

Delaware River Basin Commission

Delaware Watershed
Research Fund



Updating major wastewater
treatment infrastructure for
Delaware Estuary aquatic life uses:
Technical, economic, and social
impacts

Delaware Watershed Research
Conference

Academy of Natural Sciences of Drexel University
November 29, 2018

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Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

Delaware River Basin Commission

Compact signed in 1961 by Delaware, Pennsylvania, New Jersey, New York, Federal Government

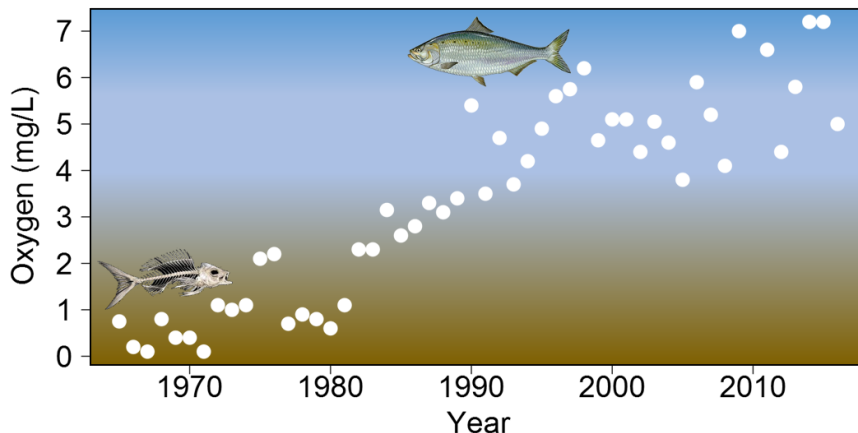
Broad Responsibilities / Authorities

- * Water Supply
- * Drought Management
- * Flood Loss Reduction
- * **Water Quality**
 - **Establish Water Quality Standards**
 - **Monitoring & Assessment**
 - **Load Reductions**
- * Watershed Planning
- * Regulatory Review (Permitting)
- * Outreach/Education
- * Recreation



Dissolved Oxygen History

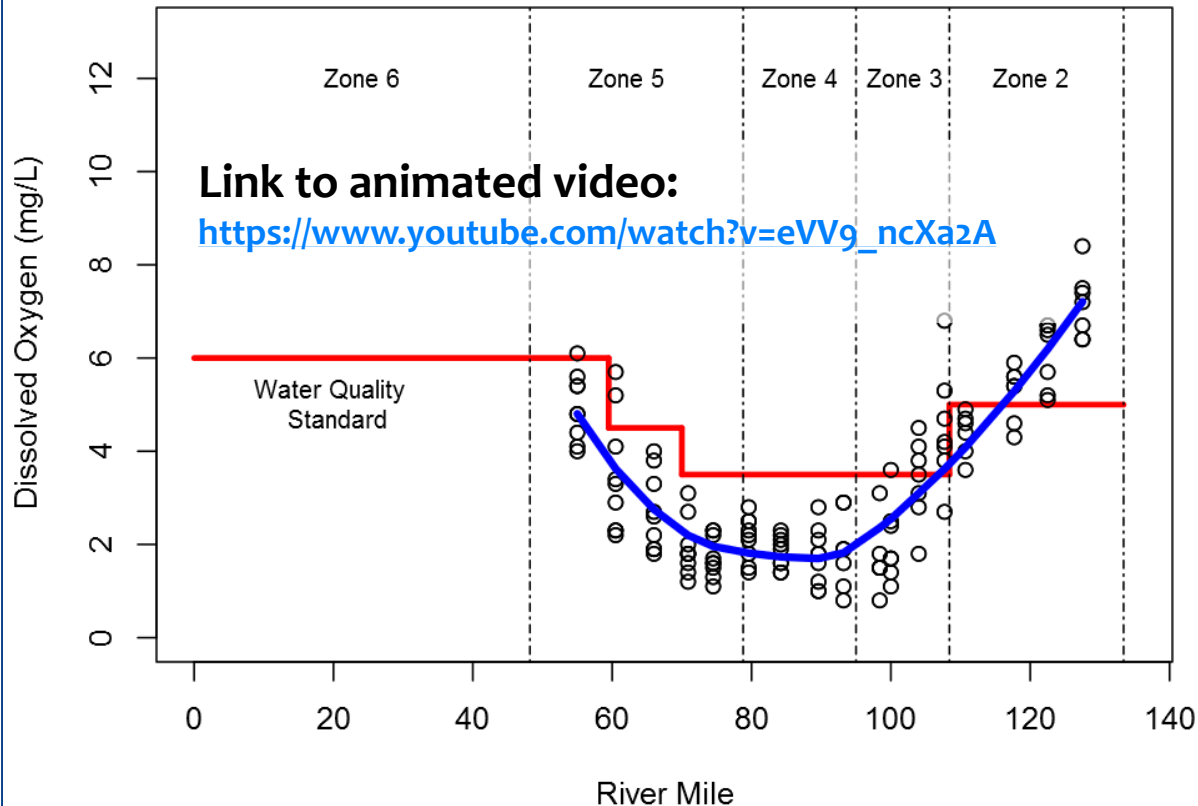
July Oxygen at Ben Franklin Bridge



- * Historically, summer DO in estuary near Philadelphia & Camden was too low for migratory fish to reach upstream to spawn
- * DRBC adopted water quality standards (1967) & wasteload allocation (1968)
- * Secondary treatment added at wastewater treatment plants 70's & 80's – funding CWA

Dissolved Oxygen

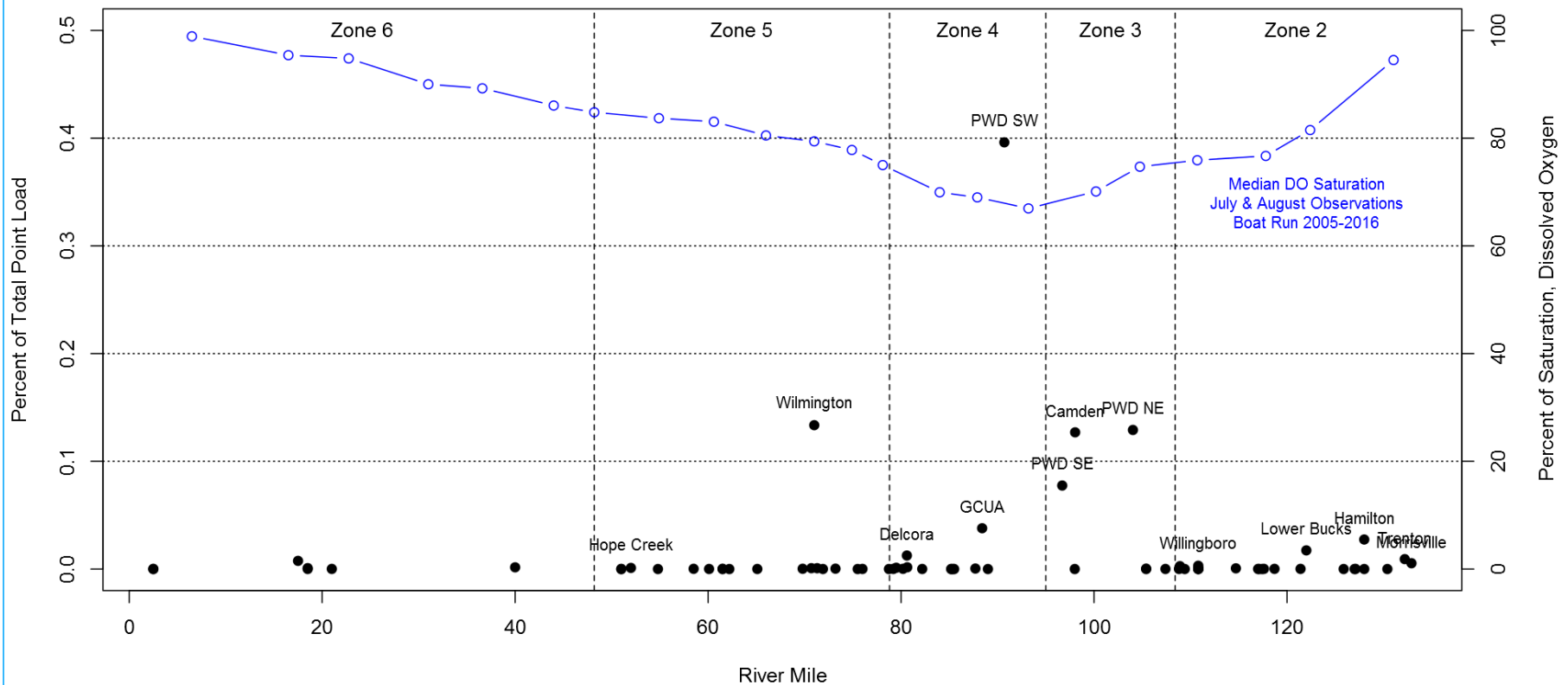
DRBC Delaware Estuary Monitoring
July & August 1967



- * 3.5 mg/L criteria near Philadelphia, Camden, & Wilmington protect fish migration (not propagation)
- * By 2000's that criteria is nearly always met

Next Phase Dissolved Oxygen

**Relative Point Discharge Load by Delaware Estuary River Mile
 NH3 - Ammonia, whole water Loading**



Resolution 2017-4

- * Shared achievement & goals
 - Continuous water quality improvement
- * Study to determine attainability of new DO criteria, with a fixed schedule
- * Initiate rulemaking
- * DO early action workgroup
- * Recognition of Philadelphia Water Department's DO partnership

- * https://www.state.nj.us/drbc/library/documents/Res2017-04_EstuaryExistingUse.pdf
- * Adopted September 13, 2017

Engineering Evaluation & Cost Estimation Project

- * Contracted with Kleinfelder
- * Planning level cost estimate for top 12 loading facilities to achieve new ammonia effluent levels and total nitrogen
- * Coordination with facilities
- * Initiated summer 2018, 2-year contract
 - * 1st progress report December, 2018
- * Tim Bradley managed a nearly identical project for New Jersey Harbor Dischargers Group
- * To be followed by an evaluation of rates and benefits by University of Delaware, Water Resources Center

Engineering evaluation & cost estimate

Preliminary Technology and Effluent Level Recommendations

Effluent Level	Conventional Activated Sludge	Pure Oxygen Activated Sludge	Fixed Film (RBC and TF)
NH ₃ -N – 10 mg/L	Conversion to IFAS with low level of media addition to aeration tanks	Add downstream BAF sized for approximately 50% of plant flow	Add downstream BAF sized for approximately 50% of plant flow
NH ₃ -N – 5 mg/L	Conversion to IFAS with medium level of media addition to aeration tanks	Add downstream BAF sized for approximately 75% of plant flow	Add downstream BAF sized for approximately 75% of plant flow
NH ₃ -N – 1 mg/L	Conversion to IFAS with high level of media addition to aeration tanks	Add downstream BAF sized for 100% of plant flow	Add downstream BAF sized for 100% of plant flow
TN – 3 mg/L	Conversion to IFAS with high level of media addition plus downstream DF	Add downstream BAF sized for 100% of plant flow plus DF	Add downstream BAF sized for 100% of plant flow plus DF



- IFAS – Integrated fixed film activated sludge
- BAF – Biological Aerated Filter
- DF – Denitrification Filter

Photo courtesy of University of New Mexico

Kleinfelder's Approach to DRBC's Nitrogen Reduction Cost Estimation Study

Phase 1 – Develop Costs for Generic Plants

- Evaluate Existing Plants
- Develop Generic Plant Descriptions for each Plant Type
 - Conventional Activated Sludge
 - Pure Oxygen Activated Sludge
 - Fixed Film – Trickling Filter and Rotating Biological Contactor
- Develop Technology recommendations for NH₃-N and TN Removal
- Finalize effluent levels for NH₃-N and TN Removal
- Develop capital cost estimates for generic plants on a \$/gpd basis for each level of treatment

Phase 2 – Develop Plant Specific Cost Estimates and Cost Curves

- Use generic plant \$/gpd costs to establish “base capital cost” for each plant and level of treatment
- Add/Subtract costs based on plant specific performance, issues and constraints
- Develop Plant Specific O&M costs for each plant and level of treatment
 - Staffing, chemicals, energy, sludge processing and disposal, maintenance
- Prepare cost curves based on total present cost
 - Plant specific capital costs plus present worth of O&M costs
- Also develop cost curves based on annualized cost
 - Amortized plant specific capital costs plus annual O&M cost
- Prepare Draft and Final Summary Reports
- Conduct Meetings and Perform Project Administration Activities

A Review of Dissolved Oxygen Requirements
for Key Sensitive Species in the Delaware Estuary

Final Report

Submitted to

The Delaware River Basin Commission



By

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November 2018



Other Actions Underway

- * Development of estuary eutrophication model
 - Model expert panel
- * DO early action workgroup
- * DO needs report from ANSDU
 - * https://www.nj.gov/drbc/library/documents/Review_DOreq_KeySensSpecies_DelEstuary_ANStoDRBCnov2018.pdf

- * Enhanced monitoring for model development
 - Point discharge monitoring
 - Boat run to year-round
 - Added salinity at tidal boundaries
 - Added nitrate at Trenton & Chester
 - Extensive tributary monitoring
 - Light extinction monitoring
 - Primary production

Questions & Discussion?

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