

Studies conducted over the past 20 years relative to canal water quality:

- a) 6-27-1990 – 25 locations sampled. Lowest dissolved oxygen measurement was 6.1 mg/L. Salinity was 14 ppt and the highest enterococcus level was 103 colony forming units/100mL. This was really not too bad when compared to the measurements that are currently being recorded by the citizen monitoring volunteers. The lowest DO measured was 6.1mg/L in 1990. This is not close to 4.0 mg/L that would cause stress to fish. In 2011, occasionally, we are seeing readings at canal ends close to zero mg/L.

<https://southbethany.delaware.gov/files/2022/10/1990-Water-Testing-1.pdf>

- b) February, 1995 – *Stormwater Management Plan Best Management Practice Alternatives* report issued by George, Miles & Buhr (GMB) Architects & Engineers. Report describes ways that homeowners and the Town can manage stormwater so as to minimize flooding while also minimizing the impact to the canals due to stormwater runoff.

https://southbethany.delaware.gov/files/2022/10/1995_GMB_CharretteReport-1.pdf

https://southbethany.delaware.gov/files/2022/10/1995_GMB_CharretteReportFigures-1.pdf

- c) 1-17-1996 – *South Bethany Canal Survey Report of Results*, 1995 by Renee J. Karrh. 13 sites were monitored. The lowest average dissolved oxygen was 2.73 mg/L at the end of the highway canal near the Bay Shore Canal. Nutrients were very high at the east end of both the Anchorage and Petherton Canals and at the Bay Shore Canal.

<https://southbethany.delaware.gov/files/2022/10/1996-CIB-Canal-Survey-Renee-Karrh-1.pdf>

- d) *1996 South Bethany Bacteria Lagoon Water Quality/Rainfall Study* by Jack Pingree. There is a weak correlation between enterococcus level and rainfall. High enterococcus levels (>3,000 colony forming units/100mL) were recorded at the east and west end of Anchorage and Petherton. The highest levels were at the east ends.

<https://southbethany.delaware.gov/files/2022/10/1996-Enterococcus-Study-1.pdf>

- e) November, 2000 – *The Evaluation of Aeration as a Method for Improving the Ecological Condition of Dead End Canals – Year 1* by Robert W. Scarborough. The aerator used was actually a horizontally placed fountain. It did eliminate stratification for about 600 feet of canal but did not significantly increase dissolved oxygen.

<https://southbethany.delaware.gov/files/2022/10/2000-Aeration-Evaluation-1.pdf>

- f) February, 2002 – *The Evaluation of Aeration as a Method for Improving the Ecological Condition of Dead End Canals – Year 2* by Robert W. Scarborough. The aerator used was actually a horizontally placed fountain. It did eliminate stratification for about 600 feet of canal but did not significantly increase dissolved oxygen.

<https://southbethany.delaware.gov/files/2022/10/2002-Aeration-Evaluation-1.pdf>

- g) January, 2001 – *Volume and Characteristics of Collected Stormwater Discharges into the Loop Section of the Anchorage Canal, South Bethany, Delaware* by Martin, Farrell, and Balascio. A ½ inch rainfall causes about 50,000 cubic feet of rainwater to enter the east end of the Anchorage Canal. This rainwater carried significant amounts of nutrients that support excessive algae growth into the canal. The first flush (the first 1,000 cubic feet) carried in excess of 100,000 colony forming units of total coliforms/100mL and 10,000 colony forming units of fecal coliforms/100mL.

<https://southbethany.delaware.gov/files/2022/10/2001VolumeandcharacteristicsofstormwaterintoAnchorage-1.pdf>

- h) August 2001 - Entrix completed a report, *Hydrodynamic and Water Quality Modeling and Feasibility Analysis of Indian River, Rehoboth Bay, and Little Assawoman Bay* for DNREC. They concluded that flushing would have a positive impact on water quality, yet it would cost 50 to 100 million dollars to complete the recommended project. For the Little Assawoman Bay the flushing would be accomplished by creating an inlet at the narrows between Little Bay and the Little Assawoman Bay.

<https://southbethany.delaware.gov/files/2022/10/HassanFlushingStudy2001-1.pdf>

- i) November, 2003 – *Tidal Pump – Improved Water Quality through Innovation* by Lloyd D. Hughes. Detailed the concept of how the Tidal Pump would work.

<https://southbethany.delaware.gov/files/2022/10/TIDAL-PUMP-17-November-2003-1.pdf>

- j) August, 2005 – *Evaluation of the Stormwater Sediment Control Forebay at Anchorage Canal, South Bethany, DE* by Scarborough and Mesinger. The sediment control forebay installed by DeIDOT in early 2004 is about 30% efficient due to the small size and minimal retention time of the forebay.

<https://southbethany.delaware.gov/files/2022/10/2005-Eval.oftheStrm.Wtr .Sed .Cntrl .ForebayatAnchorageCanal-1.pdf>

- k) September, 2005 – *South Bethany Canals Flushing Study – Proposed Tidal Pump System Residence Time Analysis* by Mike Fichera of Entrix, Inc. Showed that the Tidal Pump would reduce residence times in the South Bethany Canals from over 120 days to just a few days. Report cost \$17,000.

<https://southbethany.delaware.gov/files/2022/10/SouthBethany-STAC11-4-05-Updated-1.pdf>

<https://southbethany.delaware.gov/files/2022/10/South-Bethany-Canal-Flushing-Report-Final-1.pdf>

- l) May, 2007 – *South Bethany Canals Tidal Pump System Preliminary Engineering Study* by Oceaneering and KCI Technologies. Showed that the tidal pump would work. Showed where improvement could be made to the initial concept. Determined that the cost would be about 7 million dollars and that it would take about two years for design and construction. The study cost the Town of South Bethany \$50,000.

<https://southbethany.delaware.gov/files/2022/10/SouthBethanyTidalPumpBudgetaryCostStudyFinalReport-1.pdf>

- m) July 17, 2008 – *Tidal Pump – Town of South Bethany Joint Processing (JPP) Meeting Presentation to JPP Committee*. The South Bethany Tidal Pump Committee met with the Joint Permit Processing Committee. The Committee shared their concerns, specifically focusing on the uniqueness of the project and the potential ecological impact. They stated that we would need a consultant to lead our efforts through the permitting process and that we would probably need to complete additional studies. They felt that the permitting process would be long – at least 12-24 months, if not longer. They felt that the benefits would be concentrated only in South Bethany and would have little impact on the Inland Bays.

<https://southbethany.delaware.gov/files/2022/10/2008-07-17-JPP-Final-1.pdf>

- n) January, 2010 – Grant Proposal for The Evaluation of Diffusers as a Method for Improving the Ecological Condition of Dead-End Canals submitted by SBPOA to the Financial Assistance Branch, Division of Water Resources Department of Natural Resources and Environmental Control. The SBPOA proposal was not selected.

<https://southbethany.delaware.gov/files/2022/10/SBPOA-Grant-Proposal-Final-1.pdf>

- o) June, 2010 – *Conceptual Pollution and Stormwater Control Strategy for the Anchorage Canal Drainage Area* by the Center for Watershed Protection and JMT. Presents 25 potential retrofits (conceptual designs and budgetary costs) that would minimize nutrient loading into the Anchorage Canal while also controlling floodwater caused by rainfall. This was funded by a grant that South Bethany was instrumental in getting from the US Army Corps of Engineers. The grant plus matching funds amounted to about \$72,000.

<https://southbethany.delaware.gov/files/2022/10/Pollution-and-Stormwater-Control-Strategy-Final-Report-1.pdf>

<https://southbethany.delaware.gov/files/2022/10/Appendix-C-All-Retrofit-Concepts-Combined-1.pdf>

- p) 2007 to the present – South Bethany Citizen Monitoring of 10 sites along the canals – The results show that the further the monitoring site is from Snap Gut the lower the water quality is at the site.

<https://southbethany.delaware.gov/files/2022/10/Citizen-Monitoring-Data-Updated-1.pdf>

- q) January, 2012 – Urban Waters Small Grants Proposal for *Demonstration Project Showing that Diffusers will Improve the Ecological Condition of Dead-End Tidal Canals* submitted by the Town of South Bethany to the U.S. Environmental Protection Agency, Office of Water, Immediate Office. The Town's proposal was not selected.

<https://southbethany.delaware.gov/files/2022/10/2012-Diffuser-Grant-Proposal.pdf>