STONEYBROOK COMMUNITY DEVELOPMENT DISTRICT

LAKE BANK EROSION EVALUATION

MAY 2010

Prepared for:

Stoneybrook Community Development District
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Stoneybrook Lake Bank Erosion Evaluation Report

Project Description

Johnson Engineering, Inc. personnel conducted a visual inspection of the Stoneybrook stormwater system lake banks, Lakes 3 thru 35, during April 2010. See the attached Exhibit A for the overview of the Stoneybrook stormwater lake system and assigned numbering system. The numbering system follows the 1997 Banks Engineering "Master Drainage Plan – Stoneybrook" provided in 2006. Lakes A, B, C, D, and E were numbered 30 through 35. Lakes 1 and 2 have not been constructed so the inspection covered Lakes 3 through 35.

The visual inspection of the lake bank erosion considered potential impacts to residential and golf course structures. No potential impacts to residential structures were noted.

The visual inspection noted locations of lake bank erosion and assigned a level of severity, a type of erosion, and a potential erosion cause. Each location was photographed for documenting and further review.

The severity rankings used were;

- Immediate Attention
- Hazardous to foot and landscape maintenance
- Medium Hazard
- SFWMD Compliance Concern
- Probable Future Problem

The type of erosion categories used were;

- Bank drop-off
- Bank washout/gully
- Bank washout from pipe, grate, or sprinkler
- Eroded Swale in bank
- Other

The list of potential causes used were;

- Surface waves and unstable soil
- Surface/Roof runoff concentrated to a point in the bank
- Improperly installed pipe or grate
- Lake bank greater than 4:1
- Other

In total 301 observation locations were recorded and reviewed. The attached Exhibit B lists the locations by severity ranking and subdivides the severity ranking into the type of erosion. For use in the field, the inspector divided the Stoneybrook stormwater lake system into 10 aerial maps and labeled the erosion location for reference. These maps have been scanned and attached as Exhibit C.

Stoneybrook Lake Bank Erosion Probable Causes Discussion

The April 2010 Lake Bank Inspections used five (5) probable erosion cause factors for lake bank erosion and five (5) erosion types;

1. Surface Waves and Unstable Soil (typically results in Bank Drop-off)
2. Surface Run-off Concentrated to a Point (typically results in Gully or Washout)
3. Improperly Installed Pipe or Grate (typically results in Gully or Washout)
4. Lake Bank Slope Steeper than 4:1 (can create either Drop-off or Gully)
5. Other (should be evaluated on a case-by-case basis)

Two of the erosion types, Bank Washout from pipe, grate, or sprinkler and Eroded Swale in bank, had only two identified locations, Lake 27 Location 127 and Lake 11 Location 15. The Lake 27 location is a small diameter PVC pipe which should be investigated to determine its purpose and the Lake 11 location needs additional review to determine how the runoff is being concentrated to that point in the bank.

For many of the lake bank erosion locations there can be more than one potential cause such as steeper than 4:1 slope and surface waves. The different causes are for the most part related to the difference in corrective actions needed for the type of erosion so this probable cause discussion will review both the cause and type.

Surface Waves and Unstable Soil

The most common type of lake bank erosion is a stair-step type of drop-off, **Bank Drop-off,** at the location of the bank where the lake water level stays for the longest period of time. This water level is normally near the "Control Elevation" of the stormwater lake. Stoneybrook's stormwater lake system was designed to meet South Florida Water Management District Environmental Resource Permit criteria. This means that individual lakes and, often, a series of lakes have an outfall control structure that has a stormwater release opening that is designed to meet the Environmental Resource Permit (ERP) criteria. This opening, a port, holds back water from rainstorms for a period of time eventually returning the lake to the lowest point of the opening. The lowest point of the opening is called the "Control Elevation" and is the level lakes spend the most amount of time near. During the "rainy season", typically June thru August, the lakes will spend a significant amount of time above the Control Elevation. During the "dry season", typically December thru May, the lakes spend a significant amount of time below the Control Elevation.

Rainfall, and even irrigation, runoff travels down the lake banks with the amount of water and the speed of the water increasing until it reaches the lake water level. The typical sod placed on Stoneybrook lake banks will not survive submerged under water for more than a week or two and will only slowly grow back down the bank after the water level drops. When the prolonged high water leaves after rainy season a bare portion of lake bank is

exposed where excessive rain or irrigation run-off plus surface waves caused by wind can erode the bare lake bank. Areas along a bank with more stable soils experience less erosion. The lake bank soils below the sod are generally whatever soil material was excavated from the lakes during construction. There is generally some variation of soils for different areas within the overall development or even around a large lake.

The eroded soil gets distributed along the submerged surface of the lake near the exposed bank. Essentially the lake bank soil moves down the submerged bank toward the bottom of the lake. South Florida Water Management District (SFWMD) considers the retrieval and placement of soil from within the stormwater lake on the exposed/eroded bank as a maintenance activity that does not require a permit. Furthermore, SFWMD uses a steeper than nine (9) inch bank drop-off as its compliance criteria meaning if SFWMD personnel perform a lake bank inspection a "Non-Compliance letter" will note the areas with a steeper than 9 inch drop-off. My understanding is that SFWMD determined that over 9 inches is a human safety hazard.

Surface Run-off Concentrated to a Point

The second most common type of lake bank erosion is area in the lake bank that has become lower than the rest of the bank, a **Gully or Washout** type of erosion. Many times the sod is sagging because the soil underneath has traveled further down the bank and into the lake. The sod disguises the erosion. With sufficient irrigation the sod can continue to survive even though there is an air gap under the roots of the sod. If a swale was not intentionally graded and sodded during construction then the gully or washout is caused by surface run-off, runoff from either rain or irrigation, which finds or makes a slightly lower area in the yard and lake bank to find its way to the lake.

The concern with sod suspended in air is that a person stepping on this area of sod causes the sod to collapse and likely tripping the person with the potential of one or more types of an injury. Similarly, landscape maintenance equipment traveling across a suspended sod section can collapse the sod with the potential of overturning the equipment. This suspended sod, gully, or washout frequently aligns with the gap between residential buildings where roof and lot runoff is concentrated before draining to the lake. Unless there is corrective action such as collecting the runoff into a surface inlet that pipes the runoff to the lake below the water surface then washout problems will return after lake bank repairs are made.

Improperly Installed Pipe or Grate

At many other residential developments there are locations where stormwater runoff is directed to an inlet or grate, and then piped either directly to the stormwater lake or to the

top of the stormwater lake bank to a second grate. This second grate is a "bubble-up" structure where the collected runoff flows out to travel down the lake bank. The field evaluation of Stoneybrook lakes did not locate any "bubble-up" structures and few plastic drainage pipes at or below the lake water level. Any small diameter plastic pipes, pipes less than 4 inches in diameter, should be investigated to determine the source of the water, an example is Lake 27 at location number 127. These small pipes are unlikely to be conveying stormwater and therefore may not be an approved for discharging into the stormwater lake.

Lake Bank Slope Steeper than 4:1

The SFWMD ERP criteria specifies lake banks to have a slope of 4:1, a rise of 1 foot in a horizontal run of 4 feet, with an out of compliance criteria of 3.5:1. Bulkheads or seawalls and "hardened" banks, as in stone/rock covered, are allowed to a minimal degree and allowed over a larger portion of a stormwater lake if compensated by littoral areas elsewhere in the lake. Littoral Areas are a shallow shelf up to 2 feet below the Control Elevation, where aquatic vegetation will thrive. For most soil types, a 4:1 slope with active vegetation is resistant to erosion.

Non-residential area stormwater lake banks such as along golf courses are where most steep or rocked lake banks will be found. Many of the locations noted in the Priority/Severity column titled "Immediate Attention" and "Hazardous to Foot and Landscape Maintenance" are locations with visually steep appearing lake banks causing a **Bank Drop-off** or rocked bank sections with some soil erosion at the upper rock edge.

Other

The "Other" cause category is used for locations that do not clearly fit in the more common cause types. Each of these locations needs to be evaluated in a case-by-case manner. There were 10 "Other" cause locations identified. One is at Lake 27 Location 128 that is a golf cart bridge losing its soil foundation which is recommended for "Immediate Attention". Two of these are where bank erosion has neared an existing irrigation sprinkler head resulting in the irrigation spray aggravating the bank erosion. The balance of this category are the where there is minor erosion at the interface between the earthen bank and rock covered bank.

Lake Bank Restoration and Estimate of Probable Cost

Other residential developments in Southwest Florida are experiencing similar lake bank erosion problems. The two dominant types of lake bank erosion observed in April 2010 were **Bank Drop-off** and **Bank Washout.** Both of these lake bank problems will re-occur unless the lake bank is provided additional reinforcement. Table 1 shows seven (7) types of bank reinforcement as possible options.

CDD Lake Bank Restoration

Restoration Method	Description	Erosion Resistance See also Note 3	Special Considerations See also Note 1,2,3	Opinion of Probable Cost
				$$/lineal foot
Rip Rap	Rock or concrete pieces 3" to 6" in diameter with filter fabric	Good	Not a natural appearance and limited by SFWMD	$75.00
Stone block retaining wall	Stone blocks, multilayer, with filter fabric	Good	Not a natural appearance and limited acceptance by SFWMD	$20.00
Grassy Paver and GeoBlock	Open at top and bottom HDPE cells	Fair, possible undercutting by wave action	Natural yard appearance or alternate plantings	$20.00
GeoWeb	Flexible web which can extend into lake bottom	Good	Natural yard appearance or alternate plantings	$20.00
GeoTube	Polyester fabric tube filled with sand or organic matter	Good	Natural yard appearance or alternate plantings	$33.00
Turf Stone Paver	Open center pavers	Fair, possible undercutting by wave action	Partial sod/turf or alternate plantings	$25.00
DeltaLok	Sandbag	Good	Natural yard appearance or alternate plantings	$20.00

Note 1 SFWMD Permit Design Criteria limits the amount of bulkhead, rip rap/rock, and steeper than 3.5 to 1 bank slopes. Altering existing 4:1 grassy banks to bulkhead or rip rap/rock requires a Modification to the existing Permit

Note 2 SFWMD requires a permit modification if lake bank maintenance leaves a steeper than 9" step/rise at the normal water line.

Note 3 Adding GeoWeb 4' to 6' into lake bottom will change the rating from Fair to Good while increasing the cost 50-80%.

Alternate Plantings - Seasonally slightly submerged

Spartina/Cord Grass
Swamp Fern
Leather Fern
Rhexia (Marsh Pink)
Pipewort

These costs are generalized and assume that significant portions of a lake bank are receiving restoration. Equipment and labor mobilization for small areas of bank repair will increase the cost per lineal foot.

Lake Bank Restoration Recommendations and Opinion of Probable Costs

The field evaluation data for each lake in Stoneybrook was considered to develop a recommendation for the lake bank areas in need of restoration for lake bank drop off, bank washout repair, and improvements at existing rip rap areas. This information is shown in the Lake Recommendation Table.

For lakes that had bank areas in more than one "Severity" category the lineal feet of bank restoration or the number of bank washout locations the overall restoration extent appears in the highest "Severity" category for that lake. Two lakes, Lake 9 and 15, have lineal footage of bank restoration separated due to a portion of the area is along a golf course fairway. For both of these lakes it may be possible to separately address the fairway related bank restoration so the lineal footage was listed in the "Probable Future Problem" category.

The Opinion of Probable Costs tables include one for "Overall" to show the total estimated costs in each of the "Severity" categories and one for each "Severity" with each lake listed with its estimated restoration costs. The Stoneybrook Community Development District may want to consider a multi-year restoration project that addresses the highest severity levels initially and progress to lesser severity later. If needed this approach may be presented to South Florida Water Management District to avoid any "Non-Compliance" notifications during the restoration process.

The bank washout Opinion of Probable Cost assumes each location will need regrading, addition of stabilization material, and resodding. The Deltalok bag system and Geoweb allows for a relatively low cost flexible stabilization approach. I used $500 per location as a general repair cost. Many small bank washouts noted in the field evaluation are located in lake bank sections that also have bank drop off restoration needs and it was assumed that the bank drop off restoration would also correct these small bank washouts.

Manufacturer's literature with pictures is included in this report to aid in the visualization of each restoration options used in the Opinion of Probable Cost.

EXHIBIT A

Lake Evaluation Tables

Immediate Attention

Lake #	Location #	Erosion Type
7	48	Bank Drop Off
8	50	Bank Drop Off
8	51	Bank Drop Off
8	52	Bank Drop Off
8	53	Bank Drop Off
8	54	Bank Drop Off
8	55	Bank Drop Off
8	56	Bank Drop Off
8	57	Bank Drop Off
8	58	Bank Drop Off
8	59	Bank Drop Off

Lake #	Location #	Erosion Type
3	29	Bank washout/gully
6	41	Bank washout/gully
6	42	Bank washout/gully
6	43	Bank washout/gully
6	44	Bank washout/gully
6	45	Bank washout/gully
6	46	Bank washout/gully
8	60	Bank washout/gully
8	61	Bank washout/gully
8	63	Bank washout/gully
10	28	Bank washout/gully
11	18	Bank washout/gully
11	20	Bank washout/gully
11	21	Bank washout/gully
11	22	Bank washout/gully
16	74	Bank washout/gully
16	75	Bank washout/gully
17	79	Bank washout/gully
17	80	Bank washout/gully
17	81	Bank washout/gully
17	82	Bank washout/gully
20	70	Bank washout/gully
20	71	Bank washout/gully
20	72	Bank washout/gully
20	73	Bank washout/gully
21	140	Bank washout/gully
21	142	Bank washout/gully
22	129	Bank washout/gully
23	65	Bank washout/gully
26	94	Bank washout/gully
26	105	Bank washout/gully
27	128	Bank washout/gully
33	31	Bank washout/gully
34	34	Bank washout/gully
34	35	Bank washout/gully

Lake #	Location #	Erosion Type
11	15	Eroded Swale in bank
10	24	Other
27	120	Other

Hazardous to foot and landscape maintenance

Lake #	Location #	Erosion Type
3	7	Bank Drop Off
3	20	Bank Drop Off
3	25	Bank Drop Off
3	26	Bank Drop Off
3	27	Bank Drop Off
15	10	Bank Drop Off
21	144	Bank Drop Off
21	151	Bank Drop Off
22	130	Bank Drop Off
22	131	Bank Drop Off
22	136	Bank Drop Off
22	137	Bank Drop Off
24	68	Bank Drop Off
26	99	Bank Drop Off

Lake #	Location #	Erosion Type
3	18	Bank washout/gully
3	28	Bank washout/gully
4	34	Bank washout/gully
4	35	Bank washout/gully
4	36	Bank washout/gully
4	37	Bank washout/gully
4	42	Bank washout/gully
4	46	Bank washout/gully
6	40	Bank washout/gully
6	47	Bank washout/gully
10	25	Bank washout/gully
10	26	Bank washout/gully
10	27	Bank washout/gully
10	29	Bank washout/gully
10	30	Bank washout/gully
11	17	Bank washout/gully
15	1	Bank washout/gully
15	4	Bank washout/gully
15	5	Bank washout/gully
15	11	Bank washout/gully
16	76	Bank washout/gully
16	77	Bank washout/gully
17	78	Bank washout/gully
18	90	Bank washout/gully
19	72	Bank washout/gully
19	75	Bank washout/gully
19	78	Bank washout/gully
21	145	Bank washout/gully
21	146	Bank washout/gully
26	101	Bank washout/gully
26	113	Bank washout/gully
27	115	Bank washout/gully
27	126	Bank washout/gully
28	44	Bank washout/gully
28	84	Bank washout/gully
30	60	Bank washout/gully
34	33	Bank washout/gully

Lake #	Location #	Erosion Type
27	127	Bank washout from pipe,grate, or sprinkler

Medium Hazard

Lake #	Location #	Erosion Type
3	8	Bank Drop Off
3	17	Bank Drop Off
3	19	Bank Drop Off
4	45	Bank Drop Off
19	79	Bank Drop Off
19	84	Bank Drop Off
21	147	Bank Drop Off
21	152	Bank Drop Off
24	67	Bank Drop Off
25	5	Bank Drop Off
25	14	Bank Drop Off
26	111	Bank Drop Off
27	114	Bank Drop Off
28	30	Bank Drop Off
28	57	Bank Drop Off
28	61	Bank Drop Off

Lake #	Location #	Erosion Type
4	40	Bank washout/gully
14	49	Bank washout/gully
15	6	Bank washout/gully
15	8	Bank washout/gully
18	86	Bank washout/gully
18	91	Bank washout/gully
21	143	Bank washout/gully
25	3	Bank washout/gully
25	6	Bank washout/gully
25	13	Bank washout/gully
26	106	Bank washout/gully
27	119	Bank washout/gully
28	31	Bank washout/gully
28	32	Bank washout/gully
28	41	Bank washout/gully
28	46	Bank washout/gully
28	65	Bank washout/gully

Lake #	Location #	Erosion Type
4	43	Other

SFWMD Compliance Concern

Lake #	Location #	Erosion Type
3	9	Bank Drop Off
3	13	Bank Drop Off
3	24	Bank Drop Off
3	30	Bank Drop Off
3	31	Bank Drop Off
3	32	Bank Drop Off
4	1	Bank Drop Off
9	63	Bank Drop Off
9	68	Bank Drop Off
9	69	Bank Drop Off
12	55	Bank Drop Off
15	9	Bank Drop Off
18	89	Bank Drop Off
19	81	Bank Drop Off
21	139	Bank Drop Off
21	141	Bank Drop Off
21	148	Bank Drop Off
21	150	Bank Drop Off
22	132	Bank Drop Off
22	135	Bank Drop Off
24	69	Bank Drop Off
25	11	Bank Drop Off
25	12	Bank Drop Off
25	20	Bank Drop Off
26	93	Bank Drop Off
26	95	Bank Drop Off
26	100	Bank Drop Off
26	102	Bank Drop Off
26	110	Bank Drop Off
27	117	Bank Drop Off
28	35	Bank Drop Off
28	36	Bank Drop Off
28	38	Bank Drop Off
28	77	Bank Drop Off
32	57	Bank Drop Off
32	58	Bank Drop Off
34	32	Bank Drop Off

Lake #	Location #	Erosion Type
4	38	Bank washout/gully
4	39	Bank washout/gully
6	36	Bank washout/gully
6	37	Bank washout/gully
6	38	Bank washout/gully
6	39	Bank washout/gully

Lake #	Location #	Erosion Type
4	41	Other
4	44	Other

Probable Future Problem

Lake #	Location #	Erosion Type
3	4	Bank Drop Off
3	5	Bank Drop Off
3	6	Bank Drop Off
3	14	Bank Drop Off
3	15	Bank Drop Off
3	16	Bank Drop Off
3	21	Bank Drop Off
3	22	Bank Drop Off
3	23	Bank Drop Off
3	33	Bank Drop Off
4	2	Bank Drop Off
4	3	Bank Drop Off
4	47	Bank Drop Off
5	48	Bank Drop Off
5	49	Bank Drop Off
9	62	Bank Drop Off
9	64	Bank Drop Off
9	65	Bank Drop Off
9	66	Bank Drop Off
9	67	Bank Drop Off
11	12	Bank Drop Off
12	52	Bank Drop Off
12	53	Bank Drop Off
12	54	Bank Drop Off
13	70	Bank Drop Off
13	71	Bank Drop Off
15	2	Bank Drop Off
15	3	Bank Drop Off
18	88	Bank Drop Off
19	73	Bank Drop Off
19	74	Bank Drop Off
19	76	Bank Drop Off
19	77	Bank Drop Off
19	80	Bank Drop Off
19	82	Bank Drop Off
19	83	Bank Drop Off
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21	149	Bank Drop Off
22	133	Bank Drop Off
22	134	Bank Drop Off
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25	16	Bank Drop Off
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26	97	Bank Drop Off
26	98	Bank Drop Off
26	103	Bank Drop Off
26	104	Bank Drop Off
26	107	Bank Drop Off
26	108	Bank Drop Off
26	109	Bank Drop Off
26	112	Bank Drop Off
27	116	Bank Drop Off
27	118	Bank Drop Off
27	125	Bank Drop Off
28	22	Bank Drop Off
28	23	Bank Drop Off
28	24	Bank Drop Off
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28	72	Bank Drop Off
28	73	Bank Drop Off
28	74	Bank Drop Off
28	75	Bank Drop Off
28	76	Bank Drop Off
28	78	Bank Drop Off
28	86	Bank Drop Off
29	50	Bank Drop Off
29	51	Bank Drop Off
30	61	Bank Drop Off
32	56	Bank Drop Off
35	92	Bank Drop Off
27	122	Bank washout/gully
27	123	Bank washout/gully
27	124	Bank washout/gully
28	21	Bank washout/gully
28	25	Bank washout/gully
28	26	Bank washout/gully
28	29	Bank washout/gully
28	34	Bank washout/gully
28	45	Bank washout/gully
15	7	Other
25	17	Other
25	18	Other
25	19	Other
27	121	Other
28	64	Other

EXHIBIT B

Lake Maps

N

0 150 300 600
SCALE IN FEET

Lake Inventory			
Lake No.	Area (sq ft) (+/-)	Acreage (+/-)	Perimeter (ft) (+/-)
1	proposed	proposed	proposed
2	proposed	proposed	proposed
3	487,771.25	11.2	3,061
4	230,946.74	5.3	3,454
5	56,589.06	1.3	1,069
6	282,250.24	6.5	4,268
7	85,925	2	1,278
8	103,750	2.4	1,818
9	35,383.42	0.8	800
10	170,529.81	3.9	2,633
11	105,242.65	2.4	2,445
12	19,419	0.45	683
13	30,528.89	0.7	783
14	51,161.34	1.2	1,271
15	184,621.29	4.2	2,732
16	38,527	0.9	769
17	89,704	2.1	1,288
18	36,696.89	0.84	808
19	78,098.45	1.8	1,347
20	92,006.80	2.1	1,519
21	179,911.50	4.13	2,552
22	515,837.38	11.8	3,152
23	112,166.93	2.6	1,628
24	129,462.37	3	1,873
25	158,242.61	3.6	2,311
26	201,277.14	4.6	3,734
27	315,653	7.3	4,501
28	215,812.30	5	6,334
29	17,022.41	0.4	517
30	29,247.36	0.67	792
31	36,685.70	0.84	827
32	21,114.82	0.5	589
33	17,100.16	0.4	530
34	97,915.08	2.25	1467
35	15,032.38	0.35	480
Total	4,241,631.90	97.5	63,314

PROPOSED LAKE
CYPRESS PRESERVE "F" 6.8 ac±
PROPOSED LAKE
CYPRESS PRESERVE "G" 8.3ac±
LAKE A (#30)
LAKE B (#31)
LAKE C (#32)
BRAXFIELD LOOP
LAKE #12
LAKE #10
LAKE #29
KNUTSFORD RUN
LAKE #28
CYPRESS PRESERVE "A" 9.4ac±
C-2
LAKE #6
BELHAVEN WAY
LAKE #33
LAKE #11
WAYMOUTH RUN
LAKE #15
STONEY BROOK GOLF DRIVE
LANCASTER RUN
LAKE D (#34)
CYPRESS PRESERVE "B" 6.3ac±
WORCESTER RUN
LAKE #7
LAKE #14
PEMBROOK RUN
C-5
BELHAVEN WAY
LAKE #13
LAKE #9
CORKSCREW ROAD
C-6
C-3
STRATHAM LOOP
LAKE #4
LAKE #3
LAKE #8
LAKE #17
LAKE #16
LAKE #18
IRON CK
BRIXHAM RUN LOOP
WOODMONT LANE
CHAPLIS LANE
LAKE E (#35)
BRIXHAM RUN
AUSTIN KEANE CT
LAKE #26
STONEYBROOK GOLF BOULEVARD
C-1
LANGHOLM RUN
LAKE #19
STONEYBROOK GOLF DRIVE
LAKE #23
SHERIDAN RUN
LAKE #20
C-4
HELMSDALE RUN
BEN HILL GRIFFIN PKWY
LAKE #24
BERWICK RUN
LAKE #21
CYPRESS PRESERVE "C" 2.5ac±
LAKE #27
C-9
LAKE #25
PORTRUSH RUN
LAKE #32
WINDHAM RUN
C-7
C-8
C-10
MIROMAR OUTLETS
WINDHAM RUN
LAKE #22
I-75

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REVISIONS		

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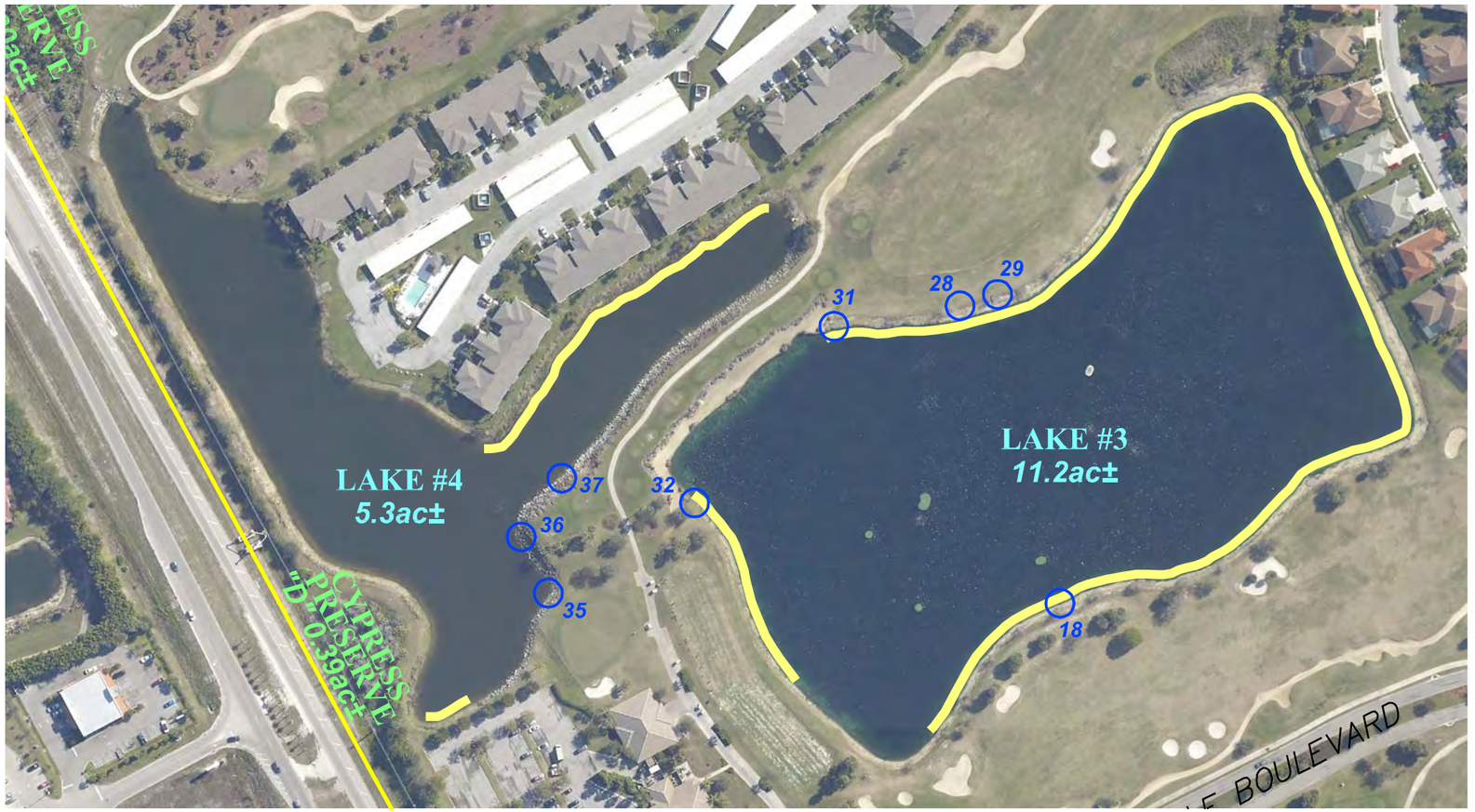
Stoneybrook CDD Worksheet

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
April, 2010	----	00-00-00	As Shown	1 Of 1



0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

\\Ftms01\Proj-jet\20034037\dwg\Stoneybrook-BASE.dwg (C-1) ap May 24, 2010 - 2:59pm

Stoneybrook
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E.B. #642 & L.B. #642

Stoneybrook CDD
Lakes 3 & 4

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-1

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Stoneybrook CDD
Lakes 5, 10, 12, 29, 30, 31 & 32

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-2

N

0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

\\Ftms01\Proj-jel\20034037\dwg\Stoneybrook-BASE.dwg (C-3) ap May 24, 2010 - 3:05pm

Stoneybrook
Lee County, Florida

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Stoneybrook CDD
Lakes 6, 7, 14, 33 & 34

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-3

0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

\\Ftms01\Proj-jei\20034037\dwg\Stoneybrook-BASE.dwg (C-4) ap May 24, 2010 - 3:07pm

Stoneybrook
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Stoneybrook CDD
Lakes 8, 16, 17, 19 & 20

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-4

0 25 50 100
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

\\Ftms01\Proj-jei\20034037\dwg\Stoneybrook-BASE.dwg (C-5) ap May 24, 2010 - 3:09pm

Stoneybrook
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Stoneybrook CDD
Lakes 9 & 13

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-5

0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

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Stoneybrook CDD
Lakes 11 & 15

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-6

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Stoneybrook CDD
Lakes 18, 26, 27 & 35

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-7

0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

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Stoneybrook CDD
Lakes 21, 22 & 25

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-8

N

0 50 100 200
SCALE IN FEET

BANK RESTORATION

WASHOUT REPAIR

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Stoneybrook CDD
Lakes 23 & 24

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-9

BANK RESTORATION

WASHOUT REPAIR

0 50 100 200

SCALE IN FEET

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Lee County, Florida

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Stoneybrook CDD
Lake 28

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	C-10

EXHIBIT C

Opinion of Probable Cost

LAKE RECOMMENDATION TABLE

Lake ID	Immediate Attention		Hazardous to foot and landscape maintenance		Medium Hazard		SFWMD Compliance Concern		Probable Future Problem	
	Bank/Drop LF	Gully #	Bank/Drop LF	Gully #	Bank/Drop LF	Gully #	Bank/Drop LF	Gully #	Bank/Drop LF	Gully #
3	-	-	2400	5	*	-	*	-	*	-
4	-	-	-	3	600	1	*	-	*	-
5	-	-	-	-	-	-	-	-	400	1
6	-	R	-	-	-	R		-	450	1
7	220	-	-	-	-	-	-	-	-	-
8	800	3	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	320	-	80	-
10	-	1	-	R	-	-	-	-	-	-
11	-	7	-	-	-	-	-	-	100	-
12	-	-	-	-	-	-	-	-	280	-
13	-	-	-	-	-	-	850	-	-	-
14	-	-	-	-	-	1	-	-	-	-
15	-	-	100	-	*	-	850	-	100	-
16	300	-	-	-	-	-	-	-	-	-
17	650	-	-	-	-	-	-	-	-	-
18	-	-	-	-	*	-	800	-	*	-
19	-	-	-	-	1000	-	*	-	*	-
20	-	1	-	-	-	-	-	-	-	-
21	-	-	2150	-	*	2	*	-	*	-
22	-	2	2500	-	*	-	*	-	*	-
23	-	-	-	-	-	-	-	-	700	-
24	-	-	400	-	-	-	-	-	-	-
25	-	-	-	-	950	-	*	R	*	-
26	-	3	240	-	*	-	*	-	*	-
27	-	-	-	2	600	-	-	-	-	R
28	-	-	-	-	3500	-	*	-	*	-
29	-	-	-	-	-	-	-	-	320	-
30 (A)	-	-	-	1	-	-	-	-	100	-
31 (B)	-	-	-	-	-	-	-	-	-	-
32 (C)	-	-	-	-	-	-	550	-	-	-
33 (D)	-	1	-	-	-	-	-	-	-	-
34 (Irrigation)	-	R	200	-	-	-	-	-	-	-
35 (E)	-	-	-	-	-	-	-	-	150	-
TOTAL	**1970**	**18**	**7990**	**11**	**6650**	**4**	**3370**	**0**	**2680**	**2**

R = Grading at top of Rip Rap

* Reduced Severity Locations included in number of lineal feet

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Stoneybrook CDD

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	1 OF 1

IMMEDIATE ATTENTION

Immediate Lake #	Bank/Drop	Rip Rap Permit Mod Required	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
7	220		4,400	4,400	4,400	7,260	5,500	4,400
8	800		16,000	16,000	16,000	26,400	20,000	16,000
16	300		6,000	6,000	6,000	9,900	7,500	6,000
17	650		13,000	13,000	13,000	21,450	16,250	13,000
TOTAL	**1970**	**$147,750**	**$39,400**	**$39,400**	**$39,400**	**$65,010**	**$49,250**	**$39,400**

HAZARDOUS TO FOOT and LANDSCAPE MAINTENANCE

Hazardous Lake #	Bank/Drop	Rip Rap Permit Mod Required	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
3	2400		48,000	48,000	48,000	79,200	60,000	48,000
15	100		2,000	2,000	2,000	3,300	2,500	2,000
21	2150		43,000	43,000	43,000	70,950	53,750	43,000
22	2500		50,000	50,000	50,000	82,500	62,500	50,000
24	400		8,000	8,000	8,000	13,200	10,000	8,000
26	240		4,800	4,800	4,800	7,920	6,000	4,800
34	200		4,000	4,000	4,000	6,600	5,000	4,000
TOTAL	**7990**	**$599,250**	**$159,800**	**$159,800**	**$159,800**	**$263,670**	**$199,750**	**$159,800**

MEDIUM HAZARD

Medium Hazard Lake #	Bank/Drop	Rip Rap Permit Mod Required	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
4	600		12,000	12,000	12,000	19,800	15,000	12,000
19	1000		20,000	20,000	20,000	33,000	25,000	20,000
25	950		19,000	19,000	19,000	31,350	23,750	19,000
27	600		12,000	12,000	12,000	19,800	15,000	12,000
28	3500		70,000	70,000	70,000	115,500	87,500	70,000
TOTAL	**6650**	**$498,750**	**$133,000**	**$133,000**	**$133,000**	**$219,450**	**$166,250**	**$133,000**

SFWMD COMPLIANCE CONCERN

Hazardous Lake #	Bank/Drop	Rip Rap Permit Mod Required	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
9	320		6,400	6,400	6,400	10,560	8,000	6,400
13	850		17,000	17,000	17,000	28,050	21,250	17,000
15	850		17,000	17,000	17,000	28,050	21,250	17,000
18	800		16,000	16,000	16,000	26,400	20,000	16,000
32 C	550		11,000	11,000	11,000	18,150	13,750	11,000
TOTAL	**3370**	**$252,750**	**$67,400**	**$67,400**	**$67,400**	**$111,210**	**$84,250**	**$67,400**

PROBABLE FUTURE PROBLEM

Hazardous Lake #	Bank/Drop	Rip Rap Permit Mod Required	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
5	400		8,000	8,000	8,000	13,200	10,000	8,000
6	450		9,000	9,000	9,000	14,850	11,250	9,000
9	80		1,600	1,600	1,600	2,640	2,000	1,600
11	100		2,000	2,000	2,000	3,300	2,500	2,000
12	280		5,600	5,600	5,600	9,240	7,000	5,600
15	100		2,000	2,000	2,000	3,300	2,500	2,000
23	700		14,000	14,000	14,000	23,100	17,500	14,000
29	320		6,400	6,400	6,400	10,560	8,000	6,400
30 (A)	100		2,000	2,000	2,000	3,300	2,500	2,000
35	150		3,000	3,000	3,000	4,950	3,750	3,000
TOTAL	**2680**	**$201,000**	**$53,600**	**$53,600**	**$53,600**	**$88,440**	**$67,000**	**$53,600**

BANK/DROP OVERALL RESTORATION OPINION OF PROBABLE COST

Severity Type	Bank/Drop	Rip Rap - **Permit Modification Required**	Stone block retaining wall	Grassy Paver and GeoBlock	GeoWeb	GeoTube	Turf Stone Paver	DeltaLok
	LF	$75.00	$20.00	$20.00	$20.00	$33.00	$25.00	$20.00
Immediat	1970		39,400	39,400	39,400	65,010	49,250	39,400
Hazardous	7990		159,800	159,800	159,800	263,670	199,750	159,800
Medium	6650		133,000	133,000	133,000	219,450	166,250	133,000
SFWMD	3370		67,400	67,400	67,400	111,210	84,250	67,400
Probable	2680		53,600	53,600	53,600	88,440	67,000	53,600
TOTAL	**22660**	**PERMIT MOD REQUIRE**	**$453,200**	**$453,200**	**$453,200**	**$747,780**	**$566,500**	**$453,200**

OVERALL WASHOUT RESTORATION

Severity Type	Gully #	DeltaLok $500 per location
Immediat	18	9,000
Hazardous	11	5,500
Medium	4	2,000
SFWMD	0	0
Probable	2	1,000
TOTAL	**35**	**$17,500**

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Stoneybrook CDD

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
May 2010	20034037	00-00-00	As Shown	1 OF 1