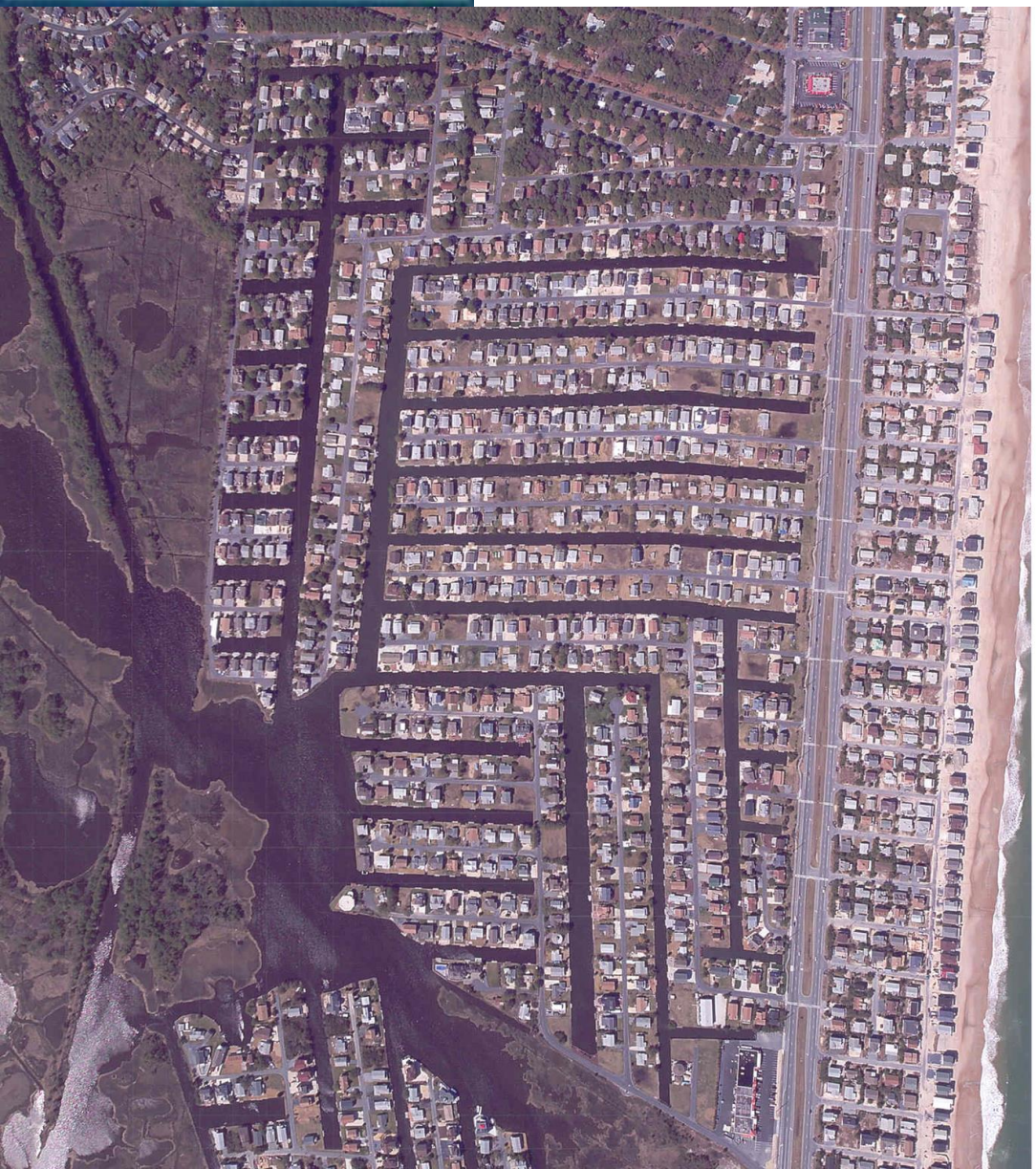


TOWN OF SOUTH BETHANY

Canal Water Quality Meeting

2 PM Wednesday,
September 12, 2007

at the
Ocean View Town Hall

Sponsored by the SBPOA

Agenda – **Canal Water Quality Meeting**

1. **Introduction and Welcome** (George Junkin, Vice President SBPOA)
2. **Purpose of Meeting** (George Junkin, Vice President SBPOA)
3. **Town of South Bethany Actions to Improve Canal Water Quality**
   (Jay Headman, Town Councilman, Chairman of South Bethany Canal Water Quality Committee)
   A. Tidal Pump Project
   B. Dredging
   C. Oyster Gardening
   D. Water Quality Monitoring Program
   E. Canal Water Quality Committee
   F. Education Project
4. **Town of South Bethany Tidal Pump Project** (Gary Jayne, Mayor)
   A. Overview
   B. "South Bethany Canals Flushing Study: Proposed Tidal Pump System
5. **Stormwater Runoff Emphasis on Route 1** (George Junkin, Vice President SBPOA)
   A. History of Monitoring Studies
   B. Possible Alternatives to Improve Current Conditions
6. **Pollution Sources and Solutions for South Bethany Canals**
   (Christopher Bason, Science & Technology Coordinator, Delaware Center for the Inland Bays)
7. **Next Steps** (All)
   What actions can we take to make the South Bethany Canals and Little Assawoman Bay "Fishable and Swimable"?

Town of South Bethany Actions to Improve Canal Water Quality - Jay Headman

A. Tidal Pump Project
B. Dredging
C. Oyster Gardening
D. Water Quality Monitoring Program
E. South Bethany Canal Water Quality Committee
   - Goal is to make canals fishable and swimable
   - Focus areas
     - Educate the community
     - Work with town, county, state, and federal governments
     - Review current town ordinances
     - Work closely with the Center for the Inland Bays

F. Education

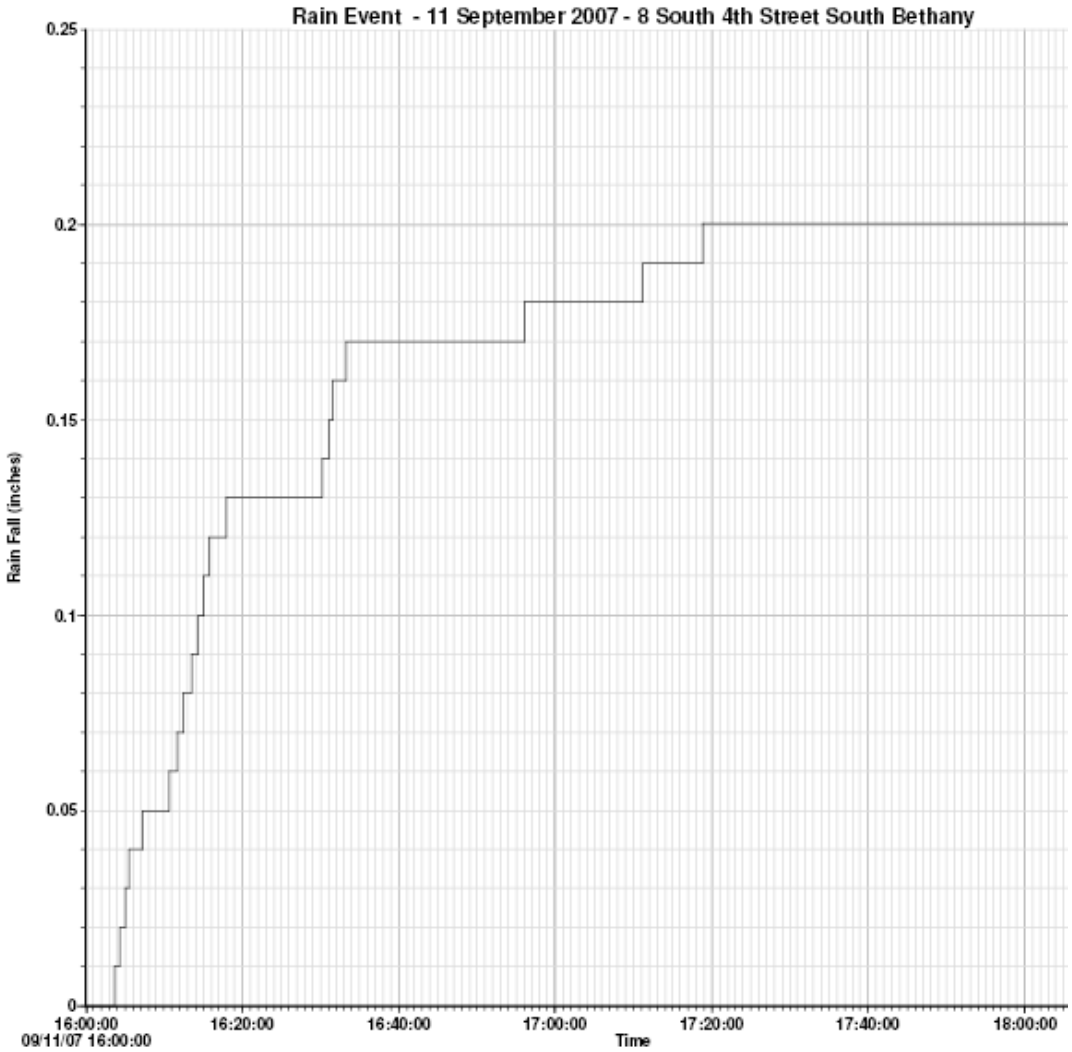
Al Allenspach is Leading the SBPOA Oyster Gardeners

Al Rae is Leading a Group to Monitor Water Quality in the South Bethany Canals

Quantities to be monitored:

- For "Fishable" Waters
  - Dissolved Oxygen
  - Water Temperature
  - Salinity
  - Nitrogen and Phosphorus
  - Secchi Depth
- For "Swimmable" Waters
  - Bacteria
- Storm Water Influence
  - Collect accurate local rain data

Yesterday's Rain Event of 0.2 inches Equates to 125 Gallons of Stormwater Runoff From a 1,000 Square Foot Roof



Town of South Bethany
Tidal Pump Project – Gary Jayne

8 Canal Feeder Pipes
18” Diameter

36” Diameter Pipe
1,600’ into the Ocean

36” Diameter Pipe
1,600’ into the Ocean

36” Diameter Trunk Line
Down Median of DE 1

Tidal Pump – Engineering Details

- Overall Configuration
- Calculations to determine piping
  - Lengths
  - Diameters
  - Material
- Locations for access manholes and shut off valves
- Instrumentation devices
- Environmental Factors
- Permitting
- Hydraulic Analysis

Tidal Pump – Significant Findings

- System is feasible and practical
- Performs as originally conceived
- Exchange of water will improve canal water quality
- Improvement in Little Assawoman Bay water quality
- Tidal differential will cause adequate water flow

No pumps are needed

- Design engineering estimated cost - $249,000
- Construction estimated cost - $5.2 - $6.7 million
- Annual operating maintenance estimated cost $18,400

Dye concentrations at initial conditions (start of dye dump)

Hours since start of dye dump

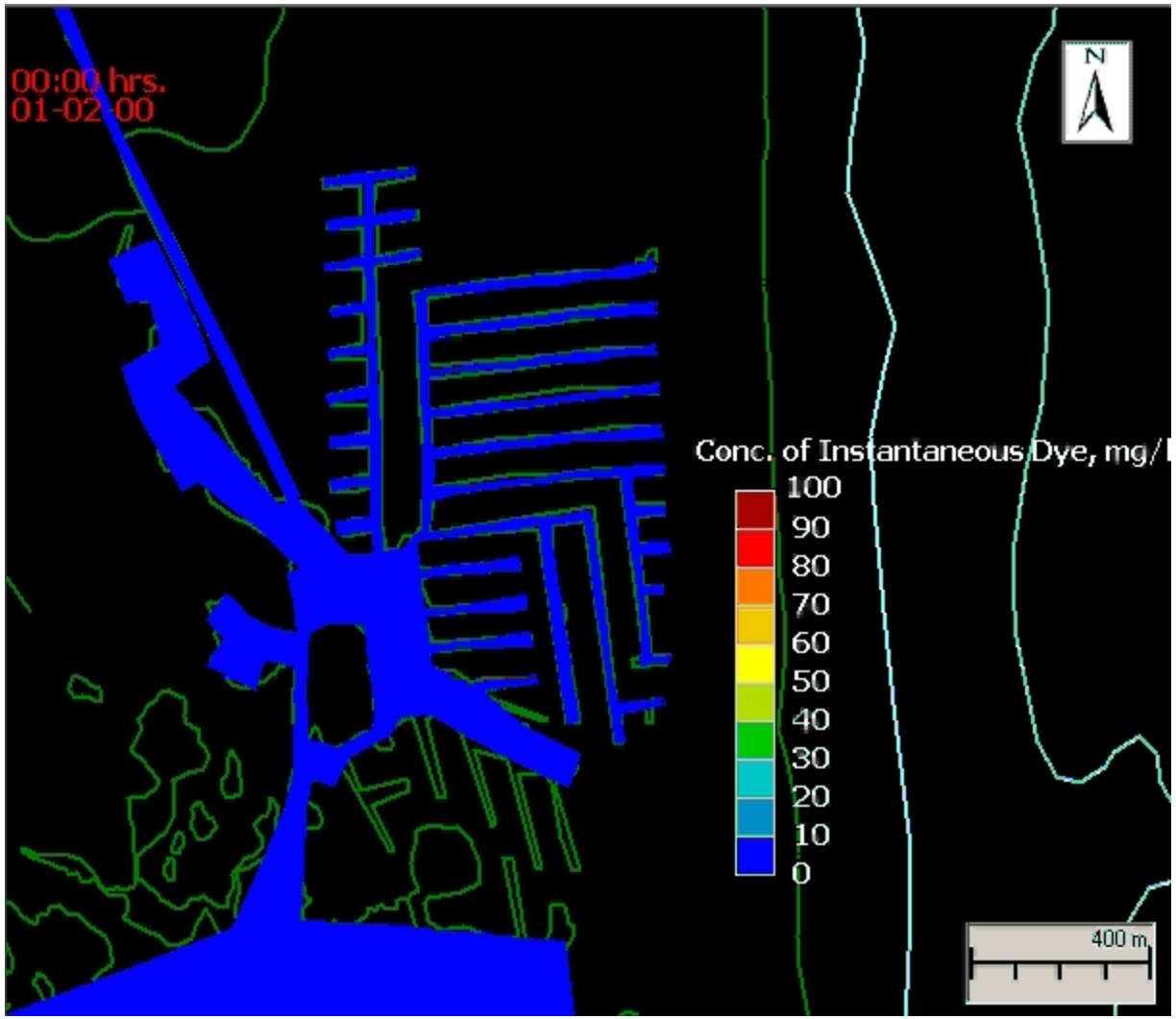
Date of model snapshot

Instantaneous Dye Dump
Current Conditions

Jan. 2, 2000
to
Apr. 30, 2000

Dye concentration starts at 100 mg/L on Jan. 2, 2000 within the canals

CLICK TO ANIMATE

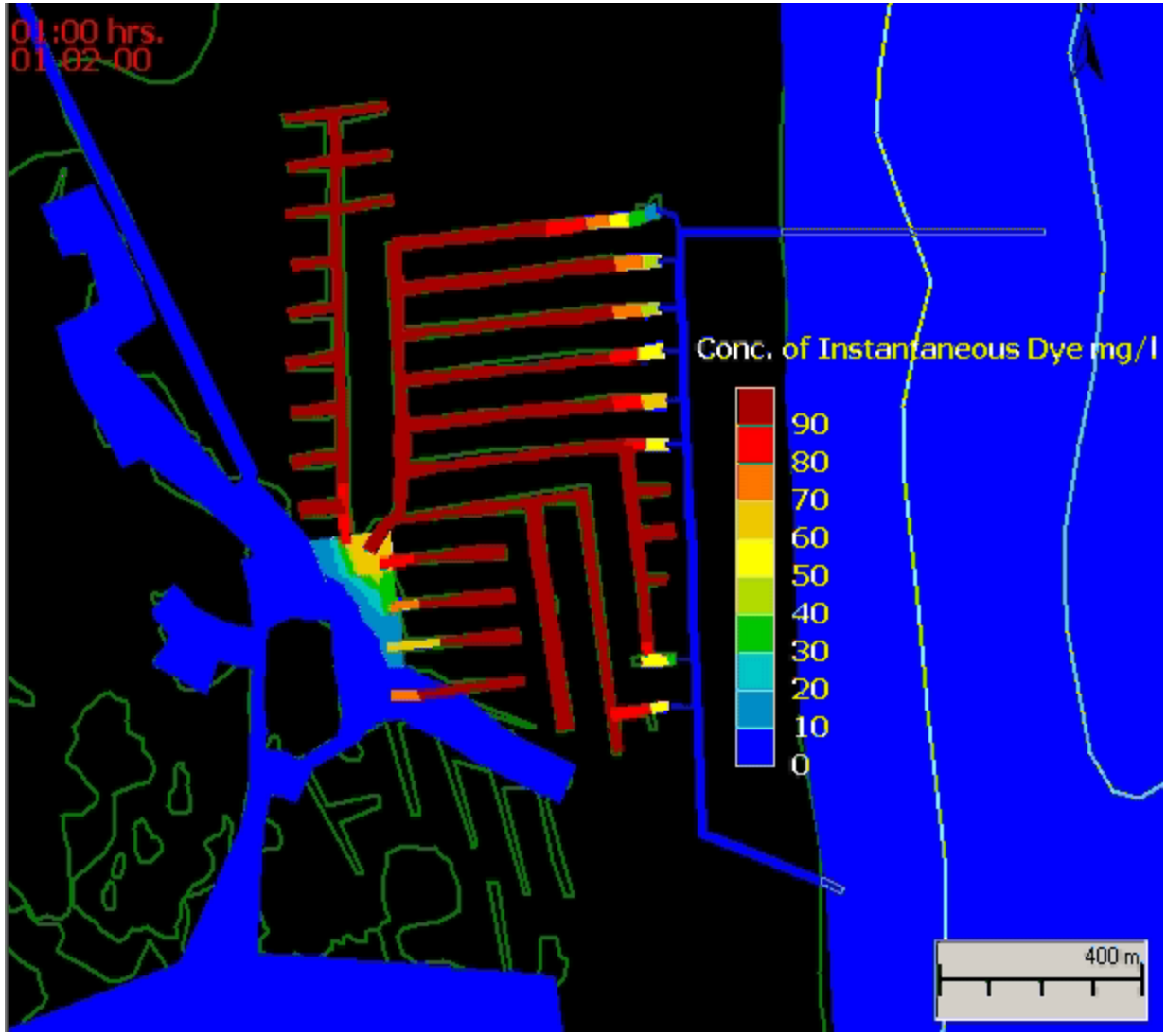


Instantaneous Dye Dump
Tidal Pump Conditions

Jan. 2, 2000
to
Jan. 31, 2000

Dye concentration starts at 100 mg/L on Jan. 2, 2000 within the canals

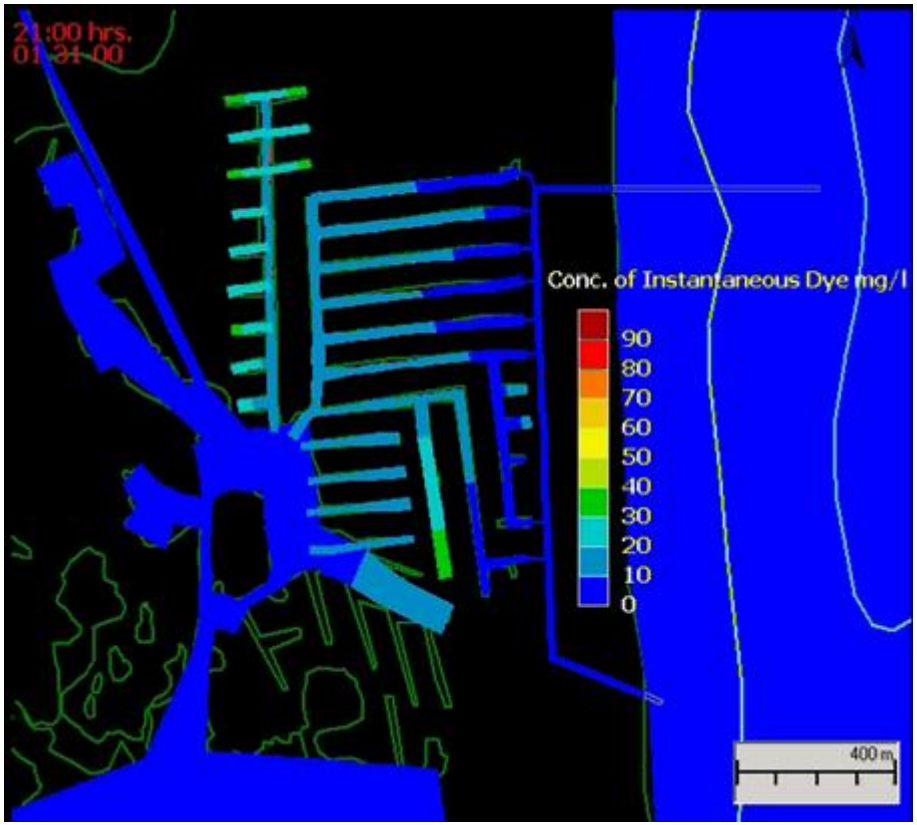
CLICK TO ANIMATE



Dye concentrations after 1 month from release

Current Conditions

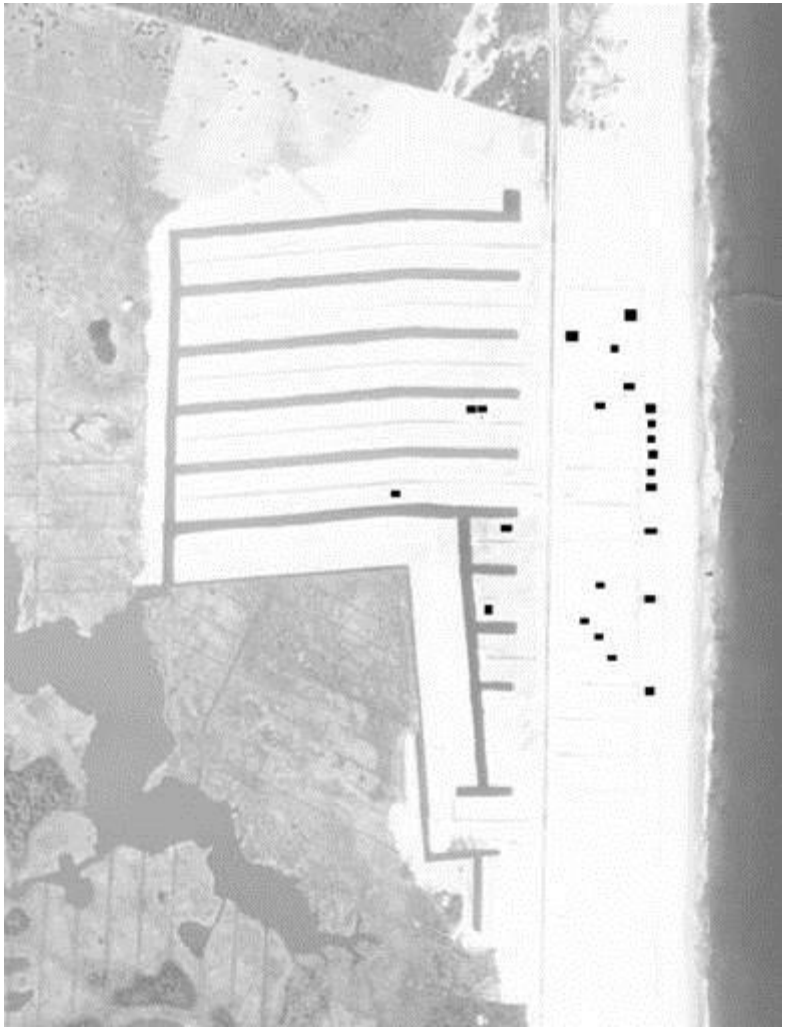
Proposed Tidal Pump



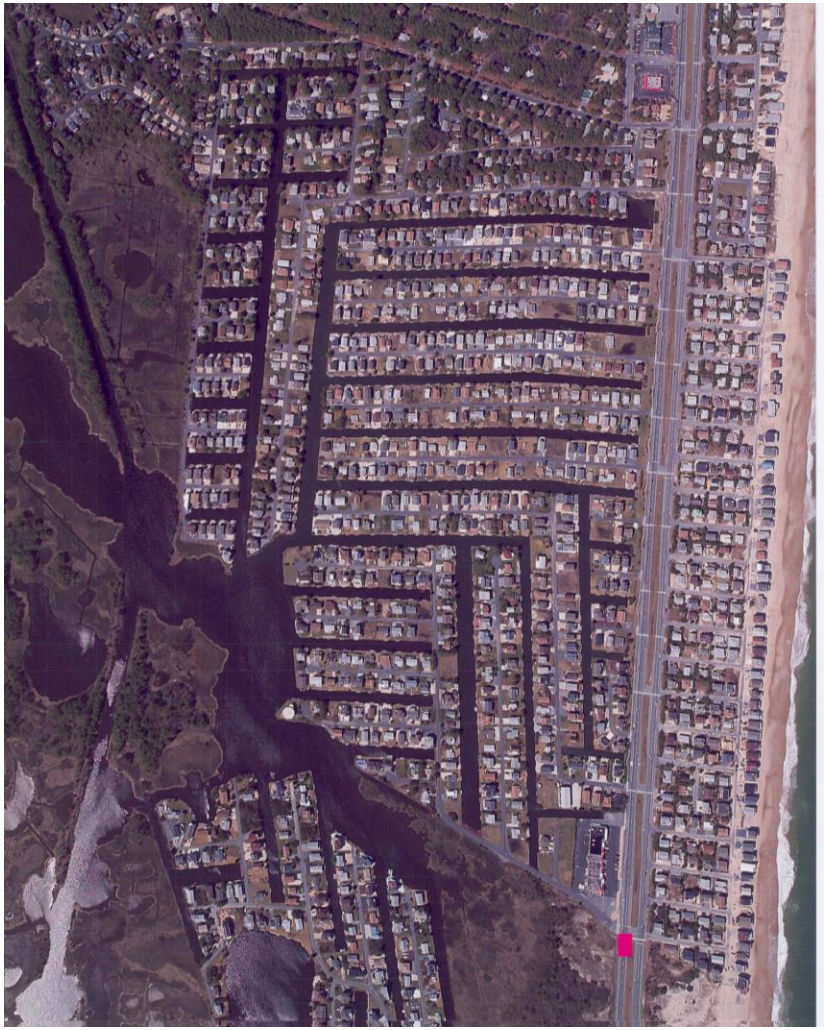
Agenda – **Canal Water Quality Meeting**

1. **Introduction and Welcome** (George Junkin, Vice President SBPOA)
2. **Purpose of Meeting** (George Junkin, Vice President SBPOA)
3. **Town of South Bethany Actions to Improve Canal Water Quality**
   (Jay Headman, Town Councilman, Chairman of South Bethany Canal Water Quality Committee)
   A. Tidal Pump Project
   B. Dredging
   C. Oyster Gardening
   D. Water Quality Monitoring Program
   E. Canal Water Quality Committee
   F. Education Project
4. **Town of South Bethany Tidal Pump Project** (Gary Jayne, Mayor)
   A. Overview
   B. "South Bethany Canals Flushing Study: Proposed Tidal Pump System
5. **Stormwater Runoff Emphasis on Route 1** (George Junkin, Vice President SBPOA)
   A. History of Monitoring Studies
   B. Possible Alternatives to Improve Current Conditions
6. **Pollution Sources and Solutions for South Bethany Canals**
   (Christopher Bason, Science & Technology Coordinator, Delaware Center for the Inland Bays)
7. **Next Steps** (All)
   What actions can we take to make the South Bethany Canals and Little Assawoman Bay "Fishable and Swimable"?

History of Monitoring Studies



In July 1954 South Bethany Canals Were Fishable and Swimmable



Development Has Reduced The Water Quality In South Bethany Canals

Summary of Studies, Monitoring And Efforts to Improve Canal Water Quality

Date	Location	Report, Study, Conference, or Measurements
1990-06-27	25 places	H2O & Air Temp., PH, DO, Sal., Bacteria
1990-08-10	6 places	Bacteria
1995		**Stormwater Charrette Focused on Land West of Rt. 1**
34 Times in 1996	**4 Sites along Anchorage & Petherton**	**Bacteria and Rain Data**
1997		**Maxted paper on Dead - End Canals**
13 Rain events in ’98, ‘99	**Anchorage**	**Precip., Runoff Volume, N, P, COD, Bacteria**
6 Months in ’01, ‘02	5 Canals	DO Increase Caused by Aeration 24 hour fish sampling
2003-05-17		Dead-End-Canal Conference
2004-04	**Anchorage**	**DelDOT Installs Sediment Forebay**
2004-04 to 2005-04	**Anchorage**	**Precip., Runoff Volume, Sedimentation Efficiency**
2006-05 to Present	Layton Russell & Anchorage	H20 & Air Temp, DO, Sal., Secchi Disk Just now starting to track Bacteria

1996 Lagoon Water Quality/Rainfall Study

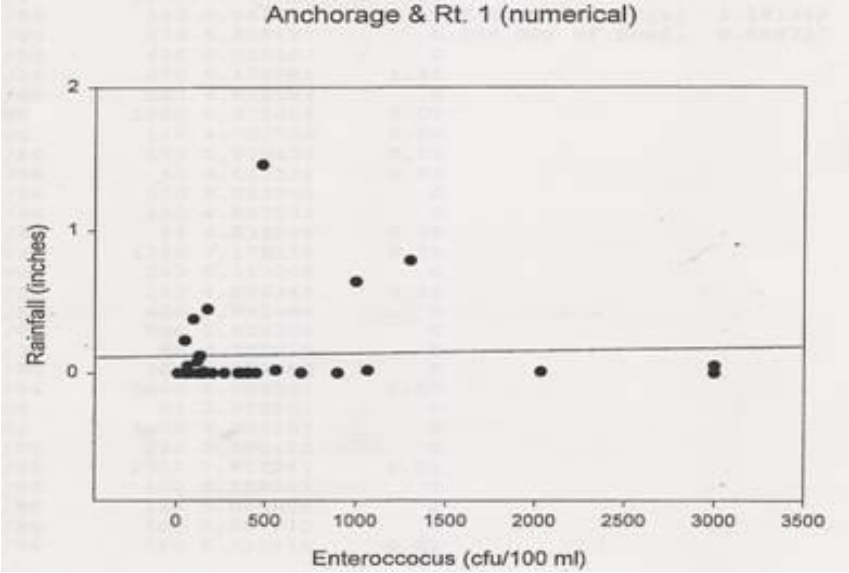
by Jack Pingree, Division of Water Resources, DNREC

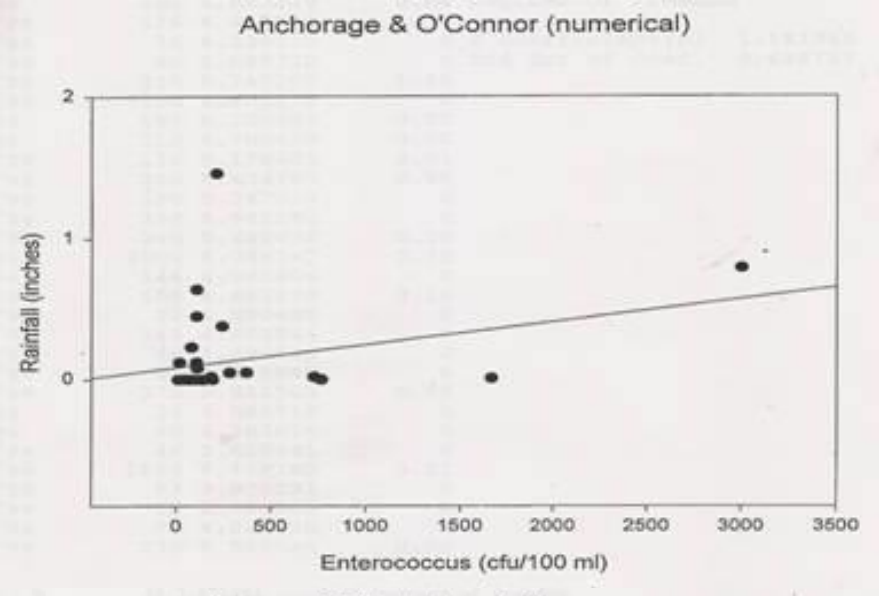
- Water Quality (Enterococcus Level) was measured 34 rain times between April 22, 1996 and August 28, 1996 at 4 sites. Swimming standard at the time was 156 cfu/100ml

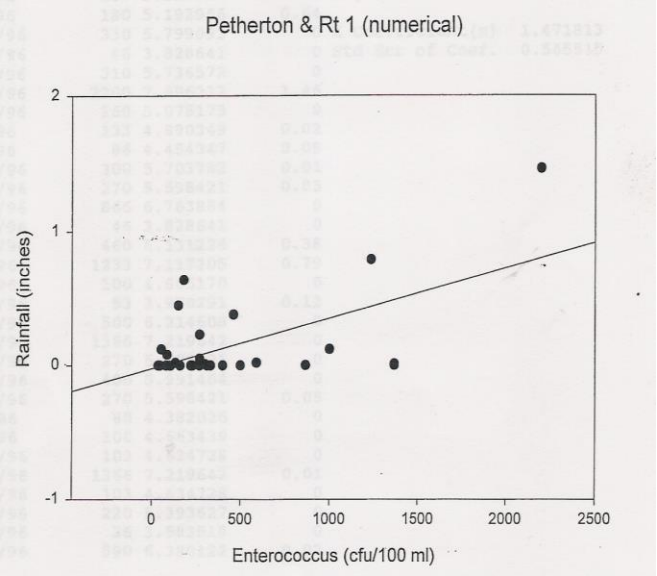
1. Anchorage & Rt. 1
   Exceeded standard 20 times
   Maximum measured 3,000 cfu/100ml
2. Anchorage & O'Connor home
   Exceeded standard 11 times
   Maximum measured 3,000 cfu/100ml
3. Petherton & Rt. 1
   Exceeded standard 20 times
   Maximum measured 2,200 cfu/100ml
4. Anchorage & Petherton
   Exceeded standard 7 times
   Maximum measured 2,166 cfu/100ml

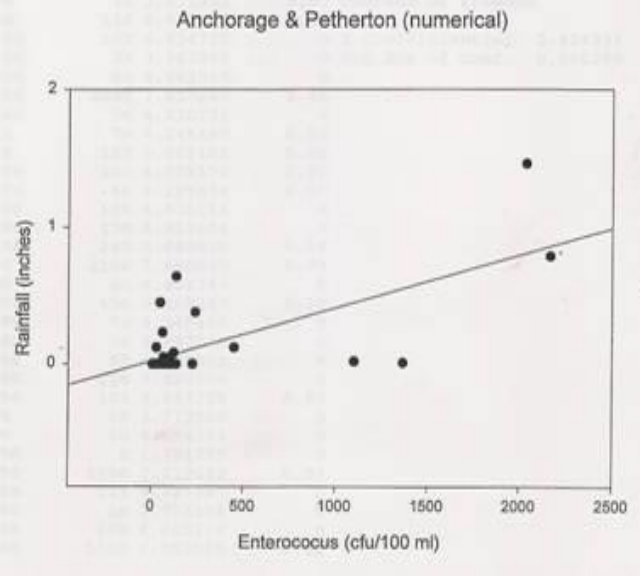
1996 Lagoon Water Quality/Rainfall Study

Plots of Rainfall Vs Water Quality







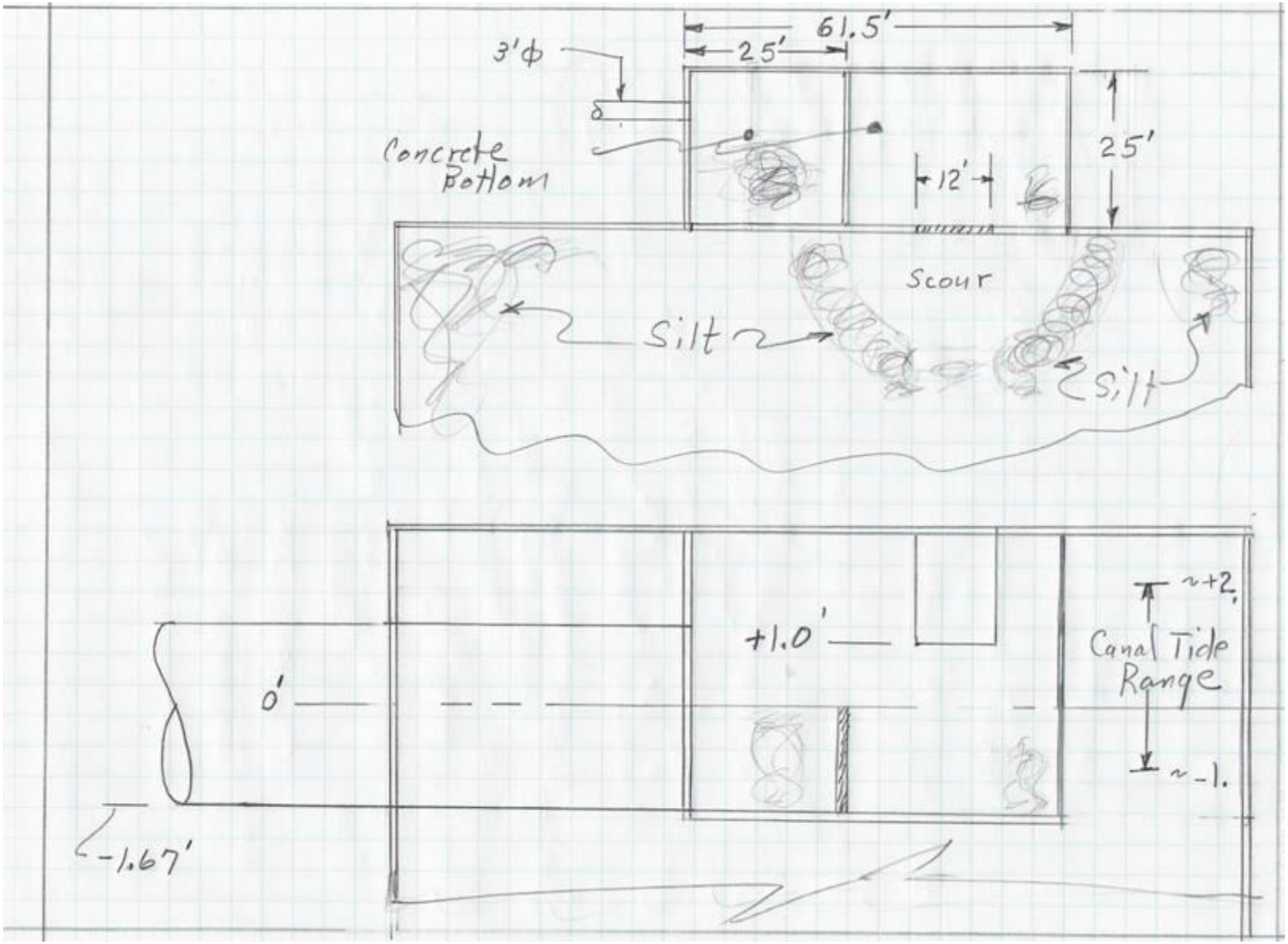


The January 2001 Report Characterized Storm Water Discharge Into The Anchorage Canal

- The study report documents that for each rainfall of about ½ inch during 1998 and 1999
  - About 360,000 gallons of stormwater were dumped into the Anchorage Canal.
  - During each event this stormwater contained
    - 6 pounds of Nitrogen
    - ½ pound of Phosphorous
    - 90 pounds of Chemical Oxygen Demand (COD) material
    - 10,000 to 100,000 colony forming units of fecal coliforms per 100ml of stormwater
- Previous Studies in the 1990s Documented oil slicks, heavy algae growths, foul odors, diminished water clarity and deposition of large amounts of silt.

In Early 2004 DelDOT Installed the Current Sediment Control Forebay at the Easterly End of the Anchorage Canal

Sketch and Dimensions for the Current Forebay



Sediment Control Forebay

36” Diameter Pipe

With an Invert Elevation of -1.67’

Timber Weir

Located 25’ into the Forebay

With Top Elevation of -0.00’

2005 Report Evaluates Efficiency of The Stormwater Sediment Control Forebay

Summary

The forebay captured a substantial amount of the storm water sediments that were destined for Anchorage Canal. Sediment capture efficiencies of forebays are typically from 50 to 90 % (USEPA, 1999), however these are based on designs for systems that have much longer residence times (24 hrs) and larger surface areas in relation to drainage area. Based on the small size of the forebay and minimal retention time the Anchorage Canal forebay performed as well as could be expected with an overall efficiency of 28 % based on volume.

The outflow design of the forebay needs modification as evidenced by the severe scour at the outfall. The outfall weir should either be widened to decrease outflow velocity and/or the canal bottom should be hardened to prevent erosion.

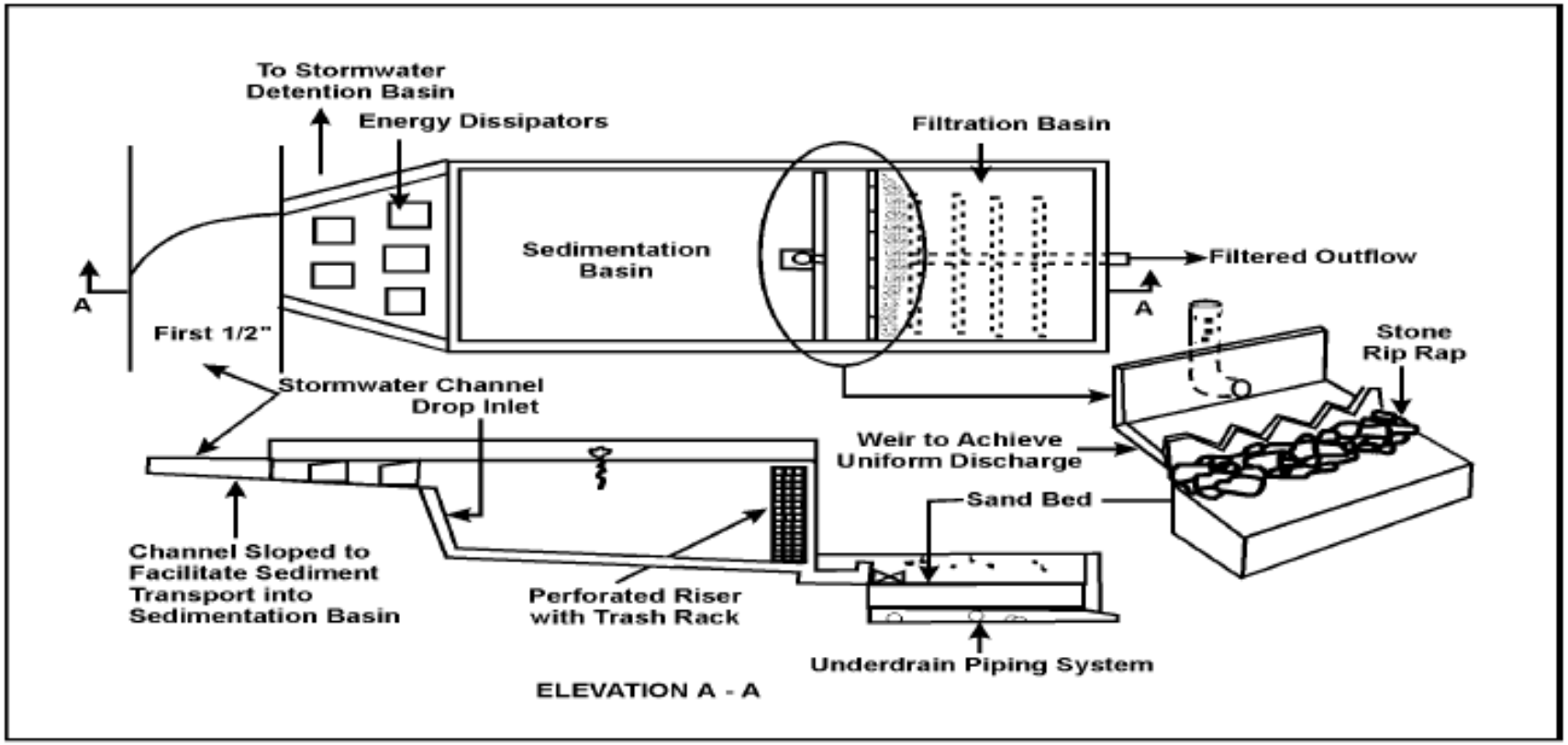
The evaluation year was completed without the occurrence of a major storm event. The largest storm monitored (7.59 cm, 3.0 in) was the equivalent of a 2-year return frequency 12-hour storm (Bonnin, et al., 2004). The ability of the forebay to trap the sediment in runoff from larger storm events can not accurately be estimated. Two factors will affect efficiency as storm water flow increases; at one point the overland flow will increase to a sufficient velocity to erode the sandy soil and transport it into the drainage system, substantially increasing the forebay loading rate. In addition, the higher velocity water flow through the forebay might re-suspend trapped sediments and flush them into the canal.

Potential Alternatives for Improving Storm Water Discharge Conditions Into the Anchorage Canal

- Alternatives suggested in the 2001 Characterization Report
  - Flow equalization basin coupled with a sand filter
  - Flow equalization basin coupled with a constructed wetland
  - Redirect stormwater to the Little Assawoman Canal
  - Redirect stormwater directly into the ocean
- Alternatives suggested in the 2005 Forebay Evaluation Report
  - Design the forebay to have longer residence times (24 hours)
  - Design the forebay to have more surface area
  - To reduce the canal scour increase the length of the spillway and/or harden the bottom of the canal.
- Concept Developed by Lloyd Hughes and Chris Bason
  - Capture all Route 1 stormwater runoff and pipe south through South Bethany to a constructed wetland in the State Park.
- Details of three significantly different alternatives follow.
  1. Sand Filter
  2. Artificial wetland
  3. Pipe to Ocean

1. Sand Filter – There is Zero Head Room Available For A Typical BMP at Anchorage

An Austin Sand Filter Which Can Accommodate Stormwater Run Off From Over 50 Acres Requires Over 6' of head.

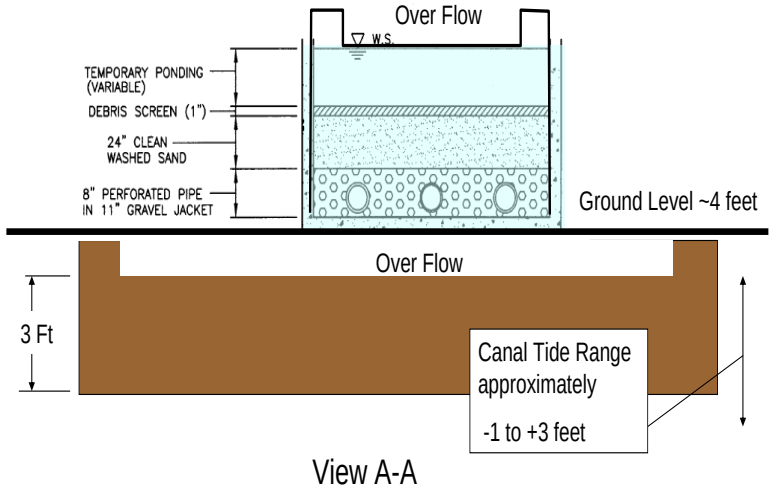


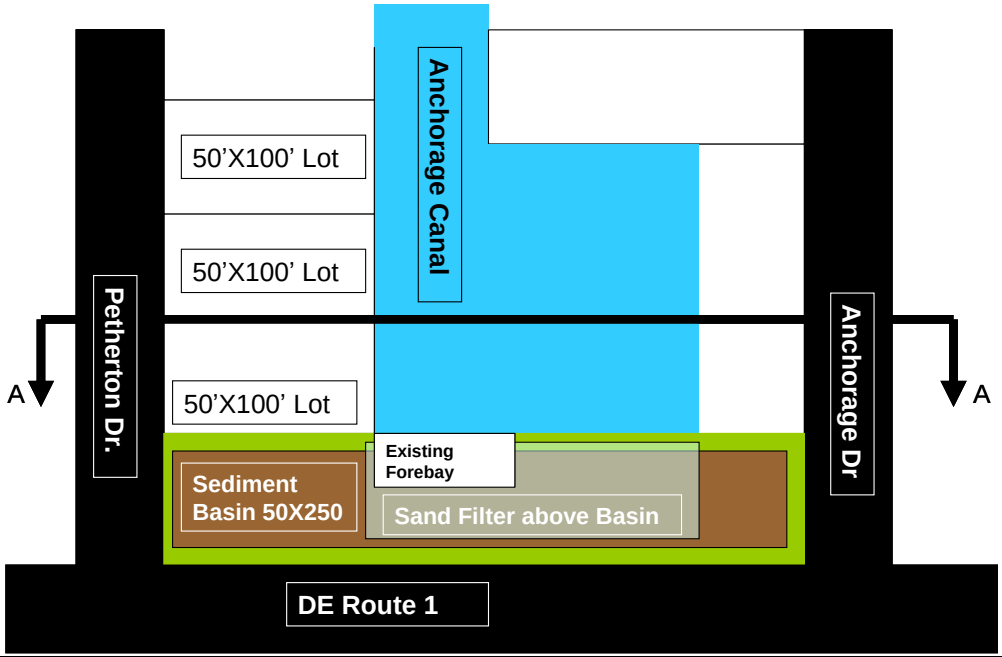
Source: Schueler, 1992.

FIGURE 1 TYPICAL AUSTIN SAND FILTER DESIGN

EPA 832-F-99-007, Sept.,1999, Stormwater Technology Fact Sheet – Sand Filters

An Innovative Approach Would Use A Low Flow Rate (200 GPM) Pump To Overcome The Zero Head Room Issue





In this innovative approach

- The sand filter is above the sediment basin
- A low volume pump empties the sediment basin into the sand filter over a 24 hour period

Note:

The sedimentation filter, designed per EPA 832-F-99-007 is significantly larger than the existing forebay

What Would A Sand Filter Do For Us?

TABLE 2 TYPICAL POLLUTANT REMOVAL EFFICIENCY

Pollutant	Percent Removal
Fecal Coliform	76
Biochemical Oxygen Demand (BOD)	70
Total Suspended Solids (TSS)	70
Total Organic Carbon (TOC)	48
Total Nitrogen (TN)	21
Total Kjeldahl Nitrogen (TKN)	46
Nitrate as Nitrogen (NO_3-N)	0
Total Phosphorus (TP)	33
Iron (Fe)	45
Lead (Pb)	45
Zinc (Zn)	45

Source: Galli, 1990

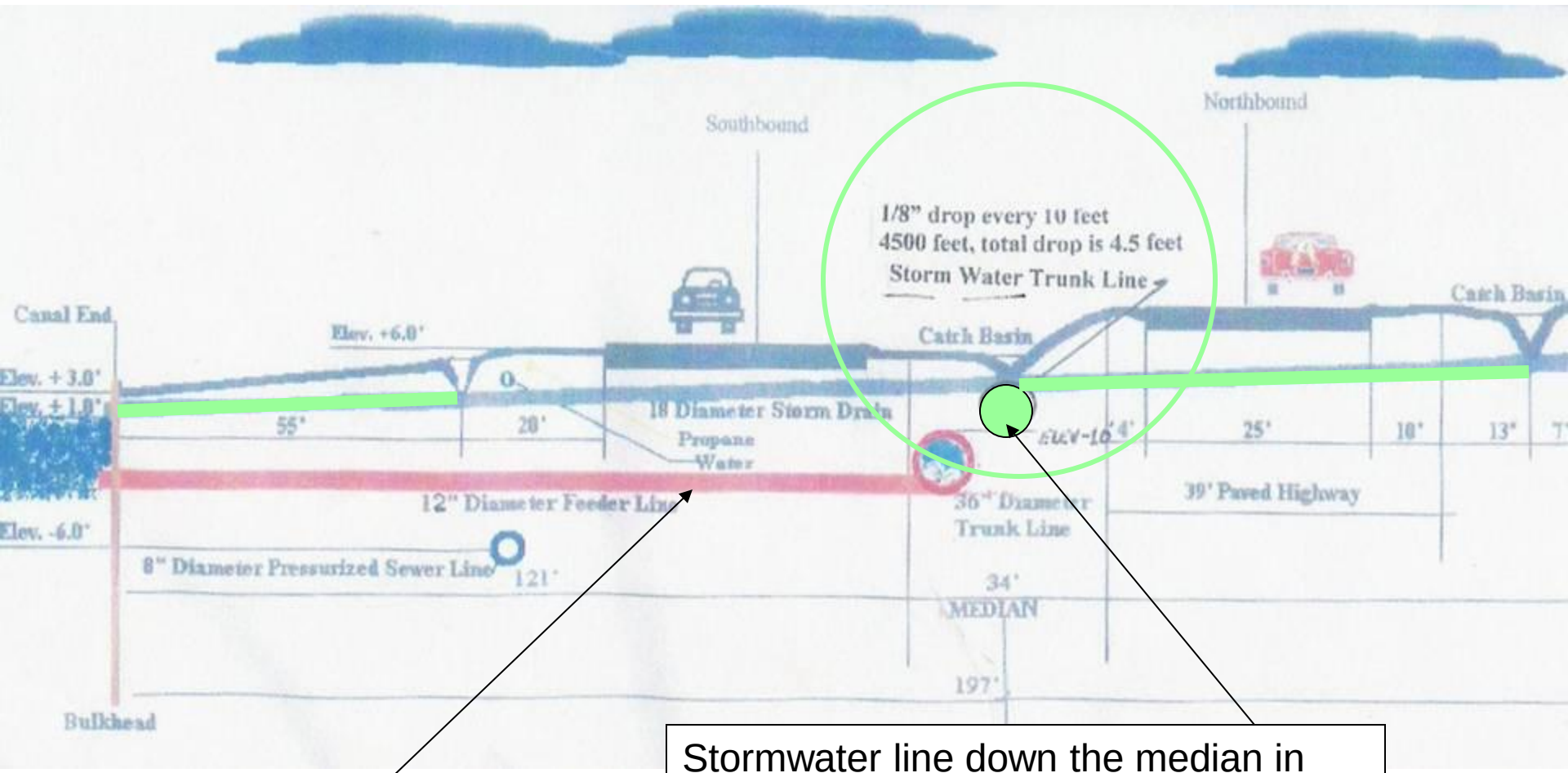
EPA 832-F-99-007, Sept.,1999, Stormwater Technology Fact Sheet – Sand Filters

Table 1. Sand Filter Data

Pollutant	Austin sand filter	Delaware sand filter
Fecal Coliform	76 %	not measured
Total Suspended Solids (TSS)	70 %	80-83%
Biochemical Oxygen Demand (BOD)	70 %	77.5%
Total Organic Carbon (TOC)	48 %	65.9%
Total Kjeldahl Nitrogen (TKN)	46 %	70.6%
Iron (Fe)	45%	not measured
Lead (Pb)	45 %	not measured
Zinc (Zn)	45 %	81.6%
Total Phosphorous (TP)	33 %	72.3%
Total Nitrogen	21 %	47.2%
Nitrate as Nitrogen (NO_3--N)	0 %	62.7%

SAND FILTER FOR TREATING STORM WATER RUNOFF

2. Capture Route 1 Stormwater and Pipe South – in the Route 1 Median, To a Constructed Wetland in the State Park



Proposed Tidal Pump Lines in Red

Stormwater line down the median in DE Route 1

A pump and an equalization basin would probably be required

An Artificial Wetland at Georgetown Industrial Park is One of the CIB Action Plan Demonstration Projects

United States Environmental Protection Agency

Office of Water (4504F)

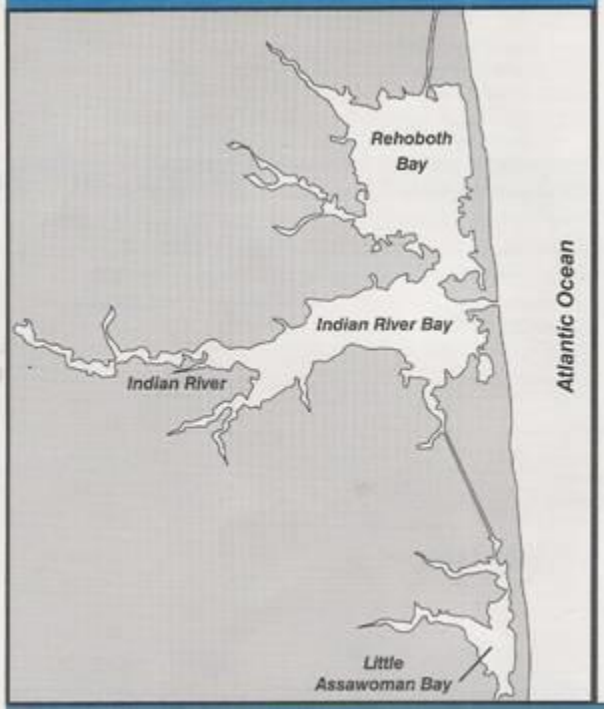
EPA 842-F-95-001C
September 1995

EPA

Georgetown Stormwater Management Project

Demonstrating Practical Tools For Watershed Management Through The National Estuary Program

Delaware Inland Bays, Delaware



Characteristics:

- The Delaware Inland Bays consist of Rehoboth, Little Assawoman, and Indian River Bays.
- The Bays and their tributaries stretch across about 32 square miles and drain a 182 square mile watershed.
- About 120,000 people live in the Bay watershed.
- Approximately 75 square miles of the watershed are used as farmland, 3 square miles are urban, and the rest is mainly open space and forest.

The Problem: The overloading of nutrients in the Bay from point and nonpoint sources has resulted in decreased water quality and loss of habitat.

- Submerged aquatic vegetation beds once thrived in the Bays; however, excessive nutrient levels have suppressed their growth.
- Soft clam, oyster, and bay scallop fisheries are essentially extinct.
- Nonpoint sources, especially stormwater runoff, are the primary source of nutrient loading in the Bays.

The Project: The Georgetown Stormwater Management Demonstration Project was designed to construct an artificial freshwater wetland for stormwater control and habitat creation in an urban area, the Georgetown Industrial Park.

3. Pipe to the Ocean – Rehoboth Beach Has 5 Stormwater Outfalls into the Ocean

Pipes are 30” to 36” HDPE, supported and held down with timber pipes every 6’

The outfalls run from the boardwalk out to an invert of the mean low water based on the restored beach. The following pictures are at Maryland Ave. were the outfall is exposed due to erosion of the restored beach.

Outfalls are located at Grenoble Pl., Maryland Ave., Rehobeth Ave., Delaware Ave., and Laurel

Our application would require a high volume pump or an equalization basin couple with a low volume pump

Agenda – **Canal Water Quality Meeting**

1. **Introduction and Welcome** (George Junkin, Vice President SBPOA)
2. **Purpose of Meeting** (George Junkin, Vice President SBPOA)
3. **Town of South Bethany Actions to Improve Canal Water Quality**
   (Jay Headman, Town Councilman, Chairman of South Bethany Canal Water Quality Committee)
   A. Tidal Pump Project
   B. Dredging
   C. Oyster Gardening
   D. Water Quality Monitoring Program
   E. Canal Water Quality Committee
   F. Education Project
4. **Town of South Bethany Tidal Pump Project** (Gary Jayne, Mayor)
   A. Overview
   B. "South Bethany Canals Flushing Study: Proposed Tidal Pump System
5. **Stormwater Runoff Emphasis on Route 1** (George Junkin, Vice President SBPOA)
   A. History of Monitoring Studies
   B. Possible Alternatives to Improve Current Conditions
6. **Pollution Sources and Solutions for South Bethany Canals**
   (Christopher Bason, Science & Technology Coordinator, Delaware Center for the Inland Bays)
7. **Next Steps** (All)
   What actions can we take to make the South Bethany Canals and Little Assawoman Bay "Fishable and Swimable"?

What actions can we take to make the South Bethany Canals and Little Assawoman Bay "Fishable and Swimable"?

- The Tidal Pump would make a significant impact on the overall health of the canals.
  - We need to search for the funding required ($5-8M)
- Homeowners on the canals can affect about 50% of the total storm runoff area
  - Education of homeowners is required relative to roof runoff, outdoor shower discharge, fertilizer and general house keeping issues.
- About 40% of the total runoff is from Route 1 and north & Route 1 and east.
  - An engineering study would be required to assess the construction costs and the pros & cons of various alternatives.