Appendix A

2005 Grand Canal Environmental Assessment Report

Grand Canal, Oakdale, New York
Environmental Assessment

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January 2005

Grand Canal Environmental Assessment

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Grand Canal Environmental Assessment

Abstract

The water quality monitoring conducted for this assessment indicates that Grand Canal is significantly impacted by nutrient enrichment and, potentially, by pathogen contamination. Poor flushing in the canal has a negative effect on its ecology. Mosquitoes do not breed directly within the canal, but the adjacent wetlands are primary breeding areas. Vector Control has identified, through arboviral surveillance efforts, West Nile Virus positive birds and mosquito pools in the area. Although there is no immediate public health threat to the residents within the Grand Canal region, the area of the canal currently requires multiple larvicide events annually. Dredging the canal in conjunction with a comprehensive Open Marsh Water Management (OMWM) strategy to provide greater water flows to adjacent wetlands, could be a major step towards decreasing the need for annual larviciding. As always, any dredging activity must be conducted in a manner to avoid creating any adverse problems with changes in the current fish and wildlife habitat, and dredging spoils must be removed to prevent foul odors to the residents in the community. The plan could reduce pesticide usage and mosquito breeding, while enhancing the ecology, increasing water circulation in the canal and restoring the surrounding wetlands.

Introduction

Grand Canal consists of a series of shallow, interconnected canals located on the east side of the Connetquot River in Oakdale (Figure 1). According to a Dowling College website, the canal was built sometime prior to 1920 to serve the former "Idle Hour" estate of William K. Vanderbilt. The canal system includes a main "outside" canal that has north and south openings to the Connetquot River, and a number of "inner" finger canals that extend into what are now residential areas. There are a number of tidal wetlands within the area encompassed by the canal, in addition to a large marsh immediately to the east of the canal that includes both tidal and freshwater wetlands. All these wetlands depend on the canal for tidal circulation.

For a number of years Grand Canal has been the subject of complaints by area residents, reportedly concerned with progressive shoaling and with conditions potentially associated with a reduction in tidal flushing. Issues that have been raised include the potential for mosquito breeding, potential West Nile virus and other epizootic activity, the possible contamination of canal waters with Vector Control pesticides (used in adjacent marshes), and general water quality deterioration. The suggestion that these conditions collectively may represent a public health risk has, at the request of Suffolk County Executive Steve Levy, prompted this investigation.

Figure 1. Grand Canal, Oakdale

At a meeting in June 2004 among representatives of the County Executive's Office, the Department of Public Works (SCDPW), and the Department of Health Services (SCDHS), a multi-agency strategy was adopted to assess environmental conditions in the canal. The objective was to document existing conditions and determine whether a risk to public health exists, and if dredging of the canal would reduce that risk. The SCDHS Office of Ecology was assigned the tasks of assessing water quality conditions, coordinating monitoring efforts, and compiling a draft report. The SCDHS Division of Public Health was to evaluate mosquito and viral epizootic activity and assess the potential for public health implications. The SCDPW would evaluate adjacent wetland and ditch conditions as they relate to mosquito breeding, in addition to determining sediment conditions for potential dredging.

Canal Water Quality

In late June, staff from the Office of Ecology surveyed the canal to determine the degree of accessibility of various areas and to establish suitable sampling locations. Twelve sites representative of the different canal areas were selected, latitude-longitude coordinates obtained, and GIS maps prepared.

Water quality monitoring was conducted on four occasions from July through early September 2004. Samples were collected at or near the time of low tide, to avoid influences from the Connetquot River, from a depth approximately six inches below the surface. The samples were delivered to the Suffolk County Public & Environmental Health Laboratory (PEHL) in Hauppauge for analysis. Parameters analyzed included nutrients, salinity, coliform bacteria, and various organic constituents (solvents, pesticides, etc). At each site the water depth and secchi depth were recorded and measurements of surface and bottom temperature and dissolved oxygen also taken. Average values for physical measurements are given in Table 1. Tables 2 and 3 include results of inorganic and organic samples, respectively. Results for selected parameters are discussed below.

- ***Water Depth:*** Average depths at the sites monitored varied from 2.5 ft. at station 10 to 10.1 ft. at station 4. In general, the shallowest water was found in the stretch from station 7 to station 11, with the deepest water found at inner canal stations 3 through 6 where numerous boats are moored. Navigation with shallow-draft outboard powered boats (19 and 25' in length) was generally not a problem, although when a 25' inboard powered vessel was used it was very difficult to

Table 1. Average Values for Physical Measurements

Station	Depth	Temperature (°C)	Dissolved Oxygen (mg/L)		Salinity (‰)	Secchi (ft)
			Surface	Bottom		
GC1	4.8	23.9	**6.5**	5.0	19.1	1.5
GC2	4.1	24.0	6.6	4.8	19.0	1.6
GC3	9.9	24.3	7.1	1.7	19.5	1.6
GC4	10.1	24.3	5.5	0.9	**19.6**	1.3
GC5	**5.6**	24.2	6.5	2.9	19.2	1.8
GC6	6.0	24.6	8.2	1.1	19.0	1.9
GC7	4.0	24.4	7.3	3.5	**18.5**	1.9
GC8	3.5	24.4	5.6	5.4	18.1	1.6
GC9	3.4	24.6	6.4	4.1	15.9	2.0
GC10	2.5	24.5	4.4	4.1	15.0	1.4
GC11 *	3.0	26.9	---	----	7.1	1.0
GC12	4.3	25.4	10.4	5.9	16.5	1.8

* Only one sample collected; no D.O. data due to meter malfunction

turn around in the narrow canals without the boat striking the bottom. Many of the boats moored throughout the canal system are greater than 25' in length.

- *Salinity:* As would be expected, average salinities generally decreased in a northward direction with increasing distance from the tidal influence of Great South Bay. From stations 1 through 8 levels varied little, averaging from 18.1 to 19.6 parts per thousand. Further north at stations 9 through 12, average salinity declined to between 15.0 to 16.5 parts per thousand.

- *Secchi Depth:* The secchi depth, a general measure of water transparency, is obtained by lowering a white disk through the water column to the point at which it disappears. Average secchi depths found in Grand Canal ranged from 1.0 to 2.0 ft., levels indicative of very turbid conditions. Factors that may be contributing to the turbidity include algal blooms, sediments that are washed off area streets or re-suspended from the bottom by boat traffic, and detritus from adjacent wetlands. Samples collected from a turbid area near station 8 on 9/7/04 revealed a massive bloom of a flagellated brown alga, *Heterocapsa akashiwo,* an organism common in brackish waters.

Table 2. Average Values for Coliforms and Nutrients

Station	Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	Dissolved Inorganic Nitrogen (DIN) (mg/L)	Total Nitrogen (mg/L)	Total Dissolved Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (DIP) (mg/L)	Total Phosphorus (mg/L)	Total Dissolved Phosphorus (mg/L)
GC1	1.033	433	0.148	0.36	0.19	< 0.005	0.063	< 0.025
GC2	3.800	967	0.092	0.45	0.24	< 0.005	0.049	< 0.025
GC3	470	197	0.132	0.38	0.18	< 0.005	0.053	< 0.025
GC4	290	130	0.212	0.56	0.30	< 0.005	0.056	< 0.025
GC5	5.713	253	0.251	0.38	0.46	< 0.005	0.057	0.030
GC6	533	193	0.092	0.24	0.20	< 0.005	0.038	< 0.025
GC7	633	533	0.221	0.47	0.32	< 0.005	0.073	< 0.025
GC8	3.500	567	0.428	0.45	0.36	< 0.005	0.050	< 0.025
GC9	1.050	650	0.633	0.76	0.94	< 0.005	< 0.025	< 0.025
GC10	1.033	777	0.668	0.96	0.82	< 0.005	0.061	< 0.025
GC11 *	1.300	800	1.350	1.50	1.50	< 0.005	0.052	0.038
GC12	460	147	0.531	1.07	0.85	< 0.005	0.071	< 0.025

Table 3. Organic Positive Detects

Date	Station	1,2,4-Trimethyl-benzene	Benzene	Carbon disulfide	1,2-Dichloro-ethene	Ethyl-benzene	Fluoranthene	MTBE	Naphthalene	Tetra-Chloroethene	Toluene	Total Xylene
07/ 26/04	GC1							1				
08/ 10/04	GC2	0.7		0.7				3	0.8	0.6	2	2
08/10/04	GC6							3				
07/26/04	GC7							3			1	1
08/10/04	GC7				0.5			3		0.9	1	1
08/10/04	GC8							2				
08/10/04	GC9				0.9			3		1		
07/26/04	GC10				1			2		0.9		
08/10/04	GC10				2		0.2	3		2	0.5	
07/26/04	GC12	1	0.9		2	0.9		2	0.9	1	5	5

* Only one sample collected

- ***Dissolved Oxygen:*** Adequate levels of dissolved oxygen (DO) are critical to the development and survival of aquatic organisms. Hypoxia (low DO) is a problem that often develops in waters that experience frequent algal blooms due to excessive levels of nutrients. Hypoxia can also develop from the decomposition of other resident plant material (macroalgae) or, in shallow systems, from the oxygen demand exerted by highly organic bottom sediments. A level of 5.0 mg/L, the New York State ambient water quality standard for DO, is a concentration below which adverse effects on aquatic organisms may begin to occur. As guidance to states developing water quality standards, the USEPA has established DO criteria for saltwater environments of 4.8 mg/L for species growth and 2.3 mg/L for species survival.

  In this survey, surface DO values in Grand Canal varied widely from 1.8 mg/L to 15.4 mg/L. Average values ranged from 4.4 mg/L at station 10 to 10.4 mg/L at station 12. Thirteen of the 44 surface measurements taken were below the 5.0 mg/L benchmark, and 3 were below the survival criteria. Bottom DO levels ranged from 0.2 mg/L to 9.2 mg/L with averages ranging from 0.9 at station 4 to 5.9 at station 12. Over 65% of the bottom DO measurements (29 of 44) were less than the 5.0 mg/L benchmark and 41% (18) were less than the 2.3 mg/L species survival criteria. The lowest averages were noted at the deeper inner canal stations (3, 4, 5 and 6). Because of the bottom topography in these areas (i.e. shallow sills preceding deeper basins), it is likely these sites act as sediment sinks for fine organic particulates that exert an increased oxygen demand during decomposition.

- *Coliform Bacteria:* Coliforms are a group of bacteria commonly found in soil, on vegetation, and in the intestinal tract of warm-blooded animals. Those of intestinal origin are referred to as "fecal coliforms" and although generally harmless, have long been used as an indicator for the possible presence of intestinal parasites or pathogens. Current standards for bathing waters permit a maximum 30-day average of 200 fecal coliforms per 100 ml of sample. The standard for shellfishing waters is 70 total coliforms per 100 ml of sample.

  Coliform levels found in Grand Canal were consistently elevated, with total coliform averages ranging from 290 to 5,713 organisms/ 100 ml and fecal coliforms averaging from 130 to 967 organisms/100 ml (Table 2). From a regulatory standpoint, these waters would be unsuitable for both shellfishing and bathing. Likely sources of coliforms in Grand Canal include stormwater runoff, waterfowl or other area wildlife, and perhaps, improperly functioning residential septic systems.

- ***Nutrients:*** Nutrients, including various nitrogen and phosphorous compounds, are essential for life in marine environments. However, over-enrichment with nutrients as a result of human activities (a process known as eutrophication) can have serious adverse impacts, both temporary and long-term, on the marine ecology. Excessive nutrient levels can cause explosive growths of phytoplankton (algal blooms), reduced water transparency, decreased levels of dissolved oxygen, and the production of foul odors. Over the long-term, impacts such as reduced species diversity and the proliferation of harmful algal species may result.

  Levels of dissolved inorganic nitrogen (DIN) are typically monitored in marine ecology programs as an indicator of nutrient enrichment. In Grand Canal, average DIN levels ranged from 0.09 to 0.67 mg/L. Stations 9 through 12 (nearest the college STP) in the northern canal area had the highest levels of DIN, collectively averaging three times as much as that found at stations 1 through 8. In comparison, long-term DIN levels in adjacent areas of Great South Bay have averaged less 0.05 mg/L. With this apparent high level of dissolved nitrogen in the canal, it is likely that algal blooms, reduced water transparency, and depressed oxygen levels are a common occurrence. Nutrient sources to the canal likely include leachate from area septic systems, runoff from fertilized lawns, and decomposing detritus from area wetlands. It is interesting to note, that the supply of nitrogen to the canal is so excessive that phosphorus has apparently become the limiting nutrient (usually not the case in temperate marine systems). This is evidenced by the very low levels of dissolved inorganic phosphate (DIP), normally at their peak during the summer, found during this survey.

- ***Organics:*** Samples were analyzed for numerous "organic" constituents (241 in total), including volatile organic compounds (VOCs), semi-volatile organics (SVOCs), carbamate and chlorinated pesticides, and a number of herbicide metabolites (a list of analytes is included in Appendix I). Because of laboratory limitations however, only a limited number of these samples could be collected. VOCs were collected at each station on one occasion; the remaining organics were only collected at 6 of the 11 sites monitored.

  Results were negative for all pesticide analytes, including the larvicide *methoprene* that is used by the Suffolk County Vector Control Division for mosquito control in adjacent wetlands. A number of VOC and SVOC compounds were identified. The gasoline additive MTBE was detected at all stations (Table 3). Many of the compounds found are present in petroleum products and likely have their source in boat engine exhaust or in stormwater runoff from area roads.

Mosquito Breeding

Routine mosquito larval surveillance conducted by the SCDPW Division of Vector Control has not identified mosquito breeding within Grand Canal. Although water movement in the canal is limited, there is apparently enough water depth and flow to allow access by fish and other predators. Representatives of Vector Control and the SCDHS Division of Public Health verified the absence of larvae in the canal this summer. This included a historical review of records of arboviral findings within three miles of the Grand Canal area. The Division of Public Health concluded that there is little relationship between the canal and arboviral findings.

Suffolk County Vector Control has however, identified several sites near the Grand Canal as primary breeding areas for mosquitoes. Although none of these sites are directly in Grand Canal itself, several are associated with freshwater and tidal wetlands that border the canal (Figure 2). Three of these sites are considered major mosquito breeding areas that are large enough to require the use of a helicopter to treat them regularly with larvicides.

Major vector species associated with these sites are *Ochlerotatus sollicitans, Oc. taeniorhynchus* and Oc. *cantator* in the salt marsh. Mosquito species breeding within the adjacent freshwater wetlands and along the upper reaches of the salt marsh are primarily *Culex pipiens/restuans* and *Aedes vexans.* Arboviral surveillance shows that during the period of 1999 to 2003, there have been 29 West Nile Virus (WNV) positive birds and 8 WNV positive mosquito pools found within a three-mile radius of the Grand Canal. In 1997, there were 5 Eastern Equine Encephalitis virus positive mosquito pools found one mile to the north of the Grand Canal at Connetquot River State Park.

Breeding potential at these three main sites, and several smaller ones near the canal, may actually have been created or exacerbated by earlier dredging projects in Grand Canal where dredge spoil was placed on a berm along the canal. This dredge spoil berm cut off tidal circulation to these marshes, causing rain and flood waters to accumulate on the marsh surface and created ideal breeding grounds for mosquitoes. In an effort to restore some tidal circulation to this marsh, Vector Control installed several culverts and opened a small breach along the berm. However, more substantial restoration work would be appropriate to restore the proper hydrology to the site and to reduce mosquito breeding.

Suffolk County Vector Control Primary Breeding Sites
Grand Canal Region - Oakdale

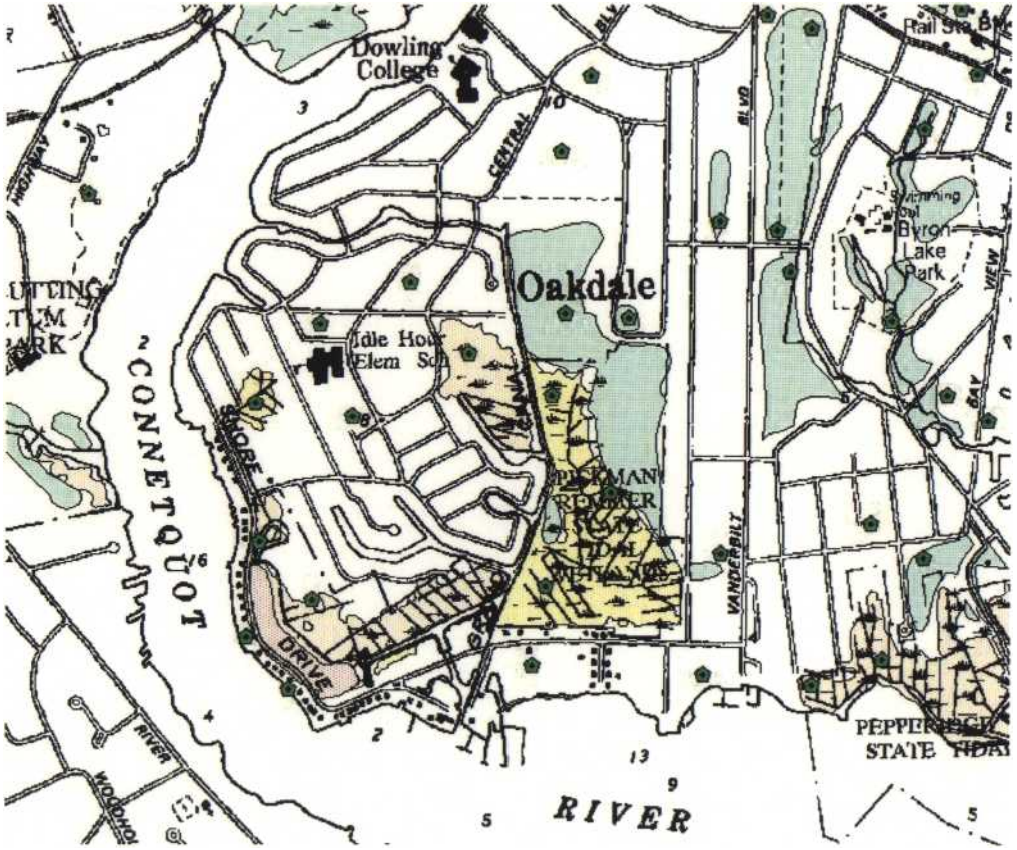

Figure 2

According to SCDPW, in their current condition these wetlands require aerial larviciding ten or more times a year, and it would be very desirable to reduce or eliminate the need for pesticide spraying via proper water management.

Dredging of Grand Canal, together with marsh restoration efforts and water management, would be expected to have a beneficial impact on reducing mosquito breeding in the area. Dredging of the canal, in conjunction with a program utilizing progressive Open Marsh Water Management (OMWM) techniques, should be considered as a first step of a comprehensive plan to fully restore the hydrology of the degraded wetlands. Such a project would need to be conducted with the cooperation of the primary owner of the wetlands along the Grand Canal: the New York State Department of Environmental Conservation (NYSDEC).

Open Water Marsh Management (OMWM)

The most effective, economical and potentially environmentally benign means of control for salt marsh mosquitoes is to manage their habitat such that the breeding of larvae and the subsequent propagation of adults is minimized. In the past, the practice of constructing mosquito grid ditches was intended as a means to drain the upper reaches of marshes in order to eliminate mosquito habitat. It is now widely recognized that this approach is only partly effective, in that all breeding sites may not be addressed by the grid pattern. Where tidal flow is limited, it is particularly difficult to provide adequate habitat for predatory fish. This is especially true for the marshes that are separated from Grand Canal by a dike. As a result, the application of mosquito larvicides (and potentially adulticides) has been necessary for mosquito control.

Open Marsh Water Management is a habitat restoration and mosquito control technique designed to re-establish natural flow patterns in ditched marshes. An OMWM project may involve a variety of procedures, including the plugging or filling of selected ditches, re-opening natural tidal creeks, and the excavation of small ponds to function as fish reservoirs. For an OMWM project to succeed, it is important that the marsh receive adequate tidal flow to ensure that marsh channels and ponds have water quality capable of supporting fish. OMWM has been successfully implemented in a number of areas of the northeast, including New Jersey, Connecticut, and Rhode Island. Currently in Suffolk County, an OMWM demonstration project is underway at the Wertheim National Wildlife Refuge as part of the Suffolk County Vector Control and Wetlands Management Long-Term Plan.

Dredging

***Dredging** History:* The Suffolk County Department of Public Works (SCDPW) has not dredged Grand Canal in the past, although the feasibility was briefly investigated in 1983. A hydrographic survey determined that there was adequate depth for navigation at that time.

Project Approvals: Grand Canal was approved for "interface dredging" in December of 2002 by the Dredging Projects Screening Committee (interface dredging clears sediment from the entrance of a canal or waterway). Other high priority projects have prevented the SCDPW from progressing with further investigation, as the Town of Islip has not requested the canal to be placed on the SCDPW priority list. The approved channel is approximately 500 ft. long adjacent to the marina at the south entrance of Grand Canal. Approval for dredging the entire length of Grand Canal (approximately 8,000 ft.) was tabled at the meeting.

- ***Sediment Composition:*** Four sediment samples from Grand Canal were recently obtained and analyzed by the SCDPW. According to the results of a grain-size analysis (Table 4), the sediment is composed mostly of fine silty material.

- ***Dredge Volume:*** Based upon an average channel width of 20 ft. (to maintain a safe distance from existing bulkheads), a design depth of 5 feet below Mean Low Water (which would yield an average depth of cut of 2.5 ft.), and a canal length of 8,000 ft., the estimated quantity of sediment to be dredged is 15,000 cubic yards.

- *Sediment Disposal:*
  a. Open Water Disposal (Surf Zone Disposal): This method of disposal utilizes direct discharge of dredged sediment into the ocean. Open water disposal is unacceptable to the regulatory agencies.

  b. Beach Nourishment: Beaches are sometimes replenished by pumping a mixture of sand and water onto them from a hydraulic dredging project. The high percentage of silt and clay found in Grand Canal makes it unsuitable for beach nourishment.

  c. Upland Disposal in a Containment Dike: This is the preferred method for disposing of sediment with a high percentage of fine material. A mixture of water and dredged sediment is pumped into a containment dike, settlement of the fine particles is allowed to occur, and clear water is allowed to return to the waterway through a spillway and effluent pipes.

Table 4. Results of Sediment Grain Size Analysis (% Passing)				
	Sample No.			
Sieve Size	**1**	**2**	**3**	**4**
3/4" (19mm)			*See*	100
1/2" (12.5mm)			*Note*	98
3/8" (9.5mm)			*Below*	*94*
1/4" (6.3mm)				91
No. 4 (4.75mm)				89
1/8" (3.17mm)				87
No. 8 (2.36mm)				86
No. 10 (2.00mm)				86
No. 16 (1.18mm)			100	83
No. 20 (0.850mm)	100	100	99	80
No. 30 (0.600mm)	99	99	97	74
No. 40 (0.425mm)	97	97	91	64
No. 50 (0.300mm)	93	96	84	55
No. 80 (0.180mm)	89	94	70	52
No. 100 (0.150mm)	85	93	66	48
No. 200 (0.075mm)	81	91	56	45
No. 230 (0.063mm)	81	90	55	44
No. 270 (0.053mm)	80	89	55	43
Note: Sample # 3 contained 36.0% organic material				

Sediment Sampling Locations	
Sample No. 1	1500'± N/o southern canal entrance near Shore Dr. 425't S/o Tower Mews Rd. in center of canal at intersection of Grand Canal and small canal running south towards the marina
Sample No. 2	1300'±N/o Sample #1. 200'± NE/o intersection of Canal Rd and Edgewater Rd. Taken in the center of the intersection of Grand Canal and small canal that runs to the west
Sample No. 3	1900't N/o Sample #2. 200'± S/o Central Blvd, and 250'± W/o Hollywood Dr. Bridge. Taken in the center of the canal
Sample No. 4	2000'± W/o Sample #3. 300'± E/o the north entrance to Grand Canal. Taken in the center of the canal

- ***Possible Upland Dike Sites:*** Three viable sites for containment dikes have been identified (Table 5, Appendix III). A combination of sites may be necessary to dispose of the estimated 15,000 cubic yards of material to be dredged from the canal.

Table 5. Potential Upland Sites for Spoil Disposal				
Dike Location	**Land Area** (acres)	**Estimated Capacity (cubic yards)**	**Maximum Pumping Distance (feet)**	Comments
Area 1	3.0	13,500	6,500	Town owned drainage reserve area
Area 2	2.0	9,000	8,000	County owned, Timber Pt. Park
Area 3	1.3	6,000 (if emptied)	15,000	Current dike is full of material from prior dredging. Owned by St. John's University
Reference Calculation: (750cy/ac/ftx6ft high fill) All quantities are approximate and subject to survey				

Project Complications:

1. Low Clearance Bridges - There are four low clearance bridges, which would hinder mobilization and operation of the small 6-inch dredge. In order for the dredge to work past the bridge obstructions, it may be necessary to partially dismantle and reassemble it, or completely remove the dredge from the canal using a crane. This additional procedure will add extra equipment, time, and cost to the project.

2. Private Bulkhead Condition - The canal is lined with individually owned private bulkheads of unknown embedment depths. Significant portions of the bulkheads are in poor condition, which could be undermined without a carefully planned channel width for the dredging operation. Before dredging could commence it would be necessary for the adjacent owners to provide the County with ***Hold Harmless Agreements.***

3. Odors Generated - Dredging of the highly organic sediments may release noxious sulfide odors to the surrounding area. These odors are expected to be temporary during the dredging operations, but may persist for some time in the spoil area.

- ***Permitting Process:*** There are three regulatory agencies that must approve a proposed dredging project through a permit application process. All three regulatory agencies include a period of public notice and comment in their permit review processes.

    1. The NYS Department of State issues a Letter of Concurrence if the project complies with the State's Coastal Management Program (CMP).

    2. The Department of Environmental Conservation issues a Work Permit and a Water Quality Certificate according to State Environmental Conservation Law (ECL).

    3. The US Army Corps of Engineers issues a Work Permit according to comments from Federal Agencies, such as the National Marine Fisheries Service, the Fish and Wildlife Service, the US Environmental Protection Agency, and the US Coast Guard.

Regulations

Under Suffolk County law, in order for a dredging project to be approved it must be judged to be in the public interest. Criteria for making this determination are set forth in Article 8-5 of the county's Administrative Code. The full text of the article is included in Appendix II. The Criteria for county dredging projects states in section A8-5 B (5) that:

A dredging project shall be deemed to be in the public interest if it supports, advances or enhances the following types of uses activities and/or facilities: 5) Recreational uses, ***including but not limited to*** *(emphasis added) boat livery stations, party boats, charter boats, marinas and yacht clubs open to use by the general public.*

Recreational uses of the canal would certainly be enhanced by dredging and this section of the Criteria does not exclude the canal from consideration. Section A8-5 B (1) allows dredging at a boat ramp with parking for *at least six cars with trailers*. There can be little doubt that a canal that provides docking for more than 100 recreational boats provides greater recreational opportunities than a ramp with parking for six vehicles. It is inconsistent to differentiate the public interest by including a boat ramp that may be utilized by a half-dozen individuals in the dredge criteria versus more than 100 boat owners on Grand Canal.

The criteria relevant to a public health reason are contained in section A8-5 B (6), of the criteria that reads as follows:

Reduction of the risk of public health problems based upon a certification by the Suffolk County Department of Health Services that the public health will be protected by dredging for the particular year the channel is proposed to be dredged.

Poor flushing of the canal and altered marsh features contribute to high levels of mosquito breeding in the adjacent wetlands. West Nile Virus positive birds and mosquito pools have been documented in the area. Mosquito breeding areas along the South Shore in the vicinity of Grand Canal are not uncommon. However, efforts to reduce mosquito breeding to minimize risk to public health are certainly prudent, especially in light of the findings of West Nile Virus-positive birds and mosquito pools in the area. Enhanced management of the greater Grand Canal area (including adjacent wetlands) presents such an opportunity to reduce mosquito breeding, with multiple ancillary benefits of minimizing pesticide usage and restoring hydrology and ecology.

Conclusions&Recommendations

The water quality monitoring conducted for this assessment clearly indicates that Grand Canal is significantly impacted by nutrient enrichment and potentially, by pathogen contamination. The excessive levels of nitrogen found in the canal suggest that algal blooms, and the consequential reduction in water clarity and depleted levels of dissolved oxygen, are a common occurrence. Potential sources of contamination include stormwater runoff from fertilized lawns and roadways, area wildlife, and perhaps, improperly functioning residential septic systems. Whatever the source however, the effect is exacerbated by the canal's low tidal prism and lack of flushing. A dredging project designed to increase flow in the canal will undoubtedly have a positive effect on its ecology.

The county dredging criteria does not exclude the canal from consideration. Recreational uses of the canal by the public, assuming more than 100 taxpaying boat owners are considered "the public," would be enhanced by dredging. Docking for more than 100 recreational boats provides greater recreational opportunities for Suffolk County residents than the criteria of a ramp with parking for six vehicles. Moreover, the canal itself is a waterway accessible for public usage and touring.

Mosquitoes do not breed directly within the canal, but the adjacent wetlands are primary breeding areas. Vector Control has identified through arboviral surveillance efforts 29 West Nile Virus (WNV) positive birds and 8 WNV mosquito pools within a 3-mile radius of the canal. Mosquito control is a public health management issue requiring multiple larvicide events annually. The best method of addressing this public health issue is through source control and abatement. In this case the wetlands bordering Grand Canal are inadequately flushed, providing a mosquito habitat. Dredging the canal, in conjunction with an OMWM strategy to provide greater water flows to the surrounding

marshlands, would be a major step in alleviating the mosquito problem in areas adjacent to the Grand Canal.

Dredging of Grand Canal could result in improvements in water quality, reduction in the use of pesticides, and enhancement of recreational uses. It is, therefore, recommended that a comprehensive program to design and implement an OMWM/dredging strategy be considered. Development and implementation of such a program should be eligible for 1/4% Sales Tax Water Quality Protection and Restoration Program funding.

Article XII Section C12-2 of the Suffolk County Charter (Drinking Water Protection Program) addresses programmatic expenses permissible under the 1/4% program. Under sub-section (a), which refers to projects recommended by the management plans of South Shore Estuary Reserve (SSER), Peconic Estuary Program (PEP), and/or the Long Island Sound Study (LISS), it appears that the proposed Grand Canal project would qualify under the *"wetlands preservation and enhancement"* and *"open marsh water management"* criteria of the *Aquatic Habitat Restoration* category.

Appendix I

Organic Constituents Analyzed by the Suffolk County Public & Environmental Health Laboratory

(Analytes detected appear in boldface type)

Group	Analyte
Carbamate pesticides	
3-Hydroxycarbofuran	Carbofuran
Aldicarb	Methiocarb
Aldicarb sulfone	Methomyl
Aldicarb sulfoxide	Oxamyl
A-Naphthol	Propoxur
Carbaryl	
Herbicide Metabolites	
2,4,5-T	Didealkylatrazine
2,4-D	Imidacloprid
2,4-DB	Malaoxon
2,6-Dichlorobenzamide	MCPA
2-Hydroxyatrazine	MCPP
3,5-Dichlorobenzoic Acid	Metolachlor ESA (CGA-354743)
4-Nitrophenol	Metolachlor Metabolite (CGA-37735)
Acifluorfen	Metolachlor Metabolite (CGA-40172)
Alachlor ESA	Metolachlor Metabolite (CGA-41638)
Alachlor OA	Metolachlor Metabolite (CGA-67125)
Bentazon	Metolachlor OA (CGA-51202)
Chloramben	Pentachlorophenol
Deisopropylatrazine	Picloram
Desethylatrazine	Propamocarb hydrochloride
Dicamba	Silvex (2,4,5-TP)
Dichloroprop	
Chlorinated Pesticides	
4,4 DDD	Dieldrin
4,4 DDE	Endosulfan I
4,4 DDT	Endosulfan II
Alachlor	Endosulfan sulfate
Aldrin	Endrin
Alpha - BHC	Endrin aldehyde
Beta - BHC	Gamma - BHC
Chlordane	Heptachlor
Dacthal	Heptachlor epoxide
Delta - BHC	Methoxychlor

Semi-volatile Organic Compounds (SVOCs)	
Acenaphthene	Diethyltoluamide (DEET)
Acenaphthylene	Dimethyl phthalate
Acetochlor	Dinoseb
Allethrin	Dioctyl phthalate
Anthracene	Disulfoton
Atrazine	Disulfoton sulfone
Azoxystrobin	EPTC
Benfluralin	Ethofumesate
Benzo(a)anthracene	Ethyl parathion
Benzo(b)fluoranthene	Fluoranthene
Benzo(ghi)perylene	Fluorene
Benzo(k)fluoranthene	Gemfibrozil
Benzo-a-pyrene	Hexachlorobenzene
Benzophenone	Hexachlorocyclopentadiene
Benzyl butyl phthalate	Hexachloroethane
bis(2-ethylhexyl) adipate	Ibuprofen
bis(2-ethylhexyl) phthalate	Indeno(1,2,3-cd)pyrene
Bloc	Iodofenphos
Bromacil	Iprodione
Butachlor	Isofenphos
Butylated Hydroxyanisole	Kelthane
Butylated Hydroxytoluene	Malathion
Caffeine	Metalaxyl
Carbamazepine	Methoprene
Carbazole	Methyl parathion
Carisoprodol	Metolachlor
Chlorofenvinphos	Metribuzin
Chlorothalonil	Naled (Dibrom)
Chloroxylenol	Napropamide
Chlorpyriphos	Pendimethalin
Chrysene	Pentachlorobenzene
Cyanazine	Pentachloronitrobenzene
Cyfluthrin	Permethrin
Cypermethrin	Phenanthrene
Deltamethrin	Piperonyl butoxide
Diazinon	Prometon
Dibenzo(a,h)anthracene	Prometryne
Dibutyl phthalate	Propiconazole
Dichlorbenil	Pyrene
Dichlorvos	Resmethrin
Diethyl phthalate	Siduron

Semi-volatile Organic Compounds (SVOCs)	
Simazine	Trichlorfon
Sumithrin	Triclosan
Tebuthiuron	Trifluralin
Terbufos	Vinclozolin
Triadimefon	
Volatile Organic Compounds (VOCs)	
1,1,1,2-Tetrachloroethane	**Benzene**
1,1,1-Trichloroethane	Bromobenzene
1,1,2,2-Tetrachloroethane	Bromochloromethane
1,1,2-Trichloroethane	Bromodichloromethane
1,1-Dichloroethane	Bromoform
1,1-Dichloroethene	Bromomethane
1,1-Dichloropropene	**Carbon disulfide**
1,2 dibromoethane	Carbon Tetrachloride
1,2 dibromomethane	Chlorobenzene
1,2,3-Trichlorobenzene	Chlorodibromomethane
1,2,3-Trichloropropane	Chlorodifluoromethane
1,2,4,5-Tetramethylbenzene	Chloroethane
1,2,4-Trichlorobenzene	Chloroform
1,2,4-Trimethylbenzene	Chloromethane
1,2-Dichlorobenzene (o)	**cis-1,2-Dichloroethene**
1,2-Dichloroethane	cis-1,3-Dichloropropene
1,2-Dichloropropane	Dibromomethane
1,3,5-Trimethylbenzene	Dichlorodifluoromethane
1,3-Dichloropropane	Diethyl ether
1,4-Dichlorobuane	Dimethyldisulfide
1-Bromo-2-chloroethane	d-Limonene
1-Methylethylbenzene	Ethenylbenzene (Styrene)
2,2-Dichloropropane	**Ethylbenzene**
2,3-Dichloropropene	Ethylmethacrylate
2-Bromo-l-chloropropane	Freon 113
2-Butanone (MEK)	Hexachlorobutadiene
2-Chlorotoluene	Isopropylbenzene
3-Chlorotoluene	Isopropyltoluene (p-cymene)
4-Chlorotoluene	m,p-Dichlorobenzene
Acrylonitrile	Methacrylonitrile
Allyl chloride	Methyl isothiocyanate
Methyl sulfide	tert-Amyl-Methyl-Ether
Methylene Chloride	tert-Butylbenzene
Methylmethacrylate	tert-Butyl-Ethyl-Ether
Methyl-Tertiary-Butyl-Ether (MTBE)	**Tetrachloroethene**
m-Xylene	Tetrahydrofuran

Volatile Organic **Compounds** (VOCs)	
Naphthalene	Toluene
n-Butylbenzene	Total Chlorotoluene
n-Propylbenzene	**Total Xylene**
o-Xylene	trans-1,2-Dichloroethene
p-Diethylbenzene	trans-1,3-Dichloropropene
p-Isopropyltoluene	Trichloroethene
p-Xylene	Trichlorofluoromethane
sec-Butylbenzene	Vinyl Chloride

Appendix II

Laws of Suffolk County, Part II Administrative Code
§ A8-5. Criteria for County Dredging Projects

A. A. No proposed county dredging project shall be approved by the Dredging Project Screening Committee nor by the County Legislature unless such project shall be in the public interest.

B. A dredging project shall be deemed to be in the public interest if it supports, advances or enhances the following types of uses, activities and/ or facilities:

1. Publicly owned, leased and/or operated marine facilities, including but not limited to mooring areas, boat basins, marinas, docks and boat ramps. Boat ramps need not consist solely of paved asphalt but may be composed of concrete, treated lumber, gravel or crushed stone extending to the mean low water mark. The parking areas associated with such a facility must accommodate at least six cars with trailers and may be composed of smooth grassed area, crushed stone, pavement or concrete. A public mooring area within an enclosed embayment must have within its proximity a publicly owned parcel of land fronting on the embayment permitting public access in order to qualify as a public purpose.

2. Marine commercial uses, including but not limited to boatyards, ship repair facilities, commercial fishery docks and product transfer sites.

3. Industrial, transportation and utility uses, including but not limited to petroleum product transfer facilities, ferry terminals and power plants.

4. Institutional uses such as education and public safety facilities.

5. Recreational uses, including but not limited to boat livery stations, party boats, charter boats, marinas and yacht clubs open to use by the general public.

6. Reduction of the risk of public health problems based upon a certification by the Suffolk County Department of Health Services that the public health will be protected by dredging for the particular year the channel is proposed to be dredged.

7. Open water shoals outside of navigation channels to improve general navigation.

8. Obtaining fill from navigation channels for the purpose of beach nourishment and shoreline construction.

9. Mitigating damage or shoaling caused by the County of Suffolk.

10. Reduction of a navigational hazard caused by shoaling at bay-canal interfaces.

C. A dredging project shall be deemed to be in the private interest in the following circumstances:

1. It does not provide direct access to or service for any of the uses or facilities mentioned in Subsection B of this section.

2. It provides service solely and exclusively to shoreline homeowners or a group of homeowners in a civic association, the membership of which is controlled by a residency requirement, regardless of the nature of the water body.

3. It dredges within privately owned facilities.

4. It only maintains privately owned boat slips or basins.

No proposed county dredging project shall be approved by the Dredging Project Screening Committee nor by the County Legislature unless the county shall have first conducted soundings or other reliable and accepted measurements in accordance with normal engineering practices and procedures of the area to be dredged to determine the estimated cost of such proposed work.

Appendix III
Aerial Images of Potential Upland Sites for Spoil Disposal

Area #1 Owner: Town of Islip (drainage reserve area)
Approx. 3 ac. 6,500' pumping distance

Area #2 Owner: County of Suffolk
Approx. 2 ac. 8,000' pumping distance

Area #3 Owner: St. John's University
Approx. 1.3 ac. 15,000' pumping distance