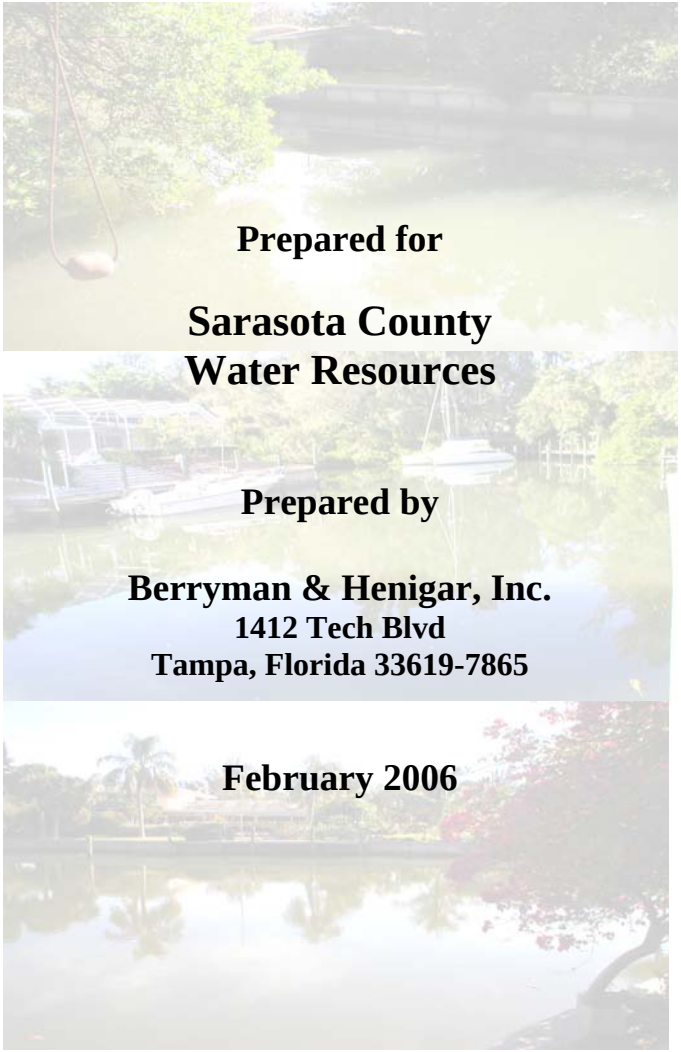
SEA PLUME WAY
SEDIMENT ABATEMENT STUDY



Prepared for

Sarasota County
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February 2006

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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 eleventh of a series of sediment abatement studies being conducted by BHI for the County. The areas being examined also include:

- Baywood Canal
- America Drive Canal
- Phillippi Cove
- South Creek
- Hidden Harbor
- Cedar Cove
- Phillippi/Pinecraft
- Grand Canal
- Baywood Avenue D
- Forked Creek Neptune

The area being considered for this study is the Sea Plume Way (canal) located east of Midnight Pass Rd between Sea Plume Way and Whitehall Place. 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. The canal is aligned between Sea Plume Way and Whitehall Place and 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**

Field investigations of the canal were made by BHI staff on December 14, 2005 and February 3, 2006. The canal is bordered by single-family medium-density residential properties at most locations. The majority of the canal property owners are using vegetation, seawalls and rock rip-rap for stabilization. Most yards and roads in the vicinity are naturally vegetated, and stabilized. There is no evidence that these are significant sedimentation sources.

The drainage basin for the canal is bordered by Vista Hermosa Circle on the north, the Whitehall Place on the south, Little Sarasota Bay on the east, and Midnight Pass on the west. The overall drainage basin consists of over 20 acres of mostly single-family medium-density residential property. Figure 2 presents the subbasins within the study area.

Soils in the area consist predominantly of Canaveral and Pompano fine sands. The soils are nearly level, somewhat poorly-drained, or very poorly-drained. Also, it is assumed that natural soils bordering the canal are covered with dredged material.

Most of the streets bordering the canal have no curbs or gutters. The small community on Sea Plume Way is densely vegetated with natural vegetation, with site clearing mostly for roads, driveways, and houses with no grass lawns. This landscaping allows some of the stormwater to infiltrate and thus reduce runoff volume and sediment load. The rear portions of all lots bordering the canal drain directly to the canal via sheet flow.

There are two 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 SP1

Outfall SP1 discharges through a culvert along Sea Plume Way to the middle portion of the canal. This outfall drains over 3.6 acres of single-family residential (Figures 4 to 11). This drainage basin area has no stormwater treatment system. The pipe discharges above the water line but there was no sediment build up observed at the outfall.

3.2 Outfall SP2

Outfall SP2 discharges through a culvert along the main entrance to Sea Plume Way and discharges to the western end of the canal. This outfall drains over 1.6 acres of single-family residential (Figures 12 to 16). This drainage basin area has no stormwater treatment system. The pipe discharges below the water line but there was no sediment build up observed at the outfall.

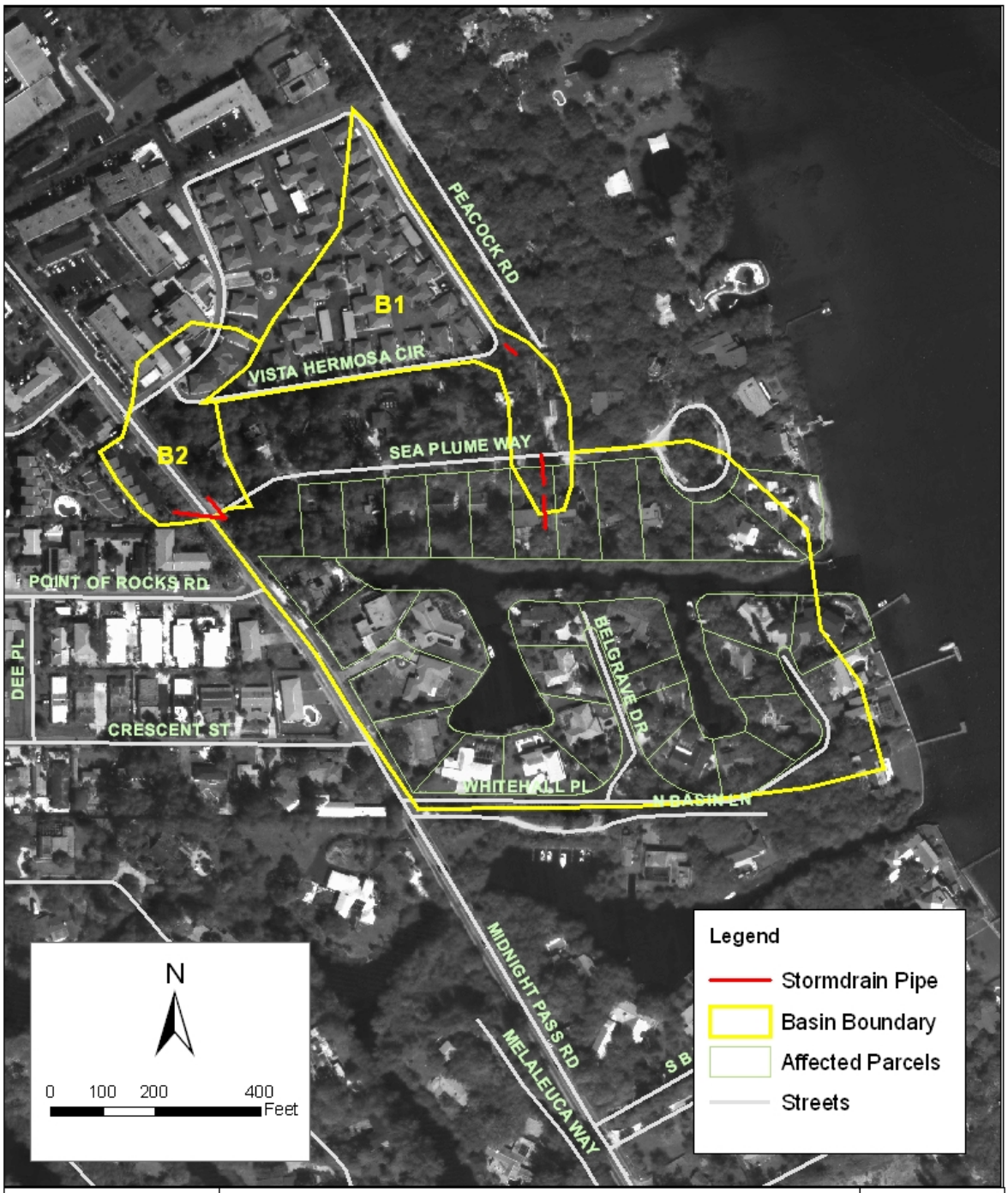

Figure 2 | **Existing Features Map**

BUREAU VERITAS
Berryman & Henigar

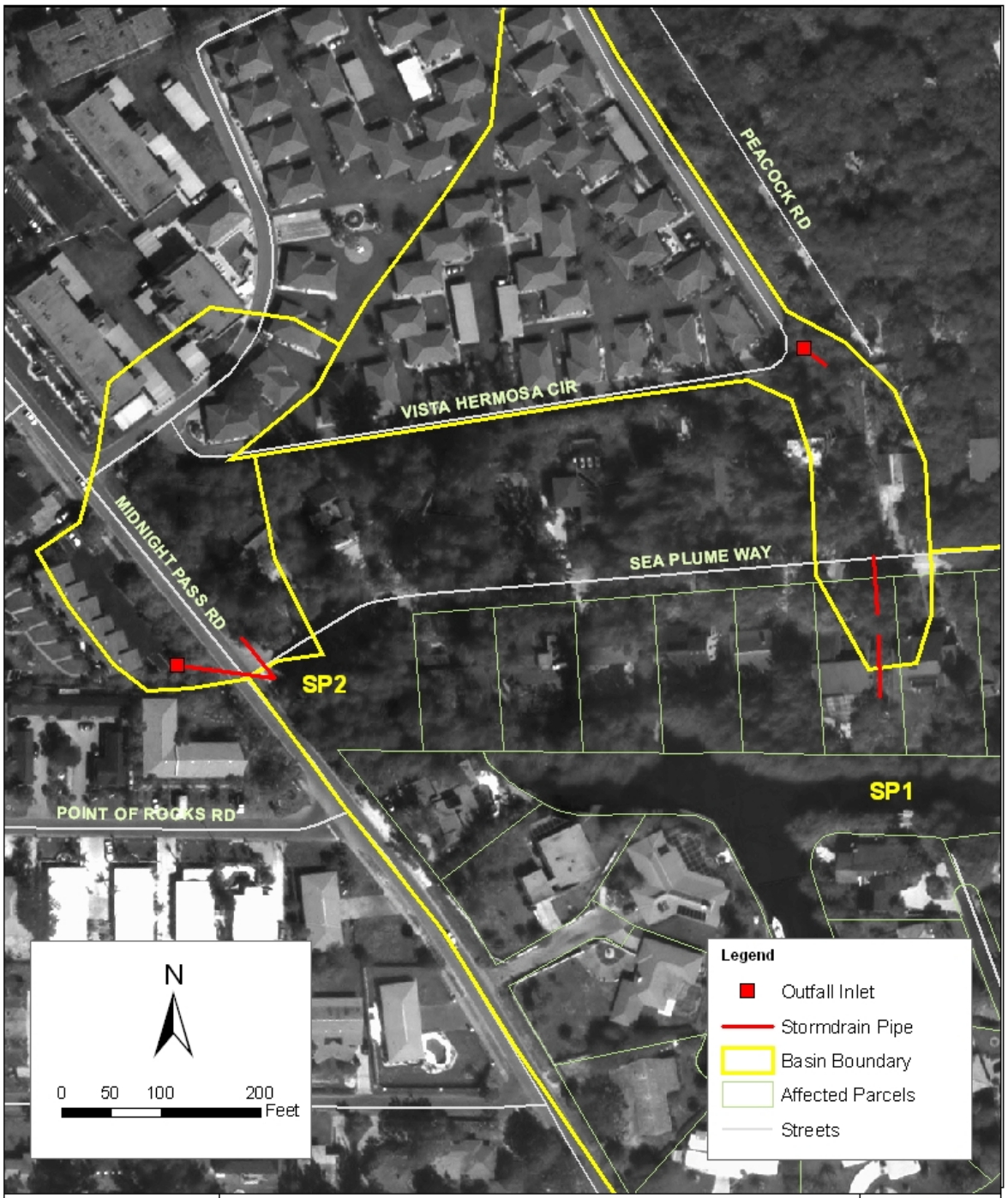

Figure 3

Existing Conditions Outfall Map

BUREAU VERITAS

Figure 4.
Northern end of culvert on Sea Plume Way upstream of outfall SP1.

Figure 5.
Outlet pipe BA1 discharging above water level.

Figure 6.
Outlet pipe SP1 discharging above water level.

Figure 7.
Canal at outlet SP1.

Figure 8.
Looking east on Sea Plume Way just north of SP1.

Figure 9.
Looking southeast from Sea Plume Way just north of SP1.

Figure 10.
Inlet on Vista Hermosa Cir. upstream of outfall SP1.

Figure 11.
Looking west on Vista Hermosa Cir. from inlet upstream of outfall SP1.

Figure 12.
Upstream end of ditch east of Midnight Pass Rd. upstream of outfall SP2.

Figure 13.
Parking lot west of Midnight Pass Rd. upstream of outfall SP2.

Figure 14.
Outfall SP2 discharging below water level

Figure 15.
Looking southeast on towards canal downstream of outfall SP2.

Figure 16.
Looking east on Midnight Pass Rd. in basin B2.

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). Table 1 summarizes the loading rates. 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. The composite loading rate was developed by averaging the land use specific loading rates as weighted by the relative proportion of land use area within the basin. 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 loadings at approximately 1,942 kg/year of TSS, 17 kg/year of TP, and 111 kg/year of TN.

Using a typical unit weight for sandy silt of 90 lb/cubic foot (Dunn et. al., 1980), the 4,281 lb annual sediment load could contain a volume of approximately 48 cubic feet (1.7 cubic yards). However, under field conditions, the sediment is expected to accumulate near the outfalls, although tidal and stream flows would disperse some of the sediment throughout the canal and into Little Sarasota Bay.

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. Sea Plume Way 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	0.01	Low Density Residential	None				31.9	0.32	2.88	0.4	0.0	0.0
1	0.72	Single Family Residential	None				56.1	0.59	4.68	40.1	0.4	3.3
1	2.90	Multi Family Residential	None				256.0	1.72	8.51	741.4	5.0	24.6
1	**3.62**	**Total Sub-basin Land Use**	**None**							**781.9**	**5.4**	**28.0**
2	0.63	Single Family Residential	None				56.1	0.59	4.68	35.3	0.4	2.9
2	1.00	Multi Family Residential	None				256.0	1.72	8.51	255.5	1.7	8.5
2	**1.63**	**Total Sub-basin Land Use**	**None**							**290.8**	**2.1**	**11.4**
3	15.01	Single Family Residential	None				56.1	0.59	4.68	841.8	8.9	70.2
3	0.11	Multi Family Residential	None				256.0	1.72	8.51	27.4	0.2	0.9
3	**15.11**	**Total Sub-basin Land Use**	**None**							**869.2**	**9.1**	**71.1**
	TOTALS									**1,941.9**	**16.6**	**110.6**

5.0 DISCUSSION AND RECOMMENDATIONS

Existing conditions land-based pollutant loadings to the canal were calculated for TSS, TP, and TN. The estimate loadings are 1,942 kg/year of TSS, 17 kg/year of TP, and 111 kg/year of TN.

The 4,281 lbs of annual sediment load will have a volume of approximately 48 cubic feet (1.7 cubic yards). However, under field conditions, the sediment is expected to accumulate near the outfalls, although tidal and stream flows would disperse some of the sediment throughout the canal and into Little Sarasota Bay. It should be noted that nutrient control is an important element of water management. Excess enrichment may 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 to reduce runoff-borne sediment entering the canal. Nutrients adsorb onto sediment particles. As such, sediment trapping has the potential to reduce nutrient loading to the estuarine system.

In the Sea Plume Way Watershed, none of the three drainage basins provide stormwater treatment. Runoff drained from over 15 acres of land either directly discharges to the canal or to the rear portion of the lots bordering the canal. In this case, it is usually not 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 may indicate 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 may 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 mow 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 may be effective.

Also not widely observed, but still present, were some areas of grass clippings and leaves in the street and in inlets. These organic materials may ultimately 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 discussions for each subbasin outfall are also included in this section. Each outfall to the canal is discussed below.

5.1 Outfall SP1

Outfall SP1 discharges through a culvert along Sea Plume Way to the middle portion of the canal. No new BMPs are recommended for this outfall because of the small basin size.

5.2 Outfall SP2

Outfall SP2 discharges through a culvert along the main entrance to Sea Plume Way and discharges to the western end of the canal. No new BMPs are recommended for this outfall because of the small basin size.

6.0 CONCLUSIONS

The Sea Plume Way 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 dredging project being investigated by the County, it is expected 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 with spreadsheet calculations. The calculations were based on 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 drainage basin. These loadings are small compared to the size of the receiving water body. Most of the other residential basins were small compared to the scale of the receiving water body.

There are two stormwater outfalls to the canal. Based on the field investigations and analysis in this report, no new BMPs are recommended for these outfalls because of the small drainage basins size compared to the scale of the receiving water body.

One of the most important aspects of pollutant reduction is source control. At some locations, it was observed that residents or landscape maintenance crews 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 quantities 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.

7.0 REFERENCES

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