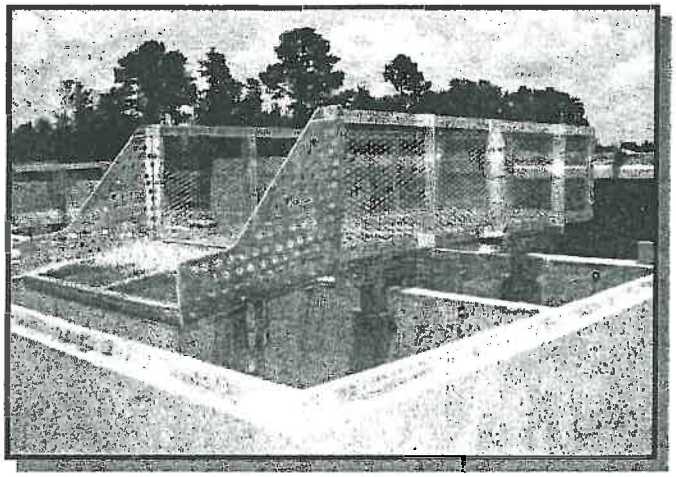
- **All structures are load rated for at least H-20. Standard wall construction of the structure is 6" thick steel re-enforced concrete. Concrete wall thickness can be thicker upon request.**

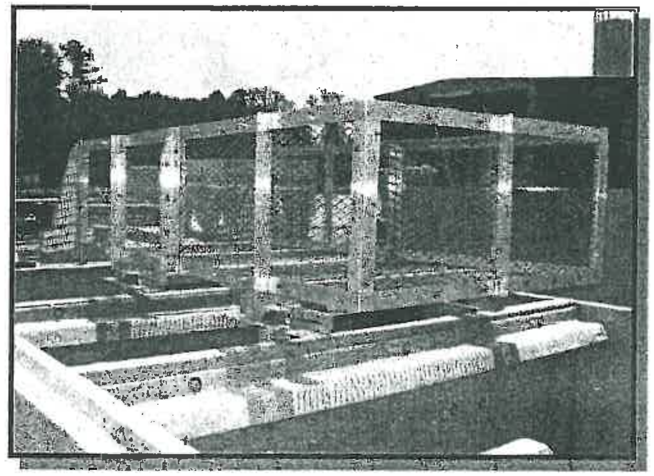
- **A wide variety of manhole lids and hatches, and dampers to block off water flow during servicing, can be incorporated into the structure.**

- **Screen systems have stainless steel screens bolted into a heavy duty aluminum framework. The screen systems are hinged to give easy access to the lower chambers, and have a wide range of adjustments to accommodate unforeseen variables during installation.**

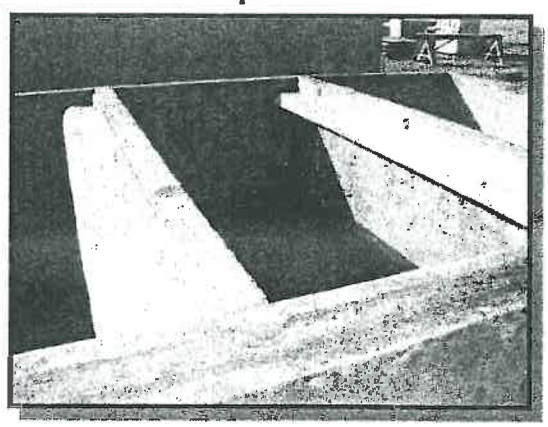
Pre-assembly Of The Nutrient Separating Baffle Box

The internal components are installed prior to delivery to the job site.

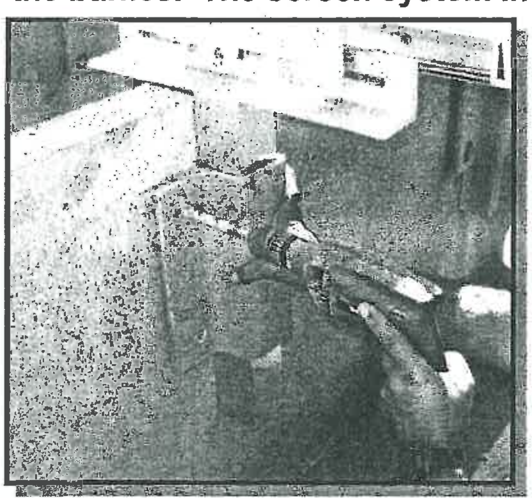


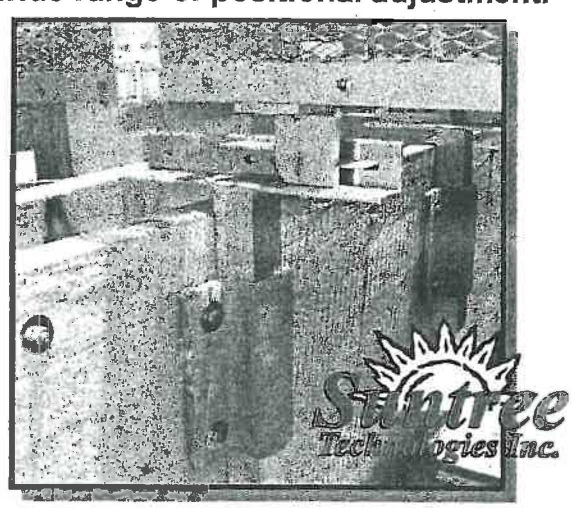


Turbulence deflectors are attached to the tops of the baffles with stainless steel bolts. Several bolts per deflector are required.



Four brackets, held in place with 4 stainless steel bolts each, secure the screen system to the baffles. The screen system includes a wide range of positional adjustment.





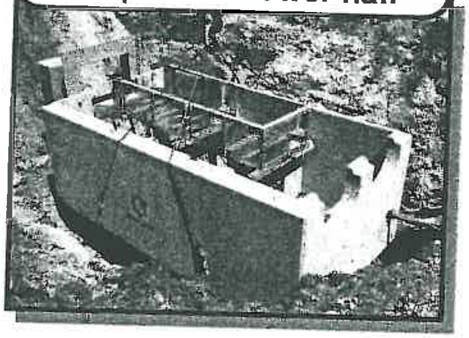
Setting The Structure

Installation Of A Nutrient Separating Baffle Box In Perry Florida

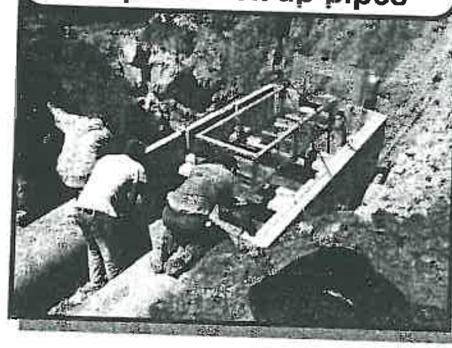
As Easy to Install As A Large Square Catchbasin

The hole was dug starting at 10:00am. By 3:00pm the same day, the entire structure was set in place with most of the backfilling done.

Step 1: Set lower half



Step 2: Hook up pipes



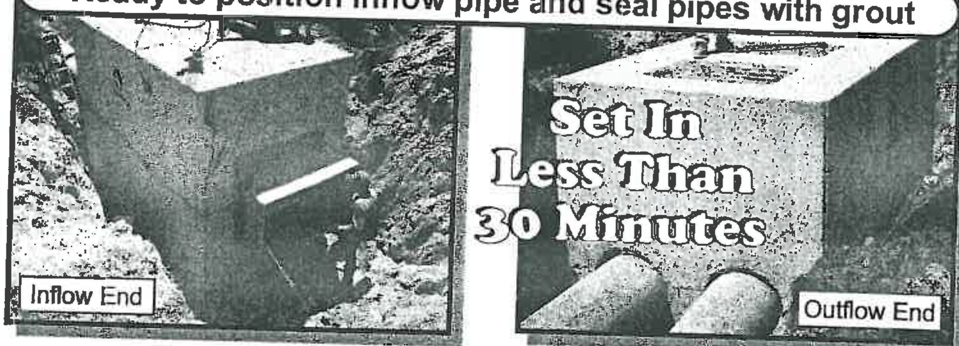
Step 3: Put sealant on joint

Step 4: Set upper half

Less Expensive To Install Than Other Systems

Because installation is so fast, the risk of washouts when retrofitting existing stormwater systems is dramatically reduced.

Ready to position inflow pipe and seal pipes with grout



No Problem For Custom Configurations

Notice the custom pipe fitting on the inflow end. It is designed to accommodate two 18" RCP side by side. To block off the water flow of submerged or partially submerged pipes during servicing, internal damper systems are available.

A Suntree representative is always available to oversee installation to ensure a successful project.

Suntree Technologies Inc.
798 Clearlake Road, Cocoa, FL 32922
Ph: 321-637-7552 FAX: 321-637-7554
www.suntreetech.com

Appendix B
Vortex Separator Examples

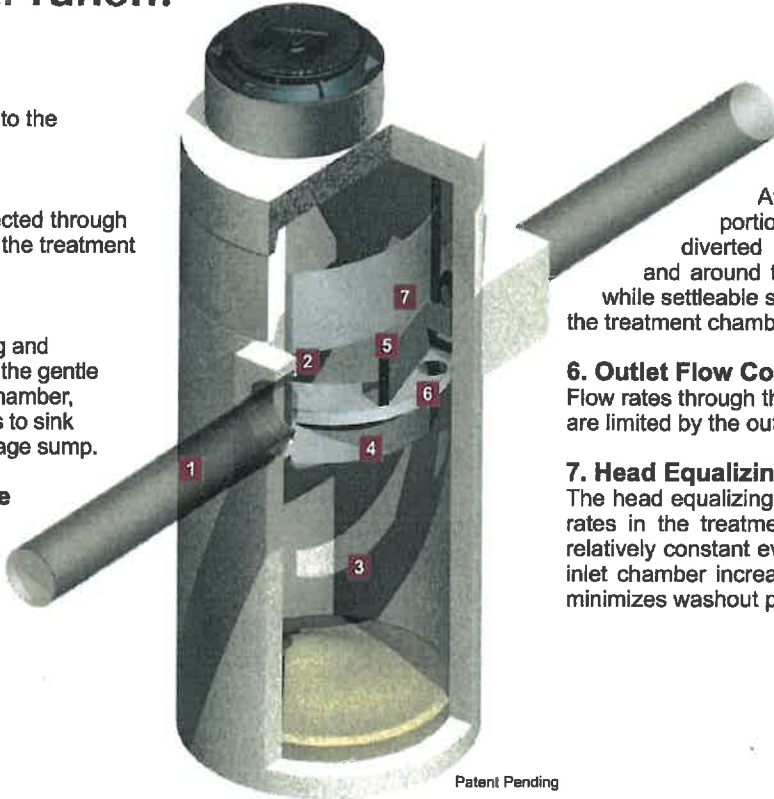
The VortSentry™ effectively captures pollutants from stormwater runoff.

1. Inlet
Stormwater runoff is conveyed into the unit through the inlet pipe.

2. Inlet Aperture
At low flow rates, all runoff is directed through the inlet aperture where it enters the treatment chamber tangentially.

3. Treatment Chamber
Gravitational separation of floating and sinking pollutants is enhanced by the gentle swirling motion in the treatment chamber, which causes the settleable solids to sink and form a conical pile in the storage sump.

4. Treatment Chamber Baffle
Trash, hydrocarbons and other floating debris are retained in the treatment chamber by the baffle wall, which extends below the resting water surface elevation.



Patent Pending

5. Flow Partition
At higher flow rates, a portion of the runoff will be diverted over the flow partition and around the treatment chamber, while settleable solids are directed into the treatment chamber.

6. Outlet Flow Control
Flow rates through the treatment chamber are limited by the outlet flow control orifice.

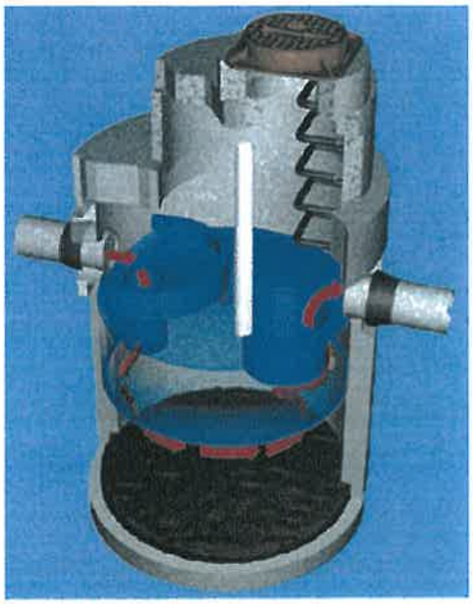
7. Head Equalizing Baffle
The head equalizing baffle allows operating rates in the treatment chamber to remain relatively constant even as flow rates in the inlet chamber increase substantially, which minimizes washout potential.

VortSentry™ Models & Dimensions

Model	Diameter		Depth (below invert)		Recommended Maximum Inlet / Outlet Pipe Size*	
	ft	mm	ft	m	in	mm
VS30	3	900	5.4	1.7	12	300
VS40	4	1,200	6.5	2.0	18	450
VS50	5	1,500	7.4	2.3	18	450
VS60	6	1,800	8.3	2.5	24	600
VS70	7	2,100	9.1	2.8	30	762
VS80	8	2,400	10.1	3.0	30	762

***Note:** To ensure that the most appropriate VortSentry™ model size is selected, please contact a Vortechnics representative.

Single Inline Unit



Here you can view the flow of runoff through the various sections of this unit.

The animation controls below will toggle the sequence on and off.

Shows Primary Flows / By-Pass Flows

- Profile Description
- Normal Operating Conditions
- By-Pass Operating Conditions
- Point Summary

Play Animation | Stop Animation

In-Line Stormceptor® Profile

The In-Line Stormceptor® is a stormwater separator that efficiently removes grit, fine sediment and free oil from stormwater. These pollutants are stored inside a treatment chamber for safe and easy removal. Stormceptor® protects lakes, rivers, streams and coastal areas from hazardous material spills and daily stormwater runoff pollution. The In-line Stormceptor® is a unique solution because of its patented internal by-pass. This prevents the re-suspension and scouring of trapped pollutants during infrequent high flow periods.

Top

Design and Operation

A fibreglass insert separates a by-pass chamber and treatment chamber. In areas where oil or chemical spills accumulate prior to cleaning, the fibreglass insert provides dual wall containment of floating oils and chemicals inside the treatment chamber. This makes the In-Line Stormceptor® ideal of industrial properties, gas stations and parking lots where there is a potential for oil or chemical spills.

Top

By-Pass Operating Conditions

During high flow periods (about 10% of the annual runoff), water flows over the fibreglass weir into the downstream sewer preventing previously trapped oil, grit and sediment from being scoured out.

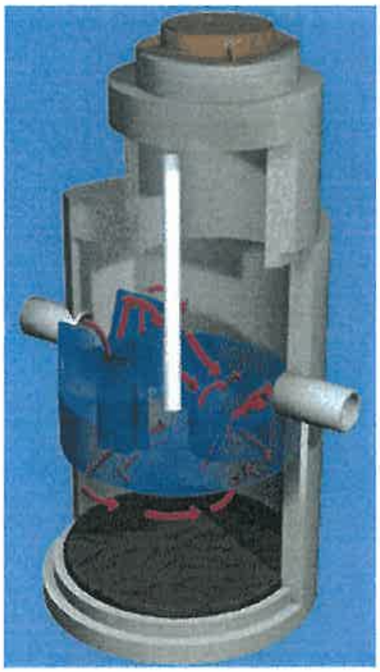
Top

Summary

- Stormwater flows into the upper by-pass chamber via the storm sewer pipe.
- Low flows are diverted into the lower treatment chamber by a weir and drop tee/orifice assembly.
- The drop tee/orifice assembly will discharge water parallel to the lower treatment chamber wall.
- Flows in access of the drop tee/orifice assembly capacity will flow over the weir and into the downstream sewer.
- Surcharged water will create a backwater effect on the riser pipe and the head differential between the drop tee/orifice assembly and outlet riser pipe will decrease.
- This prevents large flows entering the treatment chamber and scouring any trapped pollutants.
- Oils and other liquids with a specific gravity less than water will be trapped underneath the fiberglass insert.
- Sediment will settle to the bottom of the chamber by gravitational forces.
- The circular design of the treatment chamber is designed to prevent turbulent eddy currents and to promote settling.
- The riser pipe is down stream of the by-pass chamber and is connected to the downstream sewer pipe.
- Water flows up through the riser pipe based on the head at the inlet weir.

Top

Submerged Inline Unit



Here you can view the flow of runoff through the various sections of this unit.

The animation controls below will toggle the sequence on and off.

Shows Primary Flows / By-Pass Flows

- Profile Description
- Normal Operating Conditions
- By-pass Operating Conditions
- Point Summary

Play Animation | Stop Animation

Submerged Stormceptor®Profile

The Submerged Stormceptor® was developed to remove oil, grit and fine sediment from stormwater in partially submerged pipes. It is ideal for sites with high groundwater tables such as coastal area sites.

The submerged Stormceptor® works in the same way as the Inline Stormceptor® The unique features of the Submerged design include customized weir height (height depends on the average water level in the storm sewer and annual water level fluctuation) and two-inlet drop pipes. A lower drop pipe, located at the inlet of the storm sewer, is always submerged. This drop pipe transports suspended solids and bedload sediment into the separation chamber.

The higher drop pipe is located at the average water level and transports lighter material (oil, floatables, grit, sediment fines) into the separation chamber. The Submerged Stormceptor® is effective for oil, grit and sediment removal under partially submerged conditions and is effective for sediment removal under fully submerged conditions.

Top

Normal Operating Conditions

During frequent flow conditions large suspended solids will be conveyed into the treatment chamber through the lower drop pipe while floatables, oil and finer suspended solids will be conveyed into the treatment chamber by the upper drop pipe.

Top

By-pass Operating Conditions

During infrequent peak flow periods, water is conveyed over the internal by-pass weir directly to the downstream storm sewer. This process prevents high velocities of water from entering the separation chamber and scouring out previously trapped pollutants.

Top

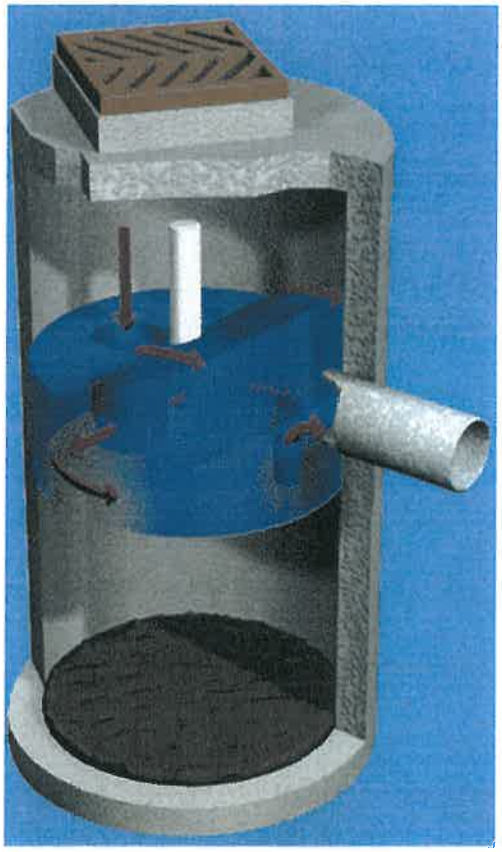
Summary

- Stormwater Flows into the upper by-pass chamber via the storm sewer pipe.
- Low flows are diverted into the lower treatment chamber by an extended weir, drop tee/ orifice assembly, and secondary drop tee assembly
- The drop tee/orifice assembly will discharge water parallel to the lower treatment chamber wall.
- Flows in access of drop tee/orifice assembly capacity will flow over the extended weir and into the downstream sewer.
- Surcharged water will create a backwater effect on the riser pipe and the head differential between the inlet drop tee/orifice assembly and outlet riser pipe will decrease.
- This prevents large flows entering the treatment chamber and scouring any trapped pollutants.
- The secondary drop tee assembly will capture oils and other liquids with a specific gravity less than water, which will be trapped underneath the fiberglass insert.
- Sediment will settle to the bottom of the chamber by gravitational forces.
- The circular design of the treatment chamber is designed to prevent turbulent eddy currents and to promote settling.
- The riser pipe is down stream of the by-pass chamber and is connected to the downstream sewer pipe.
- Water flows up through the riser pipe based on the head at the inlet weir.

Top

Stormceptor®

Single/Multi Inlet



Here you can view the flow of runoff through the various sections of this unit.

The animation controls below will toggle the sequence on and off.

Shows Primary Flows / By-Pass Flows

- Profile Description
- Design and Operation
- Normal Operating Conditions
- By-pass Operating Conditions
- Point Summary

Play Animation | Stop Animation

Normal Operating Conditions

Under normal operating conditions, stormwater flows into the upper by-pass chamber and is diverted down a pipe into the treatment chamber. This downward flow is directed by a tee outlet around the circular walls of the chamber located horizontally to the outlet pipe. Above and below this through flow, oil and sediment accumulate in relative quiescence. Inflowing fine sediment and grit settle to the floor of the chamber, while petroleum products rise and become trapped underneath the fibreglass insert.

Top

By-pass Operating Conditions

During infrequent high flow periods, peak stormwater flows will pass over the diverting weir and continue through the by-pass chamber into the downstream stormwater system. This by-pass creates pressure equalization across the by-pass chamber and prevents scouring. Bedload sediment continues to be diverted by the weir and collected in the lower chamber where it remains along with previously collected sediment and oils. Only Stormceptor® has an internal by-pass that prevents scouring of trapped pollutants during periods of peak flow.

Top

Summary

• Stormwater flows into upper by-pass chamber via an open grate at grade elevation

• Low flows are diverted into the lower treatment chamber by a weir and removable drop tee/orifice plate arrangement.

• Removable drop tee/orifice assembly will discharge water parallel to the lower treatment chamber wall.

• Flows in access of the drop tee/orifice assembly capacity will flow over the weir and into the downstream sewer.

• Surcharged water will create a backwater effect on the riser pipe and the head differential between the drop tee/orifice assembly and outlet riser pipe will decrease.

• This prevents large flows entering the lower treatment chamber and scouring any trapped pollutants.

• Oils and other liquids with a specific gravity less than water will be trapped underneath the fiberglass insert.

• Sediment will settle to the bottom of the chamber by gravitational forces.

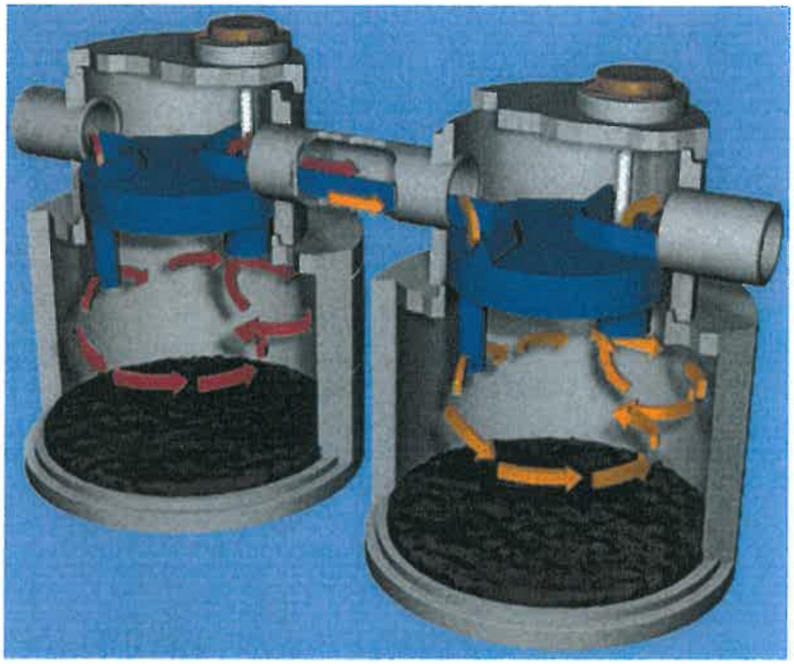
• The circular design of the treatment chamber is designed to prevent turbulent eddy currents and to promote settling.

• Water flows up through the riser pipe based on the head at the inlet weir.

• Riser pipe is down stream of the upper by-pass chamber and is connected to the downstream sewer pipe.

Top

Series Single Inline Unit



Here you can view the flow of runoff through the various sections of this unit.

The animation controls below will toggle the sequence on and off.

Shows Primary Flows

Shows Secondary Flows

Shows By-pass Flow

Play Animation | Stop Animation

- Profile Description
- Normal Operating Conditions
- By-pass Operating Conditions
- Point Summary

Series Stormceptor® System

The Series Stormceptor® was developed to remove oil, grit and fine sediment from stormwater in larger impervious catchment areas The Series Stormceptor® System consists of two adjacent Stormceptor® models that function in parallel through the use of a specially designed fiberglass insert and connecting weir. The Series system receives flow from a single inlet pipe, and splits it into two distinct streams, which are treated in two separate treatment chambers before recombining into a single outlet pipe. The Series Stormceptor® replaces the need for installing multiple Stormceptor® Units in parallel configuration. As such, there is no need for upstream or downstream structures to split or converge flows and the Series Stormceptor® takes a smaller footprint. The series system effectively doubles the treatment area of the inline system and eliminates the need for additional underground structures

Top

Normal Operating Conditions

During frequent flow conditions stormwater will be conveyed into the by-pass chamber of the first unit. While entering the first unit the flows are split evenly in two: one half of the flows are treated by the first unit while the remainder of the flows by-passes to the second unit for treatment. In summary, the flows entering the Series Stormceptor® are split into two and separated from each other for the

Top

By-pass Operating Conditions

During infrequent peak flow periods, water is conveyed over the internal by-pass weir directly to the downstream storm sewer. This process prevents high velocities of water from entering the separation chamber and scouring out previously trapped pollutants.

Top

Summary

• The flow is evenly split into two distinct sections the primary and secondary flows.

• A weir and drop tee/orifice assembly diverts the primary flow into the lower treatment chamber of the first structure.

• The drop tee/orifice assembly will discharge the water parallel to the lower treatment chamber wall.

• Oils and other liquids with a specific gravity less than water will be trapped underneath the fiberglass insert.

• Sediment will settle to the bottom of the chamber through gravitational forces.

• The circular design of the treatment chamber is designed to prevent turbulent eddy currents and to promote settling.

• Water flows through the riser pipe of the based on the head at the inlet weir.

• The riser pipe of the first structure is downstream of the by-pass chamber and is connected to the joiner pipe.

• The joiner pipe connects the first and second structures.

• A weir is embedded in the joiner pipe which separates treated and untreated flows during transfer to the second structure.

• The configuration of the of the weir around the outlet of the first by-pass chamber conveys the secondary half of the untreated low flow through the treated side of the joiner pipe.

• The configuration of the outlet weir in the second by-pass chamber prevents the mixing of treated and untreated stormwater.

• The secondary low flow enters the second structure from the untreated side of the joiner pipe.

• A weir drop tee/orifice assembly diverts this low flow into the lower treatment chamber of the second structure.

- The drop tee/orifice assembly will discharge water parallel to the lower treatment chamber wall.
- Oils and other liquids with a specific gravity less than water will be trapped underneath the fiberglass insert.
- Sediment will settle to the bottom of the chamber through gravitational forces.
- The circular design of the treatment chamber is designed to prevent turbulent eddy currents and to promote settling.
- Water flows up through the riser pipe based on the head at the inlet weir.
- The riser pipe of the second structure is downstream of the second by-pass chamber and is connected to the outlet of the secondary structure.
- The treated stormwater from the secondary structure is conveyed downstream with the treated flow from the first structure.
- Flows in access of the drop tee/orifice assembly capacities will flow over the weirs and into the downstream sewer.
- Surcharged water will create backwater effects on the riser pipes and the head differential between the drop tee/ orifice plate assemblies and outlet riser pipes will decrease.
- This prevents large flows entering the treatment chamber and scouring any trapped pollutants.

Top

Appendix C
Informational Signage for Inlets

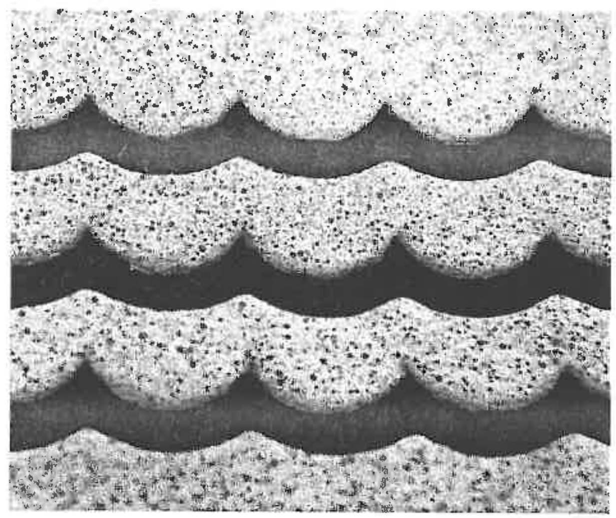
STORM DRAIN MARKINGS

High Performance Preformed Thermoplastic Pavement Marking Material

PREMARK

PREMARK® PLUS Storm Drain Markings last, so your message stays clear to the public... and doesn't get washed down the drain.

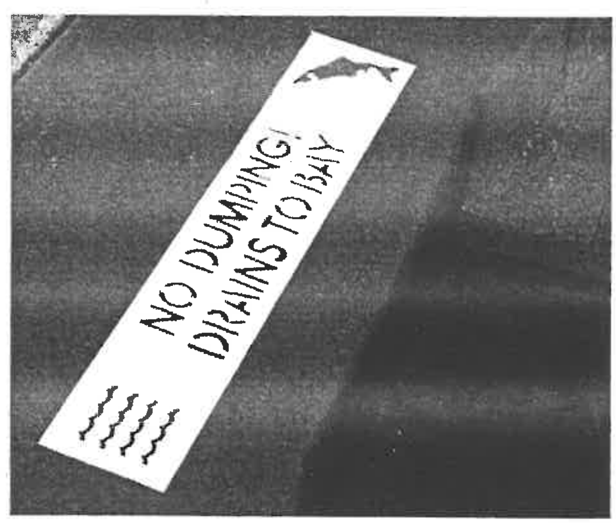
Education and public outreach are critical elements of any successful stormwater program. Because the NPDES Clean Water Act Phase II is here, you don't have time–or materials–to waste.



Unlike paint that can wash down the drain in a short time, "NO DUMPING" messages using PREMARK® PLUS preformed thermoplastic will stay in place. Therefore, you can concentrate on other Phase II requirements.

Unique and durable composition and application features:

- Lasts years longer than paint with no flaking
- High-skid resistant surface for pedestrian safety
- Retroreflective for nighttime visibility
- Indents provide visual cue for proper application
- Simple one-person application process
- Environmentally friendly, no hazardous waste during application
- Can be applied to any road or sidewalk surface
- No specific road or air temperature requirements
- Two layers in blue and white combination

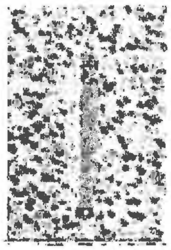


The PREMARK® Storm Drain Marking Program helps city, county and state agencies comply with NPDES Phase II requirements.

A SAFE AND EFFECTIVE WAY TO EDUCATE THE PUBLIC.

PREFORMED THERMOPLASTIC

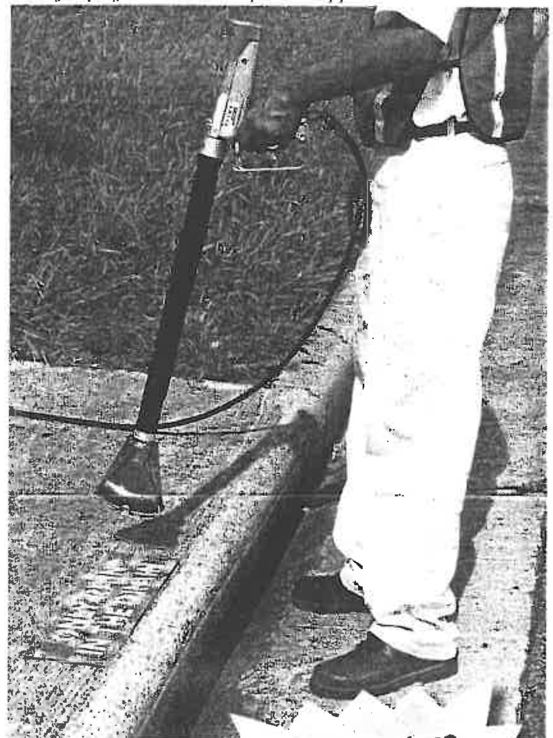
A true heavy-duty intersection grade pavement marking, PREMARK® PLUS is engineered for use where maximum wear and tear is present. PREMARK® PLUS does not slip, peel up or, in any way, lose its adhesion.



The indents on the top surface of the material act as a visual cue during application ensuring the material has reached a molten state so satisfactory adhesion and proper bead embedment has been achieved. The indents also provide a post-application visual cue that the installation procedures have been followed. Application instructions are included in each package of material.

PREMARK® PLUS does not have any road or air temperature requirements. The ambient temperature can be as low as your staff can stand and it will still work. It is not necessary to heat the pavement to a specific temperature during application eliminating the need for a temperature gun.

Performance and safety make the FLINT 2000EX Heat Torch ideal for preformed thermoplastic applications.



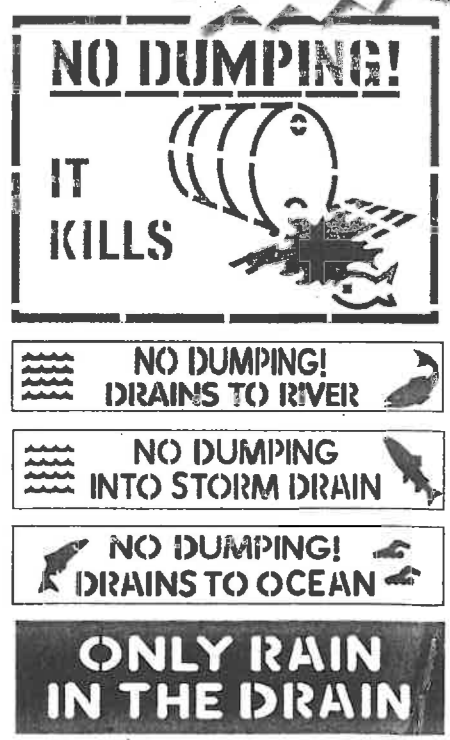
Application is easy with four simple steps:

1 Clean the surface and ensure no moisture is present.
2 Position the PREMARK® PLUS.
3 Heat the PREMARK® PLUS.
4 Chisel test to ensure bond.

Many designs to fit your need. Call to discuss the possibilities.

EXAMPLES OF PREMARK® PLUS STORM DRAIN MARKINGS		
MESSAGE	Item #	Size
STORM DRAIN DRAINS TO BAY	89182068HS	5" x 29"
NO DUMPING! DRAINS TO CANAL	89182070HS	5" x 29"
NO DUMPING INTO STORM DRAIN	89182071HS	5" x 29"
NO DUMPING! DRAINS TO POND	89182072HS	5" x 29"
NO DUMPING! FLOWS TO BAY	89182073HS	5" x 29"
NO DUMPING! DRAINS TO INLET	89182075HS	5" x 29"
NO DUMPING! DRAINS TO LAKE	89182076HS	5" x 29"
NO DUMPING! DRAINS TO STREAM	89182077HS	5" x 29"
NO DUMPING! DRAINS TO DELTA	89182078HS	5" x 29"
NO DUMPING! DRAINS TO RIVER	89182081HS	5" x 29"
NO DUMPING! DRAINS TO LAGOON	89182082HS	5" x 29"
NO DUMPING! DRAINS TO BAY	89182083HS	5" x 29"
NO DUMPING! DRAINS TO CREEK	89182086HS	5" x 29"
NO DUMPING! FLOWS TO BAY (SPANISH)	89182089HS	5" x 29"
NO DUMPING! DRAINS TO WATERWAY	89182093HS	5" x 29"
NO DUMPING! DRAINS TO RESERVOIR	89182095HS	5" x 29"
NO DUMPING! IT KILLS	89182079HS	20" x 14"
NO DUMPING - DRAINS TO OCEAN	89182096HS	12" x 12"
NO DUMPING - THIS DRAINS TO OCEAN	89182085HS	12" x 12"
DUMP NO WASTE - GOES TO OCEAN	89182069HS	18" x 16"
SWEEP IT UP! DON'T WASH IT DOWN	89182080HS	20" x 14"
ONLY RAIN IN THE DRAIN	89182092HS	18" x 6"

Custom Storm Drain Markings are available by customer request.



For more information contact:

FLINT TRADING INC.

FLINT TRADING, INC.

P.O. Box 160 Thomasville, NC 27361-0160
phone 336-475-6600 *fax* 336-475-7900

website www.flinttrading.com
e-mail sales@flinttrading.com

5000 0903

Appendix D
Property Record Cards

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	3704801	*Parcel:*	26-22-25-030000000003
Name:	CITY OF CLERMONT	*Millage Group:*	000C
Address:	PO BOX 120219 CLERMONT, FL 34712-0219	*Loc Notes:*	
Legal Description:	CLERMONT, INDIAN HILLS PARK LOT PB 8 PG 86 ORB 1473 PG 1184		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	8900	300.0	200.0		300.00	FF	0	99900

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1473	1184	4/1/1996	FS	U	V	$0.00

Value:

Total Just Value:	$99,900.00
Total Exempt Value:	$99,900.00
Total Taxable Value:	$0.00 *May Reflect Save-Our-Homes Limitations

Draw Building

1

Property Search Results

General Information:			
Alternate Key:	1621470	*Parcel:*	26-22-25-030000016600
Name:	RUONA ALBERT A & LAVERNE M	*Millage Group:*	000C
Address:	11321 MONTE VISTA RD CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, INDIAN HILLS E 40 1/2 FT OF LOT 166, W 44 1/2 FT OF LOT 167 PB 8 PG 86 ORB 2404 PG 1627		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	85.0	150.0		85.00	FF	0	43988

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
0780	2198	6/1/1983	WD	U	V	$22,000.00
0855	0957	5/1/1985	WD	Q	V	$25,350.00
1091	0849	1/1/1991	WD	Q	V	$25,000.00
1712	2388	4/29/1999	WD	Q	V	$26,900.00
2165	0803	8/15/2002	WD	Q	V	$40,200.00
2404	1627	9/5/2003	WD	Q	V	$55,000.00

Value:	
Total Just Value:	$43,988.00
Total Exempt Value:	$0.00

(2)

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	3018842	*Parcel:*	26-22-25-10000000500
Name:	LAWSON WILLIAM E & CHARLENE	*Millage Group:*	000C
Address:	PO BOX 121495 CLERMONT, FL 34712-1495	*Loc Notes:*	
Legal Description:	CLERMONT, WINONA HARBOR ESTATES LOT 5 PB 30 PG 3 ORB 1006 PG 1692		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	.0	.0		1.00	LT	0	29925

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1006	1692	4/1/1989	WD	Q	V	$20,000.00

Value:	
Total Just Value:	$29,925.00
Total Exempt Value:	$0.00
Total Taxable Value:	$29,925.00 *May Reflect Save-Our-Homes Limitations

Draw Building

3

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1704634	*Parcel:*	25-22-25-000200001300
Name:	GODWIN PATRICIA M	*Millage Group:*	000C
Address:	14948 GREEN VALLEY BLVD CLERMONT, FL 34711-8545	*Loc Notes:*	
Legal Description:	FROM A PT 300 FT S & 430 FT E OF NW COR OF S 1/2 OF GOV LOT 4, RUN S 598 FT, S 65DEG E 518.65 FT FOR POB, RUN N 25DEG E 170.5 FT TO CANAL, S'LY ALONG CANAL TO LAKE DRIVE, N 65DEG W ALONG LAKE DRIVE 130 FT TO POB ORB 699 PG 332		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0003	130.0	150.0		130.00	FF	0	55575

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
699	332	1/1/1980	MI	Q	V	$29,900.00

Value:

Total Just Value:	$55,575.00
Total Exempt Value:	$0.00

4

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1618762	*Parcel:*	25-22-25-030000000100
Name:	HEILSCHER ROY O TRUST	*Millage Group:*	000C
Address:	1808 SETTLE ST CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, DICKSON SHORES LOT 1 PB 22 PG 30 ORB 575 PG 427 ORB 1835 PG 582		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	93.0	130.0		93.00	FF	0	56585

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
575	427	1/1/1974	MI	Q	V	$23,000.00
1835	0582	6/19/2000	WD	U	I	$0.00

Value:	
Total Just Value:	$56,585.00
Total Exempt Value:	$0.00
Total Taxable Value:	$56,585.00 *May Reflect Save-Our-Homes Limitations

5

Draw Building

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1625769	*Parcel:*	25-22-25-080000001100
Name:	TILDEN ROBERT L & MARTHA	*Millage Group:*	000C
Address:	2512 BETTON WOODS DR TALLAHASSEE, FL 32312-3442	*Loc Notes:*	
Legal Description:	CLERMONT, POINT PLACE LOT 11--LESS SE'LY 16.34 FT--PB 14 PG 28 ORB 1457 PG 421		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0002	95.0	105.0		95.00	FF	0	35703

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1457	0421	7/1/1996	PR	M	V	$1.00

Value:	
Total Just Value:	$35,703.00
Total Exempt Value:	$0.00
Total Taxable Value:	$35,703.00 *May Reflect Save-Our-Homes Limitations

6

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1625246	*Parcel:*	25-22-25-070000037400
Name:	WINTERS DONALD F & BONNIE J	*Millage Group:*	000C
Address:	168 W LAKESHORE DR CLERMONT, FL 34711-	*Loc Notes:*	1651 2ND ST CLERMONT FL 34711
Legal Description:	CLERMONT, ORANGE PARK LOTS 374, 375 PB 3 PG 20 ORB 1170 PG 1918		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0100	160.0	165.0		160.00	FF	0	34819

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area
0001	FLA	001	003	1.00	855
0001	EPC	002	003	1.00	500

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built
0	0	1	0	0	0	Yes	0	855	1920

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value
0001	DGF	728	SF	1968	$2,539.00

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1170	1918	6/1/1992	WD	M	I	$1.00

Value:	
Total Just Value:	$68,943.00
Total Exempt Value:	$0.00
Total Taxable Value:	$68,943.00 *May Reflect Save-Our-Homes Limitations

7

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1625173	*Parcel:*	25-22-25-070000036200
Name:	BOYD NANITA ET AL	*Millage Group:*	000C
Address:	115 DEERCREST CR FRANKLIN, TN 37069-	*Loc Notes:*	140 WEST LAKESHORE DR CLERMONT FL 34711
Legal Description:	CLERMONT, ORANGE PARK LOTS 362, 363, 364, STRIP OF LAND BETWEEN LAKE SHORE DR & LAKE MINNEHAHA, WHICH IS BOUNDED ON E BY A LINE BEGINNING AT A POINT 5 FT E OF SE COR OF LOT 362 & BOUNDED ON W BY A LINE BEGINNING AT SW COR OF LOT 363 PB 3 PG 20 ORB 1310 PG 1916		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0100	169.0	220.0		169.00	FF	0	50915
2	0100	80.0	172.0		80.00	FF	0	14664
3	0000	.0	.0		3.00	LT	0	6750

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area
0001	FLA	001	001	2.00	960
0001	SPF	002	000	1.00	270
0001	SPF	003	000	1.00	270
0001	SAF	004	001	1.00	210

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built
0	0	2	0	0	0	Yes	0	960	1917

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

8#9

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1625157	*Parcel:*	25-22-25-070000035800
Name:	FREY STERLING	*Millage Group:*	000C
Address:	1647 FIRST ST CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, ORANGE PARK LOT 358 PB 3 PG 20 ORB 742 PG 1287 ORB 746 PG 1830		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	80.0	130.0		80.00	FF	0	15350

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
742	1287	10/1/1981	WD	Q	V	$13,000.00
746	1830	3/1/1982	QC	U	V	$1.00

Value:	
Total Just Value:	$15,350.00
Total Exempt Value:	$0.00
Total Taxable Value:	$15,350.00 *May Reflect Save-Our-Homes Limitations

Draw Building

10

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1617707	*Parcel:*	30-22-26-040000004800
Name:	BERGIN RUSSELL F JR & KIMBERLY V	*Millage Group:*	000C
Address:	430 E LAKESHORE DR CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, CLERMONT HEIGHTS S 1/2 OF LOT 48 PB 4 PG 1 ORB 1687 PG 1452		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	47.0	196.0		47.00	FF	0	18457

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
0968	0622	6/1/1988	WD	Q	V	$12,000.00
1524	0899	4/1/1997	TR	Q	V	$17,500.00
1687	1452	2/10/1999	WD	M	V	$1.00

Value:	
Total Just Value:	$18,457.00
Total Exempt Value:	$0.00
Total Taxable Value:	$18,457.00 *May Reflect Save-Our-Homes Limitations

11

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1616042	*Parcel:*	24-22-25-01500BB00801
Name:	GATES JOHN & KAREN	*Millage Group:*	000C
Address:	501 E LAKESHORE DR CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT W 100 FT OF LOT 8, W 100 FT OF N 50 FT OF LOT 9, BLK BB PB 3 PG 5 ORB 2134 PG 0943		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	150.0	100.0		150.00	FF	0	25087

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
0655	289	5/1/1981	WD	U	V	$1.00
0735	1819	10/1/1981	WD	U	V	$1.00
0762	2021	11/1/1982	CT	U	V	$1.00
2134	0943	6/7/2002	WD	Q	V	$29,000.00

Value:

Total Just Value:	$25,087.00
Total Exempt Value:	$0.00
Total Taxable Value:	$25,087.00 *May Reflect Save-Our-Homes Limitations

12

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1616069	*Parcel:*	24-22-25-01500BB01100
Name:	FREEMAN MARILYN J LANGLEY	*Millage Group:*	000C
Address:	536 FAIRFAX AV WINTER PARK, FL 32789-5022	*Loc Notes:*	
Legal Description:	CLERMONT S 1/2 OF LOT 11, BLK BB, LYING E OF MIDDLETON PARK & N OF LAKESHORE DR, LOTS 14 & 15, BLK BB--LESS E 300 FT-- PB 3 PG 5 ORB 1401 PG 791		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	230.0	570.0		230.00	FF	0	77539
2	0000	70.0	570.0		70.00	FF	0	23599
3	0000	100.0	345.0		100.00	FF	0	37665
4	0000	100.0	225.0		100.00	FF	0	18135

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1401	0791	9/1/1994	QC	M	V	$1.00
760	1328	6/1/1982	QC	U	I	$1.00

13

Value:

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	1015502	*Parcel:*	30-22-26-080000C00700
Name:	WALTERS WILLIAM H & JOYCE	*Millage Group:*	000C
Address:	862 S WATERVIEW - CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, LAKE MINN CHAIN O' LAKES 1/119TH INT IN LOT 7, BLK C PB 13 PG 66 ORB 1017 PG 519		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0000	.0	.0		1.00	LT	0	1000

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1017	0519	6/1/1989	QC	U	V	$0.00

Value:	
Total Just Value:	$1,000.00
Total Exempt Value:	$0.00
Total Taxable Value:	$1,000.00 *May Reflect Save-Our-Homes Limitations

(14)

Draw Building

Office of Ed Havill
Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	2842555	*Parcel:*	30-22-26-083000200200
Name:	QUIROGA JORGE & VICTORIA	*Millage Group:*	000C
Address:	623 LINDEN ST CLERMONT, FL 34711-	*Loc Notes:*	
Legal Description:	CLERMONT, LAKEVIEW HILLS PHASE 1, LOT 2, BLK 2 PB 24 PGS 41-42 ORB 1515 PG 2413		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0003	.0	.0		1.00	LT	0	141600

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value
0001	DOC	474	SF	1990	$1,297.00
0002	BHS	220	SF	1990	$1,281.00

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1010	2255	5/1/1989	WD	Q	V	$60,500.00
1055	0433	4/1/1990	WD	U	V	$99,500.00
1495	1116	1/1/1997	WD	Q	V	$100,000.00
1515	2413	5/1/1997	TR	U	V	$0.00

Value:

Total Just Value:	$144,178.00

15

Office of Ed Havill

Lake County Property Appraiser

Property Search Results

General Information:			
Alternate Key:	2531100	*Parcel:*	30-22-26-083000100300
Name:	MEADOWS RONALD & KATHERINE	*Millage Group:*	000C
Address:	13347 LAKE BRYAN DR ORLANDO, FL 32821-	*Loc Notes:*	
Legal Description:	CLERMONT, LAKEVIEW HILLS, PHASE 1 LOT 3, BLK 1 PB 24 PGS 41-42 ORB 2236 PG 1147, ORB 2282 PG 0665		

Land Data:

Line	Use Code	Frontage	Depth	Notes	No. Units	Type	Class Value	Just Value
1	0003	.0	.0		1.00	LT	0	141600

Building Characteristics (Residential):

Bldg No.	Section Type	Section No.	Ext Wall Type	No. of Stories	Floor Area

Residential:

Fireplaces	Baths (2 Fix)	Baths (3 Fix)	Baths (4 Fix)	Baths (Ex Fix)	Bed	A/C	Built In Kitchen	Sq. Ft.	Year Built

Miscellaneous Improvements:

No.	Type	No. Units	Type	Year	Depr Value

Sales History :

O.R. Book	O.R. Page	Sale Date	Instrument	Q/U	Vac Impr	Sale Price
1498	1650	2/1/1997	WD	U	V	$0.00
1578	1377	1/13/1998	WD	Q	V	$147,500.00
1802	2409	2/24/2000	WD	Q	V	$125,900.00
2236	1147	12/30/2002	WD	Q	V	$140,000.00
2282	0665	3/17/2003	QC	U	V	$0.00

Value:

Total Just Value:	$141,600.00
Total Exempt Value:	$0.00

16

Appendix E
Aerial Photography Sheets

CITY OF CLERMONT

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

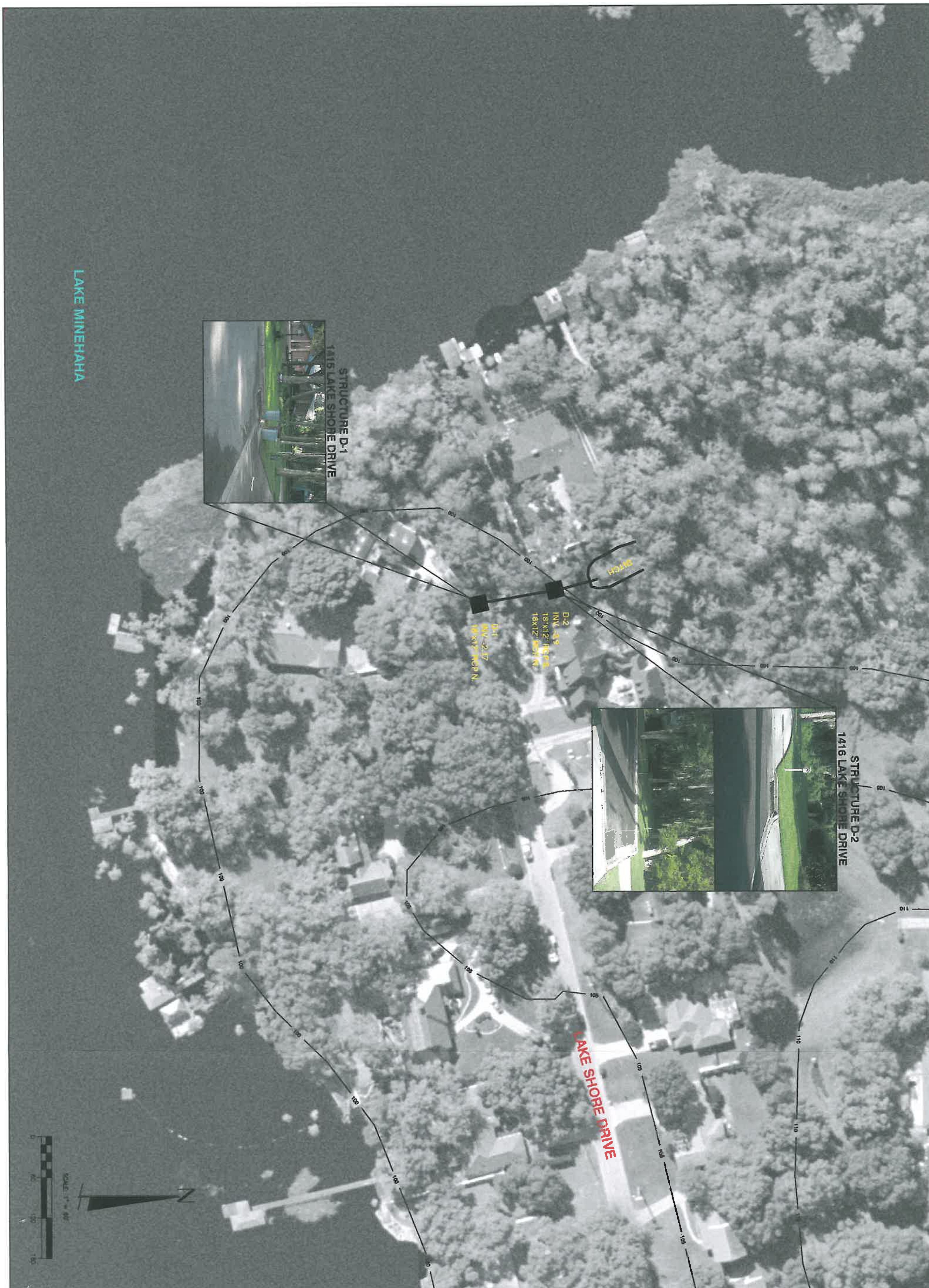
VICINITY MAP

NOT TO SCALE

SHEET INDEX

FARNER BARLEY AND ASSOCIATES, INC.
▲ ENGINEERS ▲ SURVEYORS ▲ PLANNERS
350 North Sinclair Avenue O Tavares, Florida 32778 O (352) 343-8481
State of Florida, Certificate of Authorization Number: 4709

Robert A. Em, Jr., PE Registered Eng. 54015 DATE: DECEMBER 6, 2004 SHEET 2	FARNER BARLEY AND ASSOCIATES, INC. ▲ENGINEERS ▲SURVEYORS ▲PLANNERS 350 North Sinclair Avenue ○ Tavares, Florida 32778 ○ (352) 343-8481 Certificate of Authorization Number: 4709	CITY OF CLERMONT	LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY KEY MAP AND BASIN MAP	DATE / REVISION 1 2 3 4 5 6 7 8



Robert A. Ern, Jr., PE Registered Eng 64019	DATE: DECEMBER 6, 2004	SHEET 3

FARNER BARLEY AND ASSOCIATES, INC.
▲ENGINEERS ▲SURVEYORS ▲PLANNERS
350 North Sinclair Avenue ○ Tavares, Florida 32778 ○ (352) 343-8481
Certificate of Authorization Number: 4709

CITY OF CLERMONT

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

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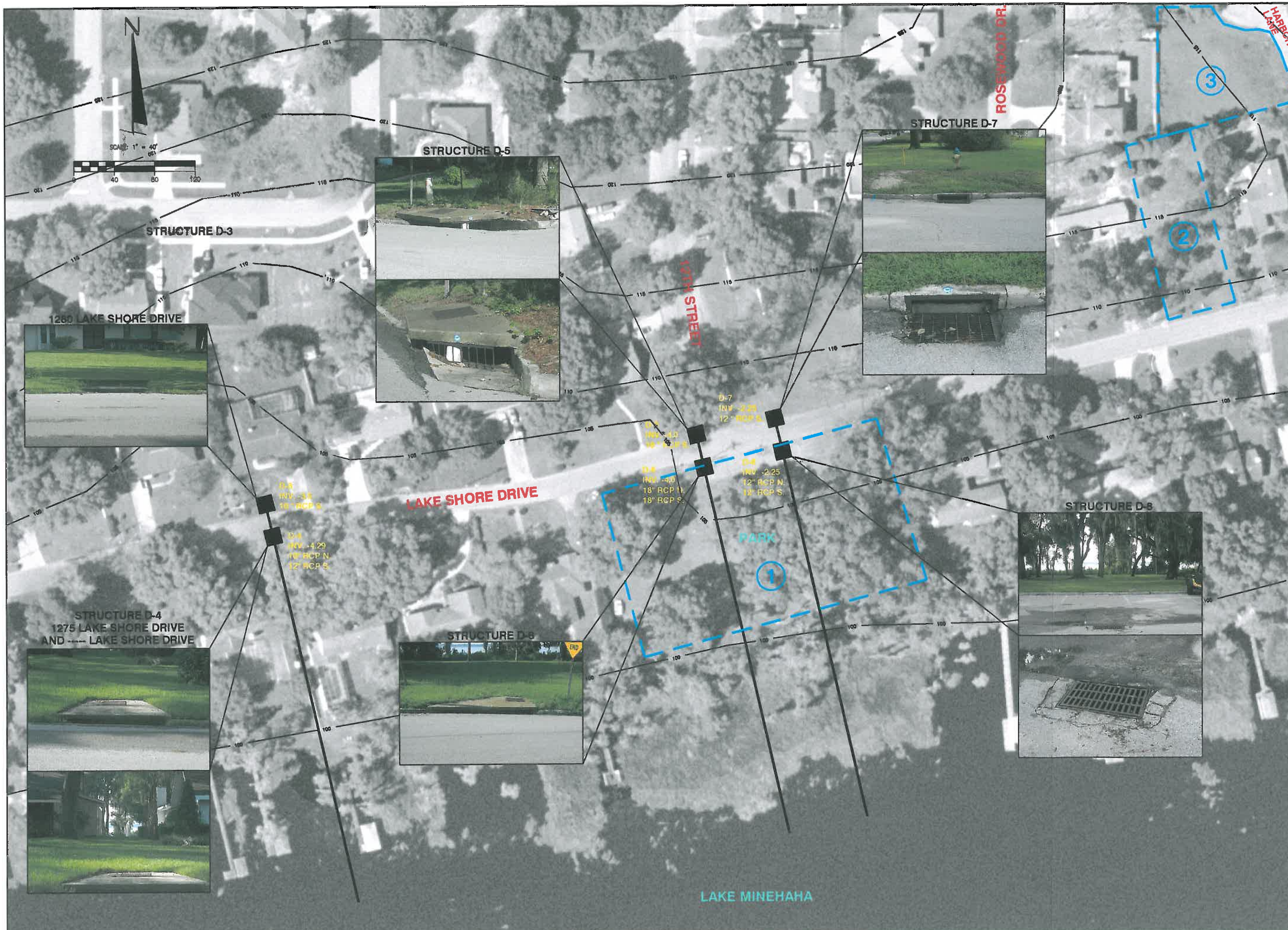

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

CITY OF CLERMONT

FARNER BARLEY AND ASSOCIATES, INC.
▲ENGINEERS ▲SURVEYORS ▲PLANNERS

DATE	REVISION
	1
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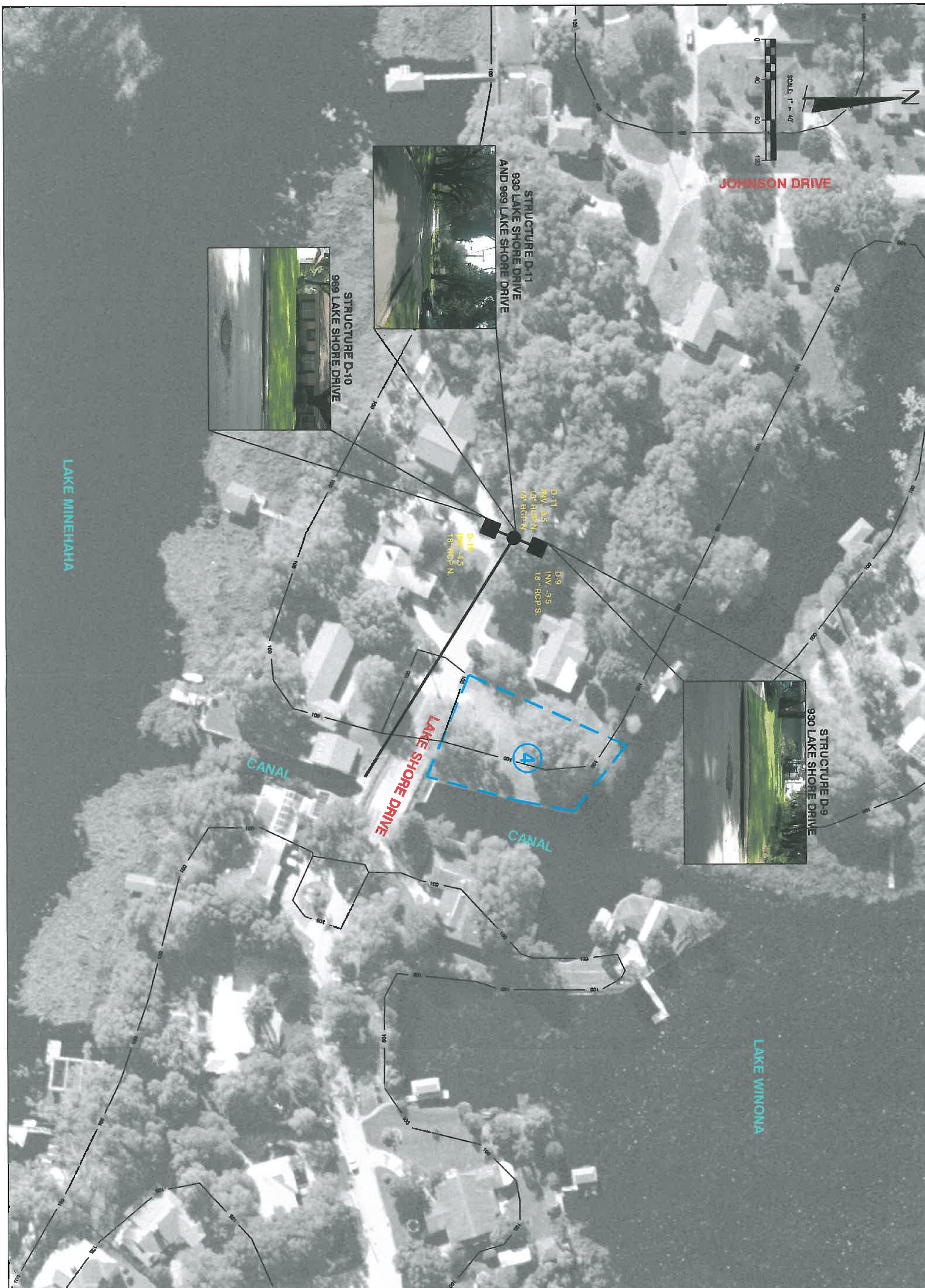
Robert A. Ern, Jr., PE
Registered Eng 54013

DATE: DECEMBER 6, 2004

SHEET 4

JOB NO. 031004.006



JOB NO. 05004004

SHEET 5

DATE: DECEMBER 6, 2004

Robert A. Em, Jr., PE
Registered Eng 64019

FARNER BARLEY AND ASSOCIATES, INC.
▲ENGINEERS ▲SURVEYORS ▲PLANNERS
350 North Sinclair Avenue ○ Tavares, Florida 32778 ○ (352) 343-8481
Certificate of Authorization Number: 4709

CITY OF CLERMONT

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

DATE		REVISION
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LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY
AERIAL PLAN

FARNER BARLEY AND ASSOCIATES, INC.
▲ENGINEERS ▲SURVEYORS ▲PLANNERS
350 North Sinclair Avenue ◻ Tavares, Florida 32778 ◻ (352) 343-8481
Certificate of Authorization Number: 4709

CITY OF CLERMONT

Robert A. Em, Jr., PE
Registered Eng. 54018
DATE: DECEMBER 6, 2004
SHEET 6
JOB NO. 03000.006

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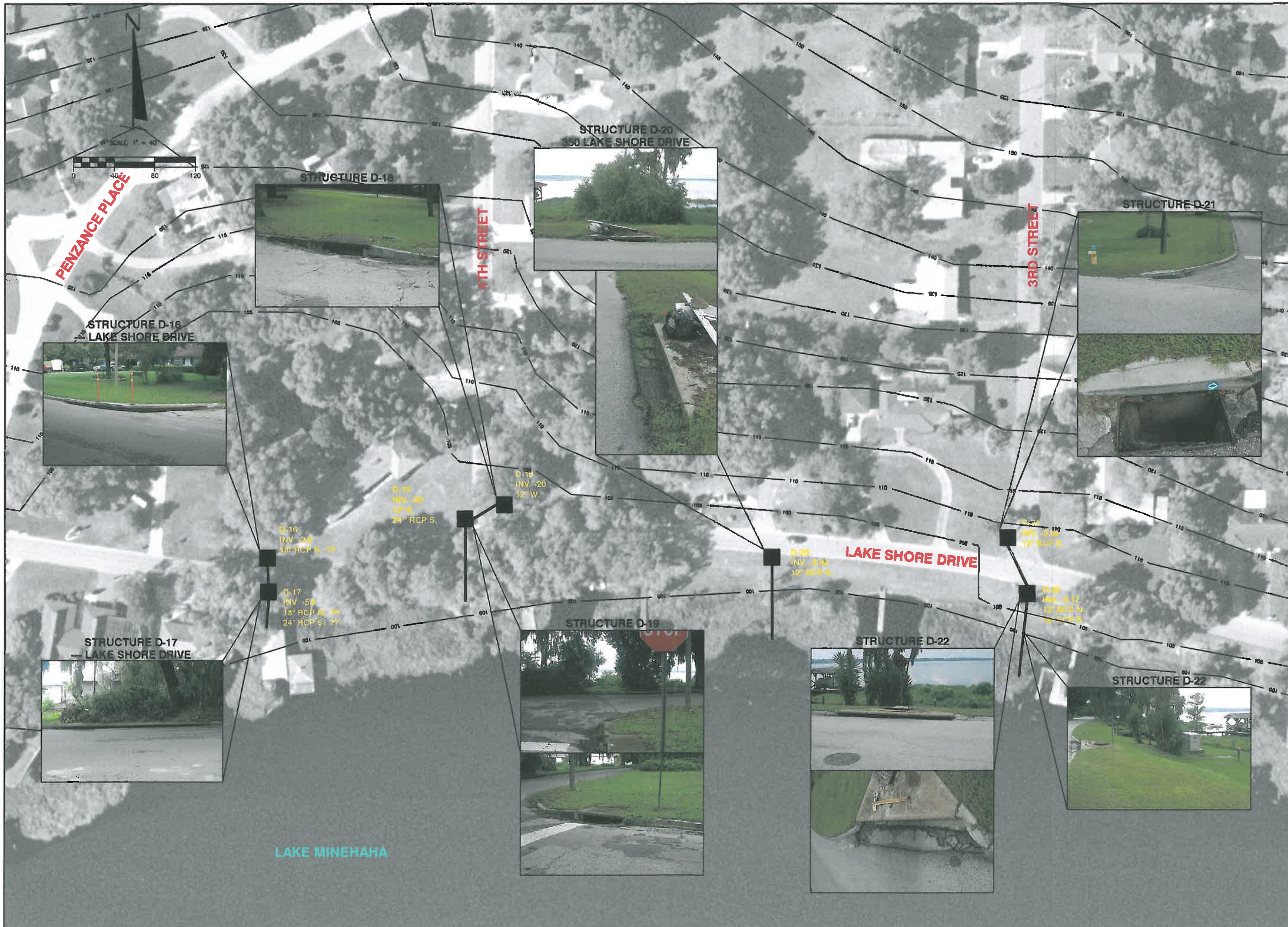

LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

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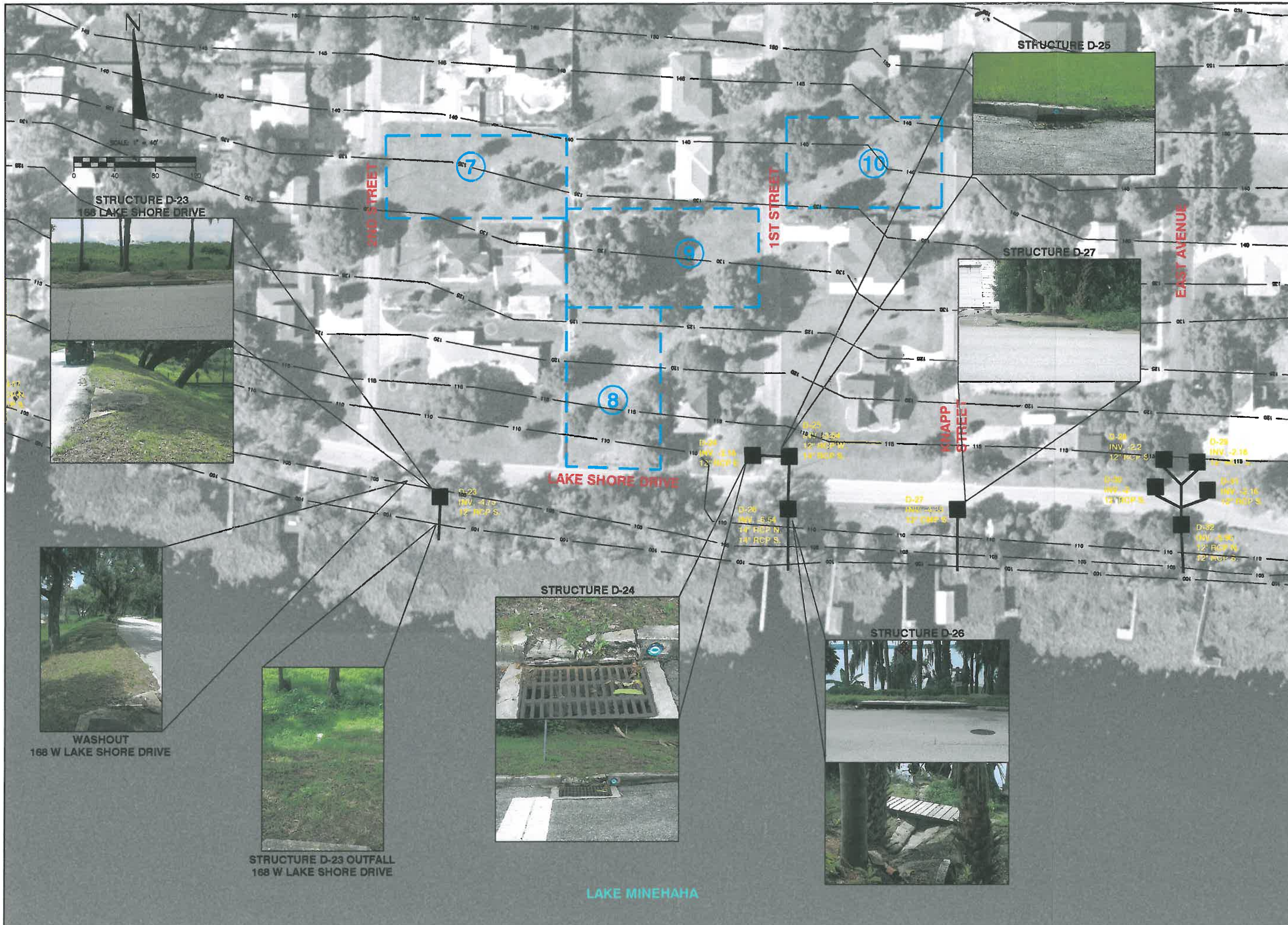
Certificate of Authorization Number: 4709

Robert A. Ern, Jr., PE
Registered Eng. 54013

DATE: DECEMBER 6, 2004

SHEET 7

JOB NO. 031004.004



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LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

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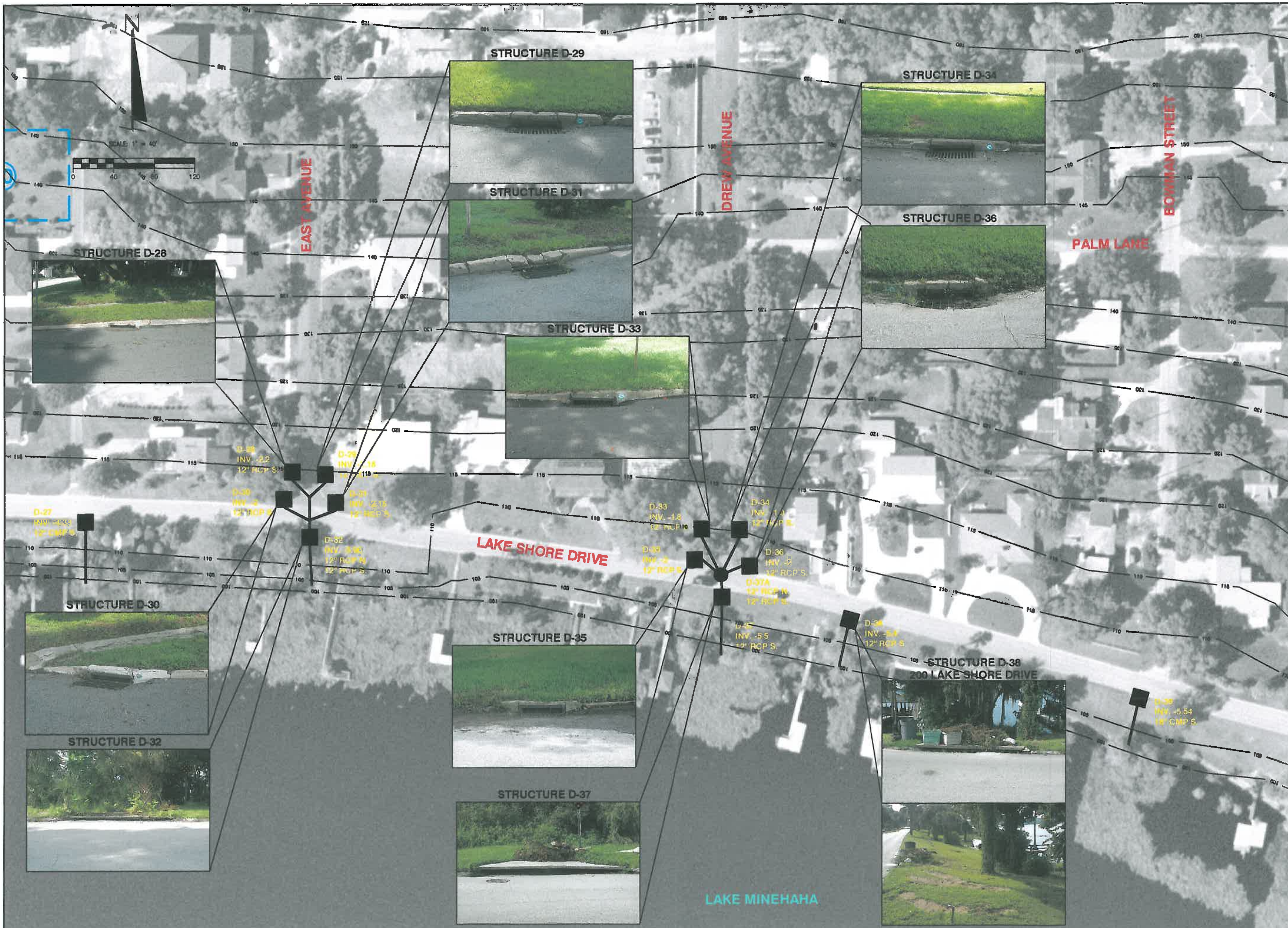
Robert A. Em, Jr., PE
Registered Eng 54013

DATE: DECEMBER 6, 2004

SHEET 8

JOB NO. 031004.006



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AERIAL PLAN

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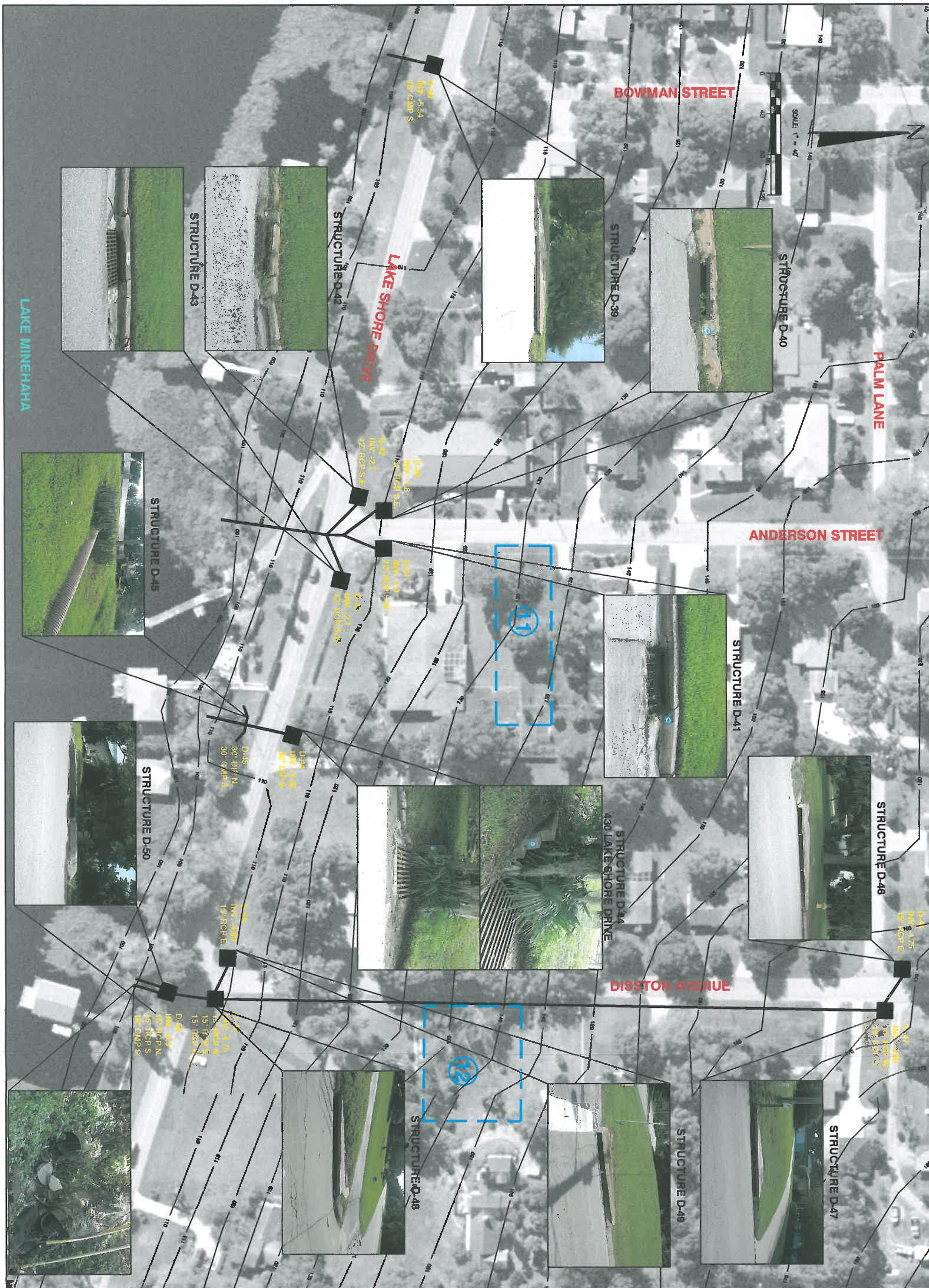
Robert A. Em, Jr., PE
Registered Eng. 54016

DATE: DECEMBER 6, 2004

SHEET 9



LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

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Robert A. Ern, Jr., PE
Registered Eng 54018

DATE: DECEMBER 4, 2004

SHEET 10

JOB NO. 03004006

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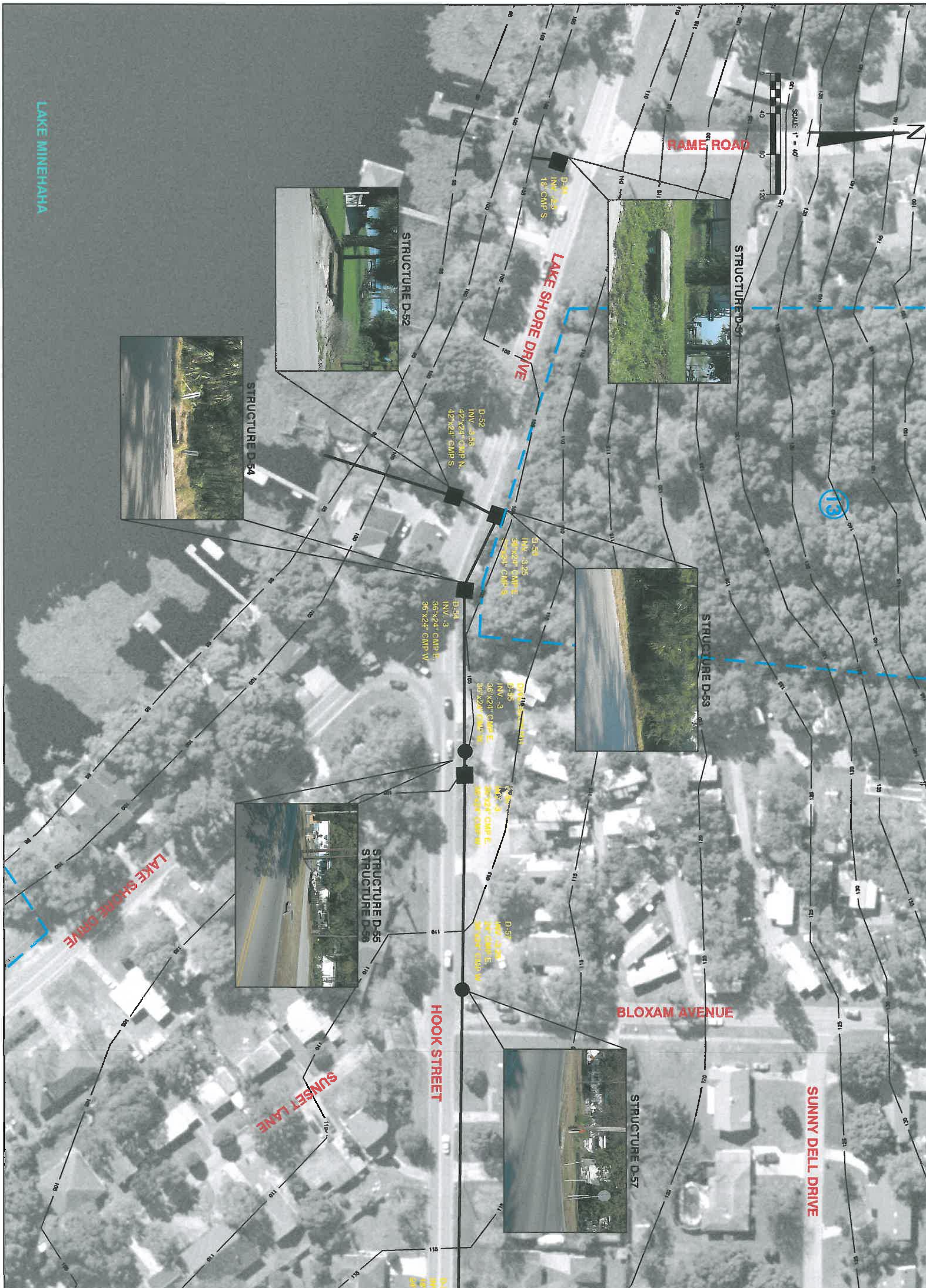

Robert A. Ern, Jr., PE
Registered Eng 54075

DATE: DECEMBER 6, 2004

SHEET 11

JOB NO. 03004.006

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LAKE MINNEHAHA STORMWATER IMPROVEMENTS STUDY

AERIAL PLAN

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Robert A. Ern, Jr., PE
Registered Eng. 54073

DATE: DECEMBER 6, 2004

SHEET 12

JOB NO. 03104006

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AERIAL PLAN

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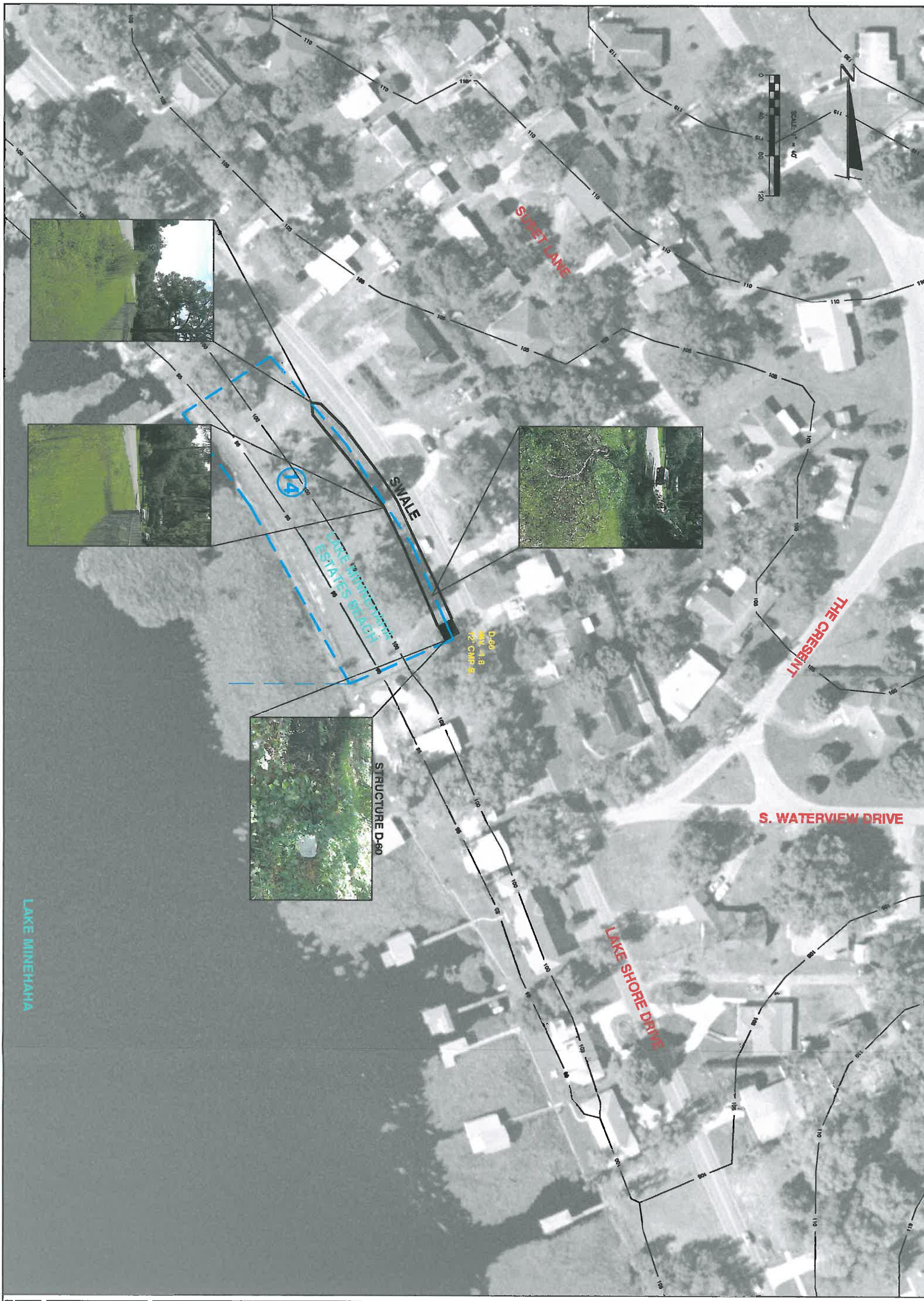

Robert A. Ern, Jr., PE
Registered Eng 54015

DATE DECEMBER 6, 2004

SHEET 13

JOB NO. 05024005

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AERIAL PLAN

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LAKE MINNEHAHA
STORMWATER IMPROVEMENTS
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Robert A. Ern, Jr., PE
Registered Eng 54013

DATE: DECEMBER 6, 2004

SHEET 14

JOB NO. 031004.006

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