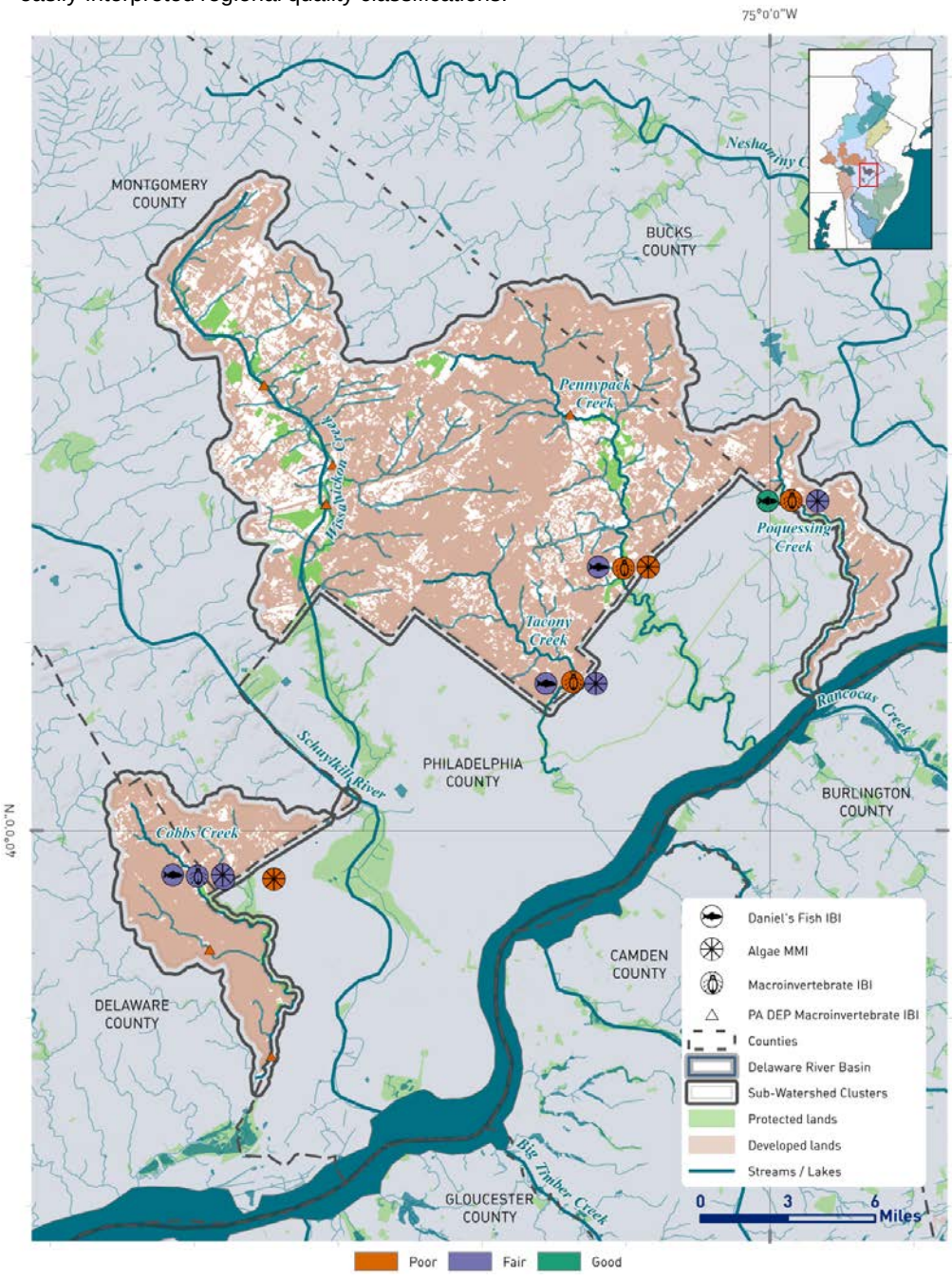
Baseline conditions in

UPSTREAM SUBURBAN PHILADELPHIA

Delaware River Watershed Initiative

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



*Circle icons represent 2013-2014 DRWI sampling sites. Number of ANS/Stroud WRC sites = **5**; Cluster Group sites = **48**.*

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.

Notable Fish & Significance to IBI

Blacknose Dace *(Rhinichthys atratulus)*
Generalist feeder, tolerant to non-specific stressors

Satinfin Shiner *(Cyprinella analostana)*
Insectivore, tolerant to non-specific stressors

Banded Killifish *(Fundulus diaphanous)*
Insectivore, tolerant to non-specific stressors

Average Daniels Fish IBI Score:
37.60 (Fair)

Notable Algae & Significance to IBI

Amphora pediculus
Nutrient tolerant, organic pollution sensitive, grazer and scour resistant

Nitzschia inconspicua
Nutrient tolerant, organic pollution tolerant, grazer and scour resistant

Cocconeis placentula
Moderate nutrient tolerance, grazer and scour resistant

Average Algae MMI Score:
4.11 (Fair)

Notable Macroinvertebrates & Significance to IBI

Midges: Chironomidae
Those present here are pollution tolerant, mainly collector gatherers

Crane flies: *Antocha*
Somewhat pollution sensitive, shredders

Average Macroinvertebrate IBI Score:
42.45 (Poor)

THE ACADEMY OF NATURAL SCIENCES
of DREXEL UNIVERSITY

July 2016

UPSTREAM SUBURBAN PHILADELPHIA

Cluster Organization

Partners: Friends of Poquessing Watershed*, Lower Merion Conservancy*, Natural Lands Trust, Pennsylvania Environmental Council, Pennypack Ecological Restoration Trust*, Temple-Villanova Sustainable Stormwater Initiative*, Tookany/Tacony-Frankford Watershed Partnership*, Wissahickon Valley Watershed Association*. (*monitoring partners)

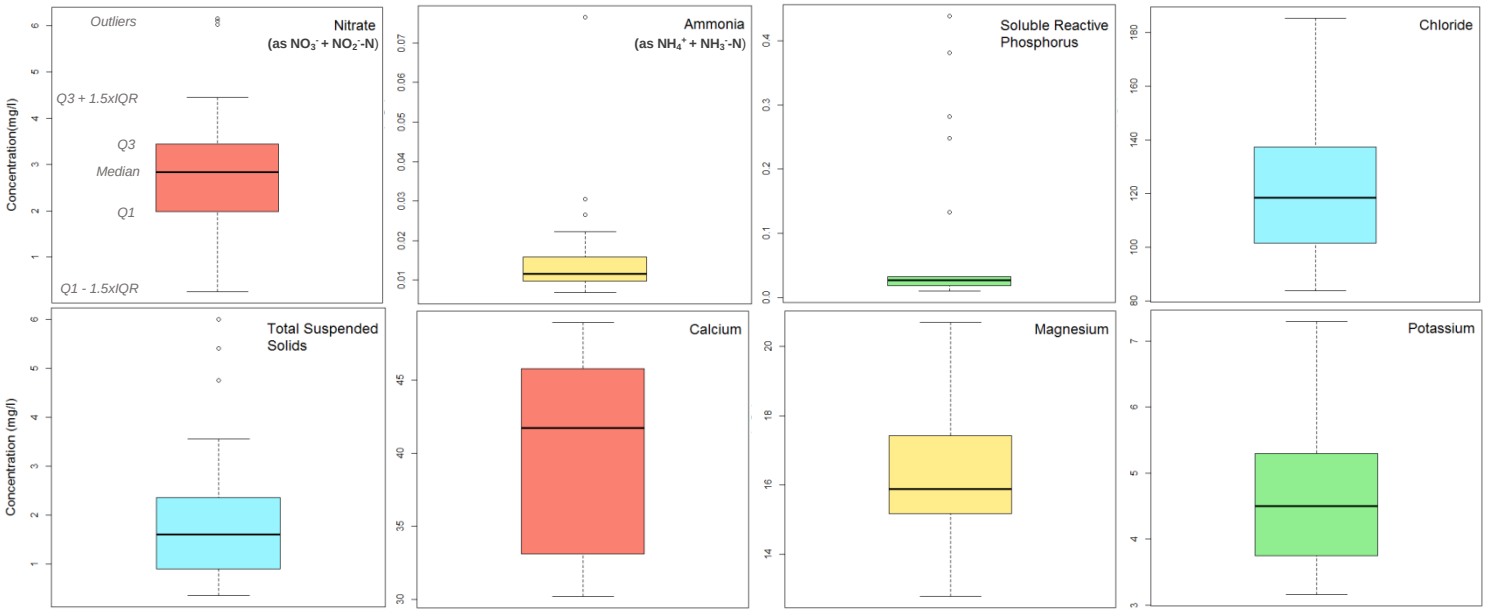
Strategy: Mitigating impacts of intense urban development and historical stream alteration on ecosystem health, via stormwater control measures (SCMs), stream buffer/upland protection and restoration, stream channel restoration, and improvements to wastewater treatment and sewer infrastructure; using modeling to plan and evaluate SCMs.

Monitoring Objectives: Linking effectiveness of individual SCMs to watershed-wide restoration efforts; monitoring to inform modeling efforts, which will then help determine where new SCM projects should be initiated. Data is collected by professionals, students, and volunteers.

Habitat Assessment

In-stream habitat assessments are a composite of variables including flow type descriptions, particle size classifications and embeddedness estimations. These features interact to influence biotic communities. Reaches sampled in the Upstream Suburban Philadelphia cluster were dominated by glide (39%; fast-flowing but not as choppy as a riffle) and pool (38%; still or backflow) flow types. Flow type is often reflected in both substrate particle size and how embedded particles are. Particle size and embeddedness then, in turn, partially determine the area of habitat available for fish, macroinvertebrates and algae within a reach. In the Upstream Suburban Philadelphia cluster, the dominant particle sizes were cobble (36%) and coarse gravel (22%). The coarse gravel, cobbles, and boulders present were about 52% embedded (covered in fine sediment; high percentages can indicate erosion of upstream land). Overall this cluster was given a habitat grade of suboptimal.

Summary Of Water Chemistry Parameters



Box-and-whisker plots of chemical parameters in the Upstream Suburban Philadelphia cluster.

There were 23 seasonal sampling events performed by the Academy of Natural Sciences and Stroud Water Research Center at five sites from 2013 to 2014. Two thirds of sampling events met criteria for nitrate concentrations for cold-water aquatic communities (<3.1 mg/L nitrate, Minnesota PCA). Three fall season sampling events on Pennypack Creek had concentrations over 6.0 mg/L, exceeding the maximum for nitrate in warm-water streams (4.9 mg/L).

Aquatic life criteria for total suspended solids (<25 mg/L TSS for cold water fisheries, NJ DEP), soluble reactive phosphorus (<0.05 mg/L SRP, a widely-referenced maximum concentration for suitability for aquatic life), and chloride (<230 mg/L chloride under chronic exposure, EPA) were achieved by all sampling events at all sites in the cluster. 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. All sampling events in this cluster met the total ammonia criterion, with concentrations below 0.07 mg/L.

Even though many streams in the Upstream Suburban Philadelphia cluster meet criteria for cold-water streams based on chemical parameters, factors such as stream temperatures, stormwater high flows and high variability in hydrology and habitat quality are not suitable for supporting cold water (trout) communities. The cluster is 77% urban, 17% forested, 4% agriculture and 2% wetlands.

Weathering is the main source of calcium (from limestone), magnesium (from igneous rocks that include biotite and pyroxene), and potassium (from igneous and silicate rocks including feldspar) in freshwater streams. Their concentrations vary depending on rainwater and pollution as well as local geology, with ion concentrations in igneous geographies roughly half those of sedimentary landscapes. Downstream this variation becomes less notable than in headwaters, and ion concentrations increase overall (Allan and Castillo, 2007).