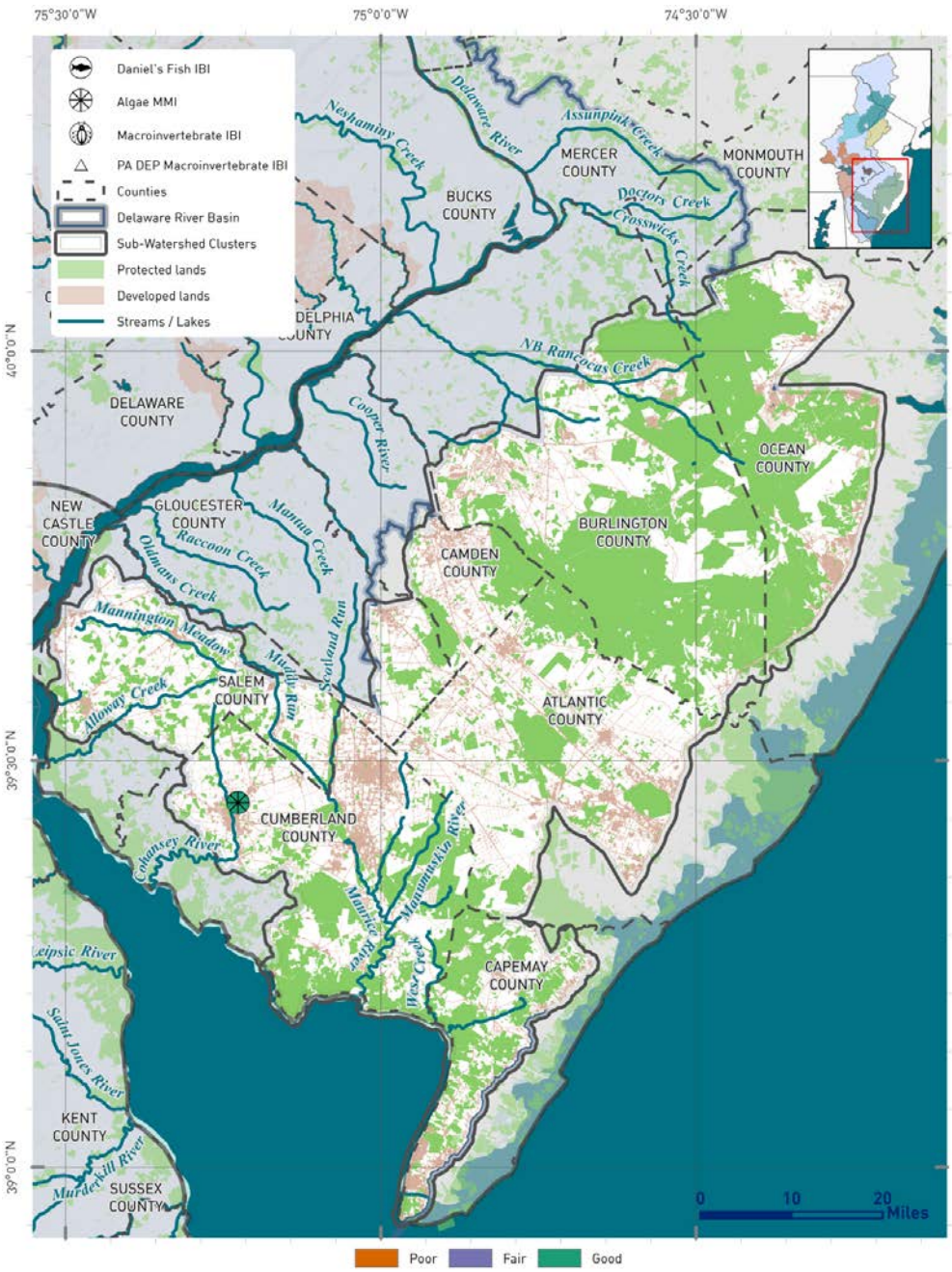
Surface Water Monitoring in the

KIRKWOOD COHANSEY AQUIFER

Delaware River Watershed Initiative



*Circle icon represents 2014 DRWI sampling site. Number of ANS/Stroud WRC sites = **1.***

Surface Water Monitoring in the Kirkwood-Cohansey

Because of the unique makeup of the Kirkwood-Cohansey Cluster and the characteristics of the aquifer system, the analytic focus in 2013 and 2014 was aquifer health and depletion, rather than surface water quality monitoring. Of the regular slate of indicators analyzed for streams in the Delaware River Watershed Initiative, only **water chemistry** and **algae** were sampled at only one site in the cluster in 2014 – Barrett's Run, where an afforestation and grassland buffer project was implemented. As more on-the-ground restoration work is funded and implemented, and as we gain a greater understanding of the mechanisms of surface water and ground water exchange in the aquifer, more surface water monitoring sites will be added. Data on chemistry and algae from three sampling events at Barrett's Run in the summer of 2014 are presented here.

Notable Algae &Significance to IBI

Achnanthidium rivulare

Nutrient tolerant, neutral pH optimum, grazer and scour resistant.

Tabellaria flocculosa

Nutrient sensitive, low pH optimum, grazer and scour resistant.

Brachysira brebissonii

Nutrient sensitive, low pH optimum, moderately grazer and scour resistant.

Average Algae MMI Score:
6.57 (Fair)

Indices of Biological Integrity: An index of biological integrity (IBI) is a collection of metrics which describe the structure and function of an ecosystem based on its biota. Metric values are converted to scores and yield a total IBI score. These scores can be translated into easily-interpreted regional quality classifications.

Rating	Daniels Fish IBI	PADEP Macro-invertebrate IBI	Algae MMI
Poor	0 – 35	0 – 45	0 – 3.33
Fair	35.1 – 46	45.1 – 74	3.34 – 6.66
Good	46.1 – 60	74.1 – 100	6.67 – 10

Multiple Indicators: Data collection includes chemical parameters as well as biota. Water chemistry alone can either over exaggerate or fail to detect changes from brief pollution events, but biota provide information on year-round water and habitat quality. Different biota respond differently to stressors. Analyzing data on multiple groups of biota tells a more complete story of ecosystem structure and function in relation to landscape variables and human activities.

THE ACADEMY OF NATURAL SCIENCES
of DREXEL UNIVERSITY
July 2016

Baseline conditions of the

KIRKWOOD COHANSEY AQUIFER

Delaware River Watershed Initiative

Cluster Organization Summary

Organizational partners: American Littoral Society, Association of New Jersey Environmental Commissions, The Nature Conservancy, Natural Lands Trust, New Jersey Audubon Society, New Jersey Conservation Foundation, Partnership for the Delaware Estuary, Pinelands Preservation Alliance, Trust For Public Land.

Cluster Strategy: To preserve and restore watershed health, including both abiotic and biotic characteristics of the aquifer and associated habitats, by addressing key stressors: development, aquifer depletion and poor stewardship of forests and wetlands. Strategies include land preservation, policy initiatives, ecological restoration, minimizing agriculture impacts and community engagement on water quality and quantity issues.

Monitoring objectives: Monitoring long-term impacts on fundamental chemical and biological indicators of watershed health, through field tests and modeling. Take advantage of long-running public and scientific studies on groundwater quality/quantity conditions.

Summary Of Chemical Parameters

Site	Date	**Nitrate** mg/L, as NO_3^-+NO_2—N	**Total Ammonia** mg/L, as NH_4^+ +NH_3^+- N	**SRP** mg/L	**TSS** mg/L	**Cl^-** mg/L	**Mg^{2+}** mg/L	**K^+** mg/L	**Ca^{2+}** mg/L
KCBR1	8/19/2014	4.54	0.016	0.0049	5.85	22.55	6.35	3.21	11.40
KCBR1	8/29/2014	4.87	0.017	0.0058	3.10	22.98	6.72	3.71	12.30

Water Chemistry: *Water chemistry parameters for one site in the Kirkwood-Cohansey Cluster, sampled two times in Summer 2014.* Barrett's Run is in an agricultural area of New Jersey, and the reach that was sampled is at the site of a stream buffer restoration and afforestation project on a farm field. Samples from both dates met the various freshwater quality criteria for suitability for aquatic communities.

Both samples achieved nitrate values suitable for warm-water (non-trout) fisheries (<4.9 mg/L nitrate), but did not meet cold-water (trout producing) nitrate criteria (<3.1 mg/L nitrate, Minnesota PCA).

Ammonia concentration and its effects on freshwater communities is highly variable; upper limits of concentrations suitable for aquatic life can range from 0.07 to 2.0 mg/L total ammonia (EPA) depending on temperature, pH and species. Both sites met the total ammonia criterion, with concentrations below 0.07 mg/L.

Both samples fall below 0.05 mg/L of soluble reactive phosphorus (SRP), a widely-referenced maximum for suitability for aquatic life. SRP can relate to agricultural land use in the area. Both samples had chloride concentrations considered safe for aquatic life under chronic exposure (<230 mg/L, EPA). Chloride can be related to urban land use via road salts and wastewater treatment.

Both sampling events meet regulatory requirements set by NJ DEP for total suspended solids (TSS) for cold-water streams (<25 mg/L). Agricultural run-off can correlate to high TSS values. Without a sampling event from before project implementation, it is uncertain at this time whether the restoration project at Barrett's Run is effectively reducing the amount sediment entering the stream due to run-off from the farm field, or whether these are typical TSS values for this waterway.

Calcium, magnesium and potassium in fresh water streams originate mainly from rock weathering, and vary in abundance depending on local geology. Ion concentrations in igneous geographies is roughly half that of sedimentary landscapes. Downstream this variation becomes less notable than in headwaters, and overall ion concentrations increase. (Allan and Castillo, 2007.) Calcium originates from sedimentary carbonate rocks like limestone, and affects alkalinity. Magnesium, important to fish development, comes from igneous rock. Potassium originates from silicate materials and igneous rock, but like nitrogen and phosphorus, can be a product of fertilizer. Rainwater and pollution can also contribute to ion concentrations.

These values provide a starting point, but with so few measurements it is not possible to draw any conclusions at this time about water quality in Barrett's Run in terms of water chemistry.