



Continuous Water Quality Data – New Jersey's Story

Biswarup (Roop) Guha

June 2, 2022



Outline

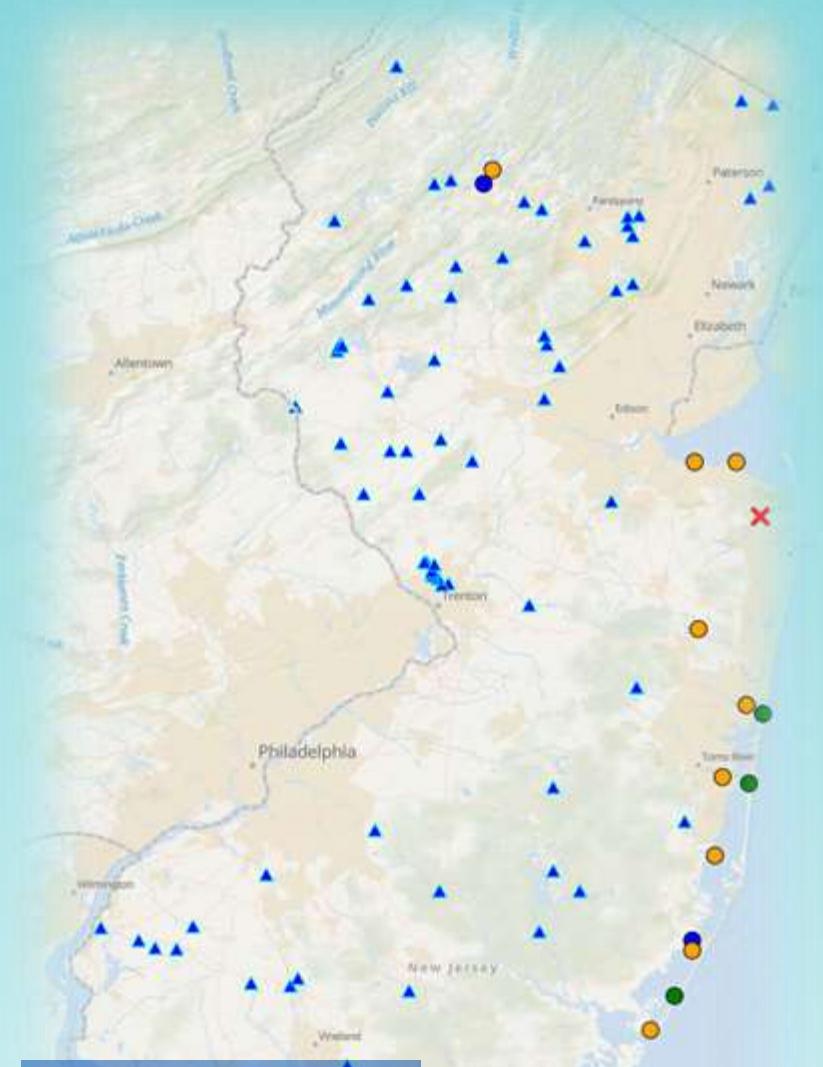
Continuous monitoring by NJDEP
– Data types we gather

Data Management - Where the data is stored

Continuous Data – The why and how of NJ data collection

How the automated assessment and quality assurance steps work

NJDEP's Assessment Process –
How best professional judgement is included



Continuous Monitoring by the DEP

<http://njdep.rutgers.edu/continuous/>

- No definition in the SWQS at N.J.A.C. 7:9B
- Time-dense: Measured hourly or more frequently
- Parameters measured can vary from unit to unit and may include Dissolved Oxygen, Temperature, Chlorophyll-a, Phycocyanin, pH, Turbidity, Specific Conductance, Salinity, and Dissolved Oxygen %.
 - Work in progress: Nutrient species (TN, TP, NO₃, PO₄ etc).
- May be real-time or deployed for at least 72 hours (deployment periods being increased)
- Buoys or Stationary
- Short-term (few days to months) or long-term (years) monitoring



Other types: Slocum glider, Aircraft sensors



Gliders and remote sensing (aircraft)



[Active Glider Deployments \(rutgers.edu\)](https://rutgers.edu)



[NJDEP New Jersey Department of Environmental Protection - Aircraft \(rutgers.edu\)](https://rutgers.edu)

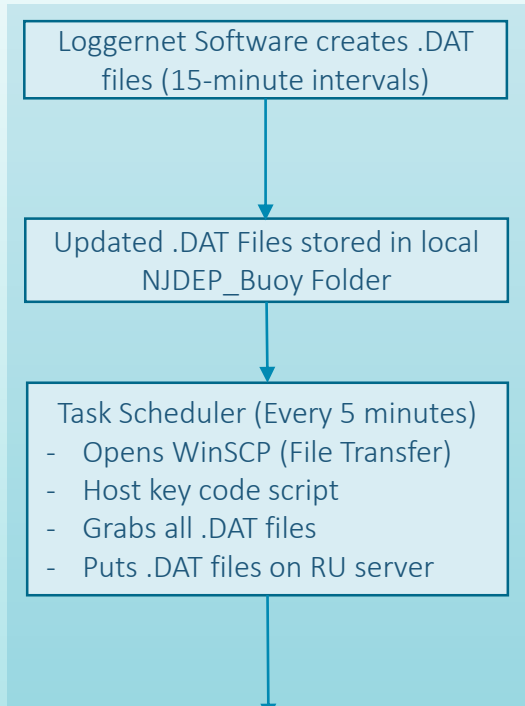


Data Management



NOTE: Excludes all up-front work for calibration, modems, electronics, equipment purchasing, and data analysis of results

AUTOMATED Data Flow



DEP Environment
RUTGERS Environment

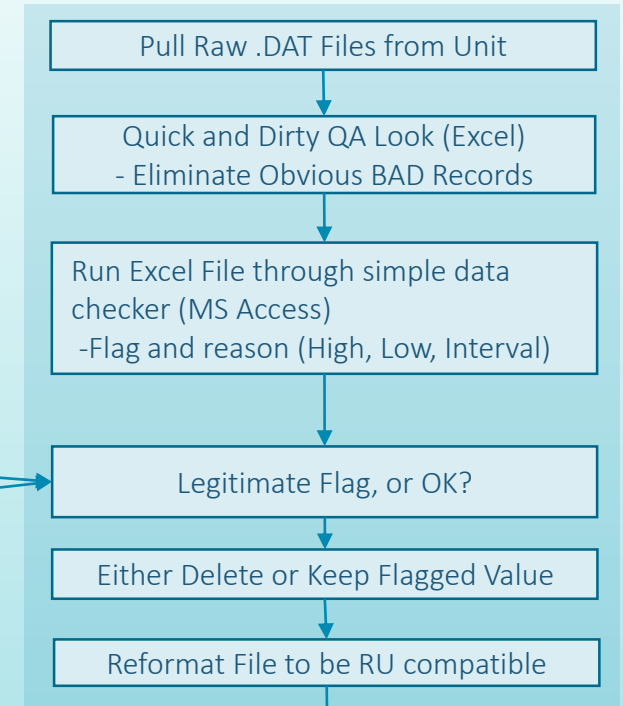
Tides
USGS Tide Gauges

Rutgers Rainfall Website/DB
<https://njdep.rutgers.edu/rainfall/>

Continuous Monitoring DB

RU Continuous Website
- Available to Public
- Search/Filtering
- Data Downloads
- Graphing

MANUAL Data Flow



RU Continuous Administration Portal

Data Records Inserted into QA Table - Permanent

Insert .DAT file records into Real-Time Table - Temporary Table

Only Graphing and Display Allowed.
No Data Download

RU Front End: <https://njdep.rutgers.edu/continuous/> ← Developed by Rutgers → RU Admin Portal: <https://njdep.rutgers.edu/portal/>

Continuous Data Management – Where the Data is Stored

- <http://njdep.rutgers.edu/continuous/> and [USGS Water Data for the Nation](#)
- [NJDEP New Jersey Department of Environmental Protection - Aircraft \(rutgers.edu\)](#)
- Freshwater flights https://njdep.rutgers.edu/aircraft_phyco/
- [NJDEP New Jersey Department of Environmental Protection - Rainfall \(rutgers.edu\)](#)
- [NJDEP-Division of Water Monitoring and Standards](#)
 - [Active Glider Deployments \(rutgers.edu\)](#)



The why and how of NJ data collection





Why do we need continuous data?

Parameter		Waterbody Classification				
		FW2-TP	FW2-TM	FW2-NT	SE	SC
Temperature (°C)	Daily Maximum	22	25	31	-	-
	Rolling seven-day average	19	23	28	-	-
	Summer seasonal average	-	-	-	29.4	26.7

Dissolved Oxygen	Turbidity	Chlorophyll-a	Total Phosphorus
<ul style="list-style-type: none"> • Not less than (never lower than) • 24-hour average (FW2-TM, FW2-NT) 	<ul style="list-style-type: none"> • Maximum 30-day average • Maximum at any time 	<ul style="list-style-type: none"> • Seasonal average 	<ul style="list-style-type: none"> • Maximum (not to exceed) • Annual average (in select lakes derived during the TMDL studies based on natural conditions)

The Surface Water Quality Standards: https://www.nj.gov/dep/rules/rules/njac7_9b.pdf

How does the NJDEP use Continuous Data?

305(b) or Integrated Report, 303(d) list of impaired waters

Protecting high quality waters: Category One Designation

Evaluate or develop new standards (e.g. EPA's marine DO criteria, temperature criteria for Pinelands)

Antidegradation

Develop TMDLs and restoration plans

Effectiveness – TMDLs and Restorations

Fisheries

Permitting


Trends

Harmful Algal Blooms (HABs)

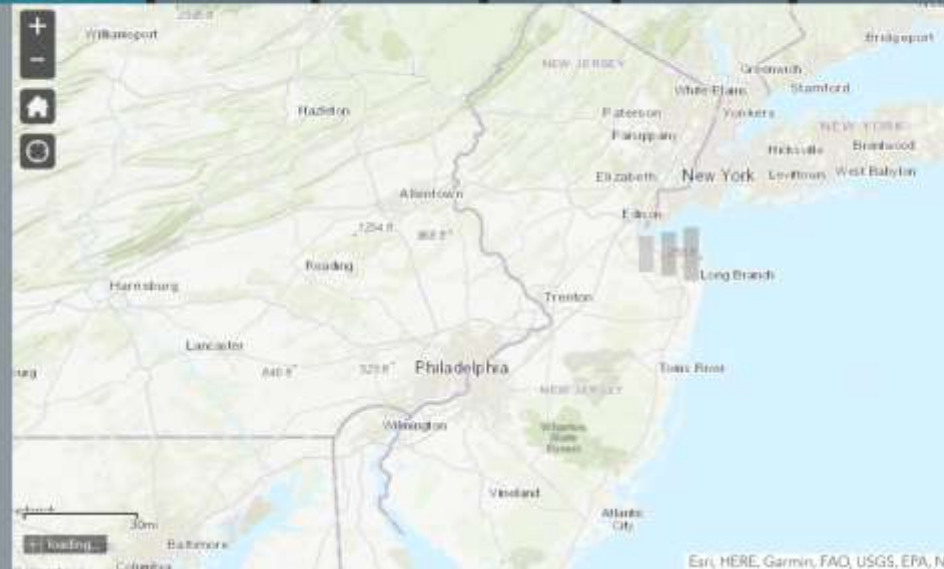


NJDEP's Assessment Process - Automation

2018-2020 Integrated Report: State

A Story Map    

[Aquatic Life General](#)
[Aquatic Life Trout](#)
[Fish Consumption](#)
[Water Supply](#)
[Primary Recreation](#)
[Secondary Recreation](#)
[Shellfish](#)
[Tutorial](#)



Description	Waterbodies Assessed	Number of AUs
Can these waters support a healthy ecosystem?	All waters	958

Required Parameters	Other Parameters
Biological Data	DO, TP, Temperature, pH, TSS, Turbidity, Ammonia, Chloride, Metals, Chlorophyll, Malathion

Zoom to View Stations

Some Insufficient Data (light blue) AUs contain multiple Full Support (green) stations. This is because these stations lack the required biological data.

■ Non Support
 ■ Insufficient Data
 ■ Full Support

All charts based on counts of assessment units.

Language Note: "Attain" and "Support" in the assessment results are used interchangeably.

Station Disclaimer: Stations represent the approximate sampling



Data Assimilation

Step 1.

Data Assimilation

- DEP data - Rutgers
- USGS – NWIS using R
- Other internal or external data with approved QAPPs

Download data from <http://njdep.rutgers.edu/continuous/> (currently done manually from the website – may include webservice call in future) and NWIS (using dataRetrieval package). Check for non-DEP datasets with approved QAPPs. Consolidate all data into one file.



Update Stations' lookup table with new monitoring stations. The lookup table includes list of all stations, lat/longs, classifications, HUC14s, WMAs, pH Region.



For new stations, check for HUC14 representativeness and colocation.





Stations lookup table

locid	newlocid	MonLocName	MonLocTyp	LatDeg	LongDeg	HUC14	LKFLG	swqs	Class2	C1	WMA	WMA_NAME_2	WREGION	region	SW_NAME	PC_STATU	PHREG	HUCTier	CommentsDG	Comments	HUC14TXT_K
HJDEP_BMWM-1816	1816	1616	Estuary	39.99817	-74.09764	BarnegatBay03	E	SE1	SE1	C1	18	Barnegat Bay	3	Atlantic Coast	Hetefacook and Lower Tills - Bay		NOFH	3	All		
3106LRBC_WQX-091002	91002	Reedy Island (RM 54.3)	Estuary	39.512822	-75.554847	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old
DRBC-R1	91002	Reedy's Island - center	Estuary	39.512822	-75.554847	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old
DRBC-EST-1	91003	North of Pea Patch Island	Estuary	39.6143	-75.57706	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old
3106LRBC_WQX-091005	91005	Pea Patch Island (RM 60.6)	Estuary	39.6143	-75.57706	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old
3106LRBC_WQX-091008	91008	New Castle (RM 66.0)	Estuary	39.67306	-75.52414	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old
DRBC-EST-2	91008	South of Delaware Memorial Bridge	Estuary	39.67306	-75.52414	Delaware River 18	E	ZONE 5			17	Maurice, Salem, and Cohamsey	5	Lower Delaware	Delaware R 3		DR	2			Old

IAN | Lookup Tables ▾ | Data Download & QA | Assessment Runner | Assessment Viewer/Editor ▾ | HUC Assessment Data | Reports | Data Dictionary

theast2020

0 ▾ entries Search:

locid	newlocid	MonLocName	MonLocTyp	LatDeg	LongDeg	HUC14	LKFLG	swqs	Class2	C1
All		All				/				
HJDEP_BMWM-1616	1616	1616	Estuary	39.99817	-74.09764	BarnegatBay03	E	SE1	SE1	C1

Analysis Process – The Automation

Step 1.

Data Assimilation

- DEP data - Rutgers
- USGS – NWIS using R
- Other internal or external data with approved QAPPs

Step 2.

Station level analysis using R scripts

- Check for negative values (all parameters except temperature)
- Flag data to check plots
 - Sudden temporary changes
 - Estimates
 - Preliminary (not finalized by USGS)
 - Common data errors (e.g. pH > 13 or <2)
 - Within accuracy of the instruments

- Two EXCEL files: Output by year and Consolidated:
 - Number of days/times with data each year
 - Years
 - Assessment for each year corresponding to the station classification, applying the respective criteria.
 - Per cent of days exceeding each year
 - Statistics
- PDF with time series plots



Level of Details

Station Level ▾

Parameter

DO ▾

Table

ContStaLevel ▾

Display

Refresh Table List

Download Table

Edit Tables

Upload Tables

View Plots

Parameter

pH ▾

List of plots

ContinuouspH_QAstations_2020_08_27_14_03_08.pd

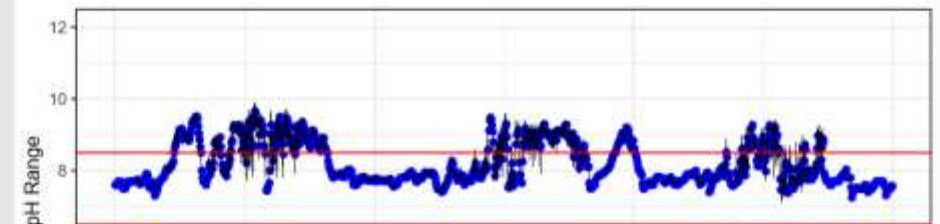
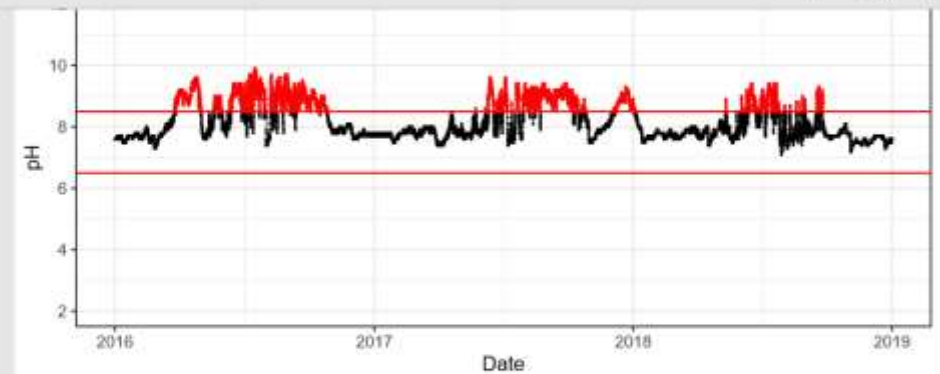
Display

Edit Tables

Upload Tables

View Plots

4 of 17



Step 3: Validate Automated assessments

- Potential instrument error or malfunction
- Precipitation
- Other lines of evidence
 - Land use
 - Hydrology
 - Geology
 - Point sources
 - Nonpoint sources
 - Aerial photography
 - Groundwater contamination
 - Biological habitat conditions
 - Restoration activities

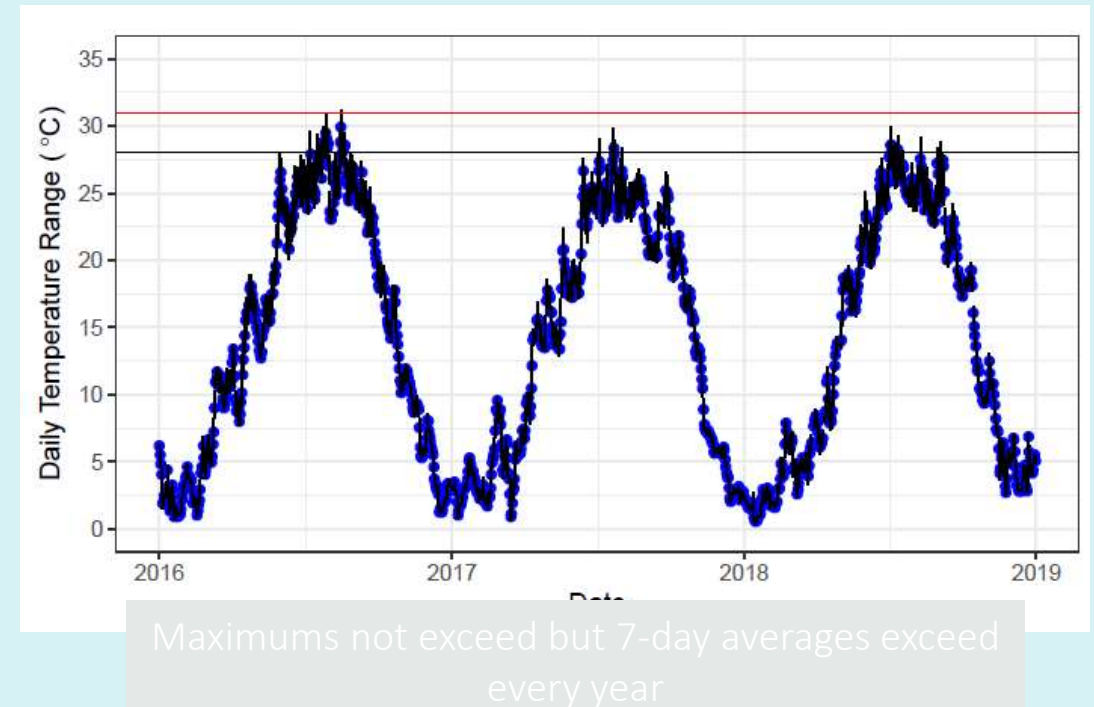
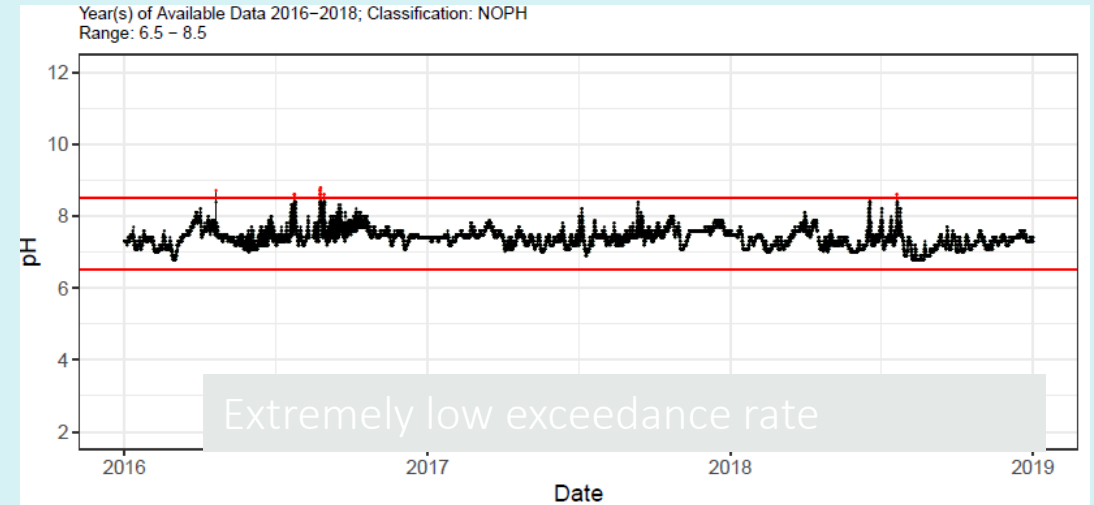
Update automated assessment results based on Best Professional Judgement (BPJ)

WMA	HUC14	Name	Region	WMAName	WatershedSizeSqmi	RiverMiles	LakeAcres	OceanSqMiles
13.00	BarneгатBay05	Barneгат Bay Central West	Atlantic Coast	Barneгат Bay	15.08	7.41	NA	15.08
WMA	HUC14	Recreation	Public_Water_supply	Fish.Consumption	Aquatic_Life_Trout	Aquatic_		
BarneгатBay05		2	NA	3	NA	2		



EXAMPLE BEST PROFESSIONAL JUDGEMENT (BPJ)

- Low exceedance rates
- Weeklong but borderline
- Weekly average exceeded
- Not enough data for decision
- Suspect data causing exceedances
- Summer exceedances previous diurnal impaired
- Need more data

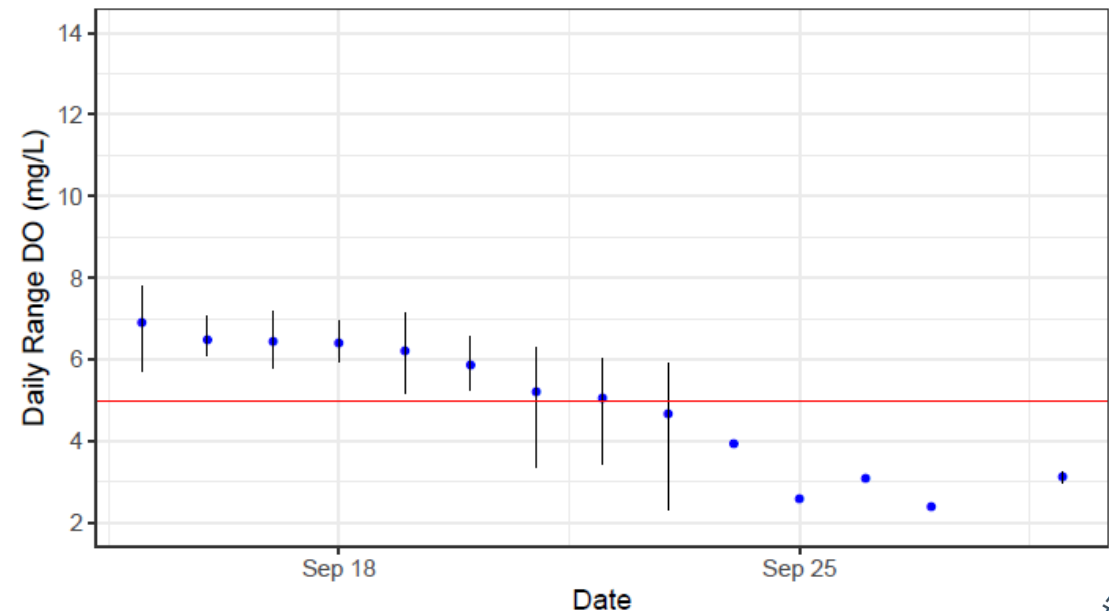
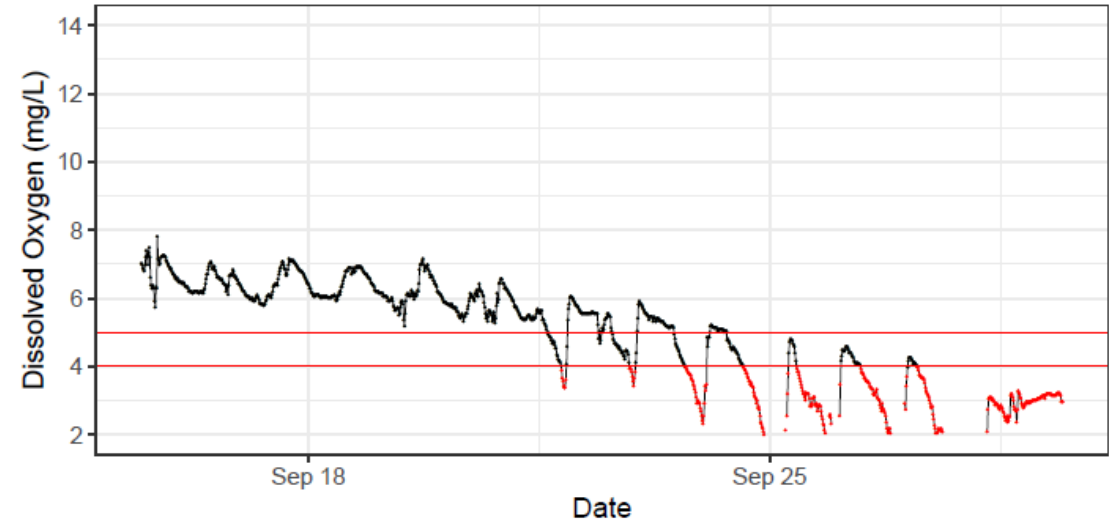


BPJ Decisions

BPJ decisions and data plot reviews help identify instrument error, site issues or weather issues to avoid false listings.

Currently, ACWA is coordinating development of a compendium of methodologies on a national scale with EPA and is assembling researched materials on continuous data assessment.

NJ evaluated statistical hypothesis testing approach (binomial method) but not considering any change in the Methods Document for the 2024 Integrated Report.



OTHER ASSESSMENTS

Choose Date Range:

2011-08-10 to 2017-11-06

Select Parameter(s)

Dissolved Oxygen (ppm)

Choose Grid

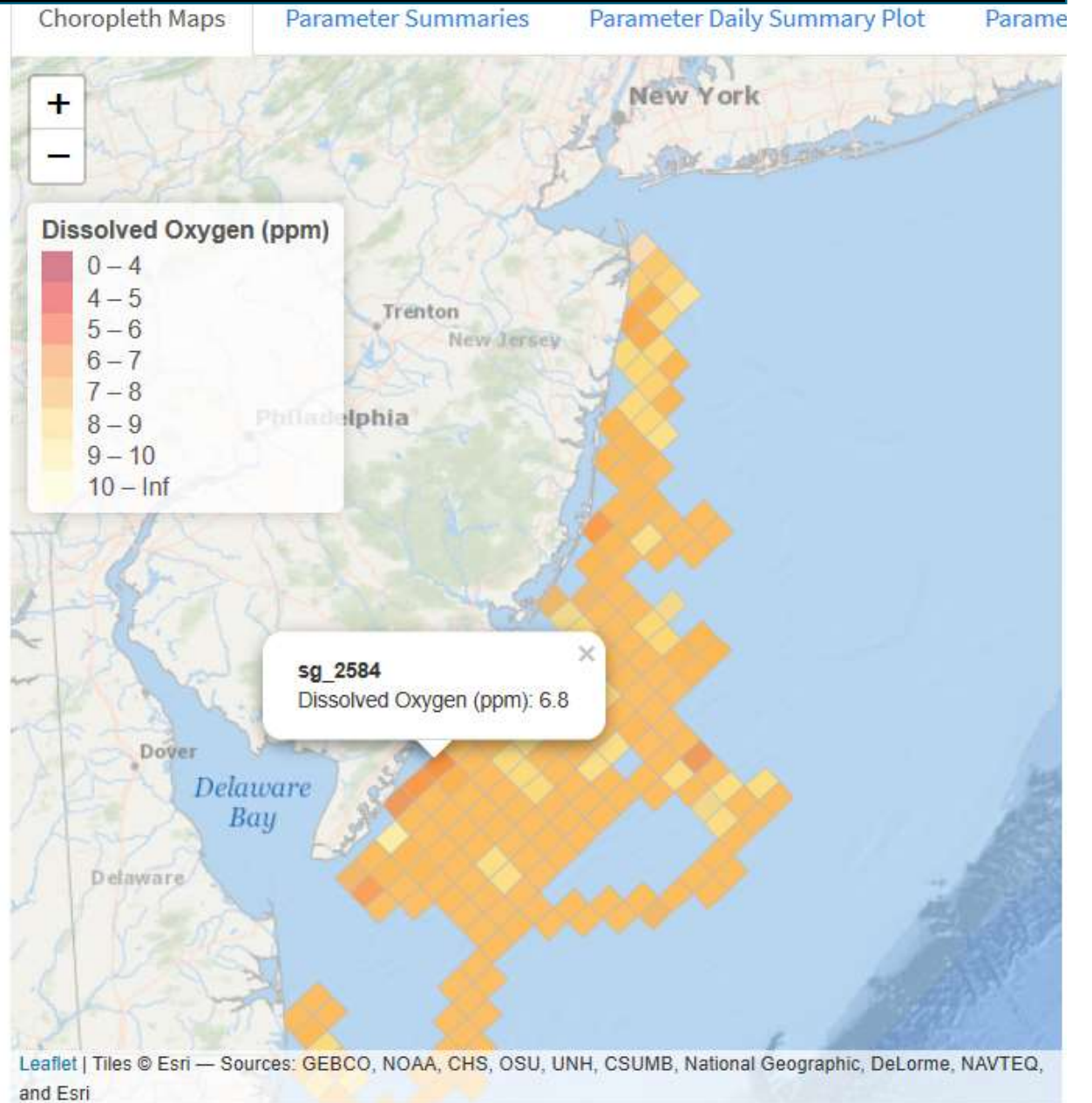
4x7 mile

Depth Limits, ft (Inclusive)

0.75 5 30

0.75 3.75 6.75 9.75 12.75 15.75 18.75 21.75 24.75 27.75 30

Submit



Like & follow us!

    @newjerseydep  @nj.dep



Thank you!

Division of Water Monitoring, Standards and
Pesticide Control

Biswarup.guha@dep.nj.gov

609-292-1592

<https://www.state.nj.us/dep/wms/>