



DRWI
DATA, GIS, & Modeling
Work Group



 **dvrpc**

April 2, 2019
DVRPC
Philadelphia, PA

WiFi Password:
Connections2045

Agenda

- **10:00 AM:** Welcome & Introductions
- **10:15 AM:** Mini Presentations and Q&A
- **11:45 AM:** Updates from Work Group Members
- **12:25 PM:** Meeting evaluation
- **12:30 PM:** Lunch and Networking

Help Us Take Notes Today

goo.gl/A27mmQ


2019.04.02 Notes ☆

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Outline

- Agenda:
- About DRWI
- Updates


@dvrpc

April 2, 2019 Meeting Notes

Agenda:

- 10:00 AM: Welcome & Introductions
- 10:15 AM: Mini Presentations and Q&A
 - John Hasse, Rowan University
 - Scott Haag, Academy of Natural Sciences of Drexel
 - Dan Ford, Heritage Conservancy
- 11:45 AM: Updates from Work Group Members
- 12:25 PM: Meeting evaluation
- 12:30 PM: Lunch and Networking

DVRPC Presentation:

Recording:

Registered Attendees (bold = attended):

-

Notes from Meeting:

About DRWI
Visit DVRPC's website to learn more about the group:
<https://www.dvrpc.org/waterquality/dataGIS/>
Also join Basecamp to stay involved, receive notifications, and join chat groups with others

Welcome & Introductions



What is the DRWI Data, GIS, and Modeling Work Group?



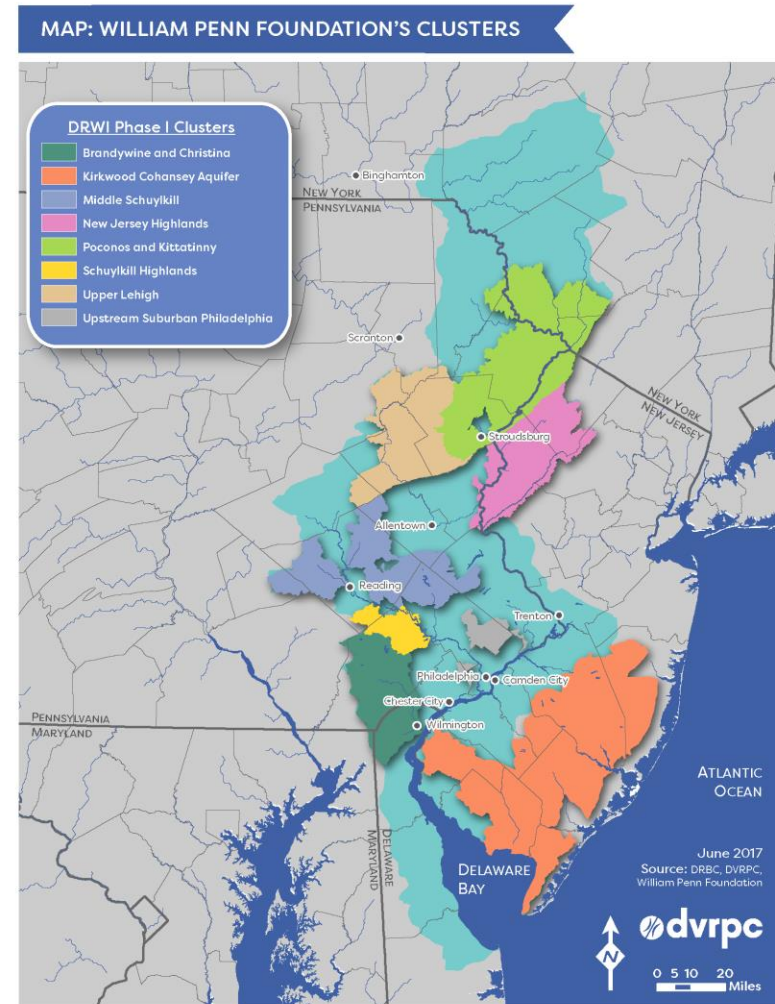
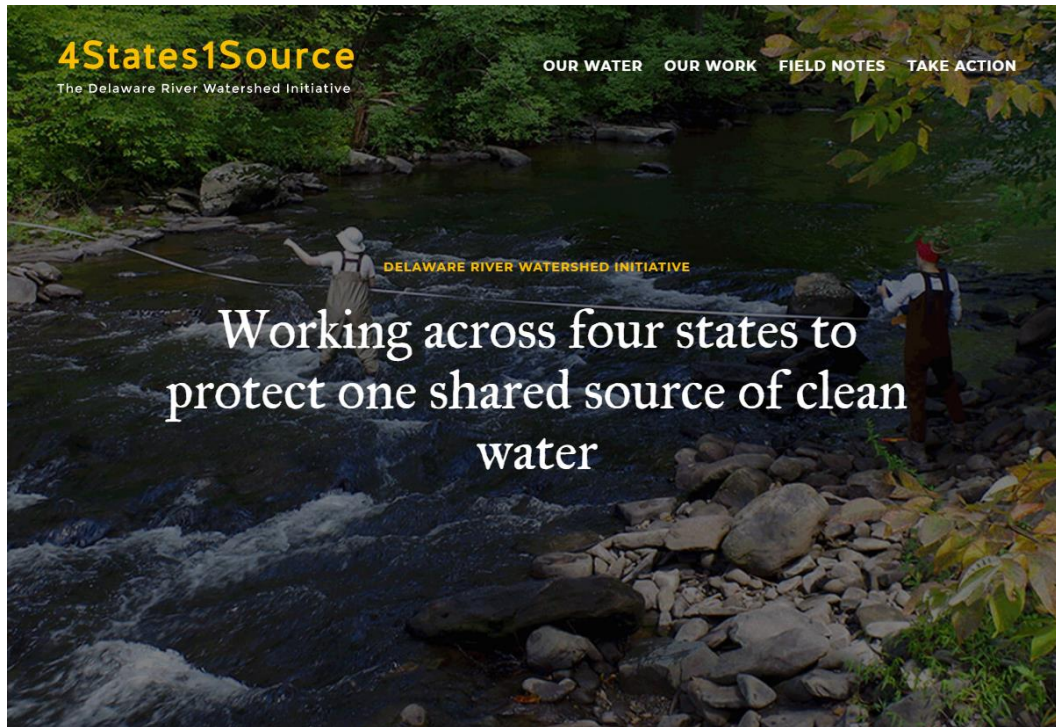
DRWI
DATA, GIS, & Modeling
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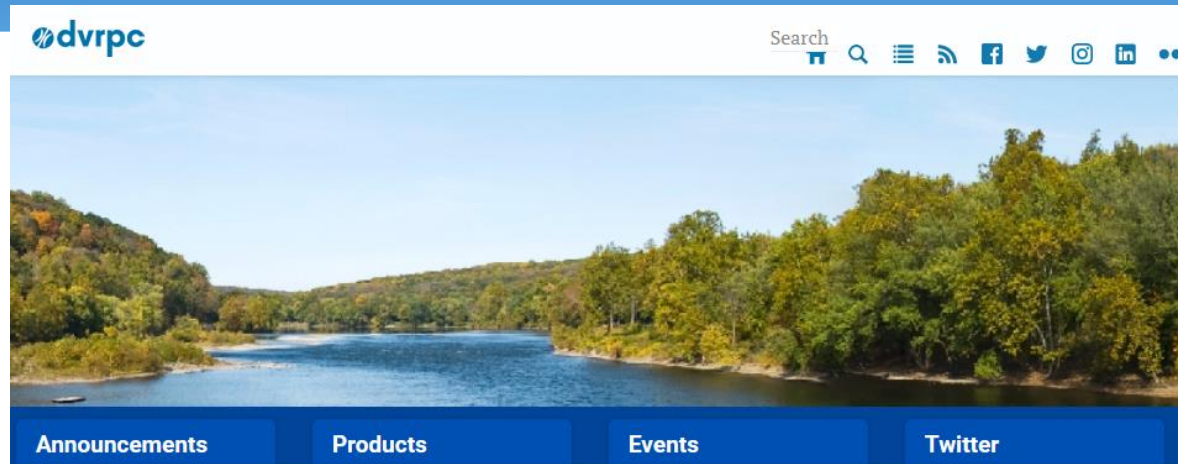
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Delaware River Watershed Initiative (DRWI)

www.4states1source.org



<https://www.dvrpc.org/waterquality/DataGIS/>



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- [Data and Products](#)
- [Long-Range Plan and TIP](#)
- [Transportation](#)
- [Land Use and Environment](#)
 - [Water Quality Programs](#)
 - [Coastal Zone Management](#)
 - [DRWI Data and GIS Work Group](#)
 - [Municipal Water Quality Actions](#)
- [Planning Assistance Center](#)
- [Commuter Services](#)
- [Get Involved](#)

Data and GIS Work Group



DRWI
Data, GIS, & Modeling
Work Group



dvrpc

What does the Data and GIS Work Group do?

From January 2018 - December 2019, DVRPC staff will convene a Data and GIS Work Group for the Delaware River Watershed, which stretches across four states and provides drinking water to over 15 million people. The group will prioritize data needs, share knowledge, expand capacity, and collaborate to

Basecamp

www.basecamp.com

The screenshot displays the Basecamp web interface. At the top, there is a navigation bar with icons for Home, Pings, Hey!, Activity, and Find, along with a search icon and a user profile icon. A notification banner at the top center reads: "Feb 13, 2018 - NEW FEATURE: We just improved the Schedule card on the home screen for a project, team, or HQ. Now it includes events and dated to-dos, as well as faces of the people involved. [Here's a quick summary of everything that's new.](#)"

The main content area is titled "Delaware River Watershed Initiative" and is managed by "Adminland". It features a card for the initiative with a green header and a list of links: [My Assignments](#), [My Bookmarks](#), [My Schedule](#), [My Drafts](#), [My Recent Activity](#), and [My Applause](#). Below this, there is a "Projects" section with a "+ New" button and a "DRWI Data, GIS, & Modeling" Work Group card. At the bottom, a footer indicates "You're using [Basecamp for Non-profits.](#)"

Introductions

- Your Name
- Your Title
- Your Organization

Speaker Twitter Handles

- @AcadNatSci
- @RowanUniversity
- @shippensburgU
- @HConservancy
- @PaMAGIC
- @USGS
- @stroudcenter

- @DVRPC
- #4states1source

Scott Haag



The Academy of
Natural Sciences
of DREXEL UNIVERSITY

Delaware River Watershed Initiative // Phase II Planning

STREAM REACH ASSESSMENT TOOL

Scott Haag, MS

Section Leader

Environmental Data Science Section

Patrick Center for Environmental Research



The Academy of
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of DREXEL UNIVERSITY

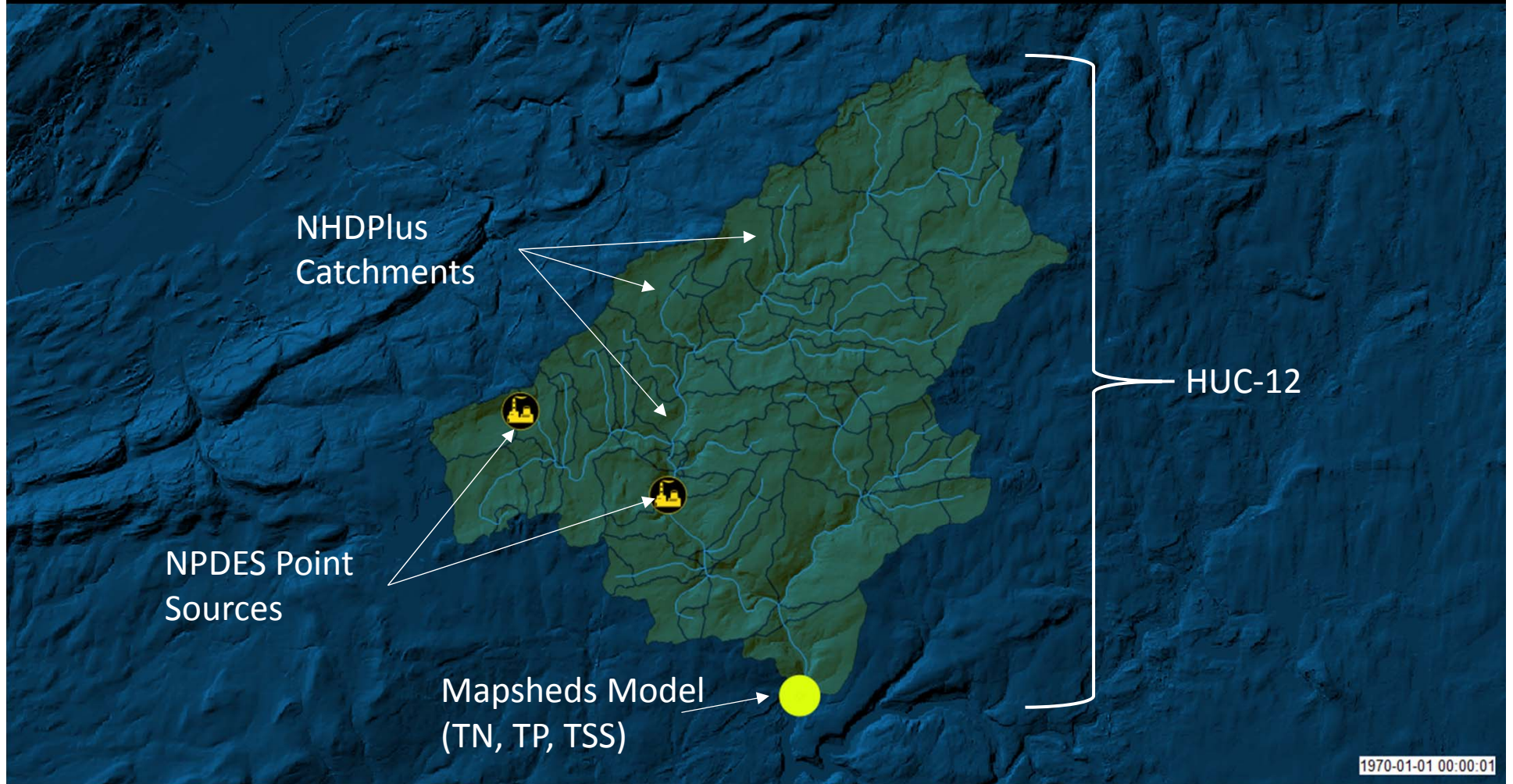
Delaware River Watershed Initiative // Phase II Planning

STREAM REACH ASSESSMENT TOOL

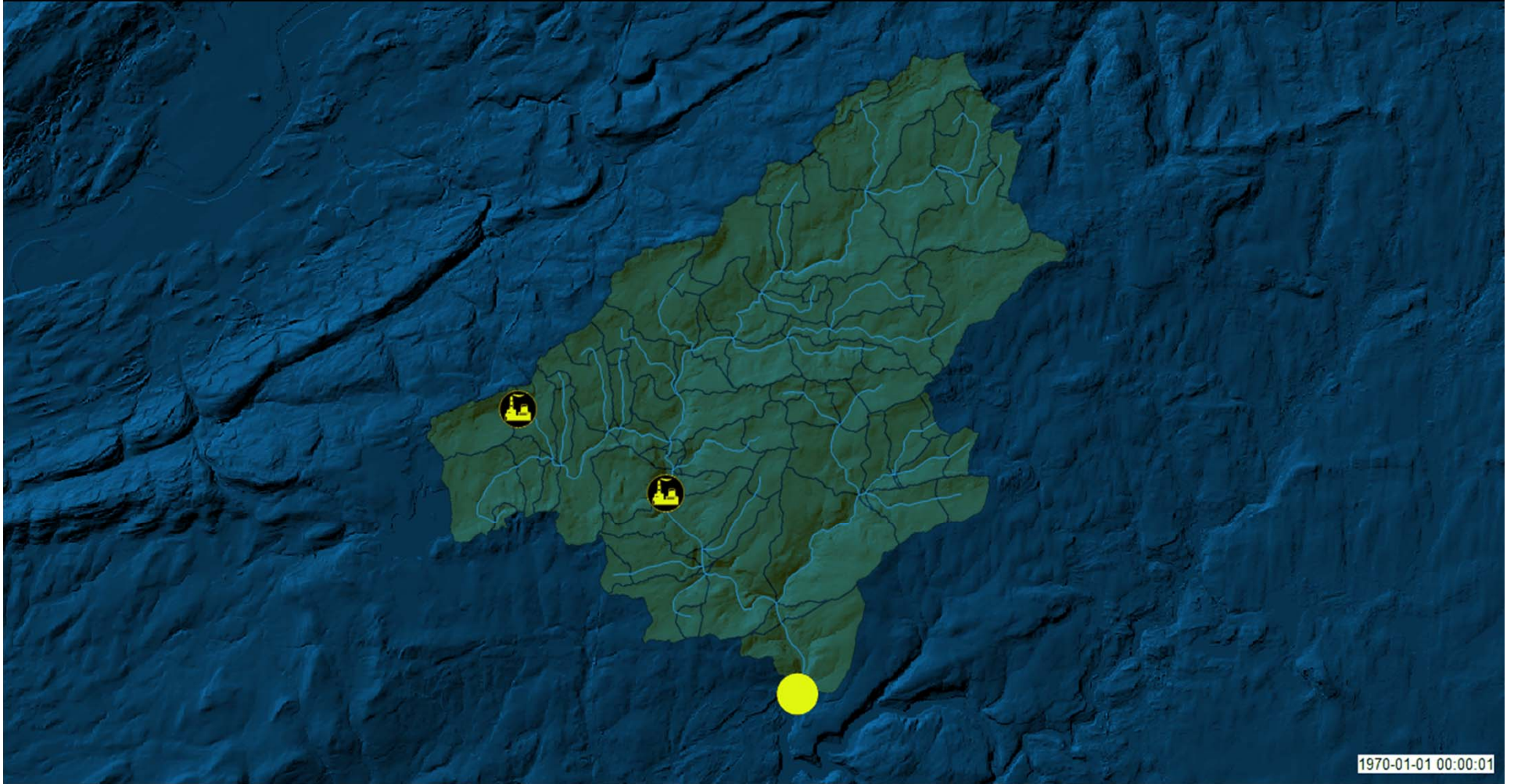
- Models nutrient yields and concentrations through out the DRB
- Created with data from multiple sources
 - Mapshed developed by Dr. Barry Evans
 - NHDPlus
 - National Land Cover Database
 - NPDES point sources
- Models at reach-scale:
 - Mean annual loads & in-stream concentrations - TN, TP & TSS
 - Ability to Produce Clean and Abundant Water – score aggregating local landscape features



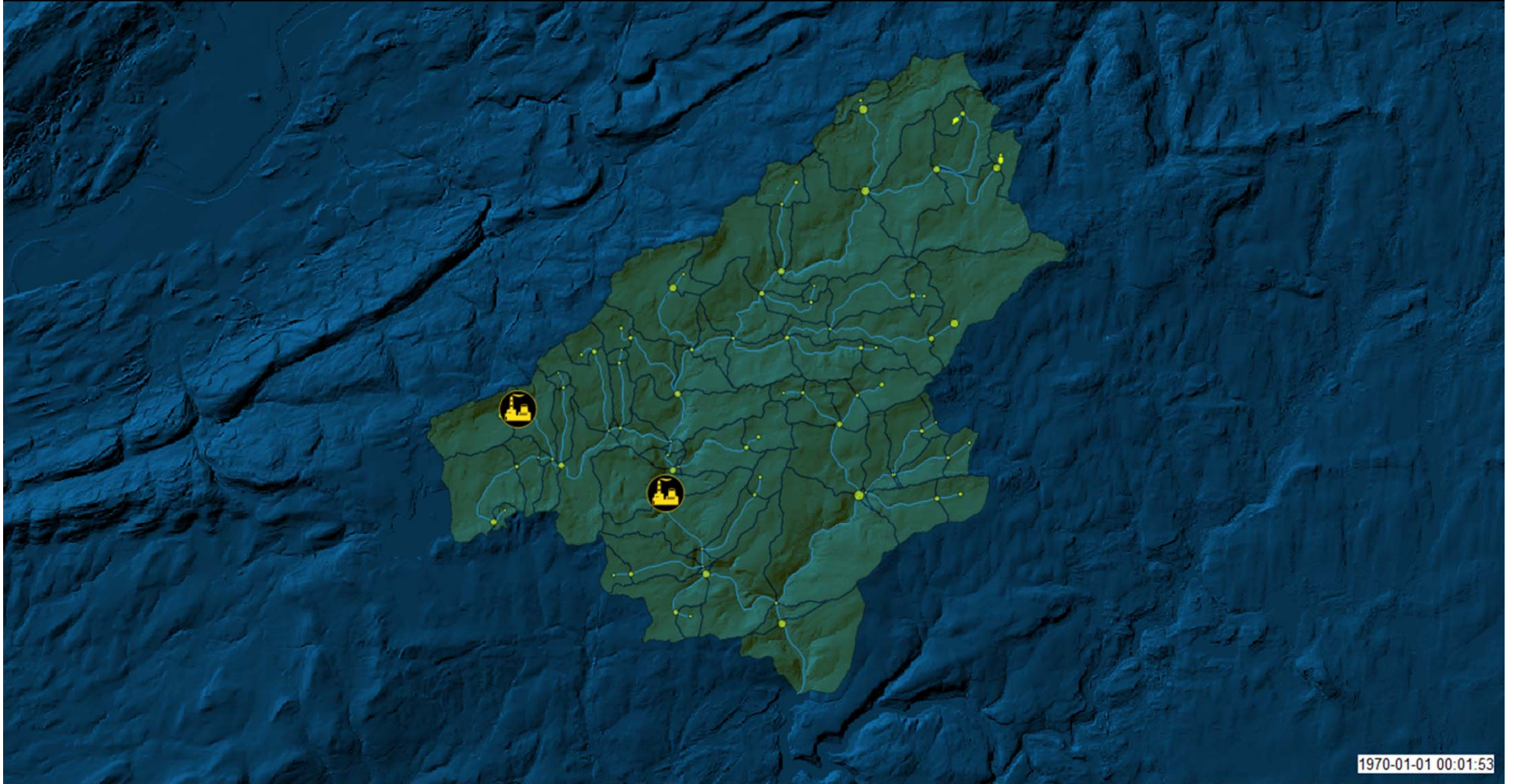
Stream Reach Assessment Tool



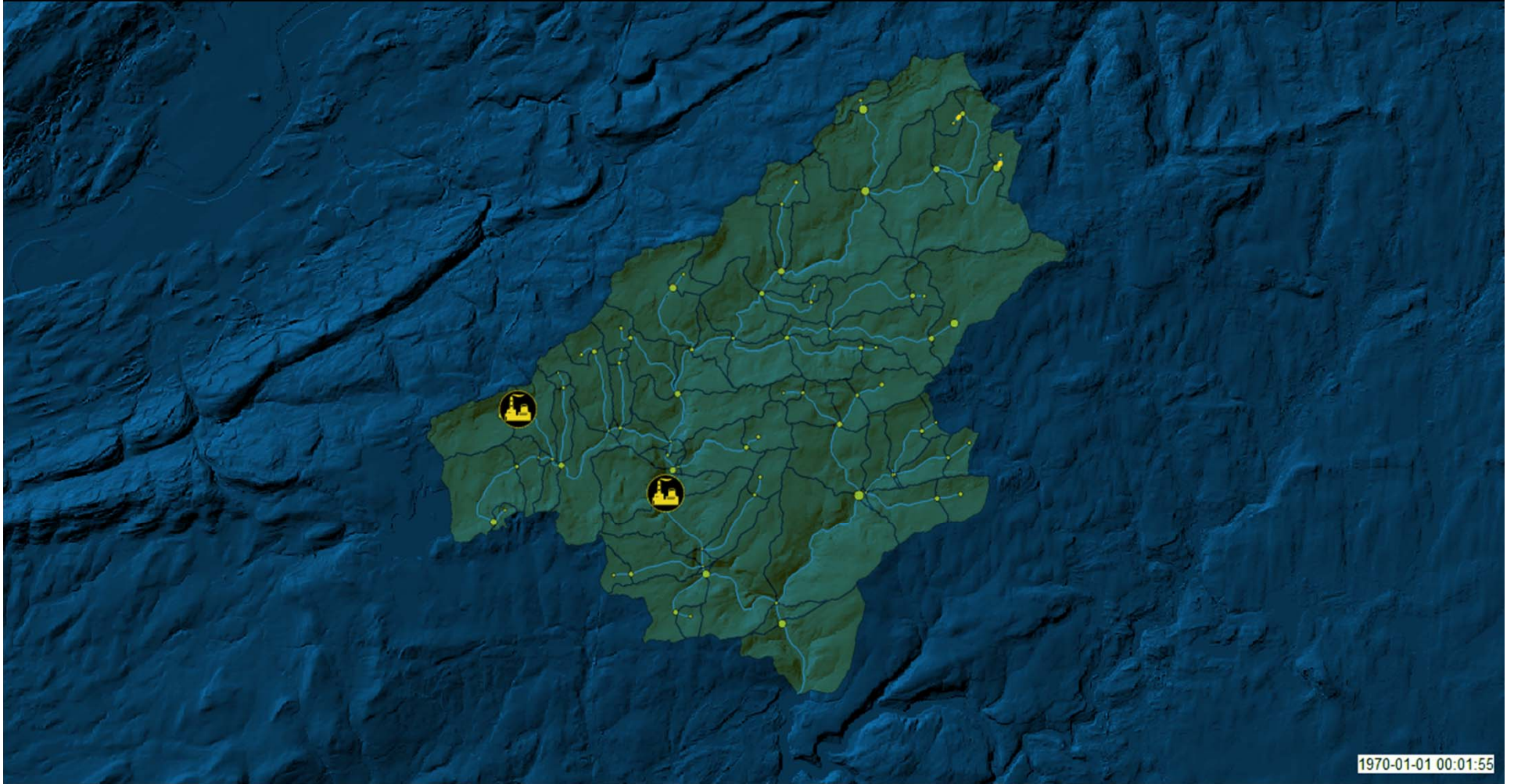
Stream Reach Assessment Tool



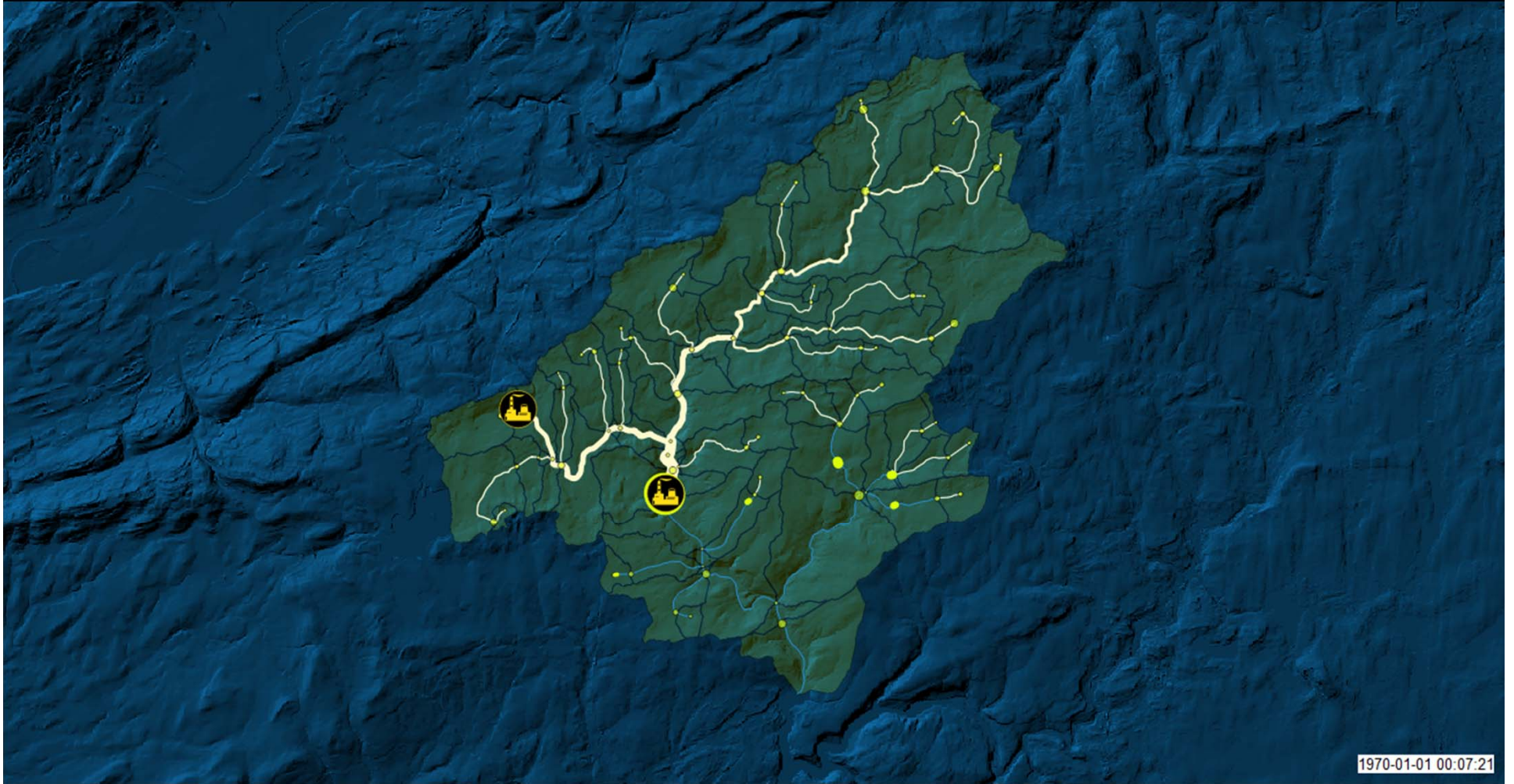
Stream Reach Assessment Tool



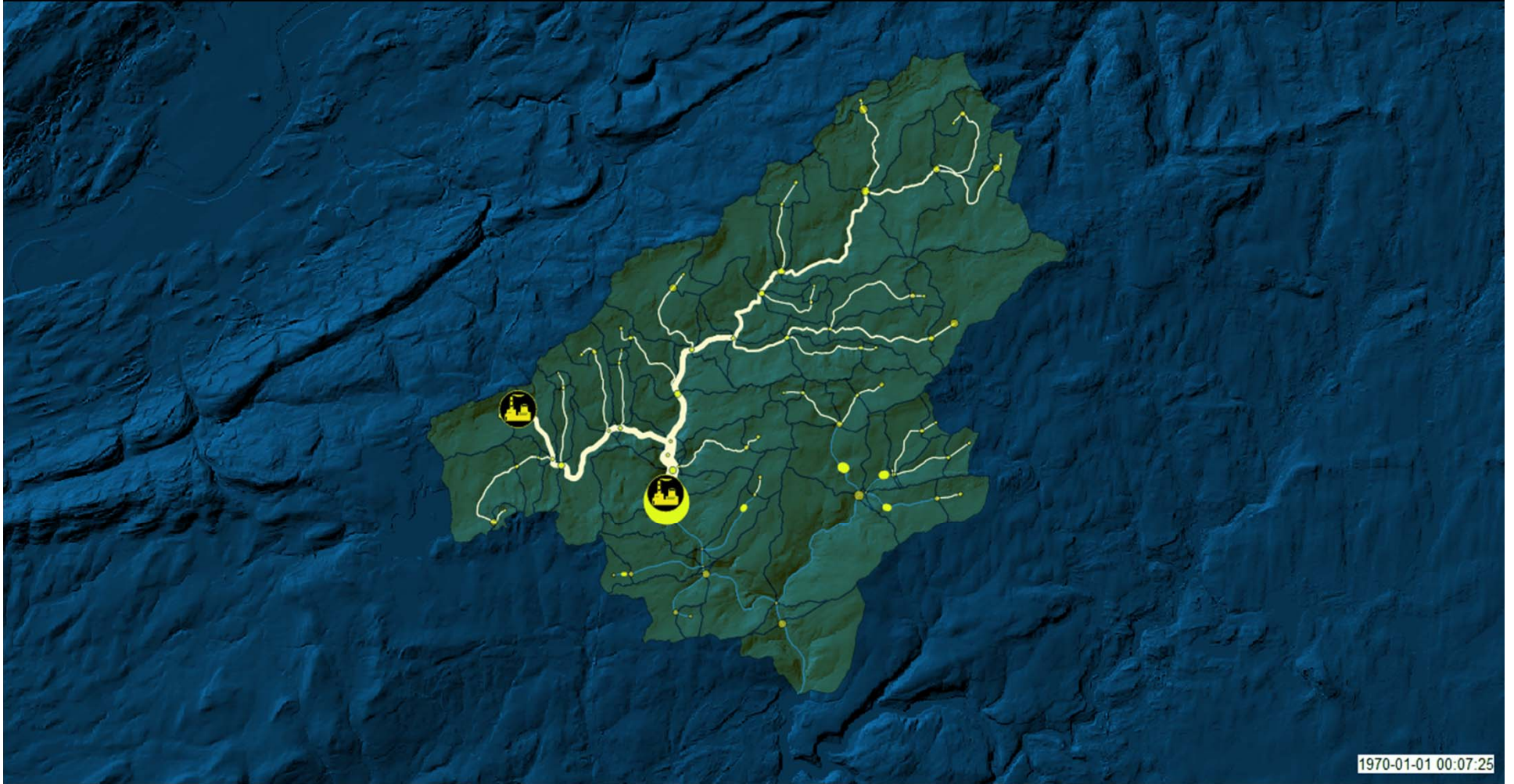
Stream Reach Assessment Tool



Stream Reach Assessment Tool



Stream Reach Assessment Tool



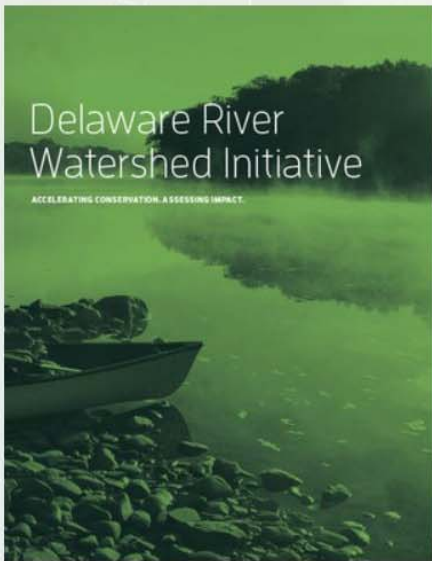
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Stream Reach Assessment Tool



Stream Reach Assessment Tool

- Introduction
- Nitrogen
- Phosphorus
- Sediment
- Ability to Produce Clean Abundant Water
- Land Cover & Land Use



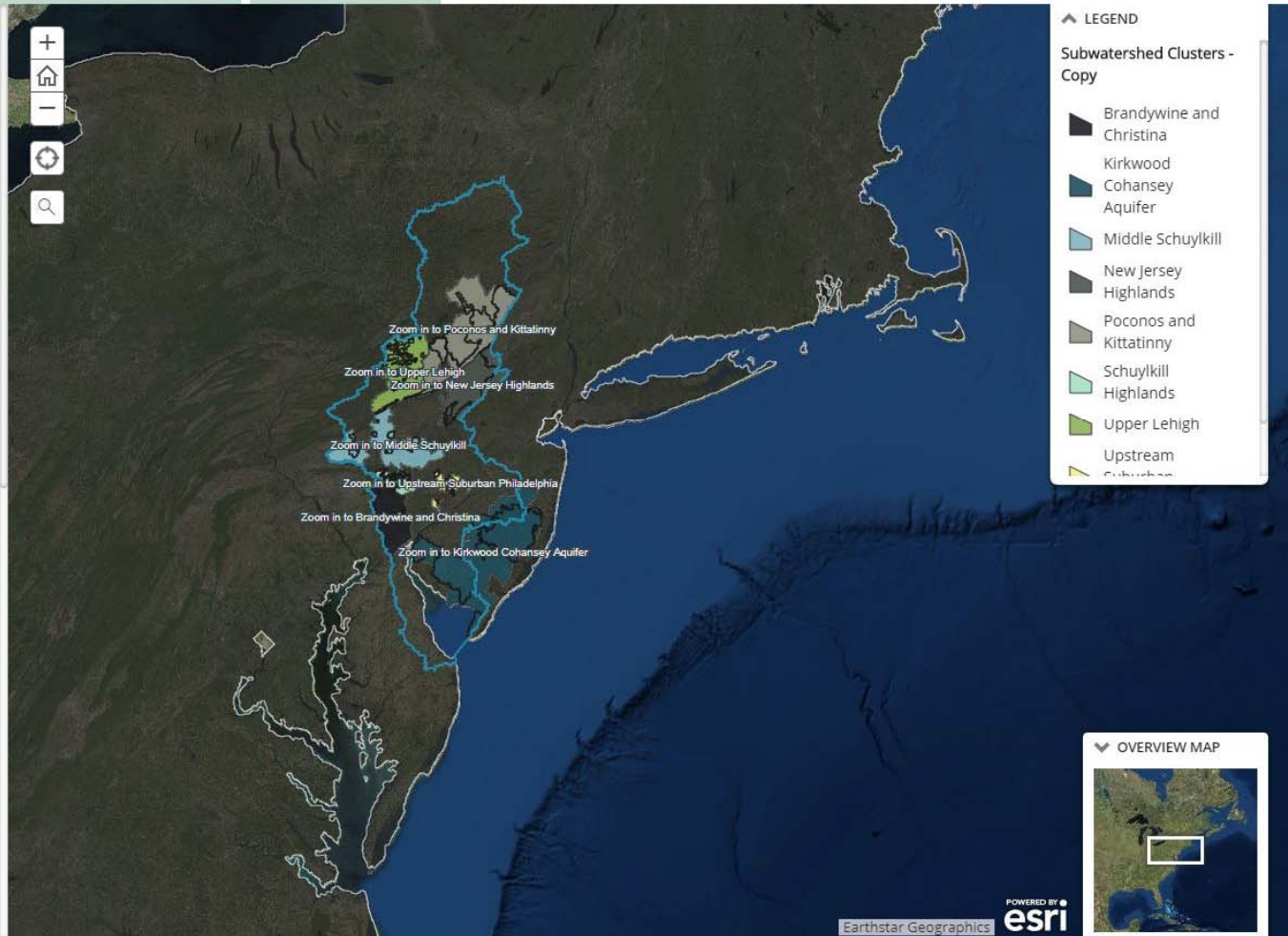
Delaware River Watershed Initiative

ACCELERATING CONSERVATION. ASSESSING IMPACT.

In an unprecedented collaboration to protect and restore water quality, more than 50 leading nonprofits have joined together to accelerate conservation in eight regions of the Delaware River watershed. Informed by science, the Initiative aligns priorities for land protection and restoration projects in these ecologically significant areas. Scientists assess water quality impacts at select sites throughout the basin to evaluate progress towards the goal: *Watersheds that provide high quality and sufficient water quantity for healthy ecosystems and human communities.*

Stream Reach Assessment Tool Overview

Land use decisions upstream affect water quality downstream. A small headwaters stream might be influenced by land use on as little as a few thousand acres; for a larger tributary, as many as two million acres may affect the river's chemical and biological traits. Understanding impacts at different scales is challenging. In order to accurately assess pollutant loads in streams and evaluate the quality of natural resources that are supporting clean water, the Stream Reach Assessment Tool (SRAT) was designed to integrate dozens of datasets to provide the following information:




LEGEND

Subwatershed Clusters - Copy

- Brandywine and Christina
- Kirkwood Cohansey Aquifer
- Middle Schuylkill
- New Jersey Highlands
- Poconos and Kittatinny
- Schuylkill Highlands
- Upper Lehigh
- Upstream Suburban Philadelphia

OVERVIEW MAP



Earthstar Geographics **POWERED BY** esri

Stream Reach Assessment Tool

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Nitrogen

High nutrient concentrations (particularly phosphorus in freshwater systems) can result in excessive plant growth (e.g., nuisance algae) and lower dissolved oxygen levels in streams. As a result, the level of nutrients in a stream is one good indicator of water quality.

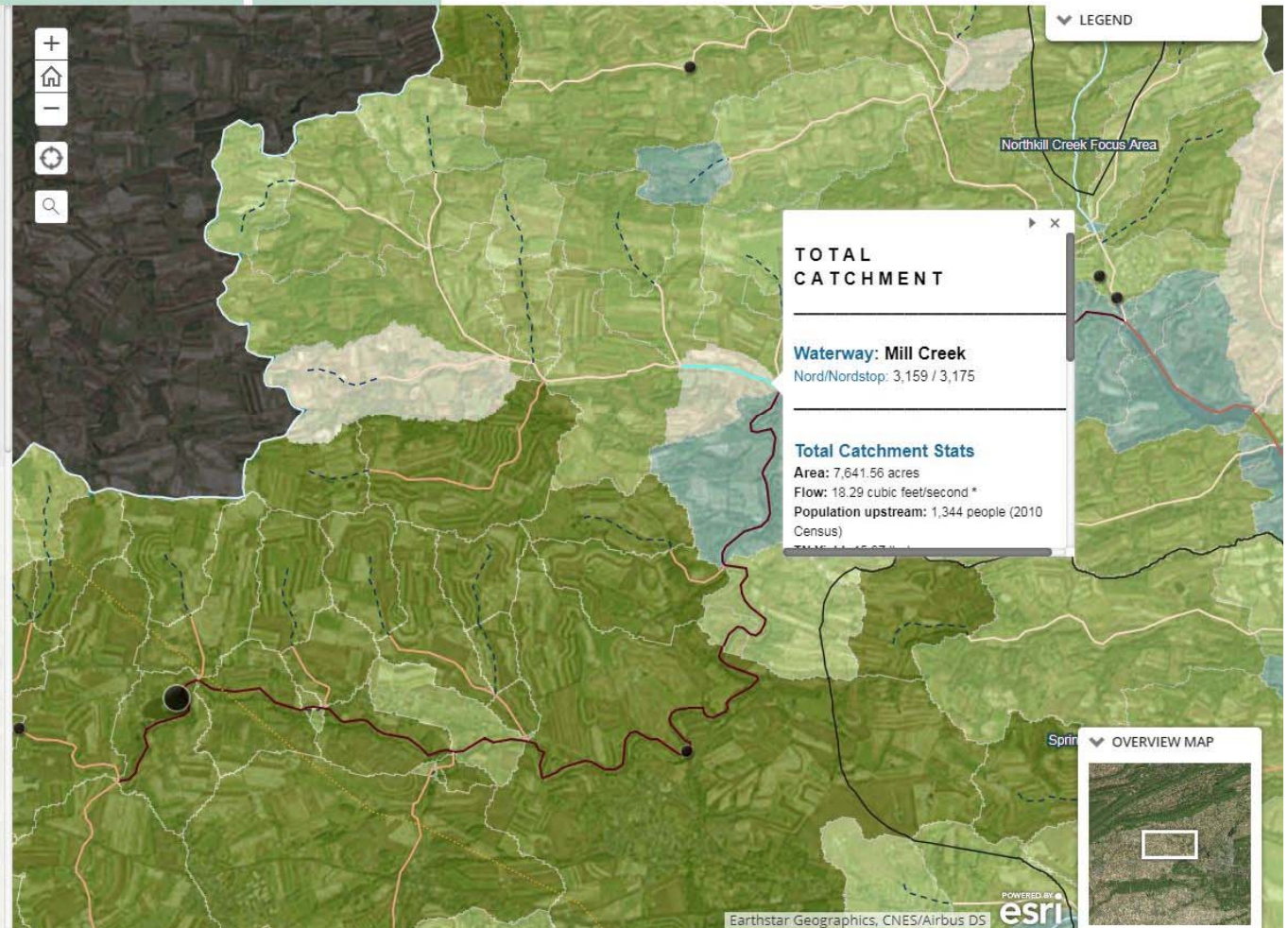
In most fresh water bodies, phosphorus is the limiting nutrient for aquatic growth. Conversely, in most estuarine systems, nitrogen is the limiting nutrient. In some cases, however, the determination of which nutrient is the most limiting is difficult. For this reason, the ratio of the amount of N to the amount of P is often used to make this determination (Thomann and Mueller, 1987). If the N/P ratio is less than 10, nitrogen is limiting. If the N/P ratio is greater than 10, phosphorus is the limiting nutrient.

If the nutrient load to a water body can be reduced, the available pool of nutrients that can be utilized by plants and other organisms will be reduced and, in general, the total biomass can subsequently be decreased as well (Novotny and Olem, 1994). In most efforts to control eutrophication processes in water bodies, emphasis is placed on the limiting nutrient. This is not always the case, however. For example, if nitrogen is the limiting nutrient, it still may be more efficient to control phosphorus loads if the nitrogen originates from difficult to control sources such as nitrates in ground water.

Nutrient (i.e., nitrogen and phosphorus) loads primarily originate from wastewater treatment plants and agricultural land. Watersheds with high farm animal populations also tend to have higher nutrient loads. In this case, much of the animal waste is used as an organic fertilizer on surrounding cropland, which contributes to the nutrient loads emanating from these areas.

Pollutant Thresholds:

Provided below is a table that presents some "threshold" values for nutrients and sediment that are intended to help determine whether a given watershed or stream segment might be impaired with respect to water quality. It must be understood, however, that these values are provided for guidance purposes only, and that actual impairments may vary based on many factors that interact at any given location. In the case of the values from Sheeder and Evans, both loading rate and in-stream concentration values are given. These latter values are to be interpreted as approximate "breakpoints" between impaired and unimpaired watersheds that were based on an analysis of observed stream data for 29 watersheds in Pennsylvania. The in-stream concentration values developed by USEPA and NJDEP, on the other hand, represent "targets" that each agency believes should be met to ensure unimpaired conditions within the general region of the Delaware River Basin. In the case of the USEPA values, a range is given for TN and TP due to that fact that values were developed for different ecoregions across the U.S. and the



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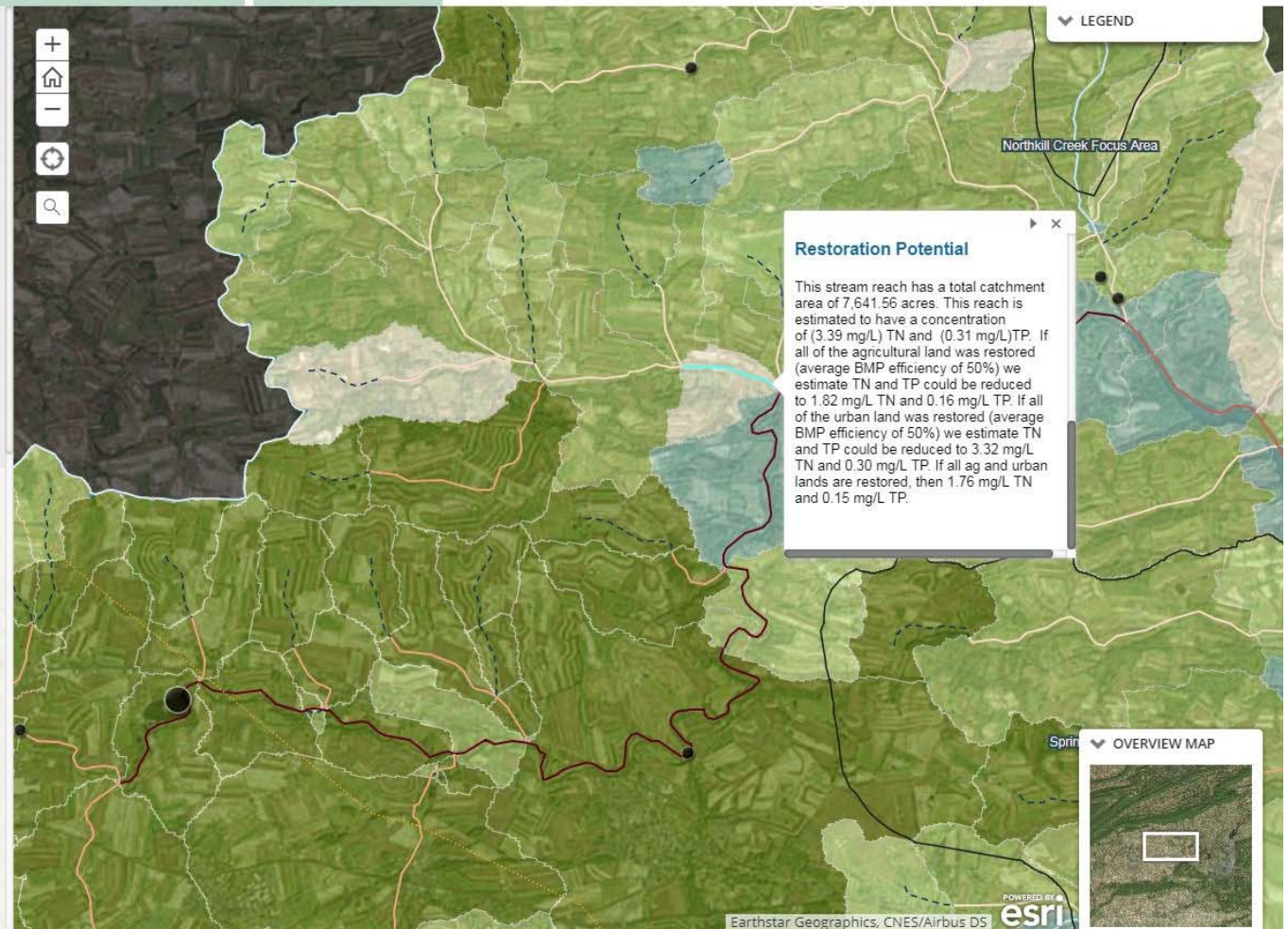
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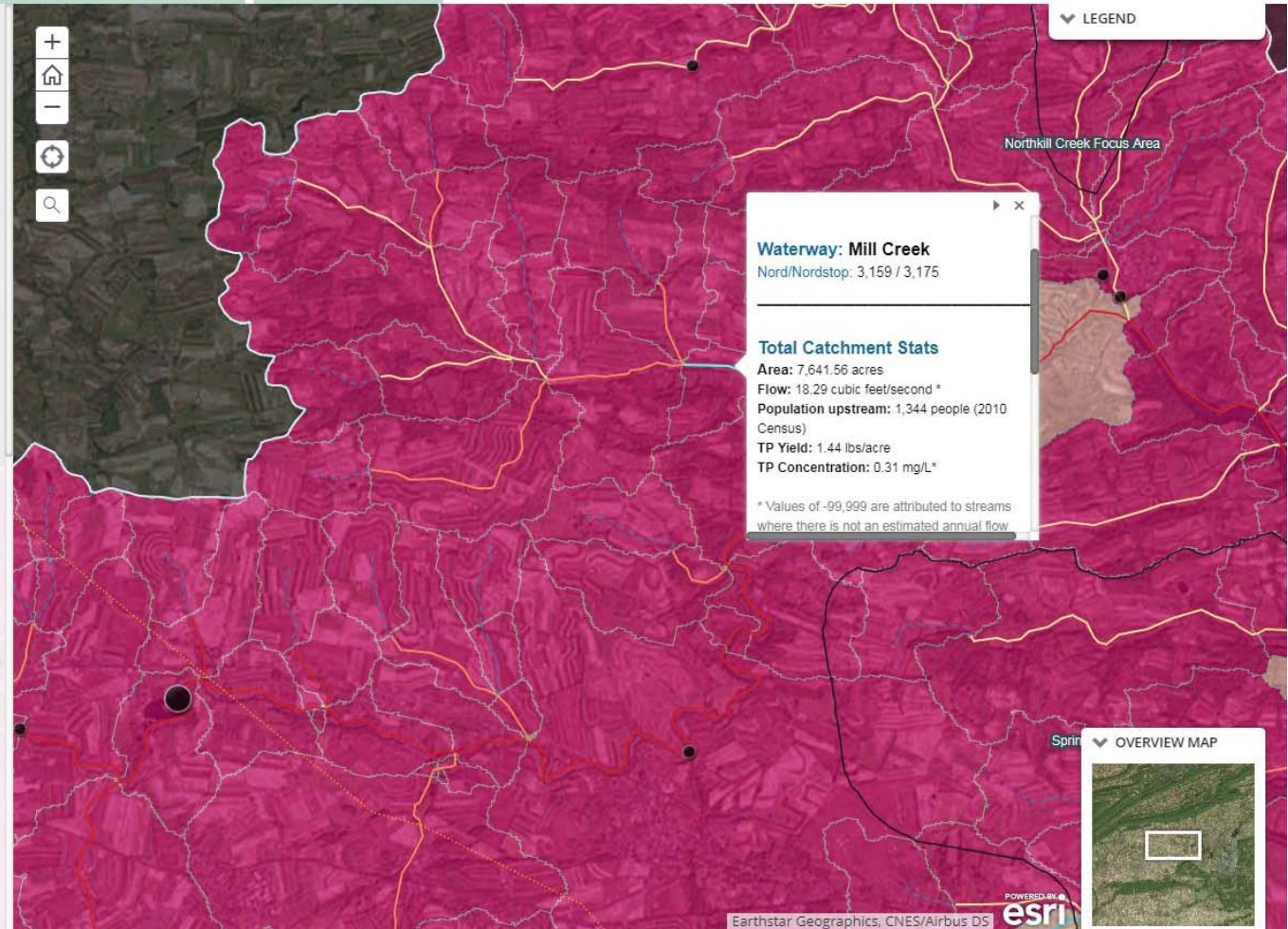
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From the table, it can be seen that a threshold value of 0.1 mg/l seems appropriate for TP. Although the values range considerably for TN, it should be noted, as described earlier, that the value for TP is usually more important due to the fact that it is the limiting nutrient for most streams in the Delaware River Basin. In the case of TSS, NJDEP has set different threshold values for TSS depending upon whether the streams do or do not support trout.

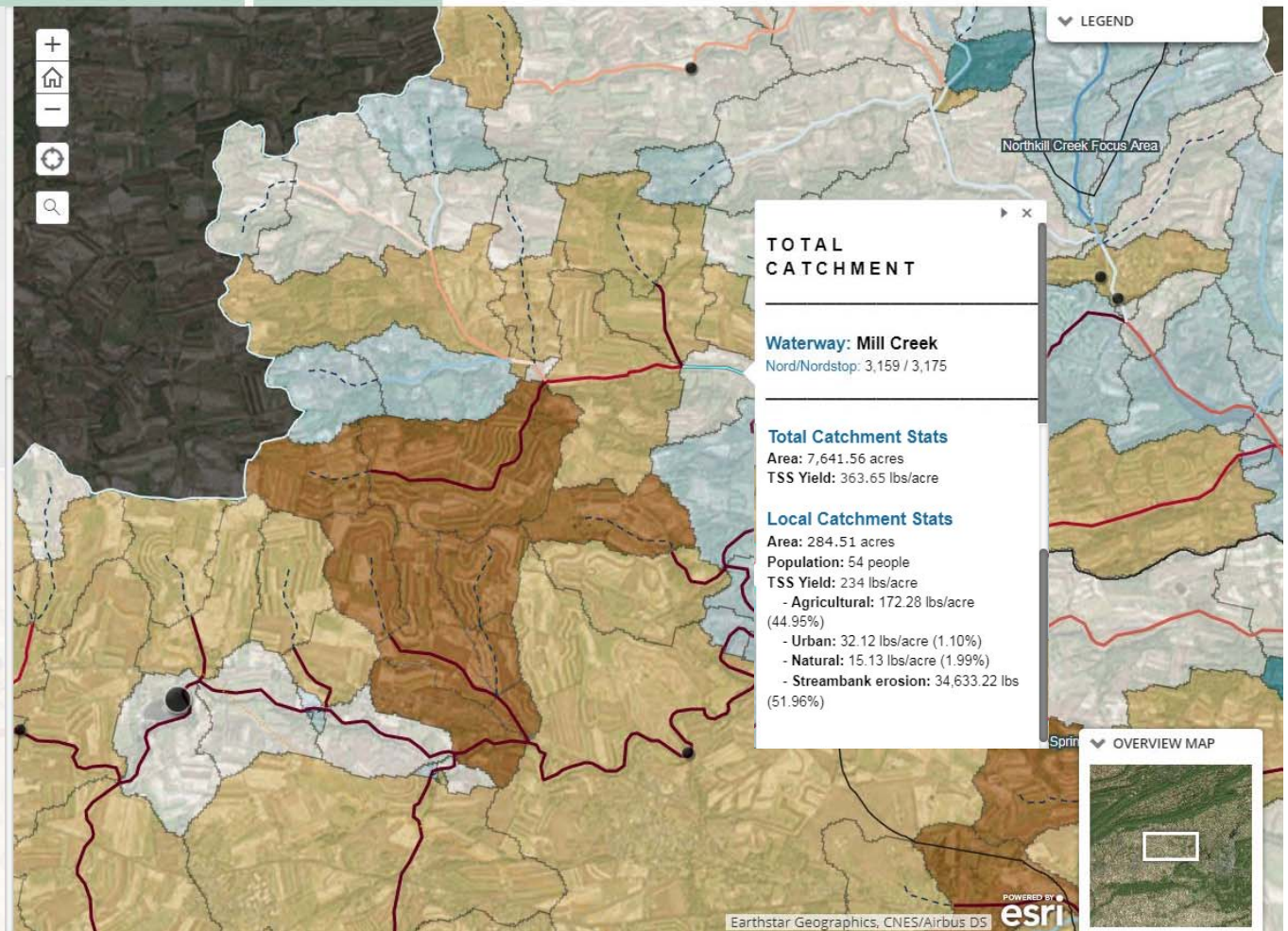
Yields and Concentration Thresholds:

	TN	TP	TSS
Sheeder and Evans	13.0 kg/ha (14.6 lb/ac)	0.30 kg/ha (0.34 lb/ac)	785 kg/ha (882 lb/ac)
Sheeder and Evans	3.0 mg/L	0.07 mg/L	197 mg/L
USEPA	0.07-1.0 mg/L	0.006 - 0.1 mg/L	---
NJDEP	10.0 mg/L	0.1 mg/L	25 - 40 mg/L (trout vs. non trout)

*Note the actual nitrogen values given in Sheeder and Evans are for inorganic N only, and are lower than those shown in the table above. The ones shown above have been adjusted upwards to account for organic N as well. Also note that the TN values for NJDEP are for nitrate-N only. In this case, the value appears to be based on the national 10 mg/l drinking water standard rather than ecological or nutrient enrichment factors.

Sources:

Sheeder, S.A., Evans, B.M., 2004. Estimating nutrient and sediment threshold criteria for biological impairment in Pennsylvania watersheds. J. Am. Water Res. Assoc. 40, 881-888.



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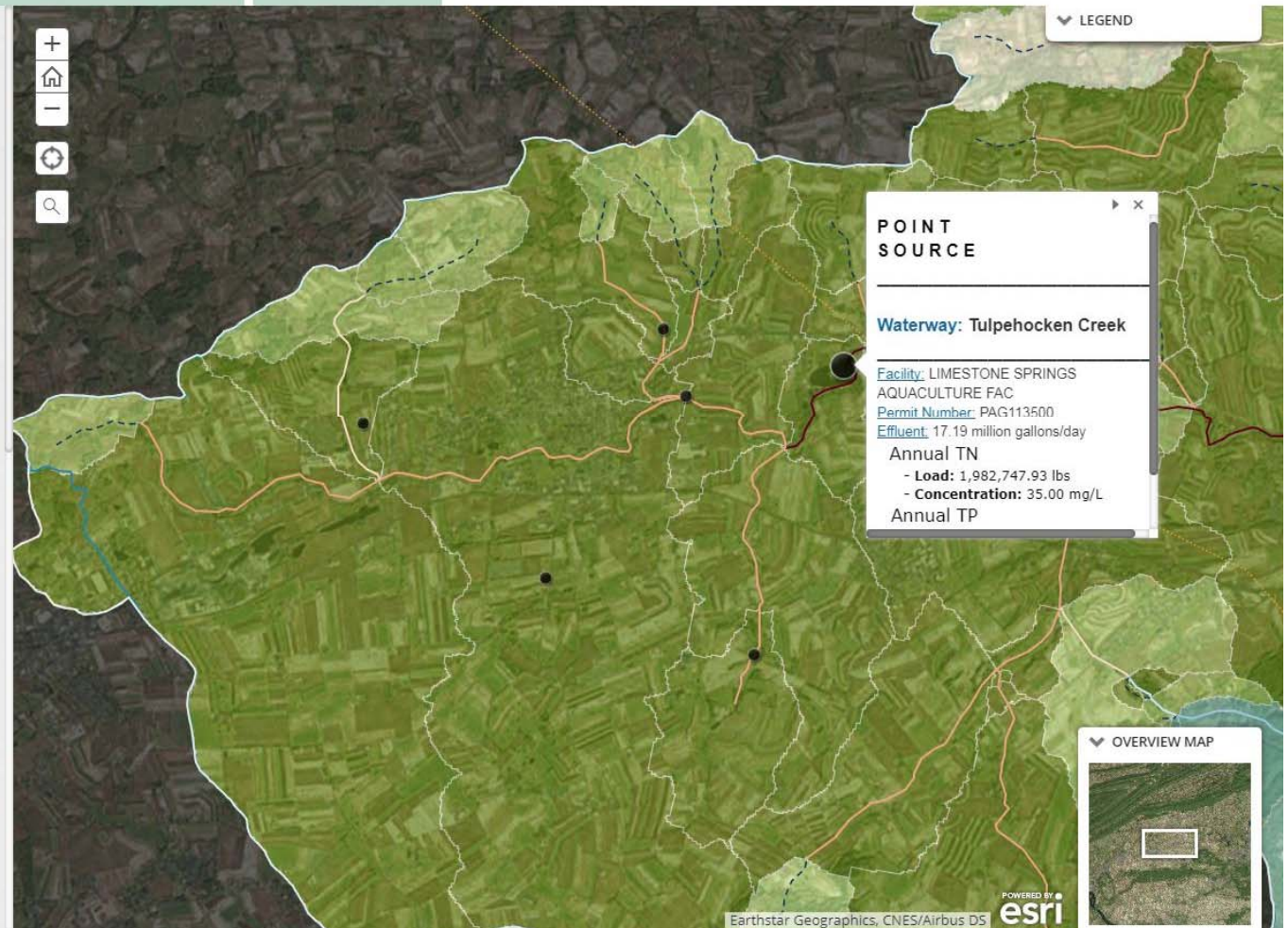
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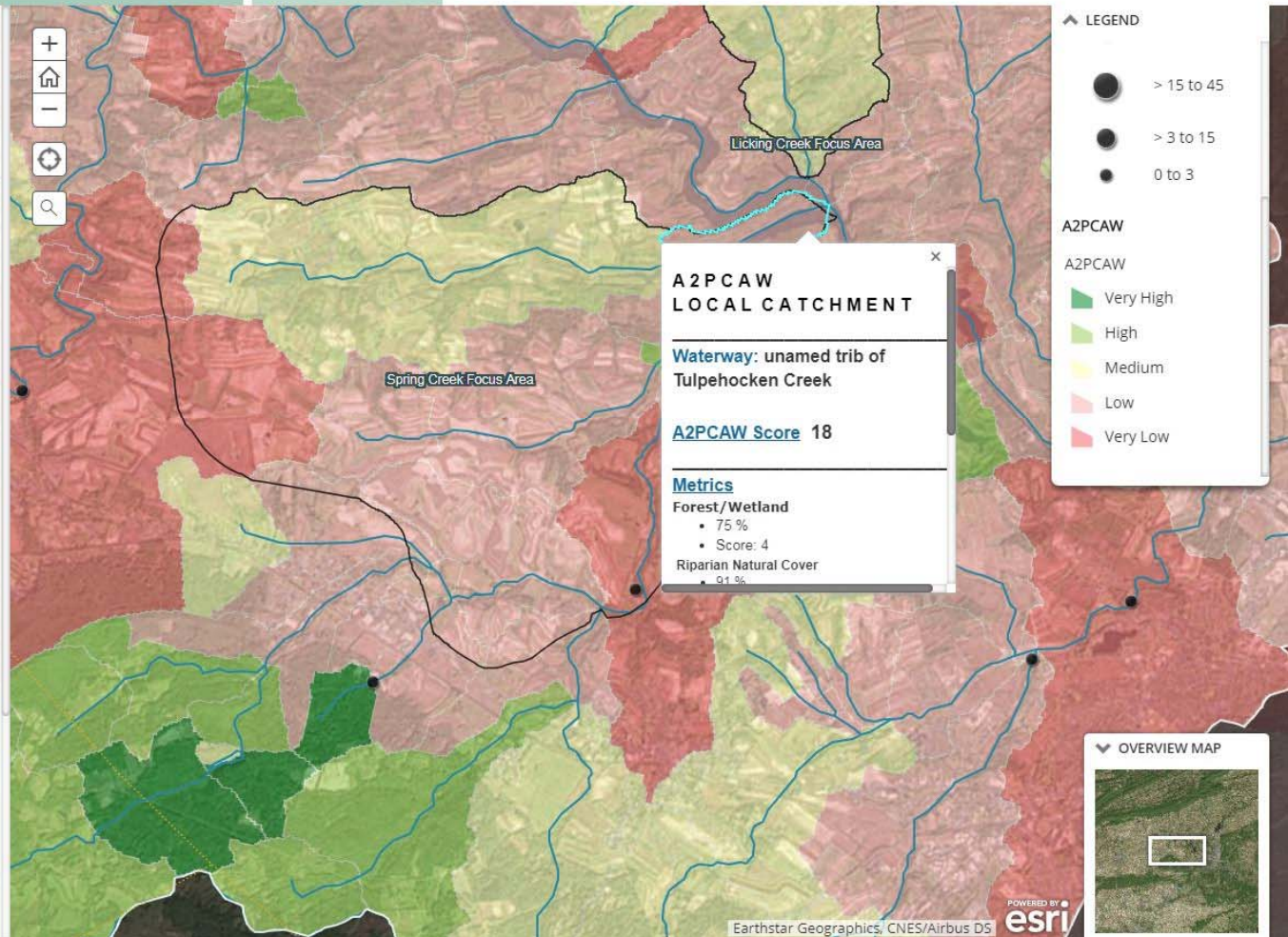
Ability to Produce Clean Abundant Water

As part of Phase I of the Delaware River Watershed Initiative, the Open Space Institute (OSI) developed a metric to measure the relative capacity of small-scale (HUC12) watersheds to produce clean surface and ground water. The metric directly considers watershed conditions including land cover, terrain and hydrology that affect both the abundance and quality of surface and ground water within a reasonably-sized watershed (i.e., HUC12 boundary).

The new indexing scheme used to derive this metric (still called the "Ability to Produce Clean Abundant Water") is summarized in the table below. This metric retains many of the analytical components of other previously-developed watershed-rating approaches such as "Forest-to-Faucet" (Barnes et al., 2008), the "Conservation Priority Index" (WRI, 2013), and the "SmartConservation" initiative in southeast Pennsylvania (<http://www.natlands.org/services/formunicipalities/smartconservation/>) upon which the earlier metrics were based. For use within SRAT, this metric was re-calculated down to the local catchment of each of the 15,000 stream reaches in the Basin to provide a finer-scale version of this metric.

Ability to Produce Clean Abundant Water Metric

	Very High	High	Medium	Low	Very Low
	(5)	(4)	(3)	(2)	(1)
% Forest/Wetland*	> 88	68 - 88	47 - 68	24 - 47	< 24
% Riparian Natural Cover	> 89	71 - 89	50 - 71	28 - 50	< 28
Erosion Potential	< 82	82 - 128	128 - 186	186 - 277	> 277
Ground Water Recharge (inches/year)	> 16.4	15.6 - 16.4	14.2 - 15.6	10.7 - 14.2	< 10.7
Stream Order	1	---	2	---	3
% Base Flow	> 60	53 - 60	47 - 53	39 - 47	< 39



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Land Cover & Land Use

Land cover and land use are highly correlated with water quality. As such, the National Land Cover Database 2011 (NLCD 2011) dataset has been incorporated into the SRAT outputs to further inform your decision making process.

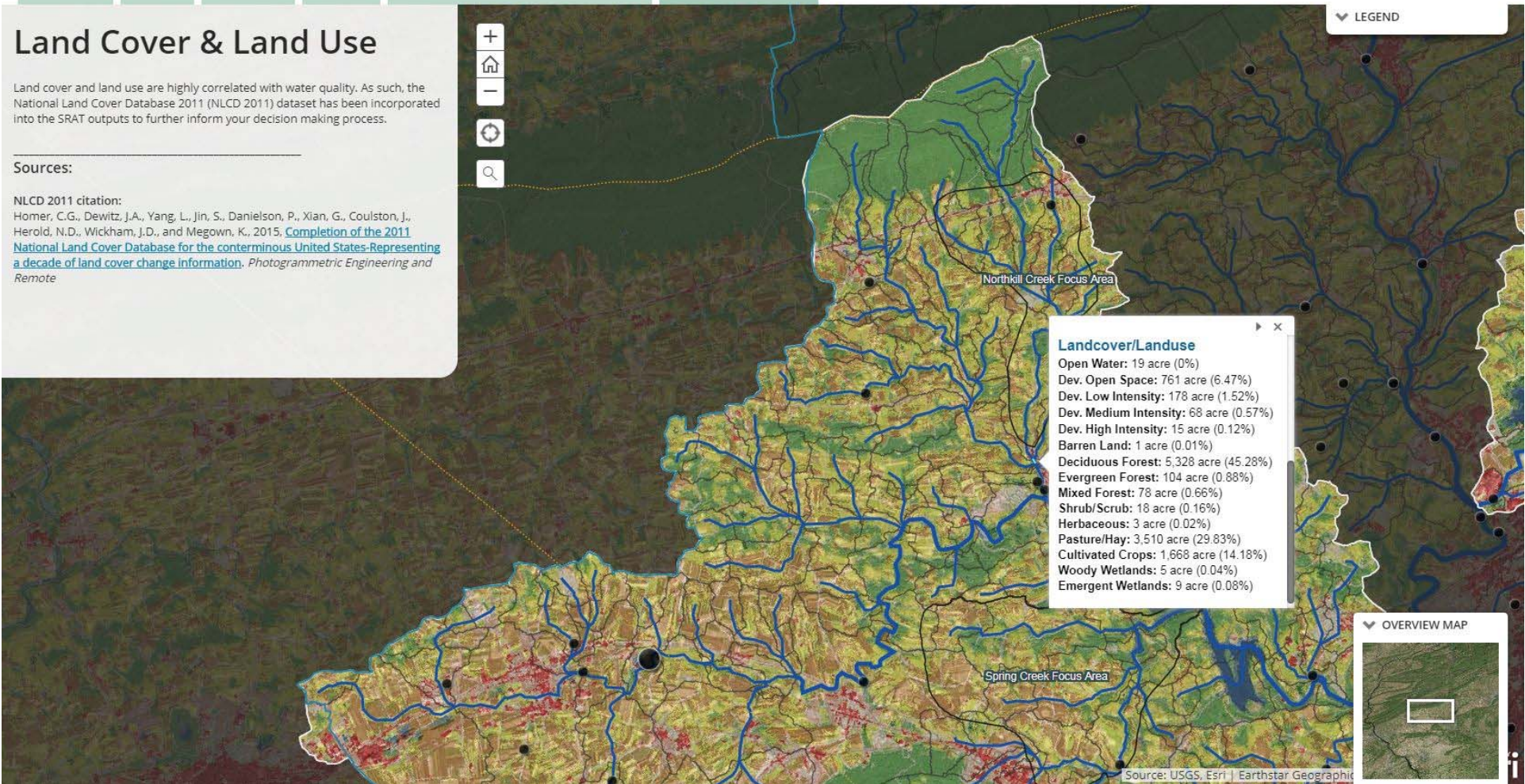
Sources:

NLCD 2011 citation:

Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, [Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information](#). Photogrammetric Engineering and Remote



LEGEND



Landcover/Landuse	
Open Water:	19 acre (0%)
Dev. Open Space:	761 acre (6.47%)
Dev. Low Intensity:	178 acre (1.52%)
Dev. Medium Intensity:	68 acre (0.57%)
Dev. High Intensity:	15 acre (0.12%)
Barren Land:	1 acre (0.01%)
Deciduous Forest:	5,328 acre (45.28%)
Evergreen Forest:	104 acre (0.88%)
Mixed Forest:	78 acre (0.66%)
Shrub/Scrub:	18 acre (0.16%)
Herbaceous:	3 acre (0.02%)
Pasture/Hay:	3,510 acre (29.83%)
Cultivated Crops:	1,668 acre (14.18%)
Woody Wetlands:	5 acre (0.04%)
Emergent Wetlands:	9 acre (0.08%)



Source: USGS, Esri | Earthstar Geographic

www.streamreachtools.org

← → ↻ Secure | <https://www.streamreachtools.org/mapping/> ☆ 📄 📺 ⋮

Space Institute, The Academy of Natural Sciences of Drexel University, Penn State University, The Institute for Conservation Leadership and The William Penn Foundation do not assume responsibility for the spatial accuracy or timeliness of data used. We disclaim any and all responsibility for errors, preclusion or other inconsistencies depicted arising from or otherwise related to this dataset. This map is intended for Phase II planning of the Delaware River Watershed Initiative and should not be used for regulatory purposes.

GIS PROFESSIONALS

We recommend that you download the SRAT dataset. There are four datasets that can be downloaded at this time:

- [APCAW](#)
- [Local Catchments](#) (Pollutant yields by catchment)
- [Total Catchments](#) (Pollutant in stream concentrations)
- [Point Sources](#)



The Academy of
Natural Sciences
of DREXEL UNIVERSITY

ERRATA

[TAKE ME TO THE STORY MAP](#)

February 21, 2017

Errata #2 Updates by Cluster

KIRKWOOD COHANSEY AQUIFER

ADDITIONS:

- We have added Total and Local Catchment data to the SRAT Story Map with a build-out of this data within the Nitrogen, Phosphorus, Sediment and Land Cover & Land Use tabs.

NEW JERSEY HIGHLANDS

MODIFICATIONS:

- Permitnum: NJ0024716 - PHILLIPSBURG TOWN STP - Facility with outfall on Lopatcong Creek moved to Delaware River.
- All non-sewage treatment plants point sources had there TN and TP concentrations adjusted in the New Jersey Highlands. The default/proxy values previously used were changed to the average TN (7.175 mg/l) and TP (1.259 mg/l) concentrations across the basin for non-sewage treatment plants. This modification was made by the request of New Jersey Highland cluster representatives.



Claire Jantz



Data sets and tools from Shippensburg University

Dr. Claire Jantz

cajant@ship.edu



<https://drbproject.org/>




<https://centerforlanduse.org/>



DRB 2070:

<https://drbproject.org/products/>

Delaware River Basin 2070

Delaware River Basin 2070 - three possible futures for the watershed.   

A map story of three possible futures for this important watershed.



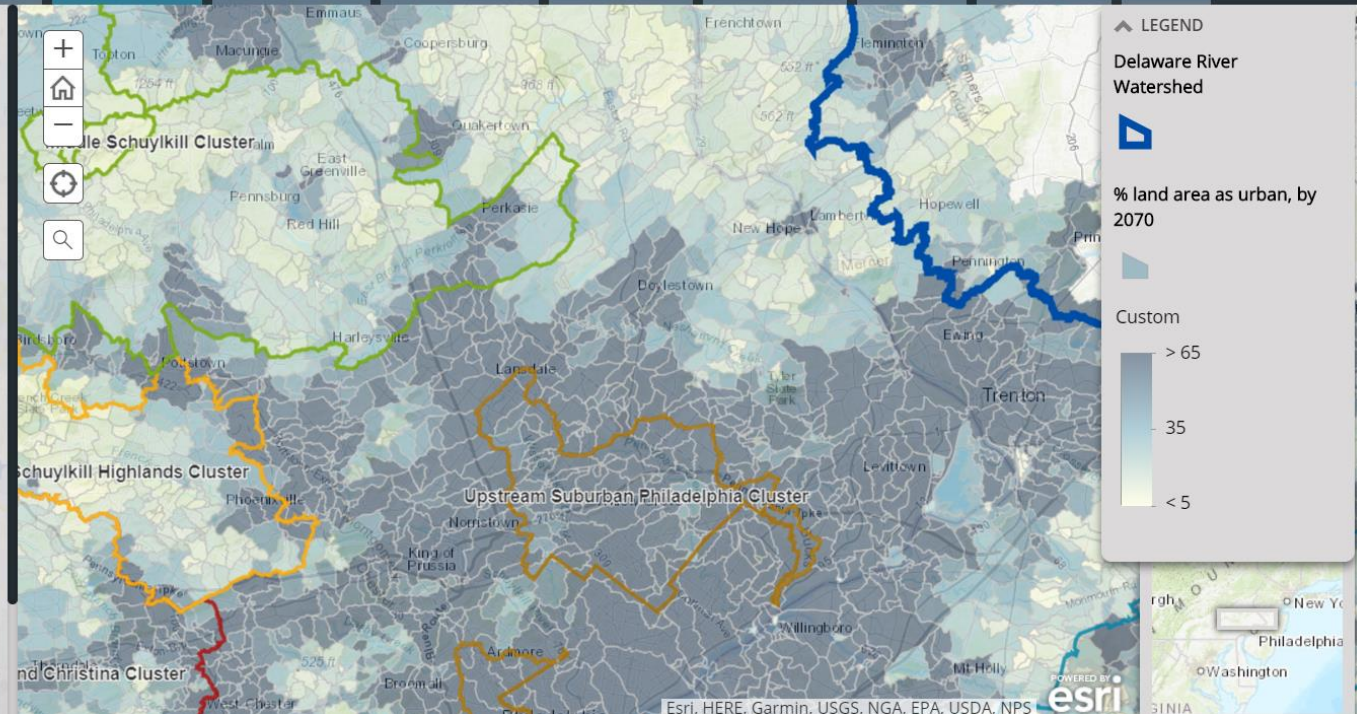
- Introduction
- Scenarios
- Observed, 2011
- Baseline, 2030
- Baseline, 2070**
- Corridors, 2030
- Corridors, 2070
- Centers, 2030
- Centers, 2070
- Summary
- What's next?
- Credits

The Baseline Scenario - a possible future in 2070

The Baseline Scenario represents an attempt to use baseline conditions and recent historical trends to project urban growth into the future. Darker tones indicate more urbanized land. *Fair warning* - any and every attempt to look this far into the future comes with a broad range of uncertainties.

To develop this scenario we relied on:

- a regional build-out trajectory, whereby development is focused on greenfield development near metropolitan areas with minimal/moderate infill;
- information about development trends for road, rail, energy (but not including specific major project proposals like the proposed I-86/87 expansion or the Lackawanna cutoff);
- information about protected areas whereby non-forested wetlands are fully protected and forested or shrub wetlands have moderate to weak protections;
- state-based population forecasts for counties out to 2020;
- the US EPA's ICLUS "basecase" population growth trajectory for counties out to 2070 (which relies on moderate fertility, domestic migration, and net



Coming soon: DRB 2100

Two scenarios of the future

CORRIDORS

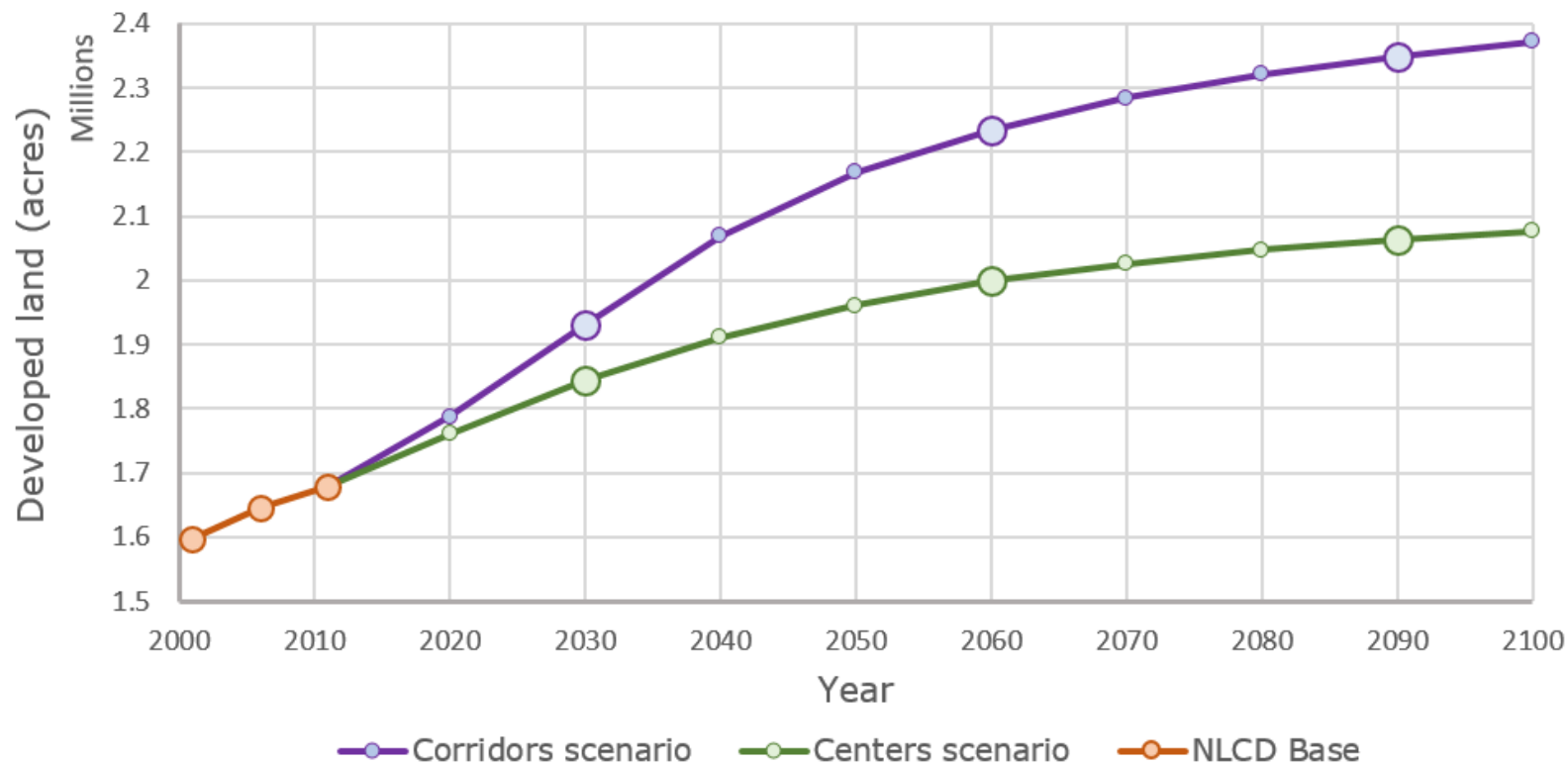


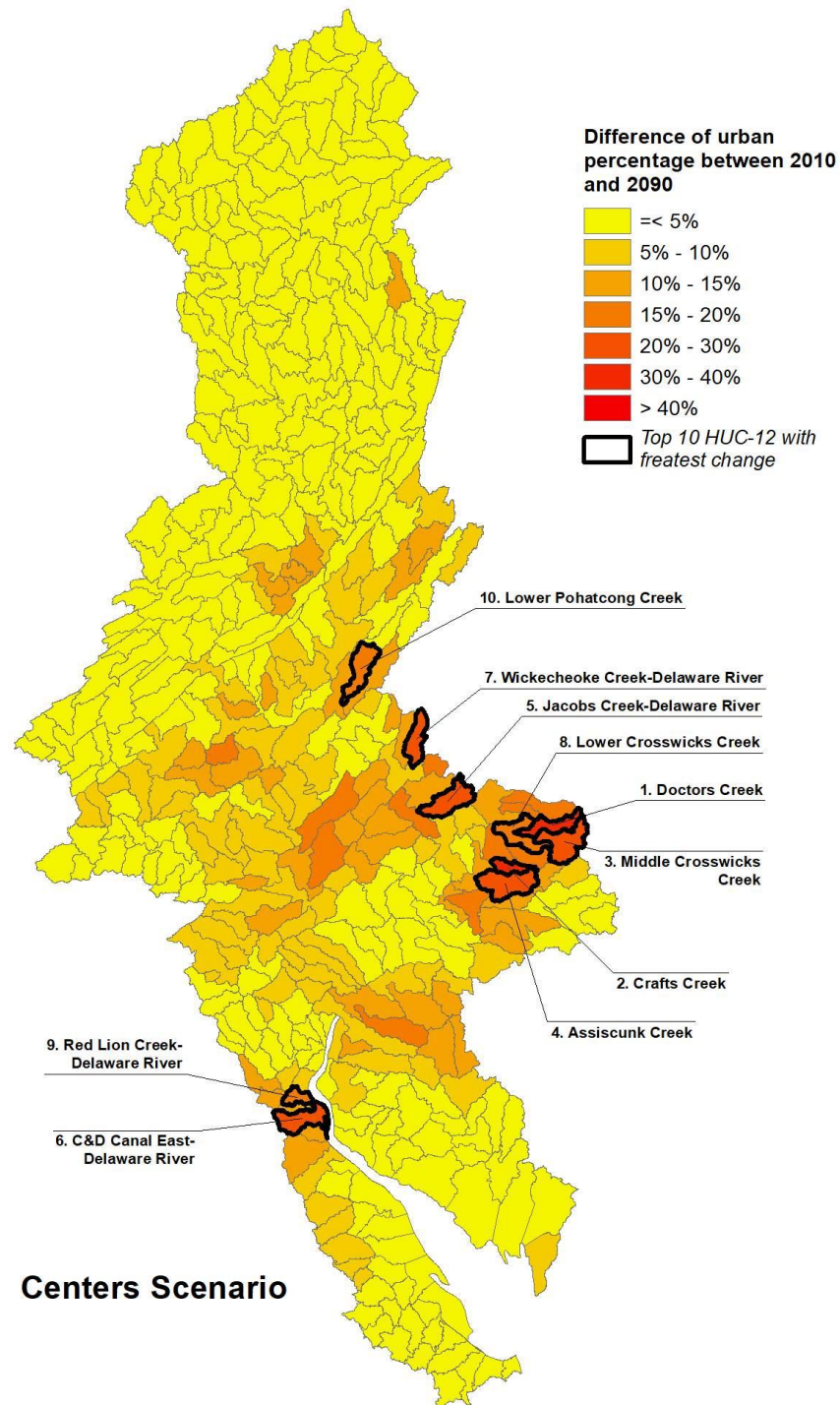
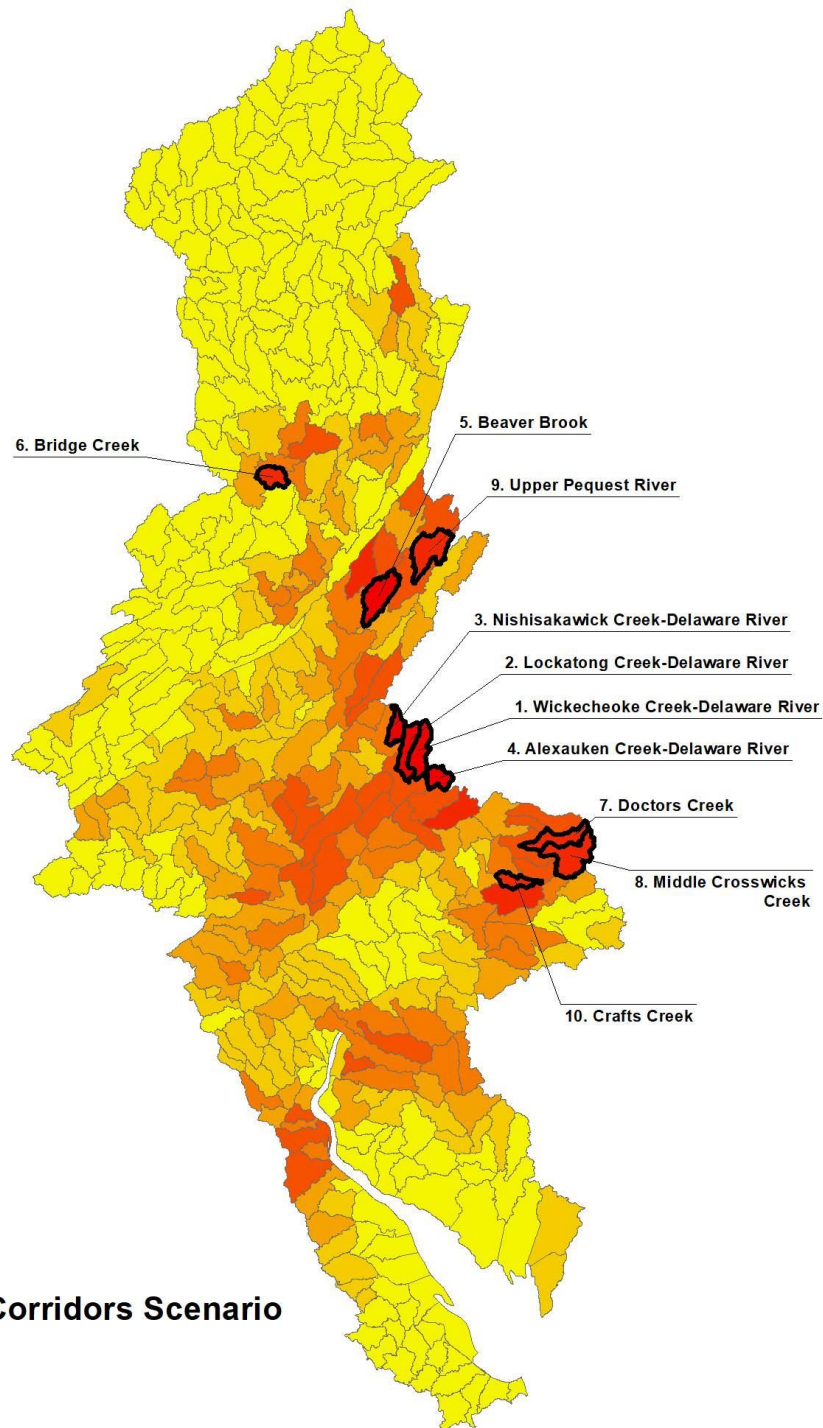
CENTERS



Basin-wide projected growth

Developed land in the Delaware River Basin, 2001 - 2100





Difference of urban percentage between 2010 and 2090

- <= 5%
- 5% - 10%
- 10% - 15%
- 15% - 20%
- 20% - 30%
- 30% - 40%
- > 40%

Top 10 HUC-12 with greatest change

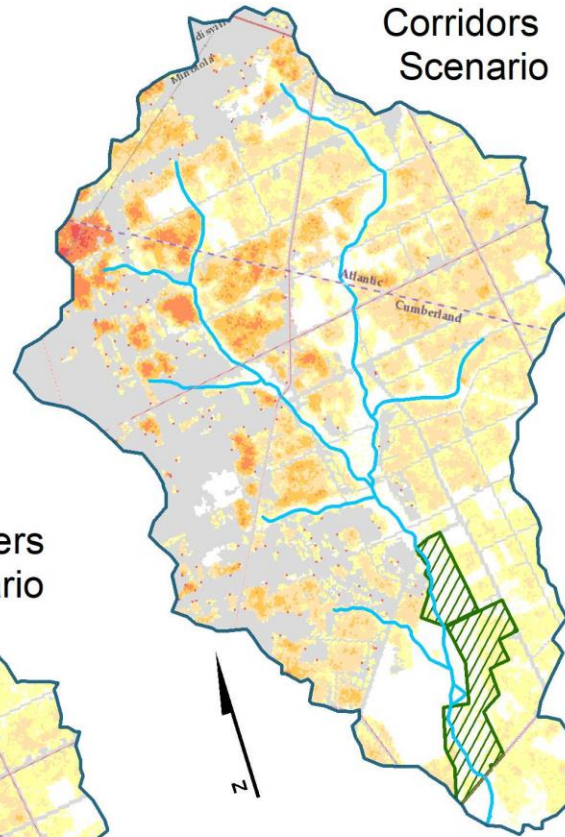
Menantico Creek

Location: Cumberland County, NJ

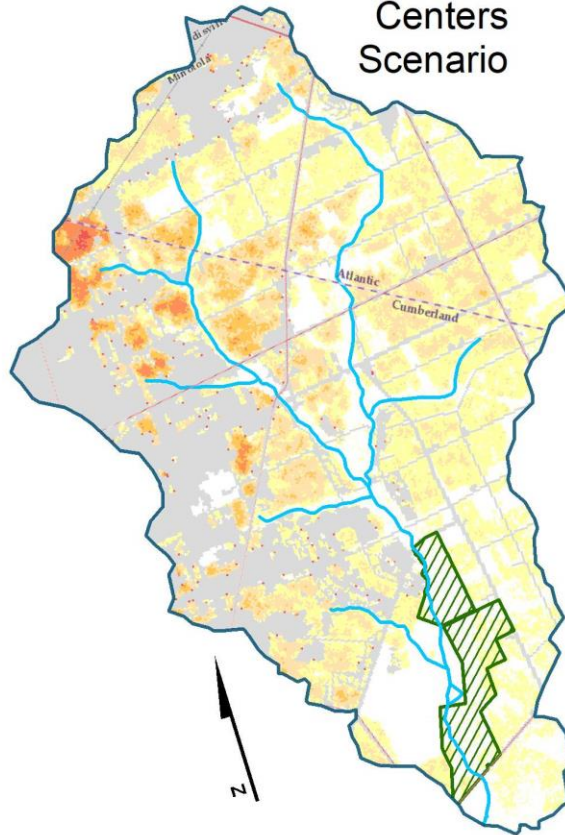
HUC12: 20402060503 (15,347.44 Acres)

	Upstream Watershed		HUC12s	
	Acres	%	Acres	%
Dev. 2011	4,436.10	28.90	6,058.92	24.15
Corridors S.	5,405.92	35.22	7,545.91	30.08
Change		6.32		5.93
Centers S.	5,123.61	33.38	7,093.42	28.27
Change		4.48		4.12

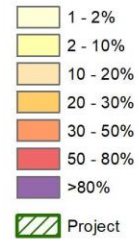
Corridors Scenario



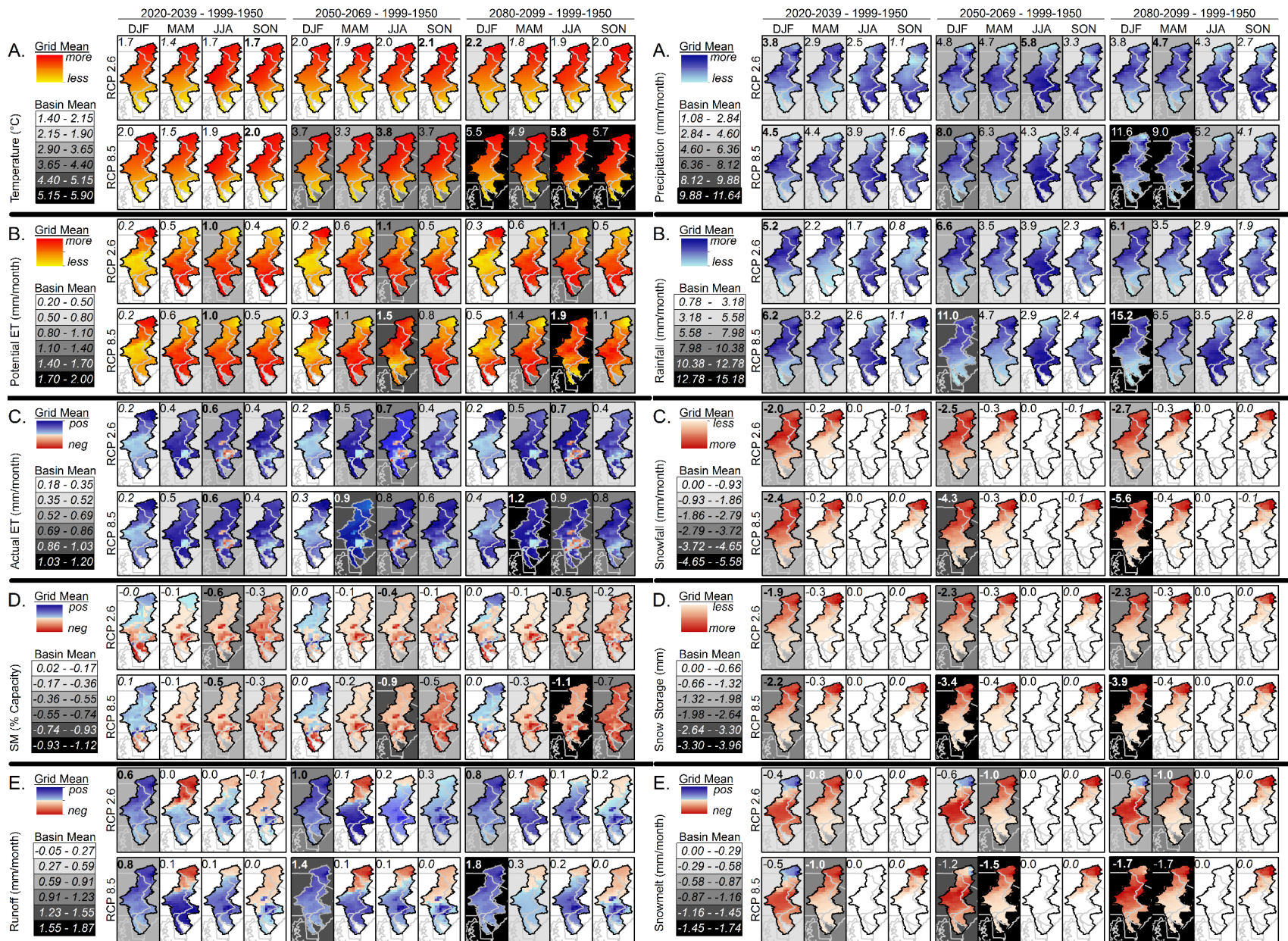
Centers Scenario



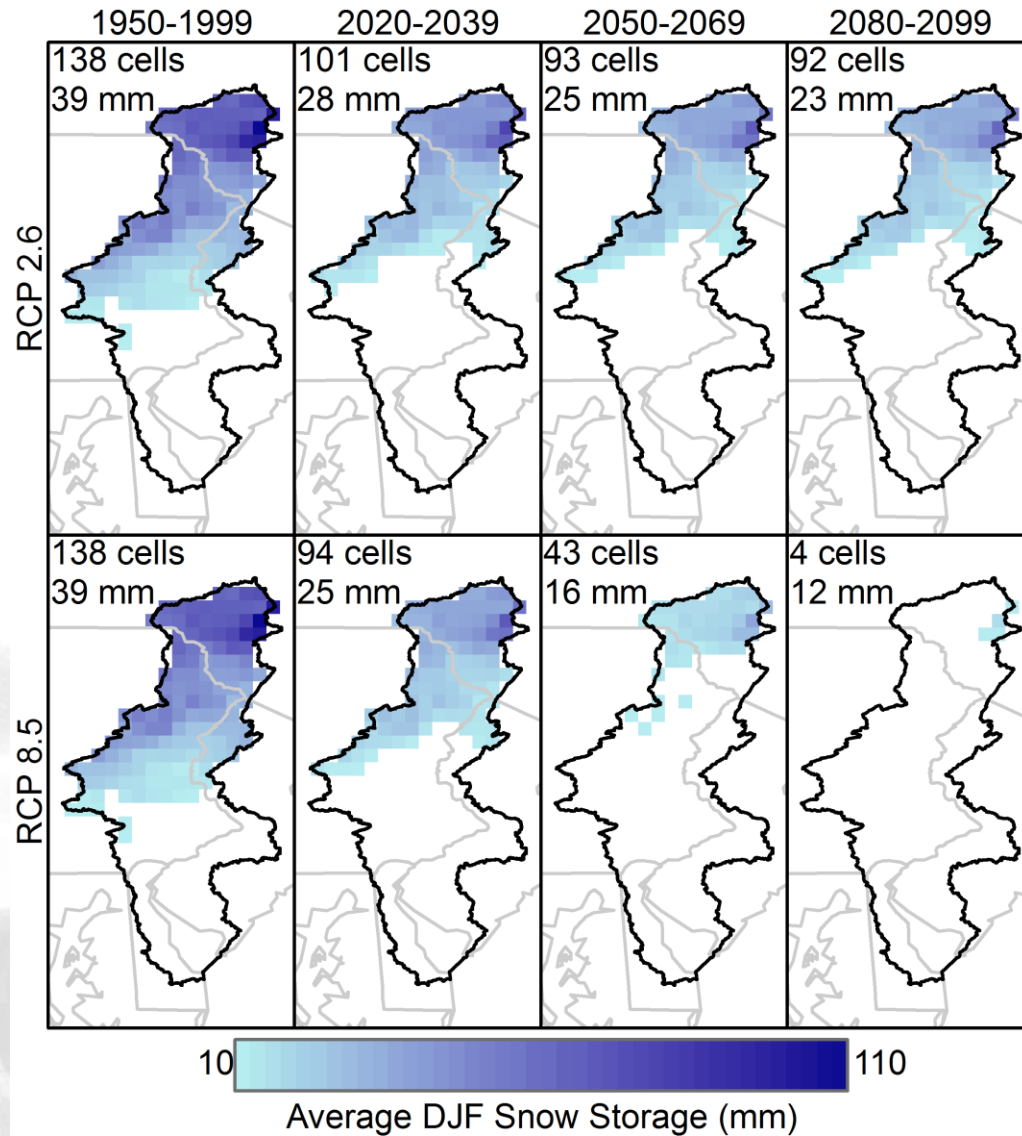
Developed in Simulation



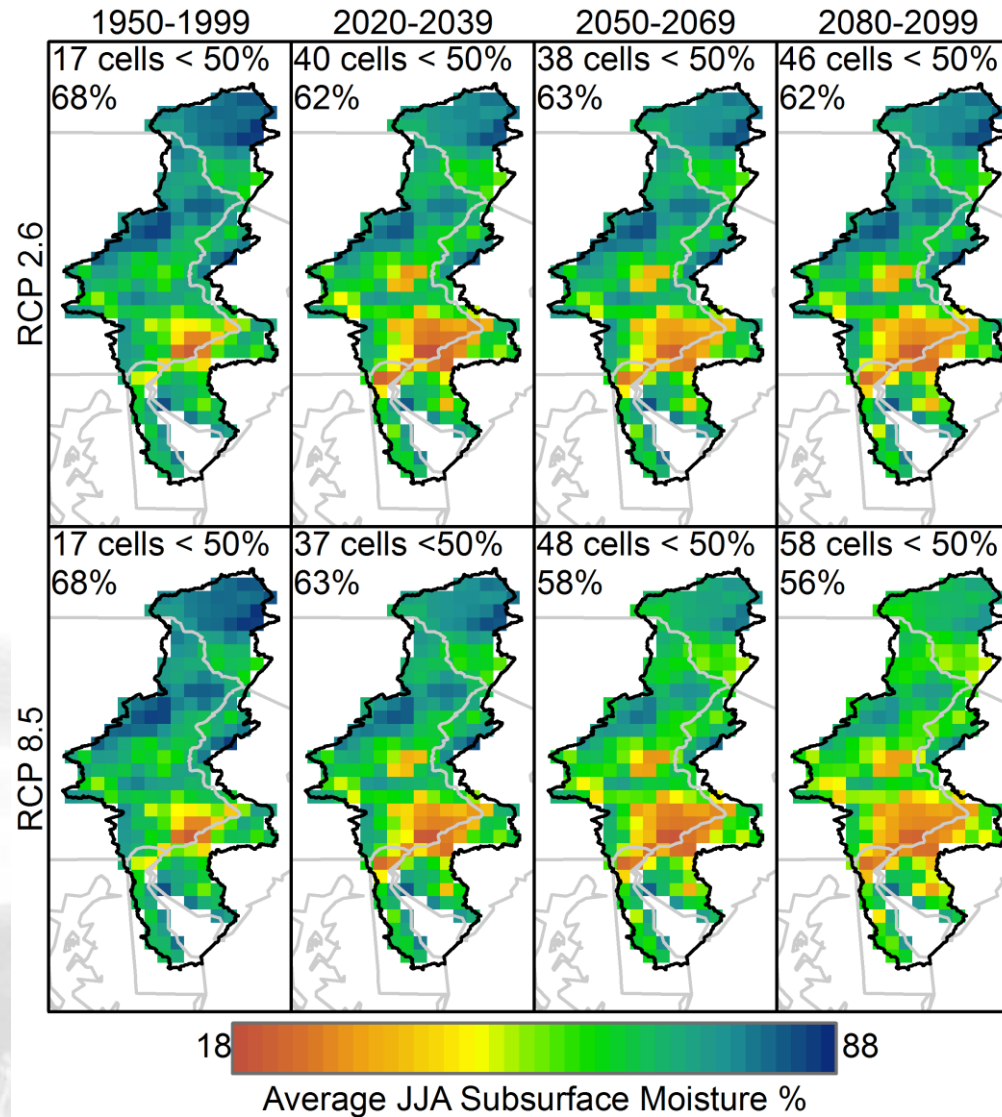
Future Hydroclimatology



Modeled DJF Snow Cover > 10 mm



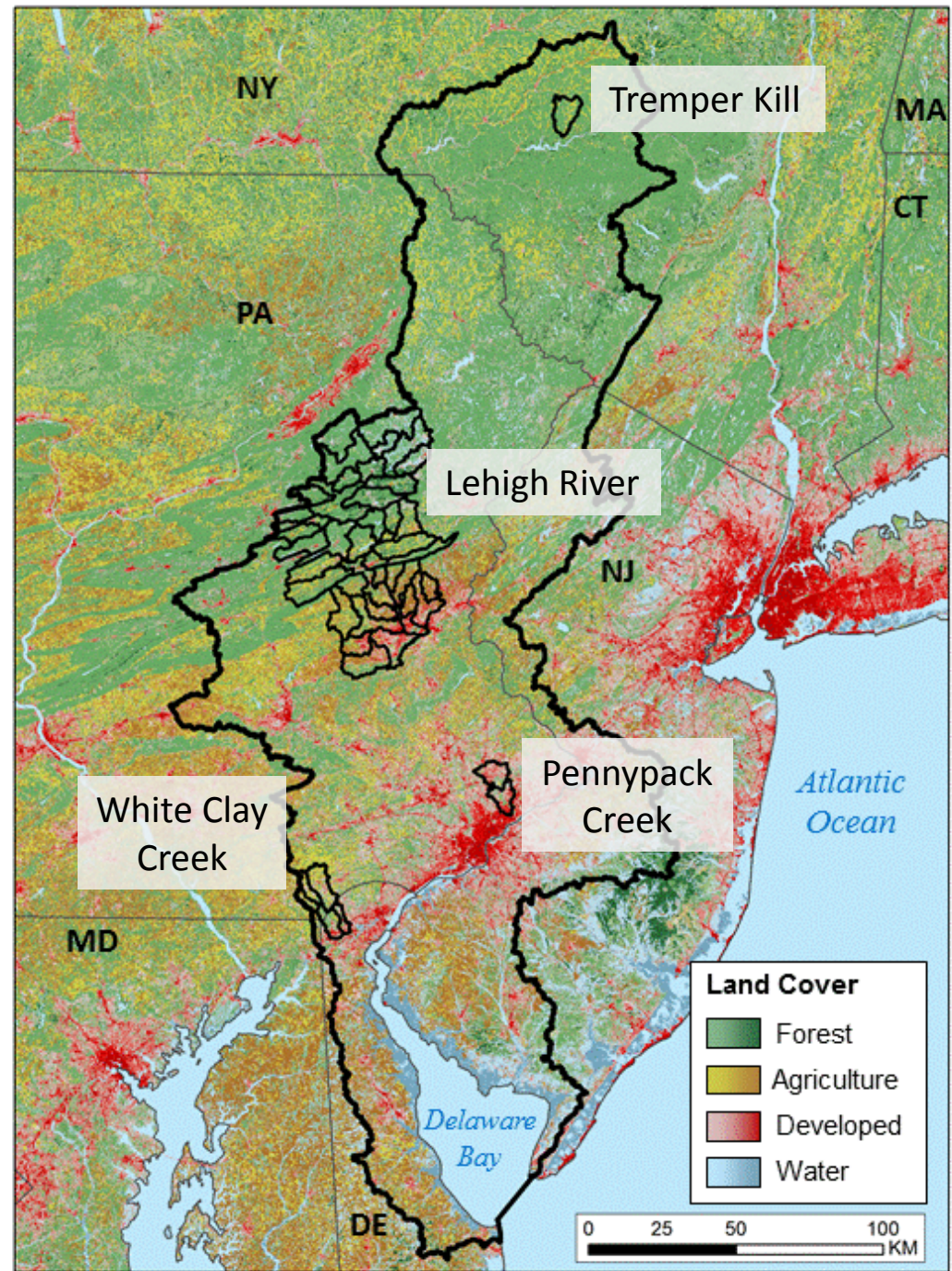
Modeled JJA Subsurface Moisture



Impact of Changing Climate and Land Cover on Floods: Delaware River Basin

Case Study Watersheds Flood modeling

Tremper Kill near Andes, NY	86 km ²
Pennypack Creek at Philadelphia, PA	129 km ²
White Clay Creek near Newark, DE	231 km ²
Lehigh River at Walnutport, PA	2303 km ²
Lehigh River at Bethlehem, PA	3313 km ²



Tree species and climate change

Balsam fir

Fraser fir

Red spruce

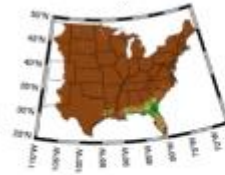
Shortleaf pine

Slash pine

Longleaf pine

Table mountain pine

Pitch pine



E. white pine

Loblolly pine

Virginia pine

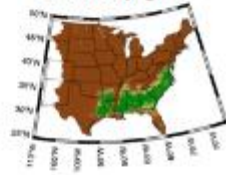
E. hemlock

Striped maple

Red maple

Silver maple

Sugar maple



Mountain maple

Yellow buckeye

Yellow birch

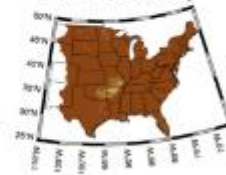
Pignut hickory

Shagbark hickory

Black hickory

Mockernut hickory

Red hickory



Am. beech

White ash

Black walnut

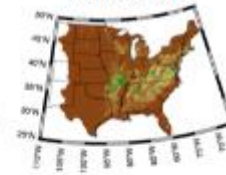
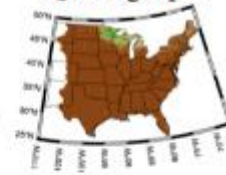
Sweetgum

Yellow poplar

Quaking aspen

Black cherry

White oak



Blackjack oak

Chestnut oak

N. red oak

Post oak

Black oak

Am. basswood

Winged elm

Am. elm



DRWI Helpdesk Service Provider

Phase I Monitoring Sites Poconos-Kittatinny Cluster

Monitoring sites

- | | | |
|------------|------------|------------|
| 2017 | 33. COBC2 | |
| 1. EDURC1 | 34. CONR3 | |
| 2. EDUHR4 | 35. COBK4 | |
| 3. EDULB5 | 36. MOC02 | |
| 4. EDULB5 | 37. MOC03 | |
| 5. EDUBC7 | 38. MCB07 | |
| 6. EDUPC9 | 39. MCB08 | |
| 7. EDULB10 | 40. MOC04 | |
| 8. EDULB11 | 41. MOC05 | |
| 9. EDUCC11 | 42. MCM07 | |
| 10. EDUC13 | | |
| 11. ARGBR3 | 2018 | 43. EDUBC2 |
| 12. ARGBR4 | 44. EDUHR3 | |
| 13. ARGBR4 | 45. EDUHR4 | |
| 14. ARCTW8 | 46. EDULB5 | |
| 15. ARCPM1 | 47. ARCPM1 | |
| 16. ARCPM1 | 48. PCDC5 | |
| 17. ARCK01 | 49. PCDC5 | |
| 18. ARCK02 | 50. PCDC5 | |
| 19. ARCN1 | 51. MCB08 | |
| 20. ARCN2 | 52. MCB08 | |
| 21. ARCHB1 | | |
| 22. ARCC1 | 2016 | 53. ARCPM |
| 23. PCBB01 | 54. ARCPM | |
| 24. POLB2 | 55. ARCPM | |
| 25. POLB3 | 56. ARCPM | |
| 26. POLB3 | 57. ARCPM | |
| 27. POLB4 | 58. ARCPM | |
| 28. POLB8 | 59. ARCPM | |
| 29. POLB5 | 60. ARCPM | |
| 30. PCDC10 | | |
| 31. COBK1 | | |



Sources: Monitoring
Cluster and Focus
ological Sur



Thank you!
Contact us: clus@ship.edu

<https://drbproject.org/>
<https://centerforlanduse.org/>



John Hasse, Ph.D., AICP



Dan Ford





LAND TRUST DATA MGMT

managing complex property data for a conservation organization



Dan Ford, Heritage Conservancy
dford@heritageconservancy.org

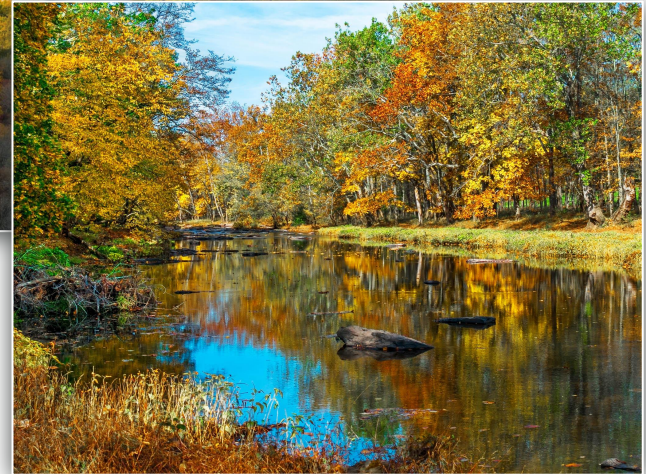
Outline

- 1** Introduction
- 2** SaaS product selection
- 3** Defining a spatial database structure
- 4** Next steps



Heritage Conservancy

- Mission is to preserve and protect our natural and historic heritage
- Accredited Land Trust serving Bucks and Montgomery counties
- Facilitated the preservation of nearly 15,000 acres of open space, farmland, wildlife habitat, and important watershed areas to date



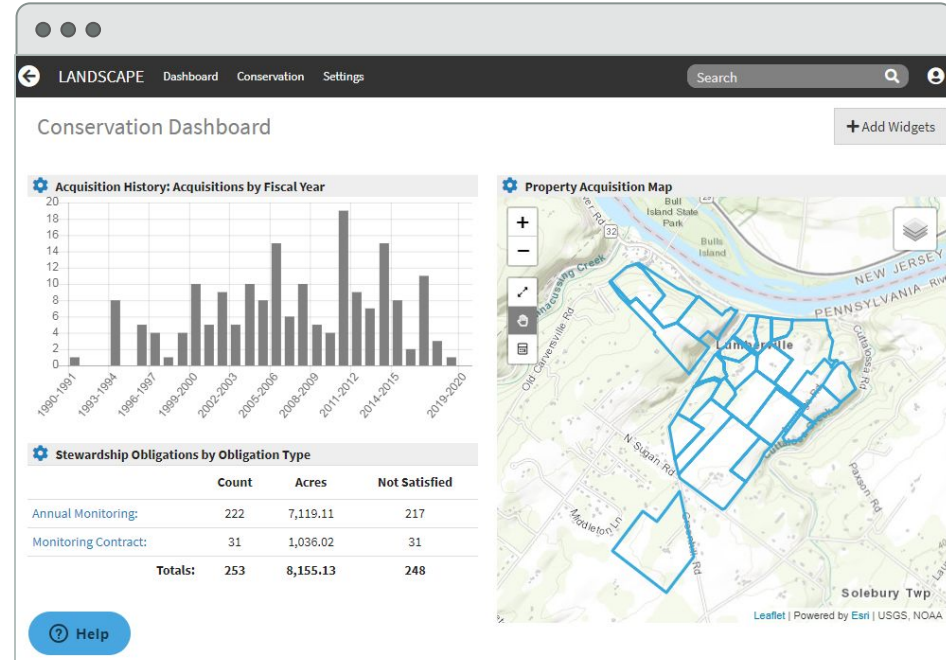
Complex data management scenario

- 65 years of property data
- Includes legal documents, pictures, reports, landowner information, spatial data, and more
- Data requires regular updates
- Multiple users access data for many different reasons



Research

- Identify areas where a SaaS solution could improve accuracy and efficiency
- Focus on end users and desired results
- Define list of potential products



Evaluate current processes: workflows

- General

- data collection
- data processing [and analysis]
- data management

- Some types

- Acquisition
 - fee simple
 - conservation easements
 - facade easements
- Stewardship
 - monitoring
 - property maintenance
 - conservation projects

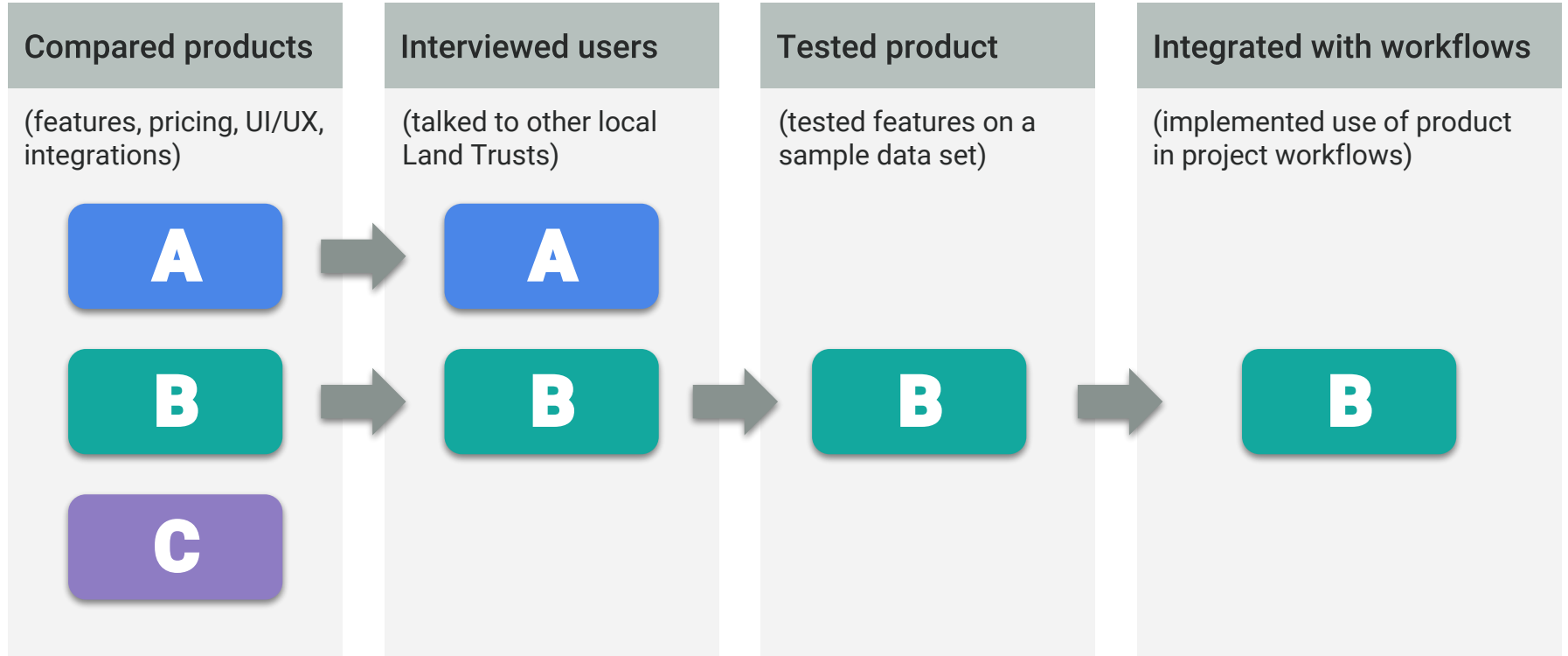
Evaluate current processes: directory structure

- Local server with word processing documents, spreadsheets, PDFs, images for all property acquisitions
- Spatial data stored on separate server
 - separate project folders
 - data sources vary
 - parcel boundaries from local government vs property boundaries georeferenced to site plans

Required features

- ✓ Display complex property database on a clean UI
- ✓ Enable interaction with database for different types of users
- ✓ Have reporting features that can be customized for different needs
- ✓ Integrate seamlessly with spatial data file types
 - + Include functionality for project and task management, specifically for stewardship activities like monitoring visits
 - + Ability to integrate with mobile data collection software

Process



Current setup

- Directory of source data and project-specific data
- Property data organized in tabular and spatial data formats on multiple servers
- Multiple “master” documents over the years

Mimicking the SaaS database structure

- Condense “master” documents
 - Maintain series of spreadsheets, organized by topic
 - Maintain spatial data feature classes
- Create Geodatabase
 - One-to-many relationships between feature classes and tabular data; use related tables to associate property information with spatial data

```
X:\Data\Heritage_Conservancy\HC_PropertyData.gdb
```

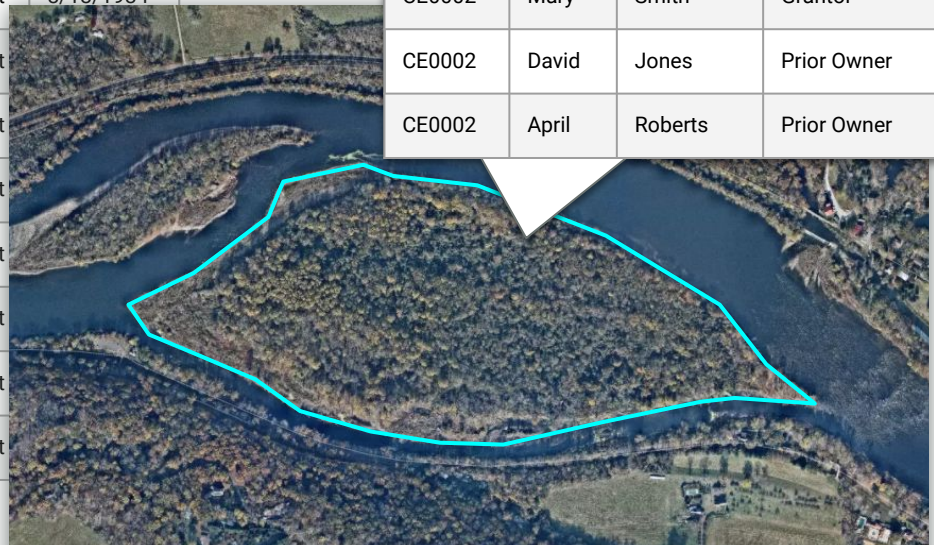
```
├─ PropertyData
|   ├─ TractBoundaries.shp
|   ├─ AcquisitionBoundaries.shp
|   └─ AcquisitionAreaTypes.shp
├─ AffiliateInfo.csv
├─ ConservationValues.csv
├─ ContactInfo.csv
├─ MonitoringVisits.csv
└─ Annotations
```

Defining a spatial database structure

Mimicking the SaaS database structure

TractId	Tract Local Jurisdiction	AcqId	Property Interest	AcqDate
CE0001	Upper Southampton	CE0001	Conservation Easement	9/6/1973
CE0002	Solebury Township	CE0002	Conservation Easement	9/22/1983
CE0003	Langhorne Manor Borough	CE0003	Conservation Easement	8/18/1984
CE0004-01	Hilltown Township	CE0004	Conservation Easement	
CE0004-02	Hilltown Township	CE0004	Conservation Easement	
CE0004-03	Hilltown Township	CE0004	Conservation Easement	
CE0004-04	Hilltown Township	CE0004	Conservation Easement	
CE0004-05	Hilltown Township	CE0004	Conservation Easement	
CE0004-06	Hilltown Township	CE0004	Conservation Easement	
CE0004-07	Hilltown Township	CE0004	Conservation Easement	

TractId	FName	LName	Role
CE0002	John	Doe	Current Owner
CE0002	Mary	Smith	Grantor
CE0002	David	Jones	Prior Owner
CE0002	April	Roberts	Prior Owner



Moving forward

- This whole process informed our project workflows moving-forward
 - Request spatial data from surveyor/engineer
 - Collect field data via mobile app
 - Add new property acquisition data to SaaS product and Geodatabase
- Digital stewardship
 - Apply stewardship best practices to data management



LAND TRUST DATA MGMT

managing complex property data for a conservation organization



Dan Ford, Heritage Conservancy
dford@heritageconservancy.org

Eric Jespersen



<https://pamagic.org/>

PA Hydrography Modernization

Status and Plans

April 2, 2019

Eric Jespersen

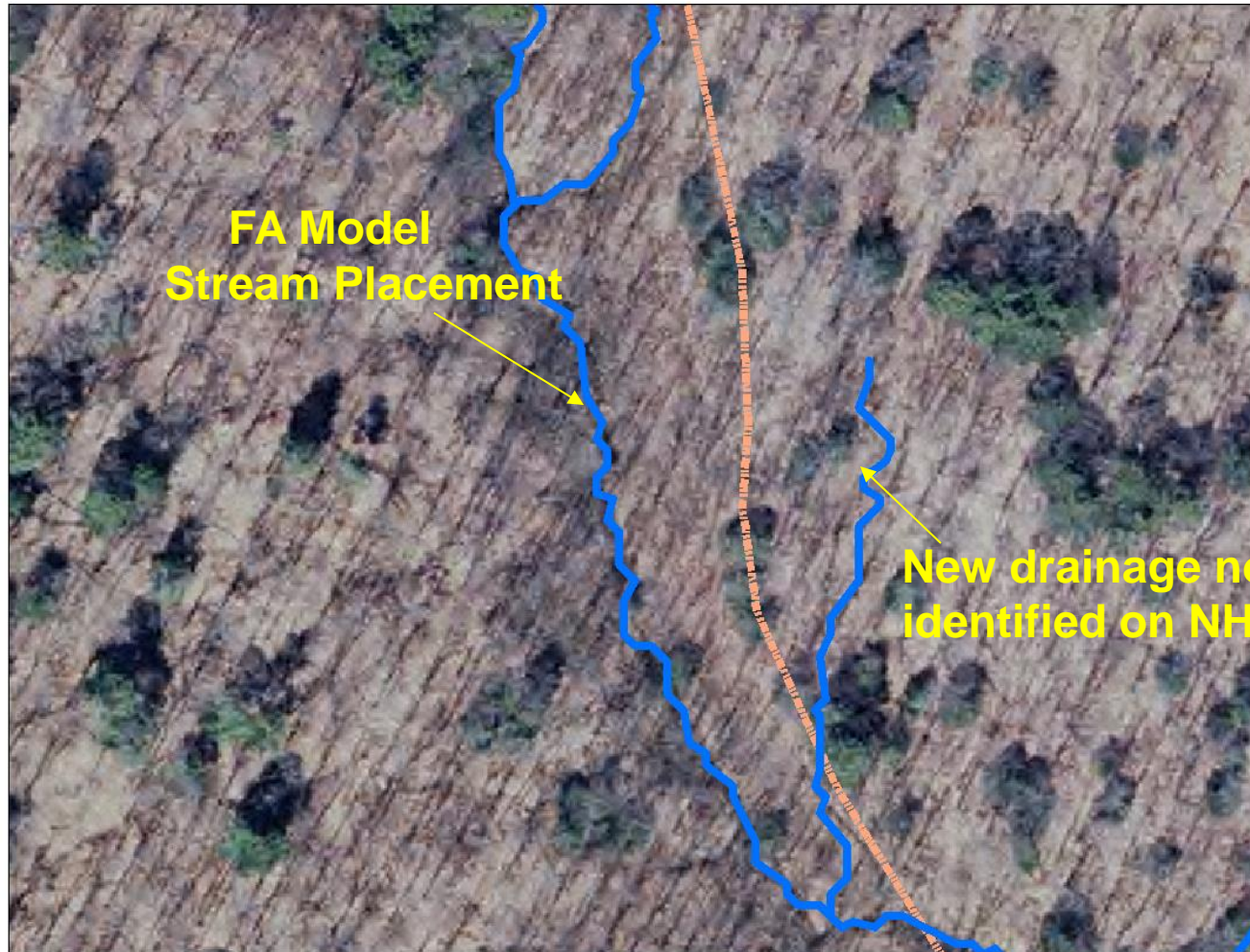


PaMAGIC VISION (Since 1996)

"The Citizens of Pennsylvania will have a coordinated, flexible and integrated geographical information infrastructure to support better decision making and more efficient use of limited resources."



Compatible with Current Mapping Standards



What was the Plan?

- Spring 2013 → Concept Development
- Autumn 2013 → Concept Promotion/**Champion Development/ Partner Recruitment**
- Spring 2014 → Project Definition/**Initial Funding**/Partner Recruitment
- Autumn 2014 → Pilot Data Development/**Funding Consolidation**
- 2015 – 2018 → Data Production/Quality Control/Application Development

Water Data Initiative

Started - Spring 2013

Publicized first – December 2013

Budget Workshop – December 2014

MS4 Sessions; Lancaster – October 2014-May 2015

Lancaster NHD Support **Pilot** – October 2015-June 2016

Data Maintenance Workshop – January 2016

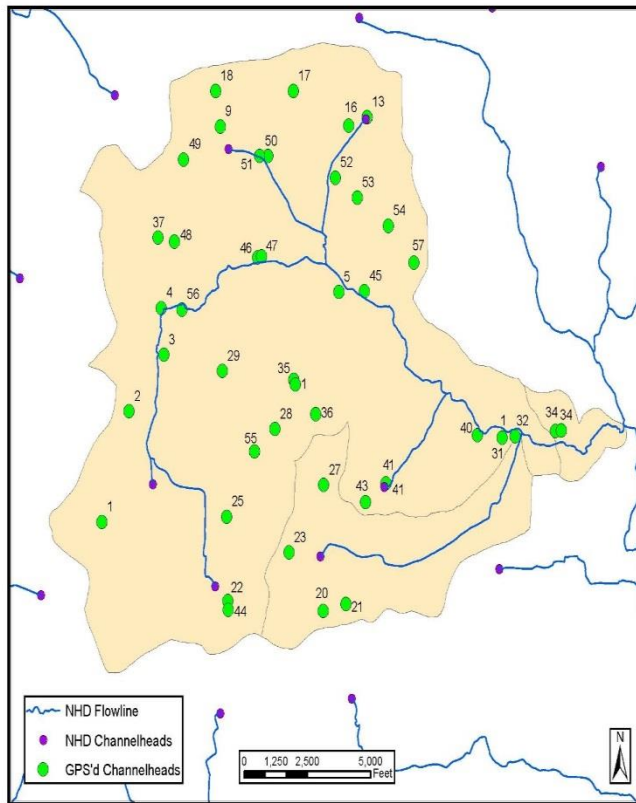
Lidar Workshop – January 2017

Data Model and Planning Workshop – January 2018

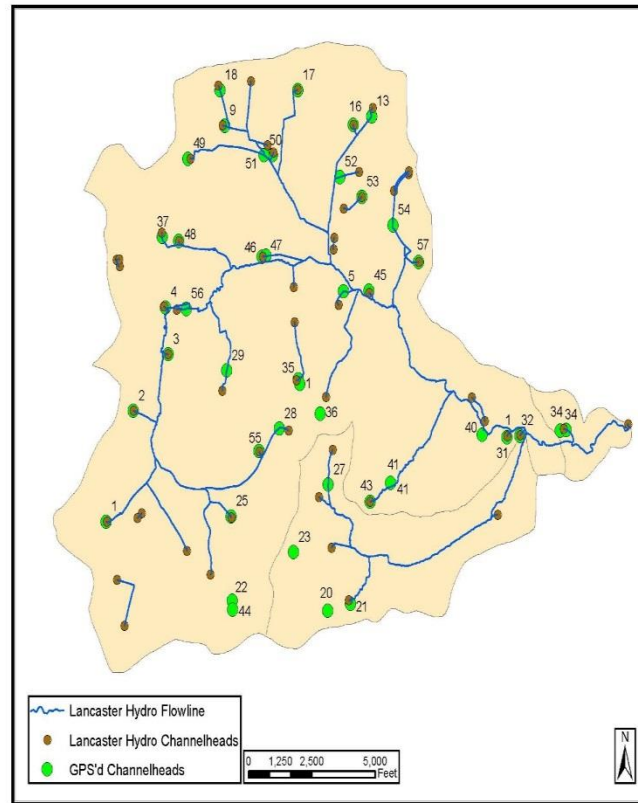
Accelerating the Plan Workshop – January 2019

Field Validation

NHD Channelhead Comparison



Lancaster Hydro Channelhead Comparison



Lancaster County NHD Support Pilot

Chiques - NHD



Lancaster County NHD Support Pilot

Chiques – Original County Hydro



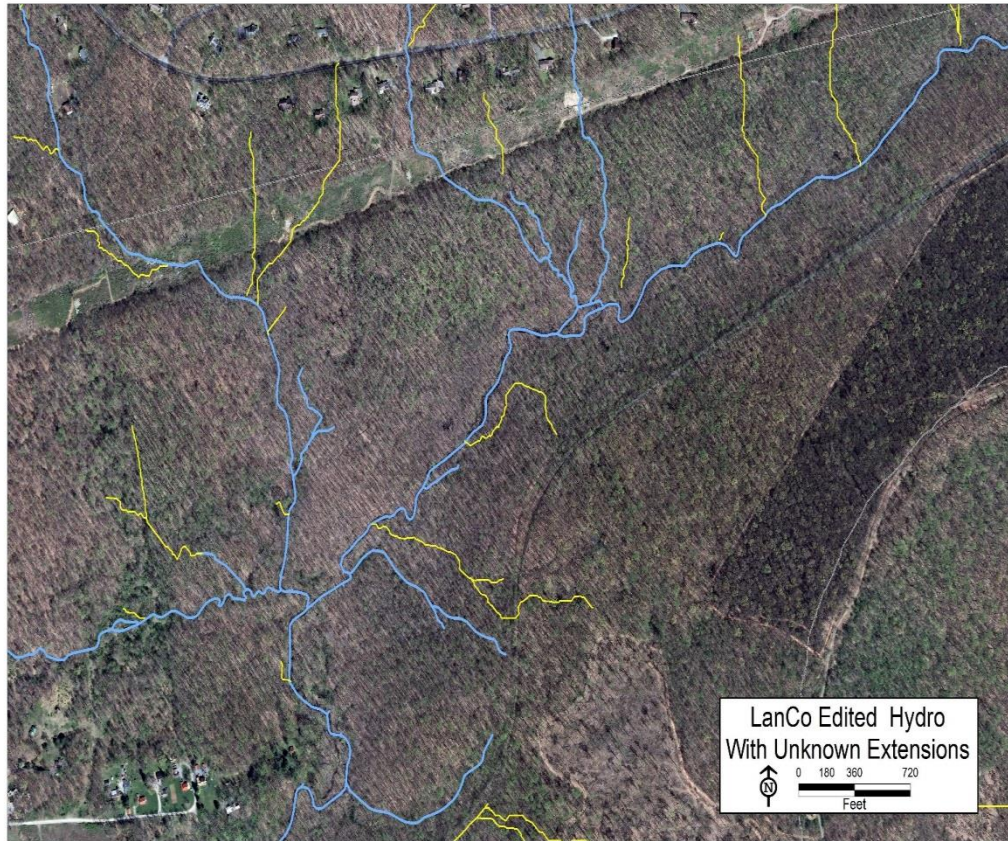
Lancaster County NHD Support Pilot

Chiques – Edited County Hydro



Lancaster County NHD Support Pilot

Chiques – County Hydro w/ Headwater Swales

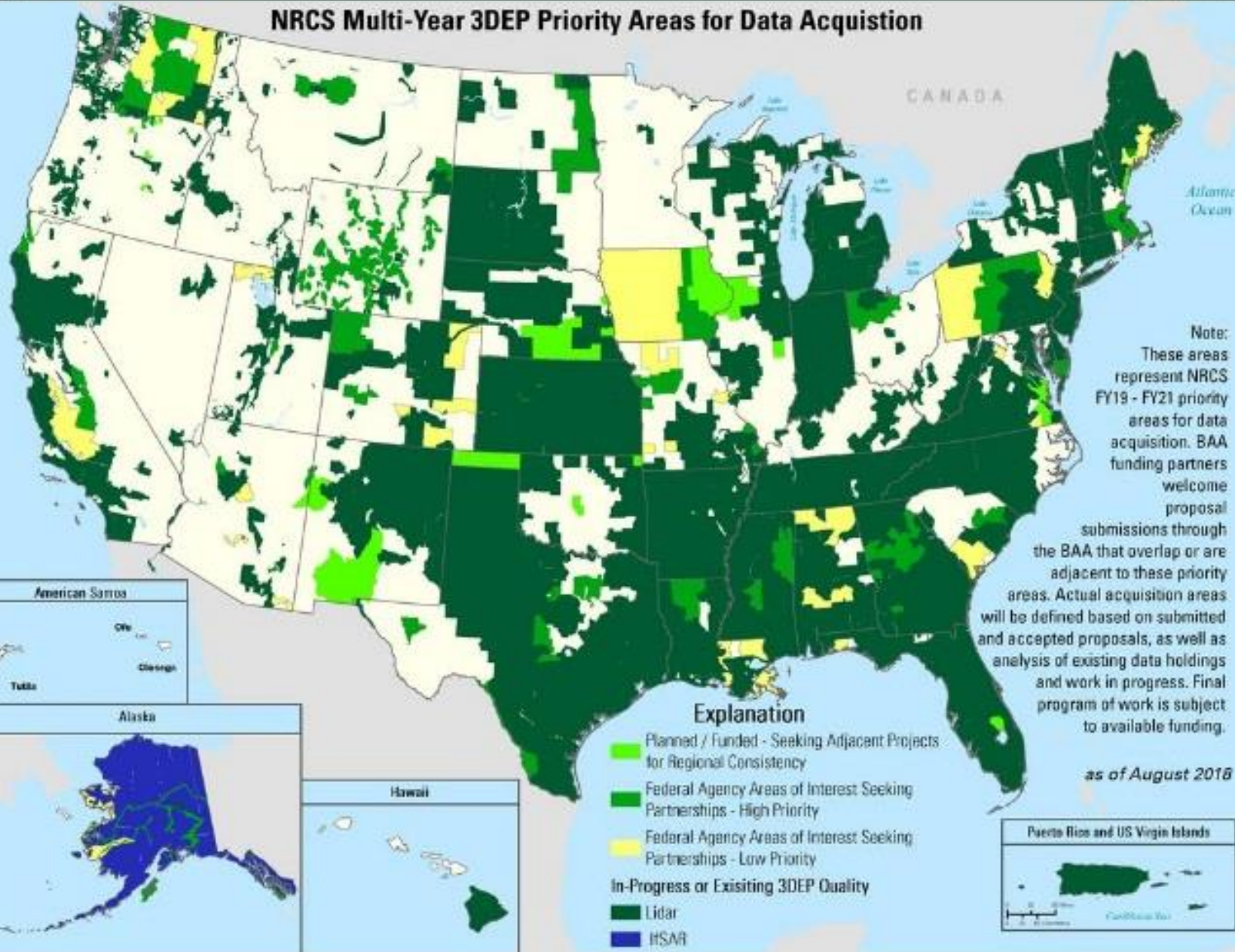


QL2 vs. QL3 Workshop

January 2017

- PAMAP lidar is rapidly becoming outdated, *and hydrography is not the only application.*
 - i.e. - Get QL2
- There is real monetary support if the State has a plan/program
- There is real technical support across the nation
 - **-but we can still make our own path**
- We have enough existing QL2 to take the next steps

NRCS Multi-Year 3DEP Priority Areas for Data Acquisition



Federated States of Micronesia

Kosovo

Palau

American Samoa

Ole

Tutuila

Northern Mariana Islands

Alaska

Hawaii

Guam

USGS 3DEP Grant Application 2018-2019

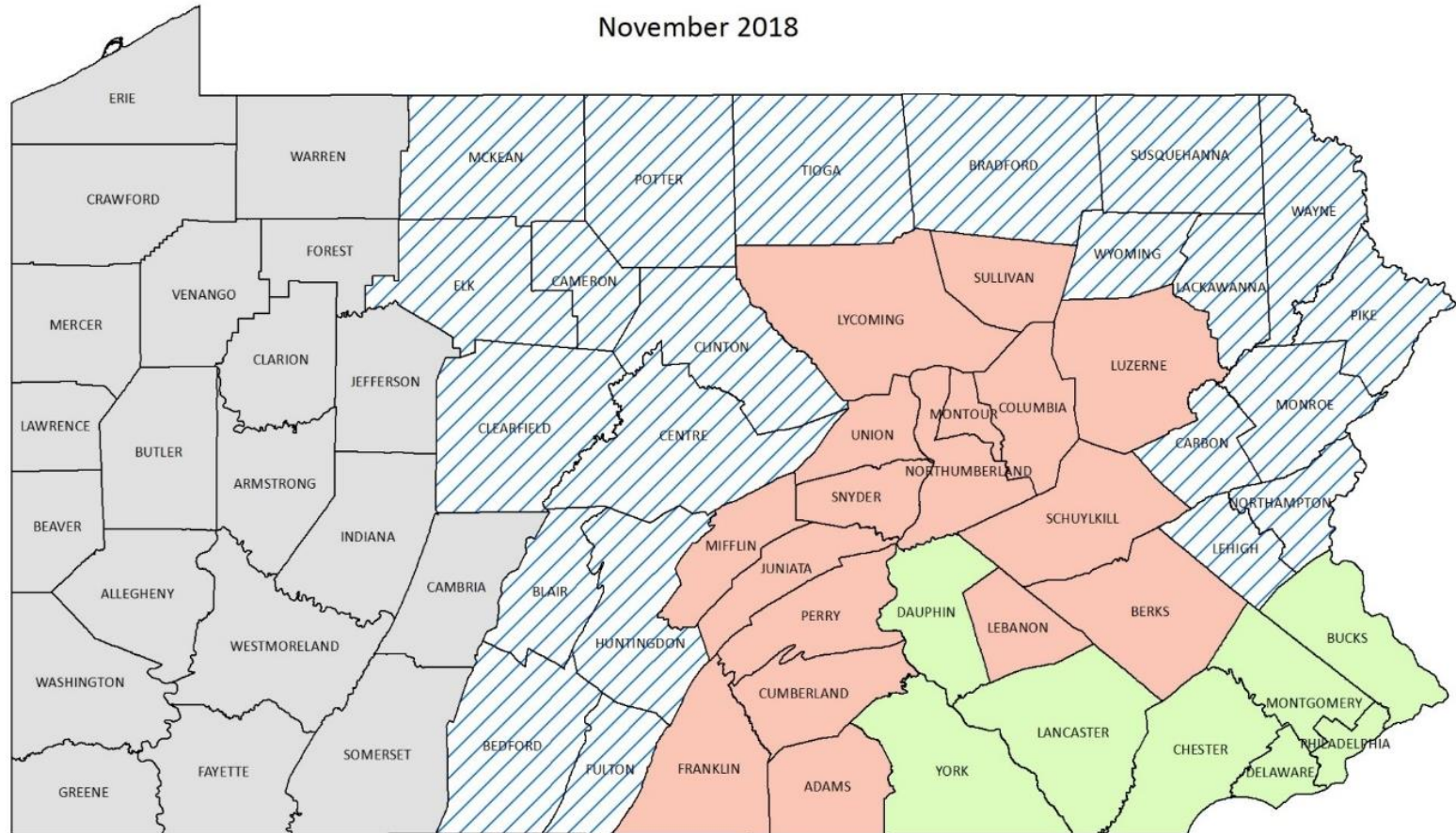
- Application made November 9, 2019
- Lead author is DCNR TopoGeo
- In-state funding \$2.15M
 - DCNR \$500K
 - DEP \$500K
 - PEMA \$500K
 - SRBC \$50K
 - PTC \$200K
 - DOT \$400K

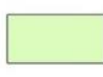
Hydrography Applications

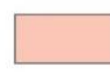
- Chesapeake Bay Program agricultural assessments and technical assistance by NRCS
- Riparian Buffer program development and execution by DCNR
- Identification and mitigation of localized flood hazards by PEMA and FEMA
- Clear connection of MS4 stormwater control measures to natural drainage
- Integration of headwaters and wetlands with modernized hydrography

Proposed Acquisition of Quality Level 2 (QL2) Lidar Data

November 2018



 QL2 lidar acquired 2014-2016
various funding sources

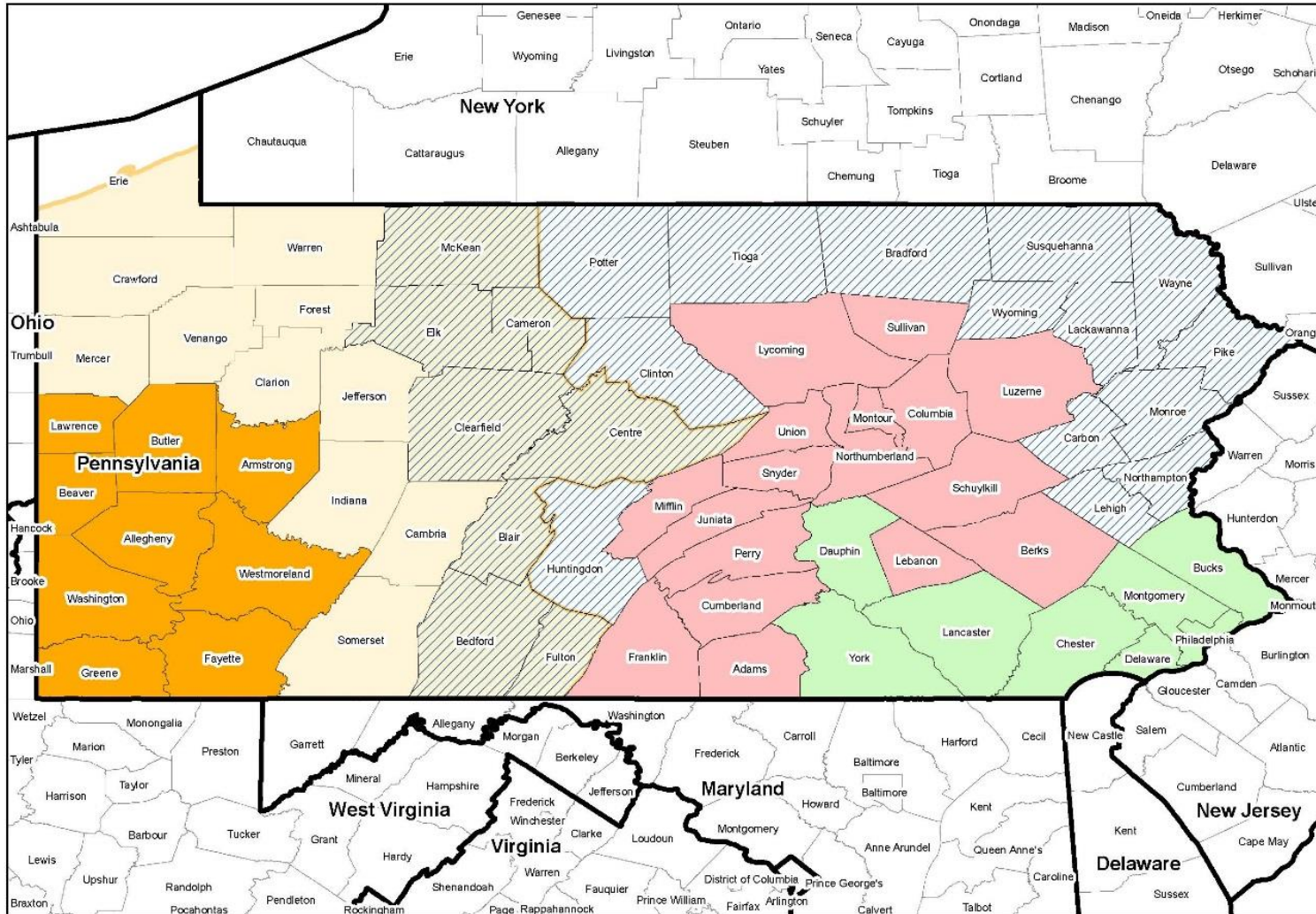
 QL2 lidar acquired 2017-2018
NRCS, 3DEP

 **Proposed to 3DEP BAA 2018-2019**



FEMA

PA LiDAR 3DEP QL2 Aquisition



Legend

- QL2_2014-2016_State Acquired
- QL2_2017-2018_NRCS, 3DEP
- 2018_BAAtoUSGS
- R3WesternPAPriorities
- 2018_HQ_Original Request

Accelerate the Plan

January 2019



Senior Geologic Scientist, DCNR

The Bureau of Topographic and Geologic Survey, Geologic and Geographic Information Services Division is looking for a responsible individual to lead Pennsylvania's effort to develop a modern, local resolution, digital hydrography dataset for Pennsylvania. If you enjoy working with geographic information systems (GIS) and other software programs to answer geospatial, geological, and topographical questions, BTGS may have a position of interest to you.



PaMAGIC/DCNR 2018-2019 Priorities



- Data Model Design
- Standard Minimum Process
 - Lancaster County Stream network – Lisa M.
 - CBP Methodology – David S. and Matt B.
- Statewide Steering
 - October 2018 Meeting – Eric J.
- Detailing Plans...

Program Management

- Overall Leadership and Promotion- DCNR and PaMAGIC
- Data Stewardship- PA Topographic and Geologic Survey
 - DCNR provide basic stream network and reference framework
 - Federal, state and local government programs connect their data to that framework
 - Public and private money in concert

Program Management

- **Localized Leadership and Cost Sharing by River Basin-** distinct data development, funding and scheduling plans in each river basin (schedule partially dictated by lidar data availability).
 - Susquehanna Basin
 - Delaware Basin
 - Ohio Basin

Data Development

- Lidar Standard- QL2 or better and less than five years old
- Flowpath derivations by standard minimum process to yield PA stream centerline 3D data model
- Network Standard- derived in modified HUC 12 watersheds, not political boundaries

Data Development

- Derivation- includes visual QC against imagery < than five years old
- Validation against local and state agency cartographic quality data
- Incentivized Local Involvement- data sharing and field QC needed
 - County, foundation and university involvement welcome

Data Development

- An iterative process, and expected normal sequences include:
 - Level 1 - Natural perennial and intermittent watercourses (and including some engineered), NHD waterbodies integrated, all vectors 3D
 - Level 2 - All cartographic and network functionality supported, channelheads further defined by field checks, additional waterbodies added, suitable for logical connections of wetlands and stormwater systems
 - Level 3 - NHD and WBD Integration
- Expect regional differences!

Data Structure

- Minimalistic attribute and metadata including only:
 - Processing settings (auto-generated)
 - Qualifiers
 - Production Schema:
 - Dissemination Schema:
- Upstream limit of inclusion qualifications (TBD)
 - Determine specific *accumulation criteria*
 - *Minimum accumulation?*
 - *Visible water?*
 - *Regional or physiographic variables?*
 - Field-verified channel heads *Citizen Science?*

Data Maintenance and Use

- Annual network update only needed to address:
 - Cataclysmic changes
 - Major land development
 - Data problems reported by related database managers
- Partner system
 - needed for reporting of changes
 - designed from the outset of flowpath creation
- Regional differences expected

Proposed 2019 Goals

- Hire a senior-level geologist to lead the hydrography program at BGS
- Regional Steering Teams in place
- Statewide QL2 Lidar Funding assured and Sequencing complete



Lidar Working Group

- *Working toward acquiring new LiDAR for the state, and planning for future data management and maintenance*
 - *Short and long-term planning (data refresh cycle)*
 - *Application Sharing Networks*
 - Basic data management and pre-processing
 - Vegetation
 - Hydrography
 - Structure/infrastructure
 - Topography and surfaces

<https://www.srbc.net/pennsylvania-lidar-working-group/index.html>

Heidi Hoppe



- * U.S. Geological Survey
- * NJ Water Science Center
- * <https://www.usgs.gov/centers/nj-water/>

U.S. Geological Survey New Jersey Water Science Center

Heidi Hoppe, Chief of the Hydrologic Data Assessment Program
New Jersey Water Science Center



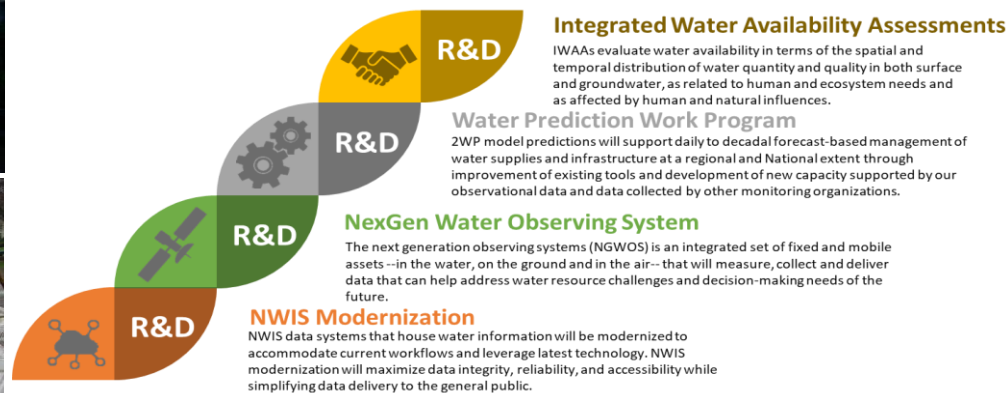
U.S. Geological Survey

Water Resources Mission Area

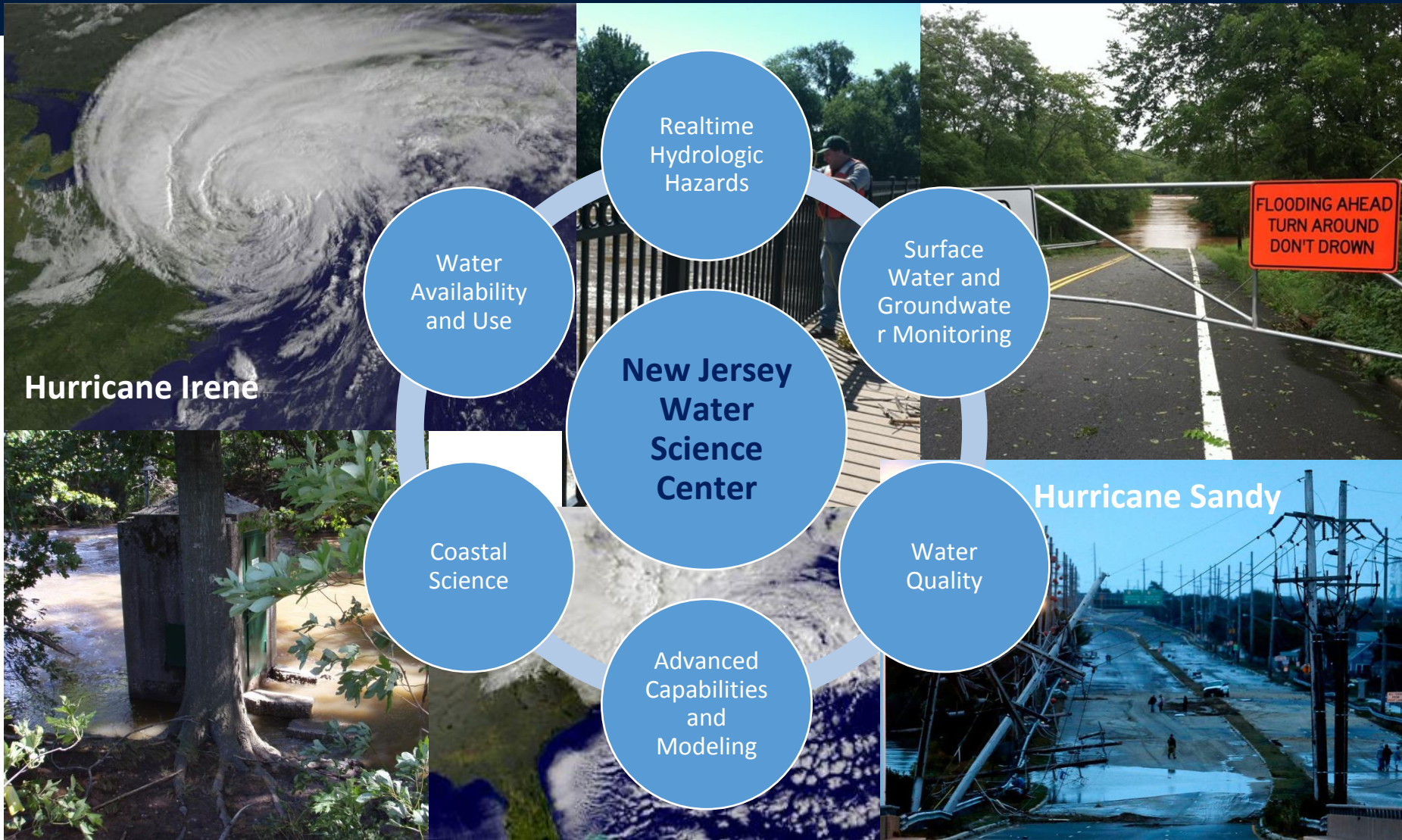
- Water is one of seven science mission areas of the USGS
- Water's mission is to collect and disseminate reliable, impartial, and timely information that is needed to understand the Nation's water resources.
- Water information is fundamental to national and local economic well-being, protection of life and property, and effective management of the Nation's water resources.
- The USGS works with partners to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions including streamflow, groundwater, water quality, and water use and availability.



Water Mission Area Priorities

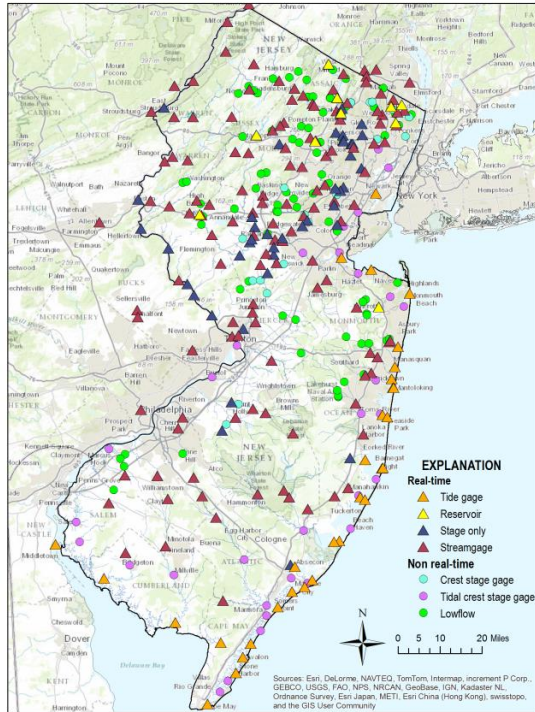


U.S. Geological Survey New Jersey Water Science Center



Surface Water Networks

Surface Water & Tide



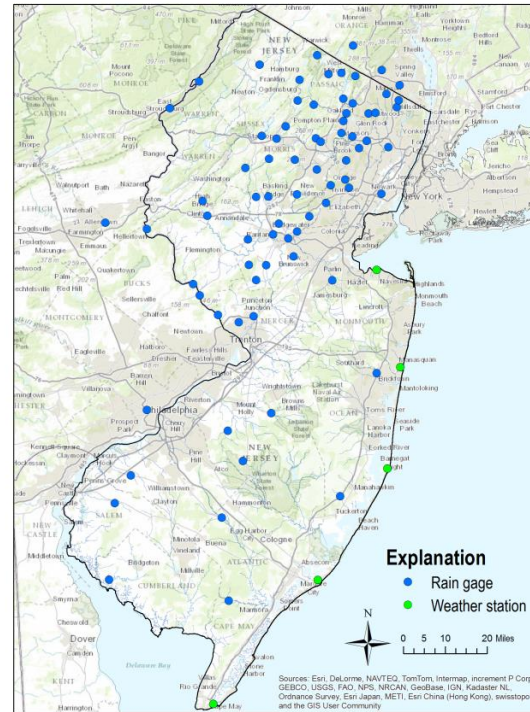
Real-Time SW Networks

- 116 Continuous-Record Discharge Gages
- 42 Continuous-Record Stage Gages
- 9 Continuous-Reservoir Elevation Gages
- 25 Continuous-Record Tide Elevation Gages

Non Real-Time SW Networks

- 17 Crest-Stage Gages
- 32 Tidal Crest-Stage Gages
- 96 Low-Flow Discharge Measurement Sites

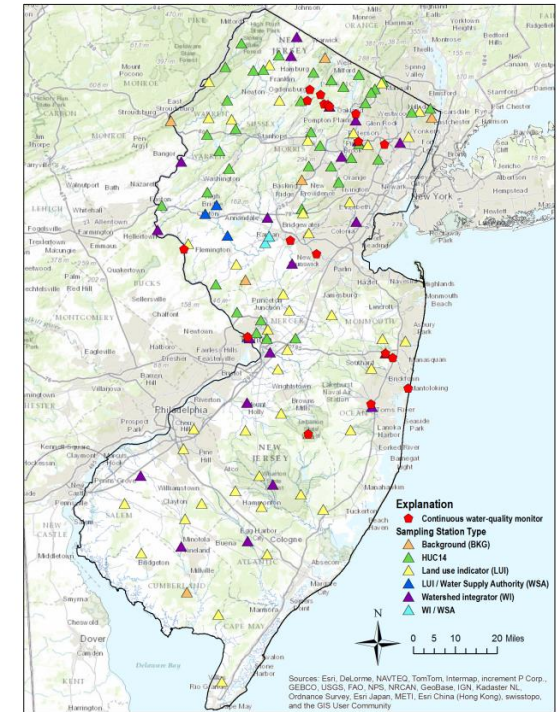
Rain & Weather Network



Real-time Precipitation and Weather Network

- 76 Rain Gages
- 25 Coastal Weather Stations (rain, wind, BP, AT, RH)

Surface-Water Quality Monitoring

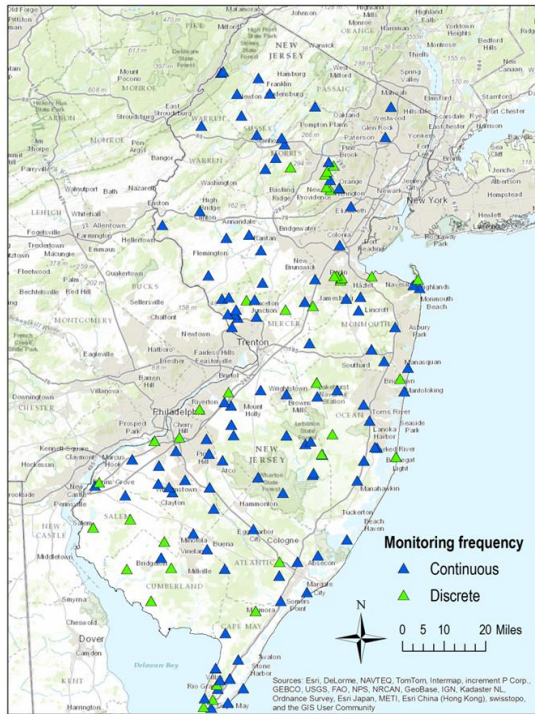


Continuous Water-Quality Monitors

- 11 Long-term Monitors
- Water-Quality Sampling Sites (all sampled quarterly)**
- 123 sites in the NJDEP/USGS ASWQMN Coop Network
 - 7 Background
 - 50 Probabilistic sites
 - 23 Watershed integrator sites
 - 43 Land use indicator sites
 - 2 NJWSA Coop Sites
 - 1 DRBC Coop Site

Groundwater Networks

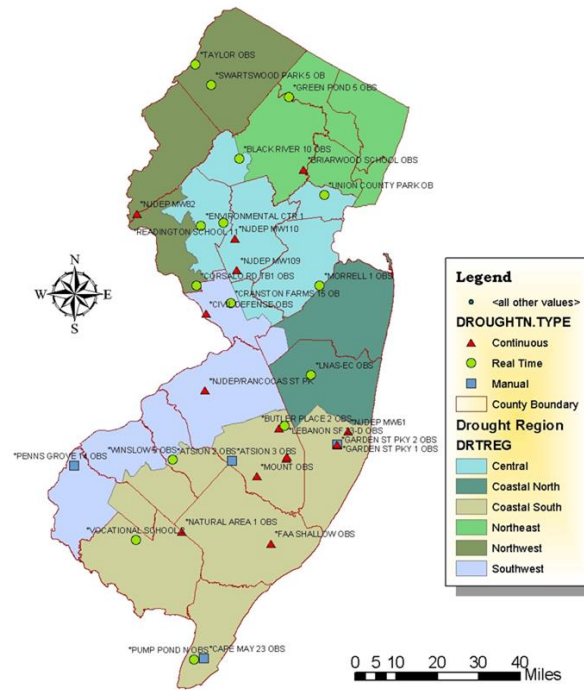
Groundwater Level Observation Network



GW Networks

- 22 Real-time Continuous-Record Wells
- 108 Continuous-Record Wells
- 47 Manual Wells

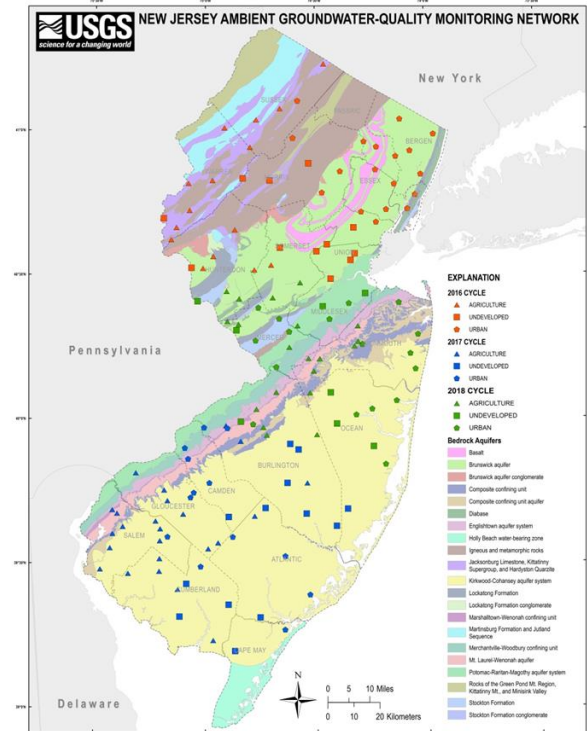
Drought Network



NJ Drought Monitoring Network

- NJDEP uses 4 indicators to evaluate status of water supply and hydrogeologic conditions
 - Streamflow at key gages
 - Groundwater levels in shallow wells
 - Water levels in water-supply reservoirs
 - Precipitation

Groundwater Quality Monitoring



Water-Quality Sampling Sites

- 150 wells in the NJDEP/USGS AGWQMN Coop Network
 - Wells selected by dominant land use targeting nonpoint source pollution
 - Agricultural
 - Undeveloped
 - Urban
 - Wells sampled on 3-year cycle (50 wells / year)

NJWSC Hydrologic Data Assessment Program Capabilities

■ Coastal Monitoring

- NOS National Water Level Observation Network (NWLON) Standard Tidal monitoring
- Surge, Wave and Tide Hydrodynamics Network
- Coastal Inundation Modeling & Mapping



■ Watercraft Work and Training

- NJWSC currently maintains a contingent of well-maintained watercraft
 - Water-Quality and Suspended-Sediment Sampling from Boats on Large River with D95 & D96 samplers
- NJWSC is a USGS Regional Watercraft Safety Training Center



■ Bathymetry Work (reservoirs)

■ Low Flow Monitoring & Analysis

■ Deep well pumping and sampling



NJWSC Hydrologic Data Assessment Program Capabilities

■ Surveying Work

- GNSS Work
- High-Water Mark Flagging and Surveying for indirects

■ Bridge Scour Monitoring & Counter Measure Assessment

■ HEC-RAS

- Flood Inundation Mapping
- Modeling flows



■ Real-time Harmful Algal Bloom (HABs) Monitoring

P
S

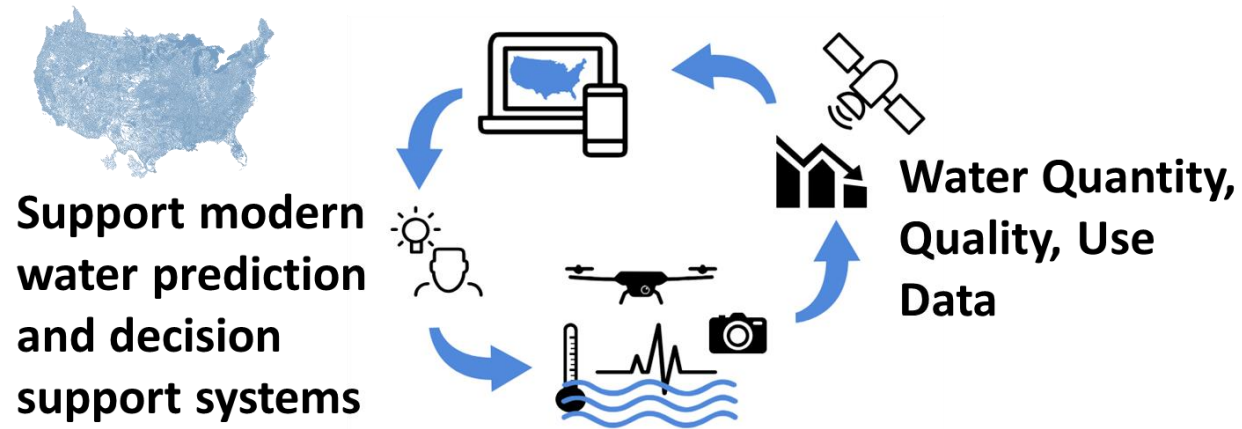
■ Contaminants of Emerging Concerns sampling

- Microplastics
- Endocrine Disrupting Compounds
- Pharmaceuticals/Personal Care Products
- Glyphosate...



Next Generation Watershed Observing System (NGWOS)

An opportunity to develop an integrated water observing system to support innovative modern water prediction and decision support systems in a nationally important, complex interstate river system.



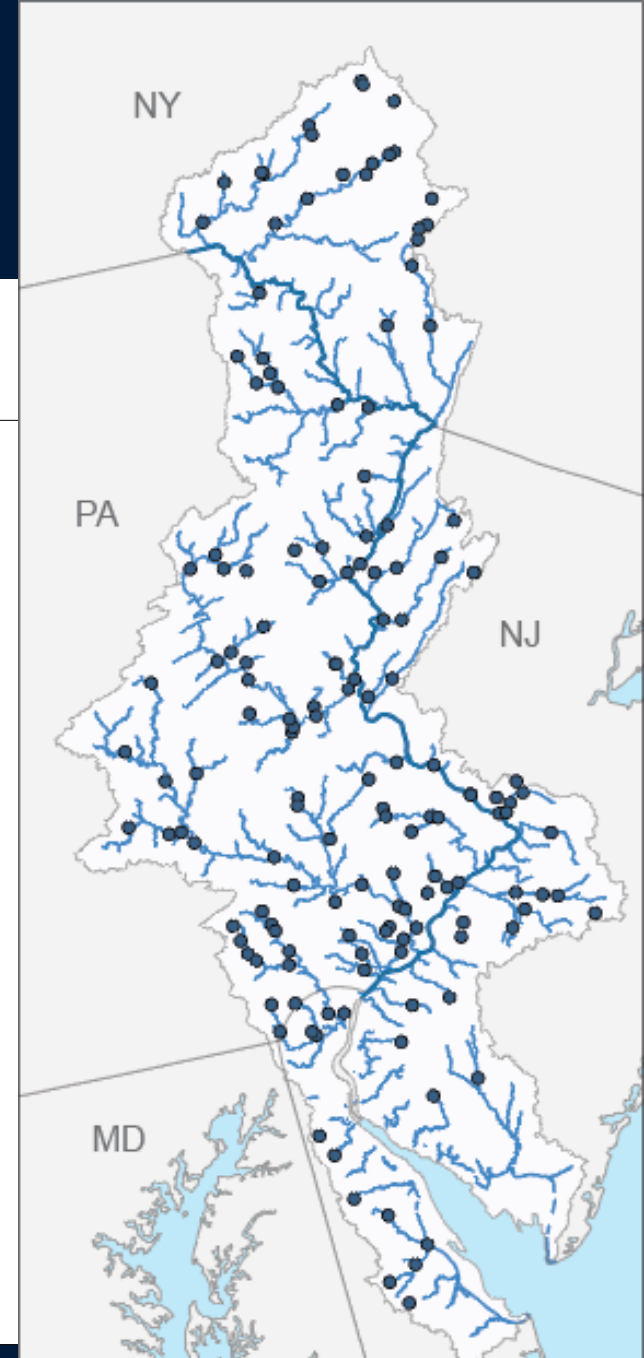
Integrated set of fixed and mobile monitoring assets in the water, ground, and air

NGWOS Delaware River Basin Pilot

...an integrated water observing system to support innovative modern water prediction and decision support systems.

The Delaware River Basin

- Ecologically diverse and critical to the regional and national economy;
- Provides drinking water to over 15 million people;
- Long history of innovative, regional solutions to insure the long-term sustainability of this treasured resource.



Existing Streamgages

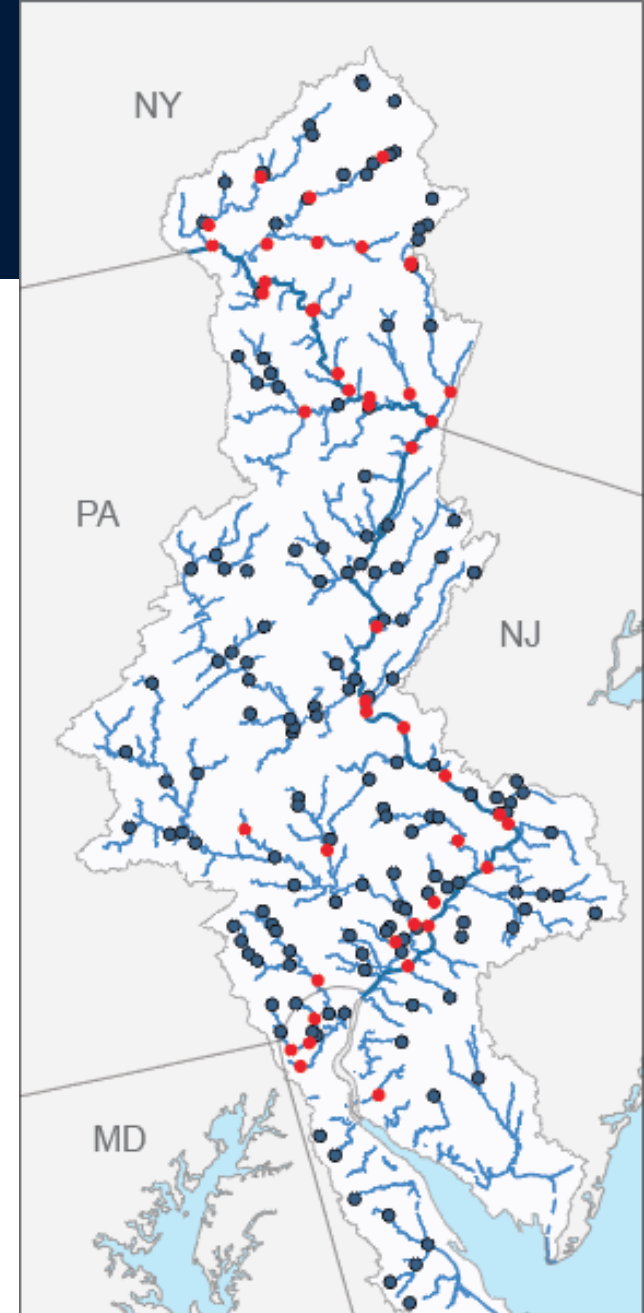
NGWOS Delaware River Basin Pilot – FY18

New Gages

- 17 new streamgages to fill critical gaps

Enhancements to the Water Monitoring Network

- Upgrades at 28 streamgages (new DCPs, Iridium communication, etc)
- Addition of water temperature monitoring (36 sites) and conductance monitoring (10 sites) to support Fisheries and Water Prediction



Existing Streamgages

Enhanced Streamgages in FY18

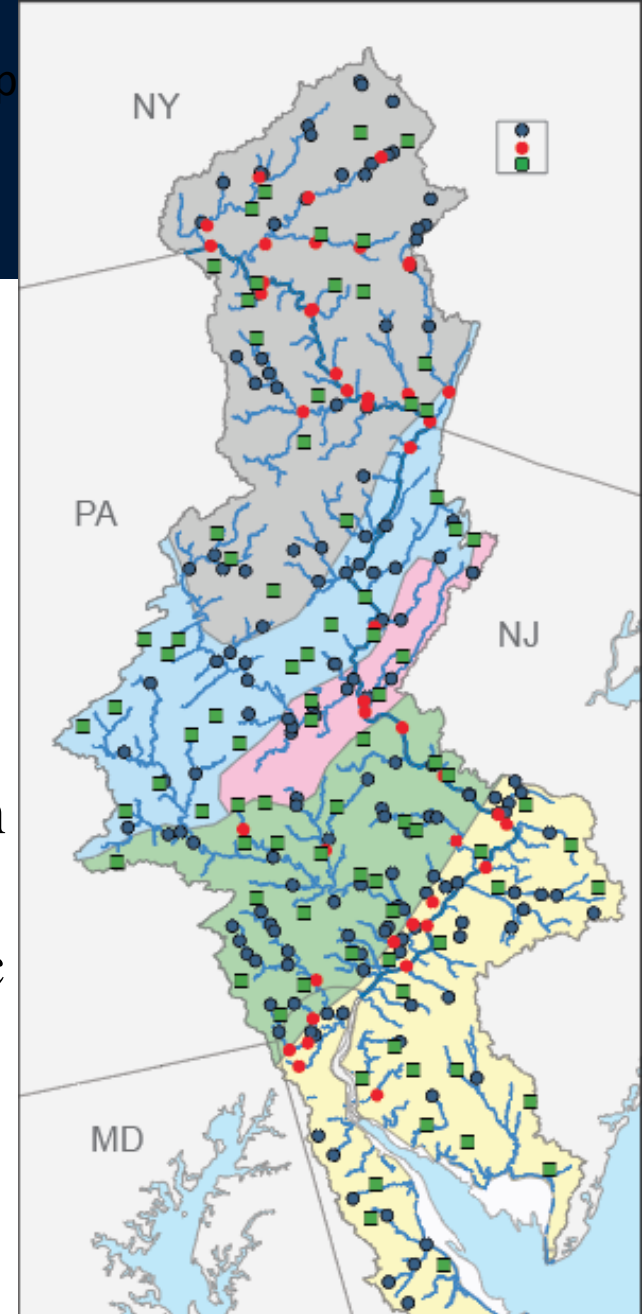
NGWOS Delaware River Basin Pilot – Proposed FY19

Enhanced Mainstem Monitoring

- Addition of temperature & salinity monitoring at more sites
- New communication platforms

Small Stream Monitoring


- About 50 new gages in areas in basins less than about 50 mi² to characterize hydrologic dynamics and improve hydrologic and ecologic models



Enhanced Streamgages in FY18

Proposed New Streamgages in FY19

NGWOS Delaware River Basin Pilot – Proposed FY19

Upper sub-basin 

Additional monitoring on a limited scale

- SW/GW interactions
- Evapotranspiration
- Snowpack
- Soil Moisture
- Sensors for nutrients and suspended sediment
- Remote Sensing

Monitoring Network Modernization

- New communication platforms
- Faster, adaptable, and interconnected; plug-n-play
- Continued R2O into NextGen technologies

NGWOS Delaware River Basin Pilot – Proposed FY19

Innovation Testing Sites

Operational testing at numerous sites

- Radars for water level and velocity
- Video images for water velocity

Technology testing at one mainstem & a couple of small stream sites

- Water-quality and sus. sediment sensors
- eDNA
- SW/GW interactions
- Radiometer – remote sensing calibration

NGWOS Delaware River

Basin Pilot – Proposed FY20

Upper sub-basin 

Increased use of Sensors and Remote Sensing for water quality in streams and groundwater and water use monitoring

Continue "Wiring the Network" (LoRa and other technologies) and investing in NextGen technologies

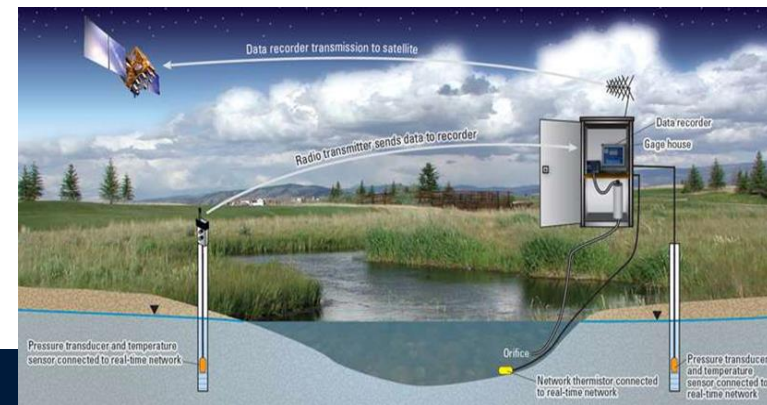
Expansion of SW/GW interactions to estimate baseflows

Link NGWOS water monitoring infrastructure with other monitoring needs (multiple our combined science capacities)

Next Generation Water Observing System (NGWOS)

When fully implemented, the USGS NGWOS will provide real-time field and remote-sensing data on:

- Streamflow;
- Water-cycle components (ET, snowpack, soil moisture);
- Broad suite of water-quality constituents;
- Connections between groundwater and surface water;
- Stream velocity distribution;
- Sediment transport; and
- Water use.



USGS Delaware River at Trenton

03-17-2019 10:00:07

USGS 01463500 Delaware River
at Trenton NJ

Questions?

Heidi L Hoppe, NJWSC Chief Hydrologic Data Assessment Program

hhoppe@usgs.gov



USGS 01463500 Delaware River at Trenton NJ
Sunday, March 17, 2019 9:00:06 AM

David Arscott, Ph.D.



- * President, Executive Director
- * Stroud Water Research Center
- * Avondale, PA

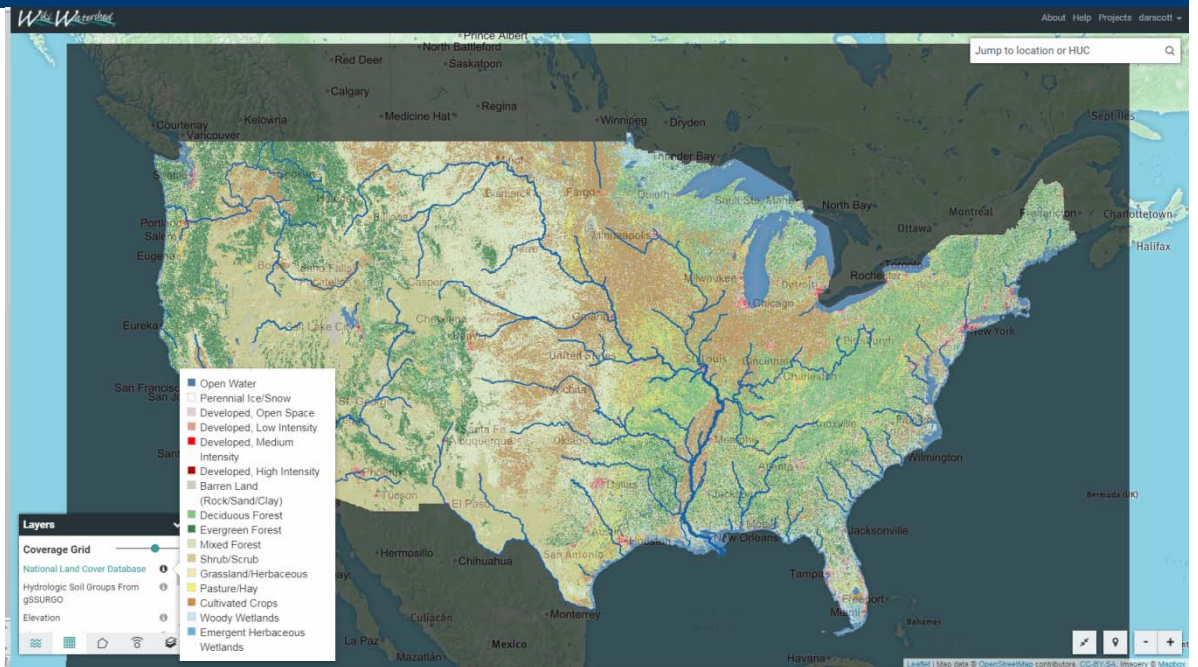
WikiWatershed®: An online toolkit for water resource managers, conservation practitioners, and municipal decision-makers

Dave Arscott

Matt Ehrhart, David Bressler



Development Team:
Drexel/ANS, LimnoTech,
PSU, UW, USU, Azavea



WikiWatershed®



Team Members

David Arscott, Steve Kerlin, Melinda Daniels,
Matt Ehrhart, Susan E. Gill (retired)

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Carolyn Staudt, Concord Consortium





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- Past NSF Grant: DRL #0929763
- Stroud Water Research Center
- Virginia Wellington Cabot Foundation
- The Dansko® Foundation
- Generous donations from Peter Kjellerup and Mandy Cabot



National Science Foundation
WHERE DISCOVERIES BEGIN



What is WikiWatershed®?

A web toolkit to support citizens, conservation practitioners, municipal decision-makers, researchers, educators, students to collaboratively advance knowledge and stewardship of our environment and fresh water.



WikiWatershed[®] *Current and Developing Resources*

- **Model My Watershed[®]** – Watershed-modeling Web app to analyze real geo-data, model storms and compare conservation or development scenarios in your watershed.
- **Monitor My Watershed[®]** – Web-based interactive map for discovery, visualization, and sharing of data and resources to assist monitoring using low-cost approaches.
- **Runoff Simulation** – Animated learning tool for Model My Watershed.
- **EnviroDIY[™]** – Community of do-it-yourself enthusiasts sharing open-source ideas for environmental science and monitoring.
- **Leaf Pack Network[®]** - International network of stream macroinvertebrate monitoring data and educational resources.
- **Water Quality App[™]** - Data collection tool for tablets and smartphones for chemical, physical, and macroinvertebrate monitoring data. Includes digital field guide for macroinvertebrates and learning tools for other measurements. Available from Google Play and iTunes.

STROUD
WATER RESEARCH CENTER



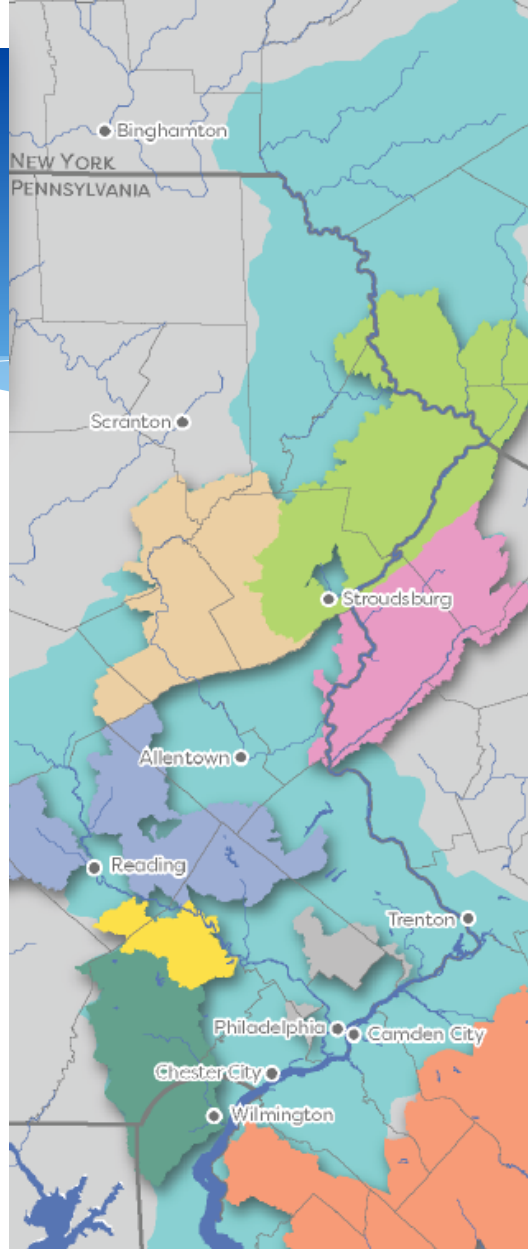
Updates from Work Group Members

Updates

- Anything you would like to share with the group?
 - Projects
 - Data Sets
 - Opportunities for Coordination
 - Questions / Something you need help with
 - Upcoming Events of Interest
 - Job Openings

Meeting Wrap Up & Evaluation

Help Desk



NEED MAPS, DATA, OR MODELING FOR YOUR DRWI EFFORTS?

The Help Desk is here to help!

Are you a nonprofit working to improve water quality in the Delaware River Watershed? Do you need maps, data, or help with Geographic Information Systems (GIS) and/or modeling?

The DRWI Data, GIS, and Modeling Work Group's Help Desk is here for you! Simply submit your request via the Help Desk Request Form:

www.dvrpc.org/waterquality/DataGIS.

There is no cost to you to receive these mapping services. The funding to cover these requests is provided by the William Penn Foundation as part of the Data, GIS, and Modeling Work Group funding.



DRWI
Data, GIS, & Modeling
Work Group

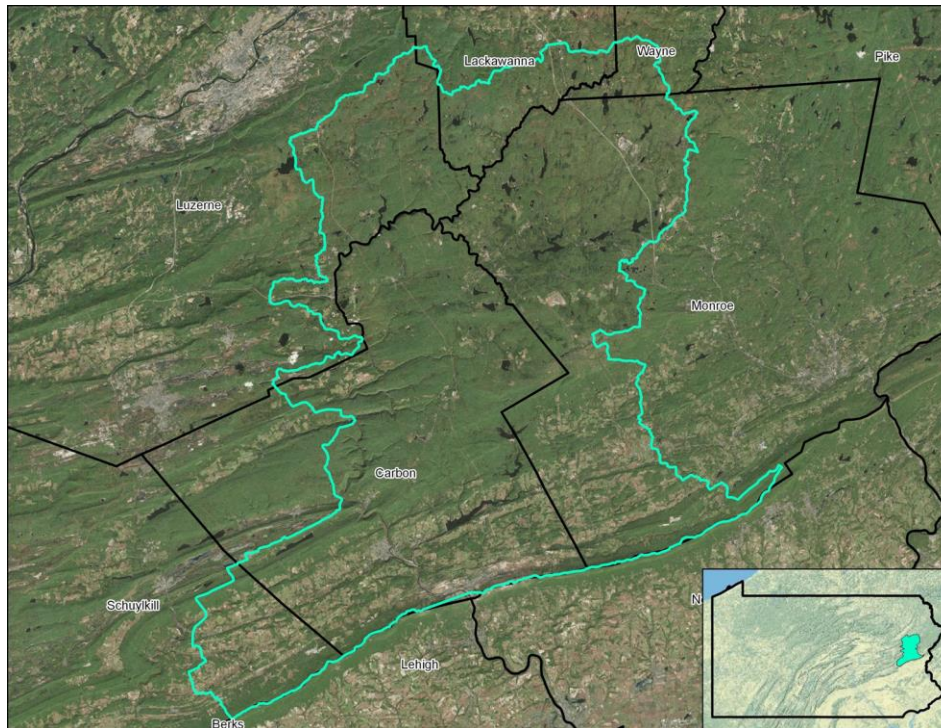


dvrpc

WWW.DVRPC.ORG/WATERQUALITY/DATAGIS/

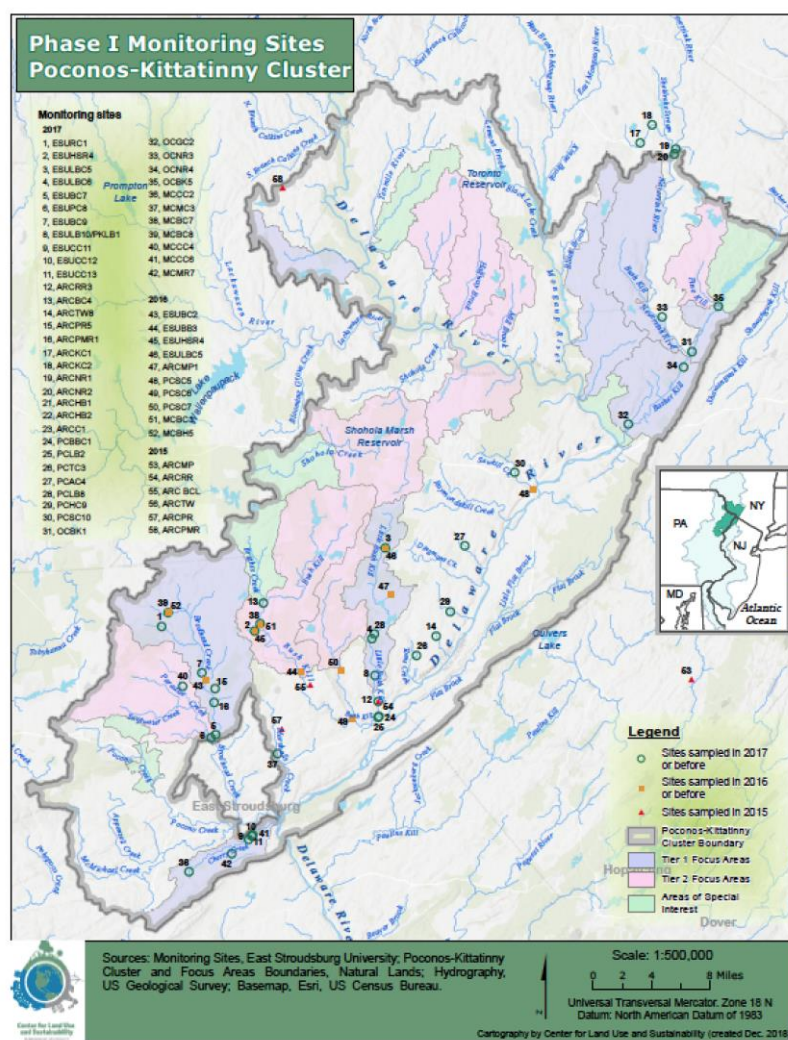


Client: Audubon Pennsylvania Mapmaker: PALTA

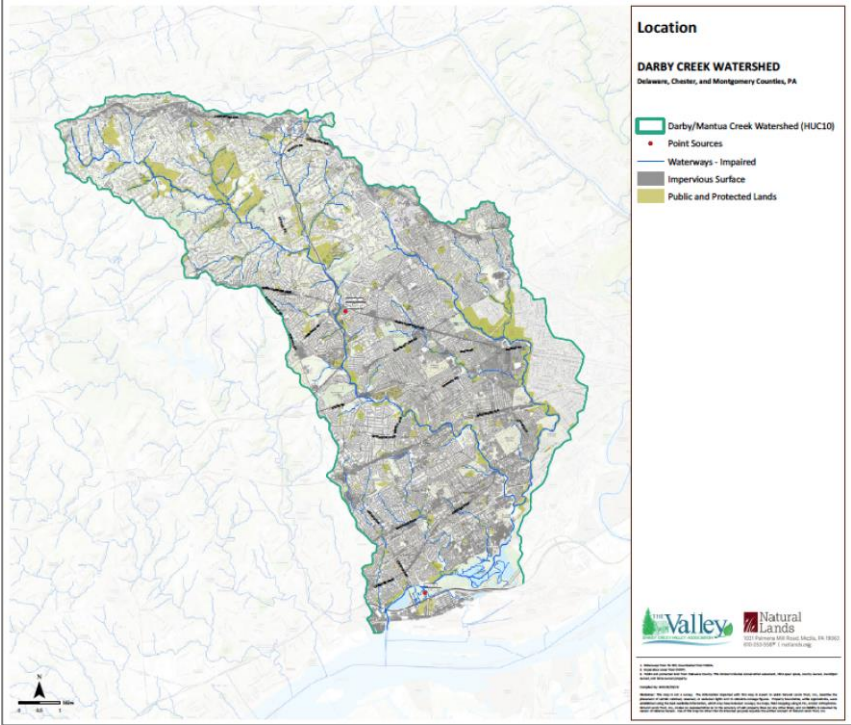


Client: Poconos-Kittatinny Cluster

Mapmaker: Shippensburg



Client: Darby Creek Valley Association Mapmaker: Natural Lands



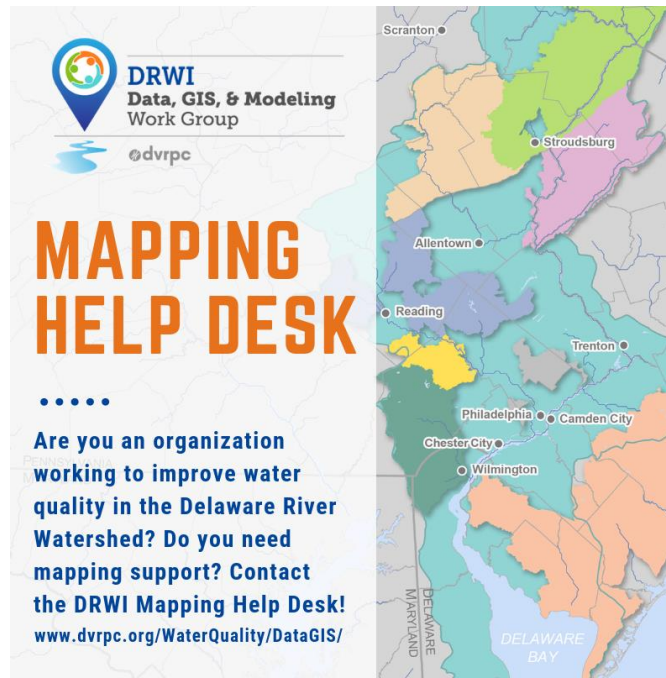
Client: Darby Creek Valley Association

Mapmaker: Natural Lands



Spread the word about the Help Desk!

- <https://www.dvrpc.org/waterquality/DataGIS/>
- "Help Desk Request Form"



The graphic features a map of the Delaware River Watershed on the right, with various counties highlighted in different colors (green, pink, purple, yellow, orange). Major cities like Scranton, Stroudsburg, Allentown, Reading, Trenton, Philadelphia, Camden City, Chester City, and Wilmington are marked. The Delaware River and Delaware Bay are also labeled.

DRWI
Data, GIS, & Modeling
Work Group

dvrpc

MAPPING HELP DESK

•••••

Are you an organization working to improve water quality in the Delaware River Watershed? Do you need mapping support? Contact the DRWI Mapping Help Desk!
www.dvrpc.org/WaterQuality/DataGIS/

Upcoming Webinars

May 3, 2019: Storytelling with Maps

Meeting Evaluation

Evaluations



Meeting Date: April 9, 2018

Help us find out what worked and what didn't work about today's meeting

1. Please rate the overall quality of the Work Group meeting.

1 2 3 4 5

Low quality High quality

2. Was the Work Group meeting a good use of your time?

1 2 3 4 5

Not a valuable use of my time Excellent use of my time

3. What did you like best about the Work Group meeting?

4. What could have been improved about the Work Group meeting?

5. Do you have suggestions for the Work Group that would help us achieve the group's objectives?

6. Would you be able to attend a Work Group meeting on the following dates?

Check all that apply.

___ Monday, July 9, 2018

___ Friday, July 13, 2018

___ Monday, July 16, 2018

___ Monday, July 23, 2018

___ Tuesday, July 24, 2018

___ Tuesday, July 27, 2018

Please join us for lunch!



<http://espressoandcream.com/2012/08/vegetarian-lasagna-with-goat-cheese-and-summer-squash.html>

Thank you!

<https://www.dvrpc.org/waterquality/DataGIS/>

For more information, contact:

Christina Arlt, AICP

carlt@dvrpc.org

215-238-2890