CEDAR COVE CANAL SEDIMENT ABATEMENT STUDY

Prepared for

**Sarasota County
Water Resources**

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April 2005

Bureau Veritas
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1.0 INTRODUCTION

Sarasota County's Navigable Waterways Program (NWP) routinely conducts feasibility studies for residential canal dredging throughout the unincorporated coastal regions of the County. To compliment some of the feasibility projects, Sarasota County has engaged Berryman & Henigar, Inc. (BHI) to perform a series of sediment abatement analyses to determine if opportunities exist for reducing future land-based sediment accumulation in the canals. Sedimentation is a significant concern to the citizens residing along the canals. Residents with property along canals in the County are typically assessed for the costs of canal dredging.

This report is the sixth of a series of sediment abatement studies being conducted by BHI for the County. The areas being examined include:

- Baywood Canal
- America Drive Canal
- Phillippi Cove
- South Creek
- Hidden Harbor
- Cedar Cove
- Phillippi/Pinecraft

The area being considered for this study is the Cedar Cove Canal (canal) located west of US 41, south of Roland Street, and north of Matheny Creek. The canal discharges to Little Sarasota Bay. See Figure 1 for the project location map.

2.0 BACKGROUND

The canal is a natural system that has had anthropogenic modifications for increased draft clearance and navigability and to provide fill material for residential developments on Cedar Cove. The canal is aligned between Roland Street and Captain Kidd Avenue and it varies in width between 30 and 420 feet as it discharges to Little Sarasota Bay.

One of the concerns voiced by the citizens along the canals is the possibility of future sedimentation from stormwater runoff causing a loss of canal depth after the expense of the dredging operation. To address those concerns, the County has engaged BHI to analyze the stormwater systems entering the canals and estimate the effects these systems may have on future sediment accumulation.

3.0 SITE CONDITIONS

Canal sedimentation can be the result of many factors, including stormwater discharges, upland erosion, illegal discharges, algae build up from low dissolved oxygen and/or high nutrient levels in the canals, wind blown currents, or tidal influences. Most canals are influenced by a combination of these factors. A careful investigation is required to determine the causes of sedimentation prior to recommending courses of action to reduce sedimentation in canal systems.

Figure 1 | **Project Location Map** | Berryman & Henigar

Field investigations of the canal were made by BHI staff on December 21, 2004 and March 18, 2005. The canal is bordered by single-family low-density residential properties at all locations. The majority of the canal property owners are using vegetation, seawalls and rock rip-rap for stabilization. Most yards and roads in the bordering streets were well vegetated, maintained, and stabilized, showing no significant sedimentation sources.

The drainage basin for the canal is generally bordered by 1st Street on the north, Matheny Creek on the south, US 41 on the east, and Baywood Way on the west. The overall drainage basin consists of almost 68 acres of low density residential, single family and multi family residential, commercial, and open space property. See Figure 2, which shows subbasins within the study area.

Soils in the area consist predominantly of EauGalli, Myakka, and Pomello fine sands. The soils are nearly level, poorly-drained and/or moderately well drained fine sand. Also, it is assumed that natural soils bordering the canal are covered with dredged material.

Some of the streets bordering the canal have gutters while others have shallow swales and driveway culverts. The rear portions of all lots bordering the canal drain directly to the canal via sheet flow. The fronts of the lots and the streets drain to the street gutters around the canal. As can be seen in the site photographs, most of the yards and streets are clean and well maintained.

There are three stormwater pipes that discharge to the canal. The pipes are shown on the Existing Conditions Outfall Map, Figure 3. Each outfall is identified and discussed below.

3.1 Outfall CC1

Outfall CC1 discharges through a series of inlets along Roland Street to the uppermost portion of the canal. This outfall serves the largest drainage basin discharging to the canal, and drains almost over 26 acres of commercial, low density and multi family residential property from a pond just south of Roland Street (Figures 4 to 6). The pipe discharges above the water line and there was no sediment build up observed at the outfall.

3.2 Outfall CC2

Outfall CC2 is a small pipe discharging to the middle portion of the canal. This pipe drains a little over 4 acres of low density, single family and multi family residential property along Buccaneer Drive and part of Captain Kidd Avenue (Figures 7 and 8). This drainage basin area has no stormwater treatment system. There was no sediment build up observed along the shoreline at this outfall.

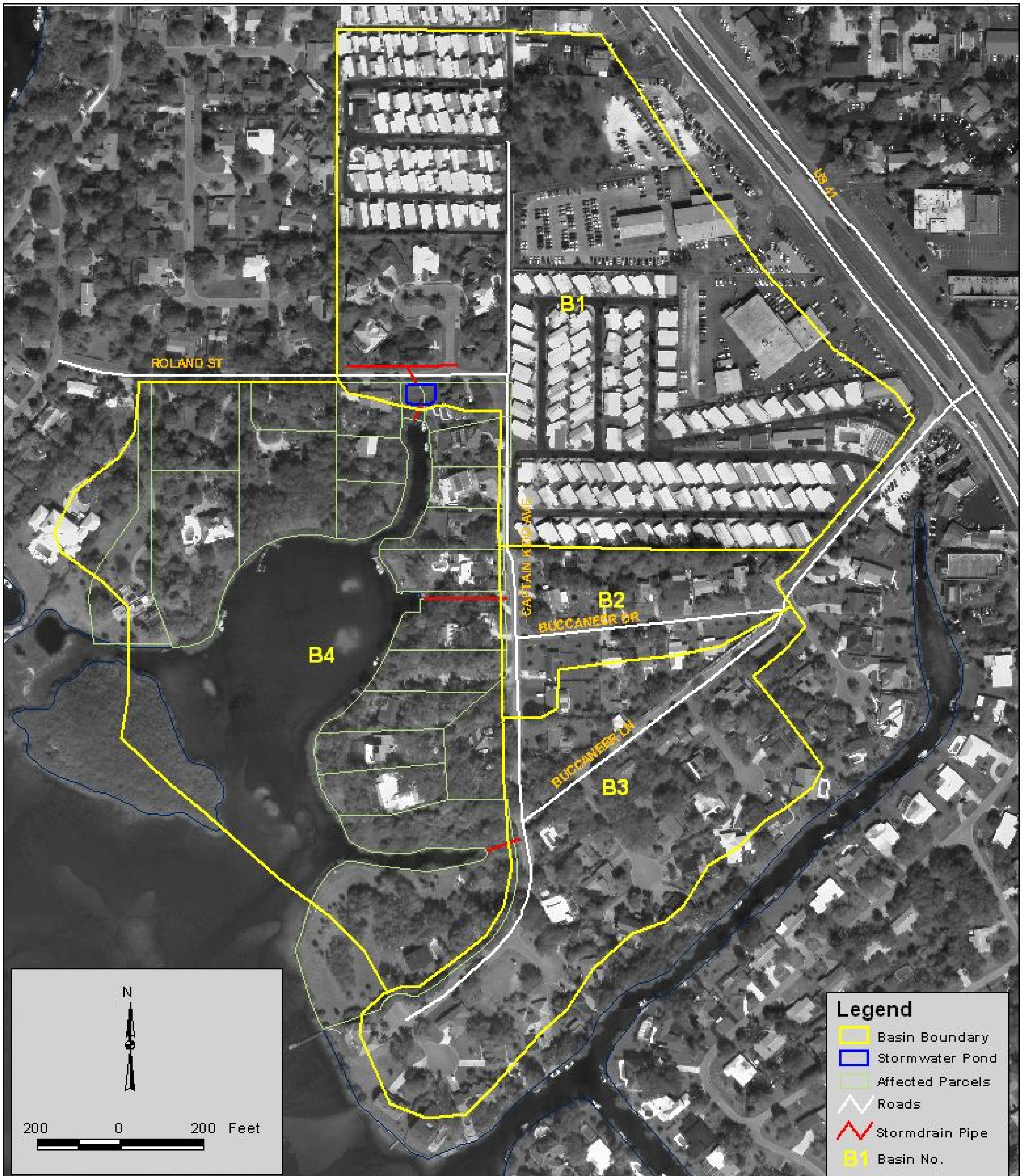

Figure 2	Existing Features Map	Berryman & Henigar

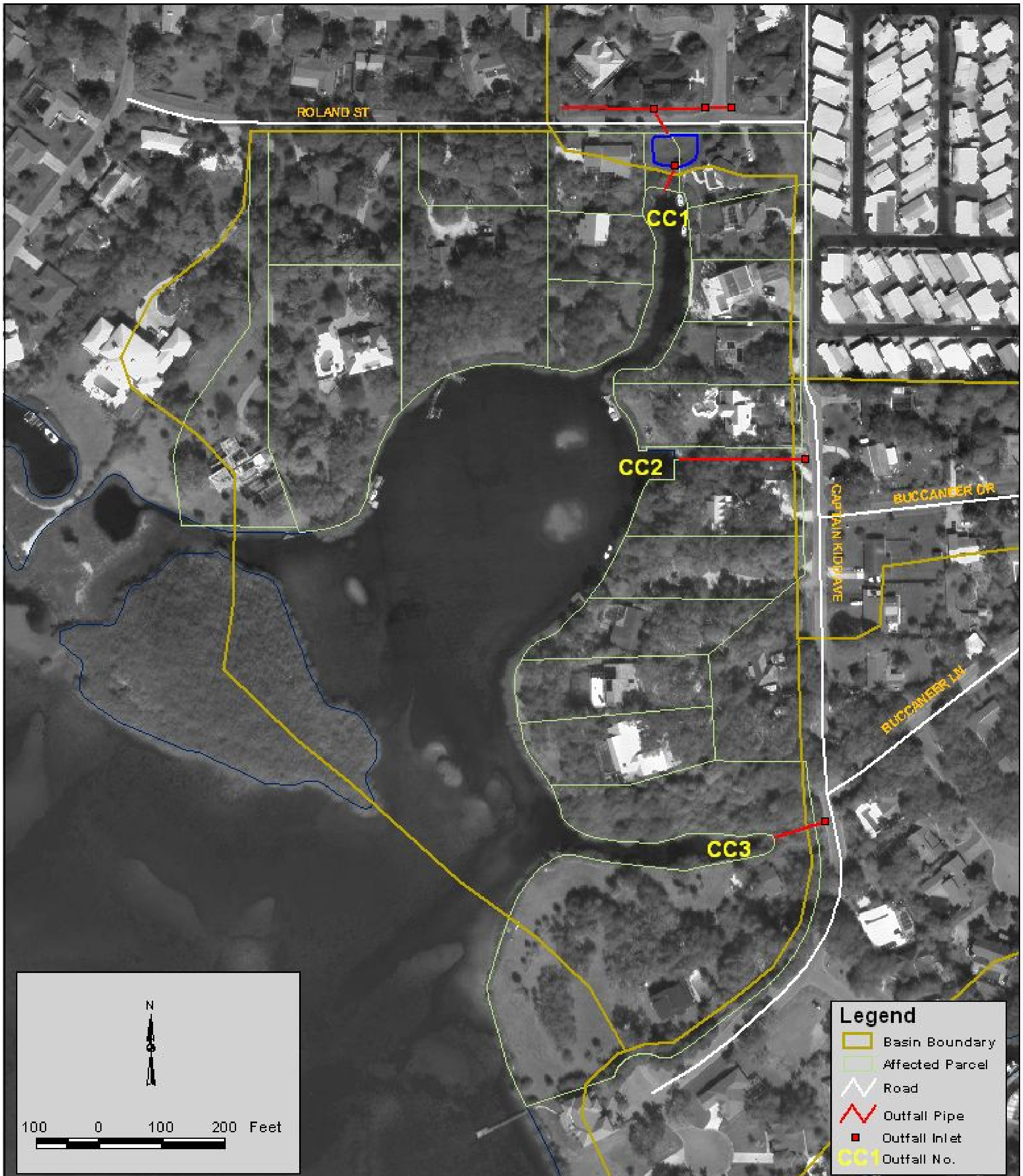

Figure 3	Existing Conditions Outfall Map	Berryman & Henigar

Figure 4.
Roland St. looking west in Basin B1. Note shallow swale.

Figure 5.
Dry Retention Pond upstream of outfall CC1.

Figure 6.
Canal at outlet CC1.

Figure 7.
Outlet CC2 - mitered end on Captain Kidd Ave.

Figure 8.
Captain Kidd Ave. looking south in Basin B2.

Figure 9.
CC3 - Inlet on west side of Captain Kidd Ave. in Basin B3. Note leaf loads.

Figure 10.
Captain Kidd Ave. looking south in Basin B3.

Figure 11.
Sediment on curb across the street of outlet CC3.

3.3 Outfall CC3

Outfall CC3 is a pipe discharging to the lower portion of the canal. This pipe drains 12.45 acres of low density and single family residential property into an inlet just south of the intersection of Buccaneer Lane and Captain Kidd Avenue (Figures 9 to 11). This drainage basin area has no stormwater treatment system. Sediment on the curb across the street from the inlet, and leaf loads around the inlet were found during the field visit. Sediment build-up along the shoreline at this outfall was not verified due to the lack of access to the outfall.

4.0 POLLUTANT LOADING ASSESSMENT

A pollutant loading analysis was performed to quantify potential land-based sediment and other pollutant loadings entering the canal. The analysis used a spreadsheet-based model, with loading estimates based on land uses from the Southwest Florida Water Management District (SWFWMD) FLUCCS land use GIS coverage, drainage basin boundaries obtained from Sarasota County that were further discretized around the outfalls, stormwater treatment efficiency rates for Best Management Practices (BMPs) (ASCE, 2001), and annual pollutant loading unit rates (ERD, 1994). Loading rates used are summarized in Table 1. BMP treatment efficiencies are shown in Table 2. Land uses were field verified. This type of planning-level analysis does not take into account short-term erosion from sources such as construction sites or leaking pipe joints.

Pollutant loadings were estimated by multiplying the total acreage in each drainage basin by a composite annual loading rate that was developed by weighting the land use specific loading rates by the relative proportion of basin area in that land use. Where appropriate, the gross loadings were adjusted to account for BMP reduction factors to estimate the net pollutant loadings by parameter.

The existing conditions pollutant loadings are presented in Table 3. Loadings were calculated for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). While TSS can account for sediment build up in a canal, nutrients from TP and TN can lead to algae blooms and vegetation growth, with subsequent muck accumulation in water bodies. The assessment estimates current TSS loading at 3,499 kg/year, TP loading at 40 kg/year, and TN loading at 283 kg/year.

Using a typical unit weight for sandy silt of 90 lb/cubic foot (Dunn et. al., 1980), the 7,714 lb annual sediment load could contain a volume of approximately 86 cubic feet (3.2 cubic yards), or about 0.0032 inches annually over the area of the canal bottom. However, under field conditions, the sediment would tend to accumulate near the outfalls, although tidal and stream flows would disperse the sediment throughout the canal and into South Creek.

Table 1.
Summary of unit pollutant loading rates for central and south Florida (ERD, 1994).

LAND USE CATEGORY	UNIT LOADING RATE (kg/ac-yr)						
	TOTAL N	ORTHO-P	TOTAL P	BOD	TSS	TOTAL Zn	TOTAL Pb
Low Density Residential	2.88	0.169	0.320	7.63	31.9	0.06	0.052
Single-Family	4.68	0.335	0.594	14.3	56.1	0.122	0.083
Multi Family	8.51	0.924	1.72	38.4	256	0.188	0.299
Low-Intensity Commercial	5.18	0.157	0.650	36.1	343	0.511	0.635
High Intensity Commercial	13.0	1.52	1.96	79.3	435	0.782	0.985
Industrial	7.30	0.519	1.24	39.5	383	0.543	0.872
Highway	6.69	0.361	1.32	21.9	182	0.508	0.727
Agricultural							
a. Pasture	4.54	0.732	0.876	7.99	126	---	---
b. Citrus	2.91	0.123	0.197	3.60	21.9	---	---
c. Row Crops	2.84	0.421	0.595	---	---	---	---
d. General Agriculture	3.62	0.380	0.551	5.80	74.0	---	---
Recreational/Open Space	1.07	0.003	0.046	0.956	7.60	0.005	0.021
Mining	2.21	0.131	0.281	18.0	176	0.229	0.378
Wetland	1.81	0.204	0.222	4.96	11.2	0.009	0.039
Open Water	3.23	0.130	0.273	4.02	8.05	0.073	0.065

Table 2.
BMP selection guide (ASCE, 2001).

BMP	Design Factor				Type of Pollutant					
	Land Area Needed	**Distance Above Groundwater**	**Soil Type Needed**	**Cost**	**Mainten-ance**	**Total Nitrogen % Removal**	**Total Phosphorus% Removal**	**Suspended Solids % Removal**	**Heavy Metals % Removal**	**Floating Trash Removal**
Ponds										
Dry Retention Online	High	Low	A or B	High	Medium	60-98	60-98	60-98	60-98	High
Dry Offline Retention or Detention	High	Low	A or B	High	Medium	60	85	90	65-85	High
Wet Detention	High	High	Any	High	Low	26	65	75	25-70	High
Wet Detention With Filtration	High	Low	Any	High	High	25	65	85	60-85	High
Dry Detention	High	Low	A or B	High	Medium	15	25	70	35-70	High
Alum System		NA	NA	High	Medium	50	90	90	80-90	0
Constructed Wetlands	High	0 ft.	C or D	High	High	****	****	High	High	High
Sand Filters										
Austin Sand Filter	Medium	2 ft.			High	31-47	50-65	70-87	20-84	N/A
D.C. Underground Sand Filter	Medium				High					N/A
Delaware Sand Filter	Medium	2 ft.			High	47	41	57	45.2	N/A
Alexandria Stone Reservoir Trench	High				High	47.2	63-72	79-84	***	N/A
Texas Vertical Sand Filter	Medium	7 feet	N/A		High					N/A
Peat Sand Filter	Medium				High					N/A
Washington Compost Filter System	200 S.F/cfs	4 feet	N/A		High	N/A	41	95	75.8	N/A
Other										
Baffle Boxes	Low	NA	NA	Medium	Medium	0	30-40	20-90	Unknown	Low
Vegetated Swales	Medium	Low	A,B, C	Medium	Low	0-25	29-45	60-83	35	Low
Buffer Strips	Low	1 ft-2 ft	A,B,C	Medium	Low	20-60	20-60	20-80	20-80	Low
Infiltration Trenches	Low	2-4 ft	A or B	Medium	High	45-70	50-75	75-99	75-99	High
Inlet Devices	None	NA	NA	Low	High	**	**	Low-Medium	Low	High

** Traps particulate phosphorus and nitrogen in the form of leaves and grass - not effective for dissolved nutrients

*** No Data Available

**** Varies widely

Table 3. Cedar Cove Canal Pollutant Estimates
Existing Conditions

Basin No.	Area (ac)	Land Use	Type of Treatment System	% TSS Reduc-tion	% TP Reduc-tion	% TN Reduc-tion	TSS Loading Rate (kg/ac-yr)	TP Loading Rate (kg/ac-yr)	TN Loading Rate (kg/ac-yr)	TSS Loading (kg/yr)	TP Loading (kg/yr)	TN Loading (kg/yr)
1	3.85	Low Density Residential	None				31.9	0.32	2.88	122.7	1.2	11.1
1	15.45	Multi Family Residential	None				256.0	1.72	8.51	3,953.9	26.6	131.4
1	6.97	Commercial	None				343.0	0.65	5.18	2,390.7	4.5	36.1
1	26.26	Total Basin Land Use	Dry Pond	70	25	15				1,940.2	24.2	151.8
2	0.30	Low Density Residential	None				31.9	0.32	2.88	9.6	0.1	0.9
2	3.83	Single Family Residential	None				56.1	0.59	4.68	215.0	2.3	17.9
2	0.18	Multi Family Residential	None				256.0	1.72	8.51	46.3	0.3	1.5
2	4.31	Total Basin Land Use								270.9	2.7	20.3
3	0.28	Low Density Residential	None				31.9	0.32	2.88	8.8	0.1	0.8
3	12.17	Single Family Residential	None				56.1	0.59	4.68	682.9	7.2	57.0
3	12.45	Total Basin Land Use								691.7	7.3	57.8
4	14.48	Low Density Residential	None				31.9	0.32	2.88	461.8	4.6	41.7
4	2.28	Single Family Residential	None				56.1	0.59	4.68	127.7	1.4	10.7
4	0.87	Open Space	None				7.6	0.05	1.07	6.6	0.0	0.9
4	17.62	Total Basin Land Use								596.1	6.0	53.3
	TOTALS									**3,498.8**	**40.3**	**283.2**

5.0 DISCUSSION AND RECOMMENDATIONS

Existing conditions land-based pollutant loadings to the canal were calculated for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). The estimate loadings are 3,499 kg/year for TSS, 40 kg/year for TP, and a TN loading of 283 kg/year.

The 7,714 lb annual sediment load could contain a volume of approximately 86 cubic feet (3.2 cubic yards), or about 0.0032 inches annually over the area of the canal bottom. As stated above however, under field conditions, the sediment would tend to accumulate near the outfalls, although tidal and stream flows would disperse the sediment throughout the canal and into South Creek. It should be noted that nutrient control is an important element of water management. Excess enrichment can result in algae blooms, excess aquatic vegetation growth, and subsequent accumulation of detritus turning to muck. Thick layers of muck were observed in other canals in the general area, mainly in dead-end canals with mangrove or overhanging trees and brush.

This section describes recommendations on how to reduce runoff-borne sediment from entering the canal. Nutrients can become adsorbed onto sediment particles, so trapping sediment also can reduce nutrient loading to the estuarine system.

In the Cedar Cove Canal watershed, only one of the four drainage basins provides some level of stormwater treatment, accounting for 26 acres out of the total of 68 acres in the basin with BMPs treating the stormwater. Of the 42 acres not being treated, 17 acres directly discharge to the canal or are in the rear of the lots bordering the canal, where it is not generally feasible to install BMPs other than rear lot swales.

Although not widely observed, some silt accumulation was noted on the bottom of the canal and can be indicative of a combination of sediment from soil erosion and muck from high nutrient levels in the canal. Potential nutrient sources include algae from the bay, fertilizers, leaves, grass, organic yard debris, and pet wastes from local runoff. Inlet devices and other land-limited BMPs can be effective in capturing TSS from runoff, but not nutrients. Reduction of nutrients in urban settings can be more effectively accomplished with source controls. Educating the homeowners in the area to reduce fertilizer use, prevent grass clippings from entering the canals, and mowing less frequently would benefit the nutrient levels in the canals. Also, small back yard swales to hold runoff instead of letting it run directly into the canal can be effective.

The dead-end portion of the canal has limited circulation due to tidal exchange and stream flow, therefore, it could experience conditions such as low dissolved oxygen levels and silt accumulation. High nutrient levels can lead to algae blooms, which lead to muck accumulations.

There were some areas of grass clippings and leaves in the street and in inlets which could end up in the canal. These nutrient sources affect the muck build up in the canal. In addition, lawn mowers should blow the leaves and grass back into the yards instead of into the street or the canal. It is therefore recommended that the County continue to provide public education regarding methods of source control and single lot design that could reduce sediment and nutrient loadings to the canal.

Specific recommendations for each subbasin outfall are also included in this section. Each outfall to the canal is discussed below.

5.1 Outfall CC1

This is the largest drainage basin (B1) discharging to the canal and although it has a dry retention pond it does not provide adequate treatment for the basin. BHI recommends a series of BMPs due to the large drainage basin size. There are several vault types of BMPs available which are effective in removing sediment, but an enhanced nutrient separating baffle box just upstream of the dry retention pond is being recommended for this outfall. This BMP has an added benefit of reducing nutrient loads by trapping grass, leaves, and organic debris and keeping this material dry so that the nutrients do not leach out into the stormwater (BHI, 2004). Other vault-type BMPs do not have this feature. An added feature of using this second BMP is that it would help the County achieve nutrient reductions recommended for Sarasota Bay.

5.2 Outfall CC2

Captain Kidd Avenue has a small pipe that drains to the middle portion of the canal through Outfall CC2. No new BMPs are recommended for this outfall because of the small basin size.

5.3 Outfall CC3

Just south of the intersection of Buccaneer Lane and Captain Kidd Avenue there is an inlet that drains to the lower portion of the canal through Outfall CC3. Sediment on the curb across the street from the inlet, and leaf loads around the inlet were found during the field visit. BHI recommends an inlet device to be installed for this outfall.

6.0 CONCLUSIONS

The Cedar Cove Canal has isolated areas of sedimentation problems typical of many residential canals along the coastline. Accumulations of sediment occur from natural erosion and anthropogenic activities such as construction and land clearing. In addition, muck accumulates in canal bottoms from algae blooms caused by elevated nutrient levels in the canal waters. Stormwater runoff brings nutrients and other pollutants to the canals where poor circulation allows the pollutants to settle to the bottom. With the canal dredging project being investigated by the County, it is natural that the affected property owners would inquire as to possible methods to reduce future sedimentation and dredging expenses.

An analysis of the land uses and drainage basins of the canal was undertaken to determine possible causes of sediment build up in the canals. Outfall pipes to the canal were inspected for obvious joint leakage or erosion problems. There were no obvious signs of sediment in the pipes themselves, indicating that there were no significant structural problems to the system.

To further examine potential pollution sources to the canals, a pollutant loading analysis of the stormwater runoff from the watershed was undertaken. TSS, TN, and TP loadings were estimated using a spreadsheet calculation accounting for the land areas, land uses, pollutant loadings, and existing stormwater treatment systems. This analysis suggests that the highest pollutant loadings originate in basin B1, the largest basin, despite the existing dry retention pond.

Most of the residential basins were small but had no treatment system in place. Recommendations are summarized in Figure 12.

There are three stormwater outfalls to the canal. Based on the field investigations and analysis in this report, it is recommended that one baffle box be constructed just upstream of the exiting dry retention pond at outfall CC1, and that an inlet device be installed at outfall CC3.

One of the most important aspects of pollutant reduction is source control. At some locations it was observed that residents were allowing grass clippings to wash or blow into the inlets. A strong public education effort will inform residents that changing their day to day activities can be one of the best methods of pollution control. By reducing fertilizer application amounts and frequencies, reducing lawn sprinkling to twice a week, reducing mowing, controlling disposal of grass and yard debris, and cleaning pet refuse, the homeowners can take a large part in reducing nutrient loading to the canals and thereby reducing muck accumulations in the canals.

Figure 12	Recommended Sediment Abatement Facilities	Berryman & Henigar

7.0 REFERENCES

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