

Opening/Welcome

“Defining Data and Workflows for PA Hydro”

January 28, 2020

Eric Jespersen, Matt Mercurio, Ellen Fehrs



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."



DCNR's Vision: As **Pennsylvania's** leader and chief advocate for conservation and outdoor recreation, we will inspire citizens to value their natural resources, engage in conservation practices, and experience the outdoors.

The PA Geological Survey's Mission is to serve the citizens of Pennsylvania by collecting, preserving, and disseminating impartial information on the Commonwealth's geology, geologic resources, and topography in order to contribute to the understanding, wise use, and conservation of its land and included resources."↓



Site Hosts

- Thank You!
 - Safety
 - Logistics

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

Today's Collaborators??

- By sector
- Prior participants
- By name

Program and Technical Briefings

- **Water Data Initiative to Date**
 - Jespersen (PaMAGIC)
- **Elevation Derived Hydrography Program in PA**
 - Fehrs (PA Geological Survey)
- **National Perspectives**
 - Aichele (USGS)
- **Critical Points of Failure in Hydrography**
 - Brenner (QSI)
- **Morning Wrap**
 - Mercurio (PaMAGIC)

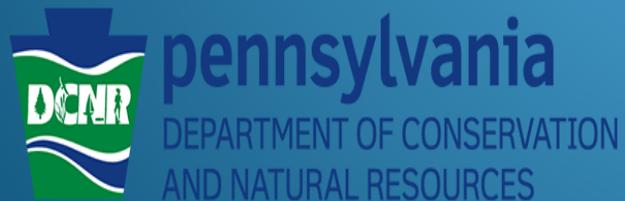
Susquehanna Basin Activities, Partnerships and Challenges

- **Basin Characteristics**
 - Moore/Ebersole (PA Geological Survey)
- **Ongoing Stream Data Development**
 - Saavedra (Chesapeake Conservancy/Bay Program)
- **Stream Network Dynamics Studies**
 - Duncan (PSU)
- **Leadership, Promotion, and Pacing**
 - Blackmer (PA Geological Survey)

Modernizing PA Hydrography Initiative to Date

January 28, 2020

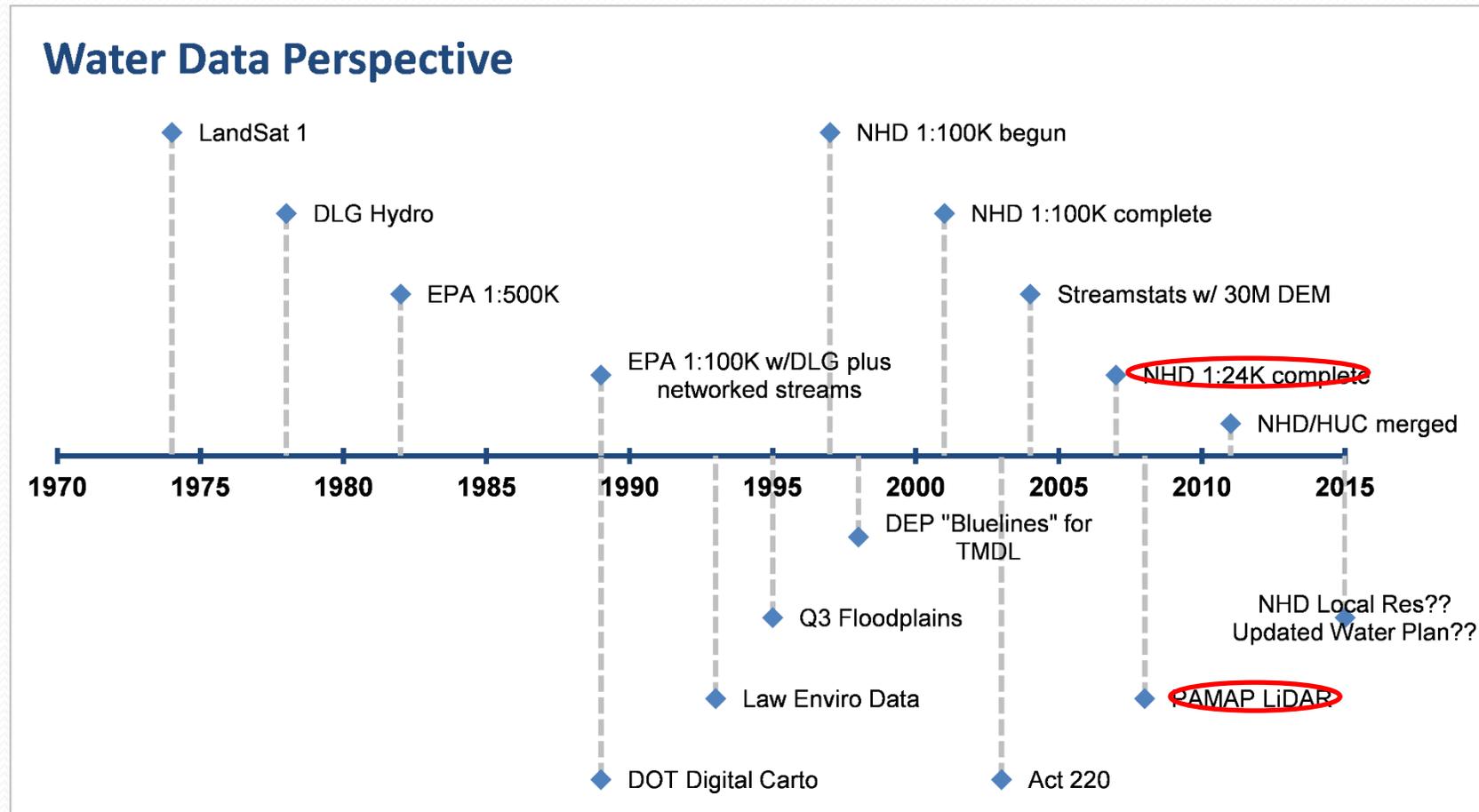
Eric Jespersen, Gale Blackmer



What was the Plan?

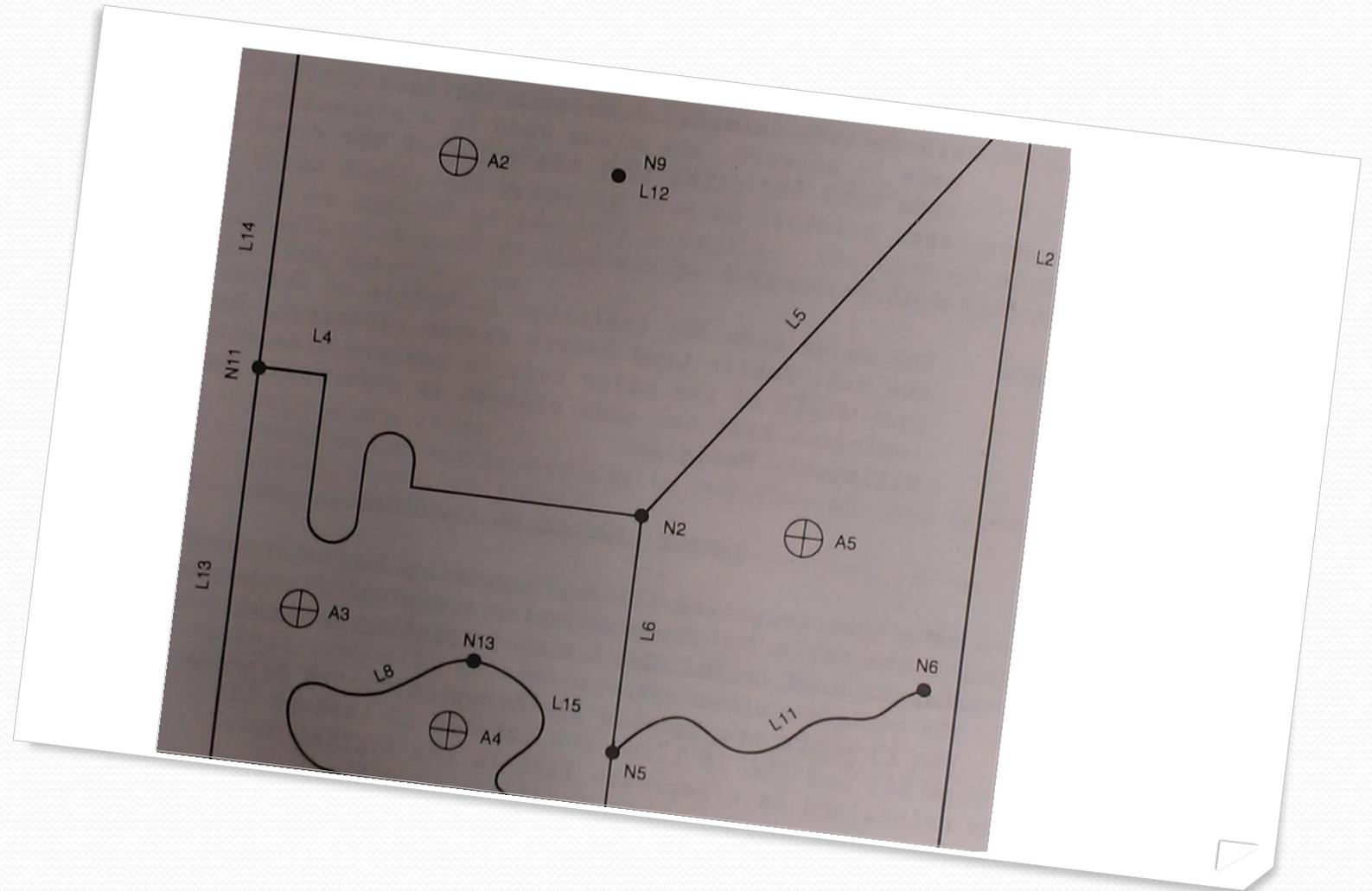
- Spring 2013 → Concept Development
- Autumn 2013 → Concept Promotion/**Champion Development/ Partner Recruitment**
- Spring 2014 → Project Definition/**Initial Funding**/Partner Recruitment
- Autumn 2014 → Pilot Data Development/**Funding Consolidation**
- 2015 – 2018 → Data Production/Quality Control/Application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

Digital Data Timeline



Late 1970's

Nodes, lines, areas



2001 – 1:100K NHD
2007 – 1:24K NHD

EPA Data
merged with
USGS Spatial Rigor



Two Water Data Players

**EPA Reach Files – Good Attributes
Networked streams**

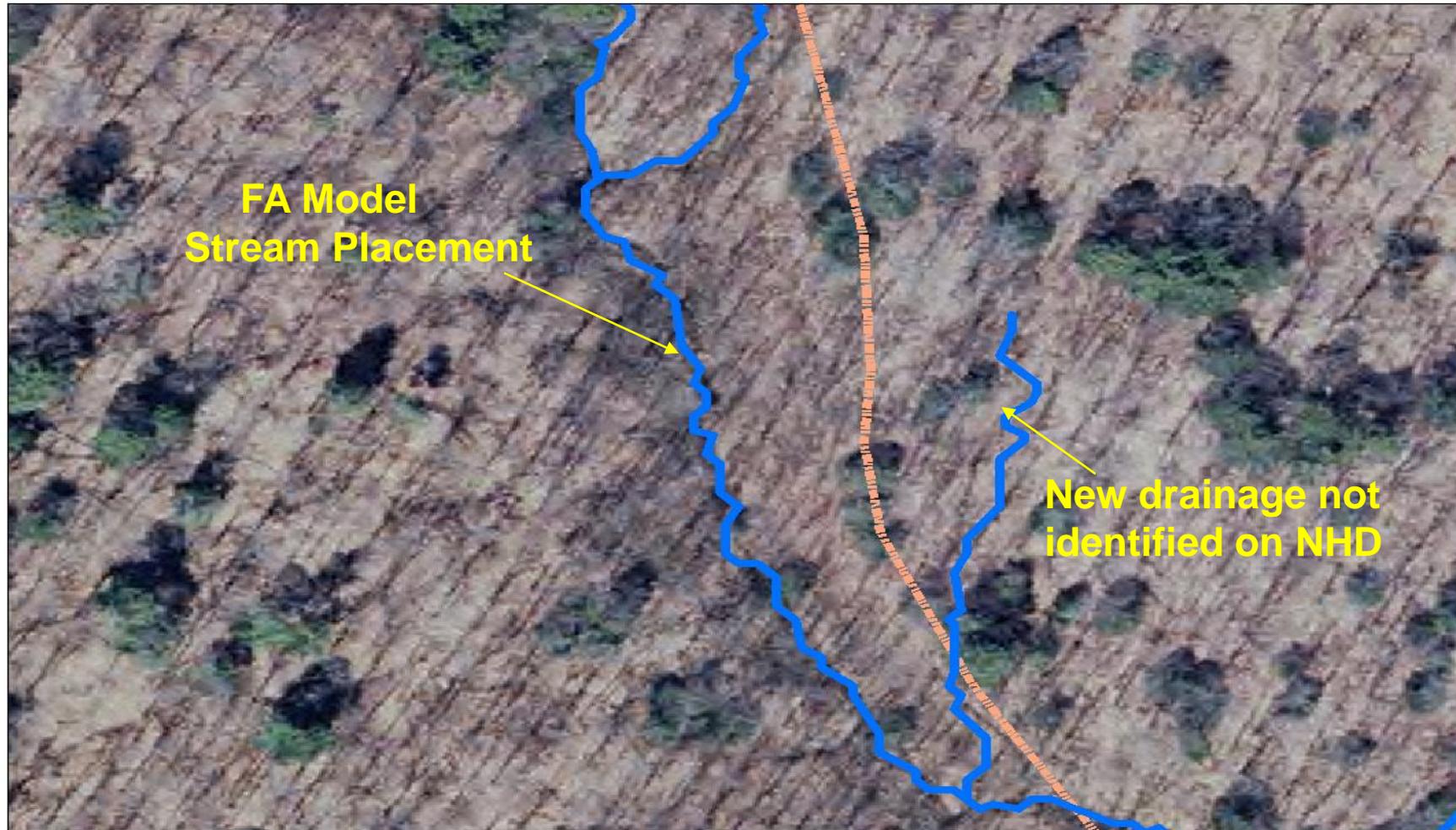
**USGS DLG – Good Lines
Compatible with LU/LC, GNIS**

Act 220 – 2008 Report

Principal Priorities:

1. “...collect, interpret, and disseminate water resources information into the future. Sound...decisions can not be made without...**reliable and current data.**”
2. “...an **integrated approach**...should be encouraged and sustained.”
“Integrating...interdependent water uses will significantly improve their sustainability.”
3. “...encourage **technical advances** designed to conserve and enhance water resources.”

Compatible with Current Mapping Standards



Budget Workshop Recap (2014)

- Establish a *minimum* data production standard to ensure regulatory fairness rather than a single standard production method
- Possible use of some simplified data model that might support later conflation to NHD
- No statewide project should be undertaken (pilots and project scoping excepted) without maintenance and update defined
- Recommend Pilot project in Lancaster County

Context – First large-scale QL2 Lidar collected in PA

Data Maintenance Workshop (2016)

- Begin with a **simplified database** of the best accuracy we can afford and sufficient attributes to link to existing regulatory datasets, and taking advantage of technology advances to **add complexity** and connections in the near future.
- It was unanimous that there should be a **single steward** managing a system that allows **multiple contributors** to add to the official database

Data Maintenance Workshop (2016)

- Topography, geology, roads, culverts, stormwater systems and other infrastructure all inform and improve our understanding of water data *when they are spatially compatible*.
 - 1:2400 is a realistic horizontal expectation
 - No vertical precision discussed
- The data model design and the stewardship model are entwined.

Context –

*PA GeoBoard begins operations

*Delaware Basin and Chesapeake Bay High-precision Land Cover Data sets

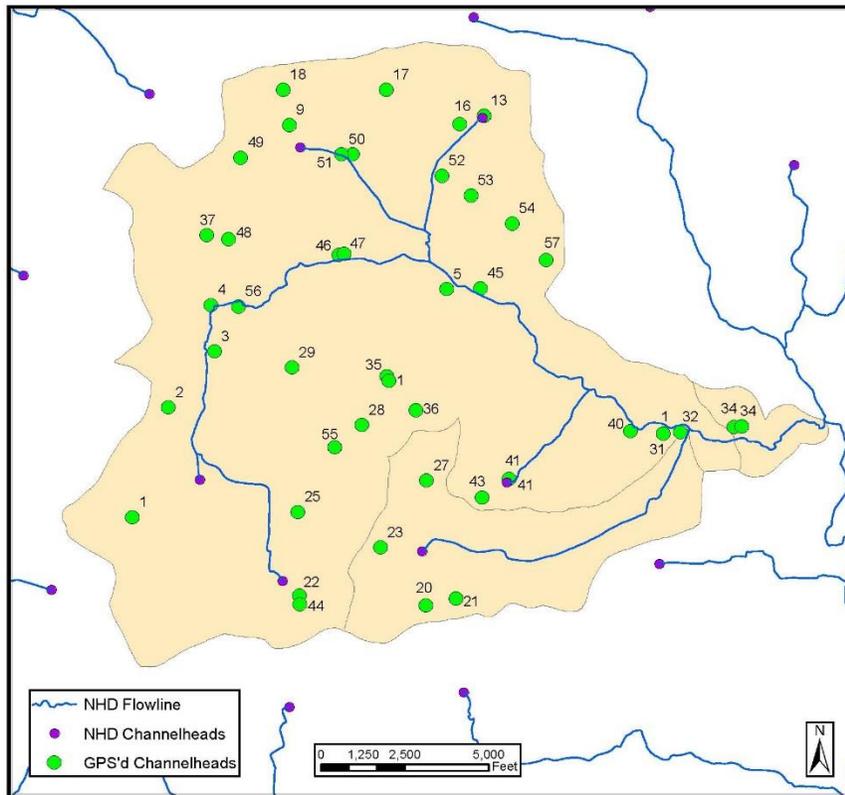
Lancaster County Pilot (2016)

- **\$30,000 USGS NHD Support Grant**
 - **Funding Opportunity USGS-15-FA-0516**
- County Hydrography background
 - 1993/1998 - Streams < 10 feet wide mapped centerline only; >10 feet wide as polygons
 - 2000 - Update - networked streams and added flow direction to all
 - 2012 - Major update from imagery, supported with 2008 LiDAR DEM; DEM enforcement

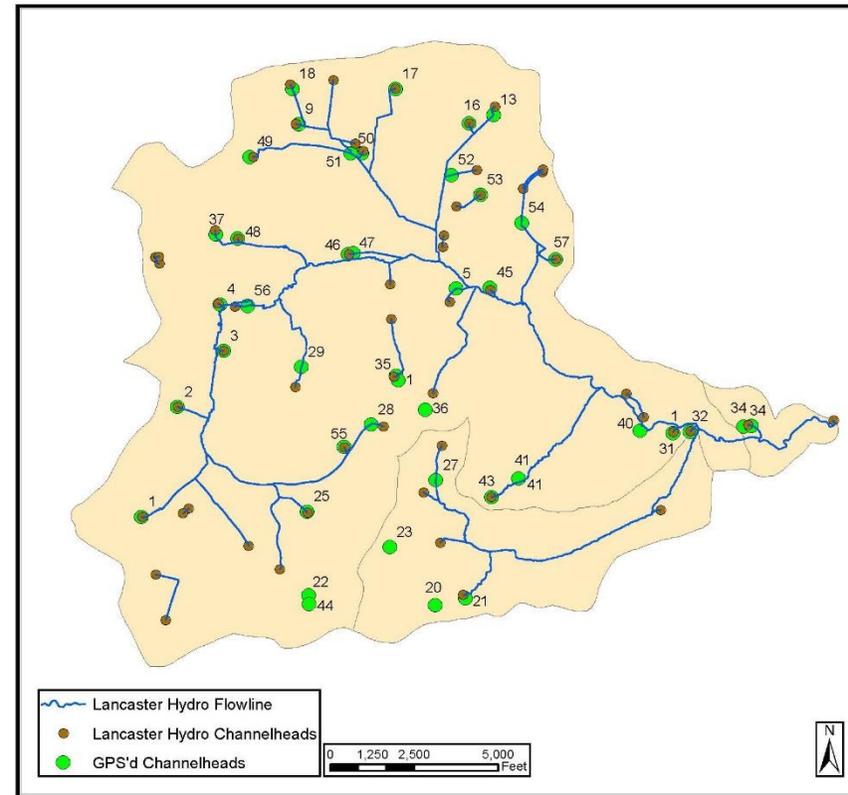
Primarily photogrammetric

Field Validation

NHD Channelhead Comparison



Lancaster Hydro Channelhead Comparison



Lancaster County NHD Support Pilot

Chiques - NHD



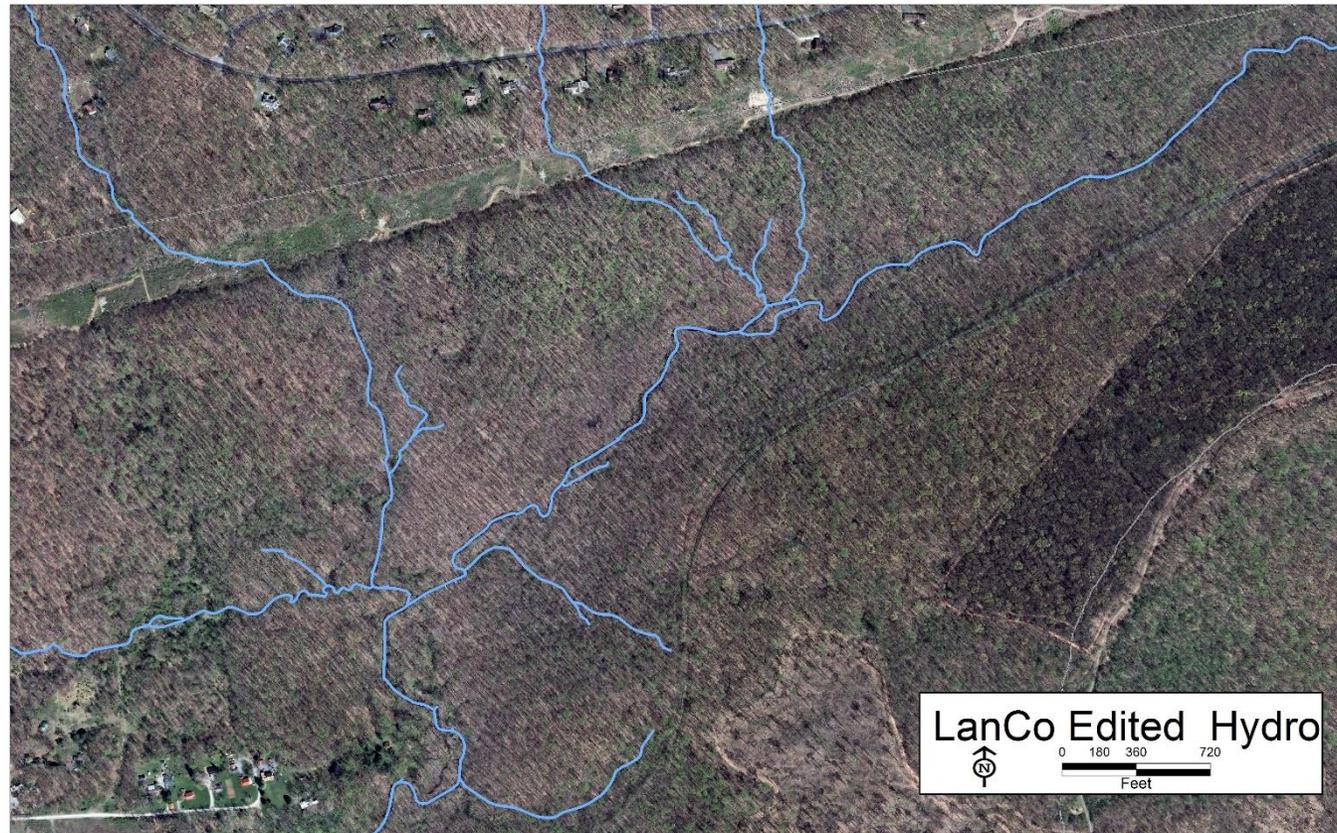
Lancaster County NHD Support Pilot

Chiques – Original County Hydro



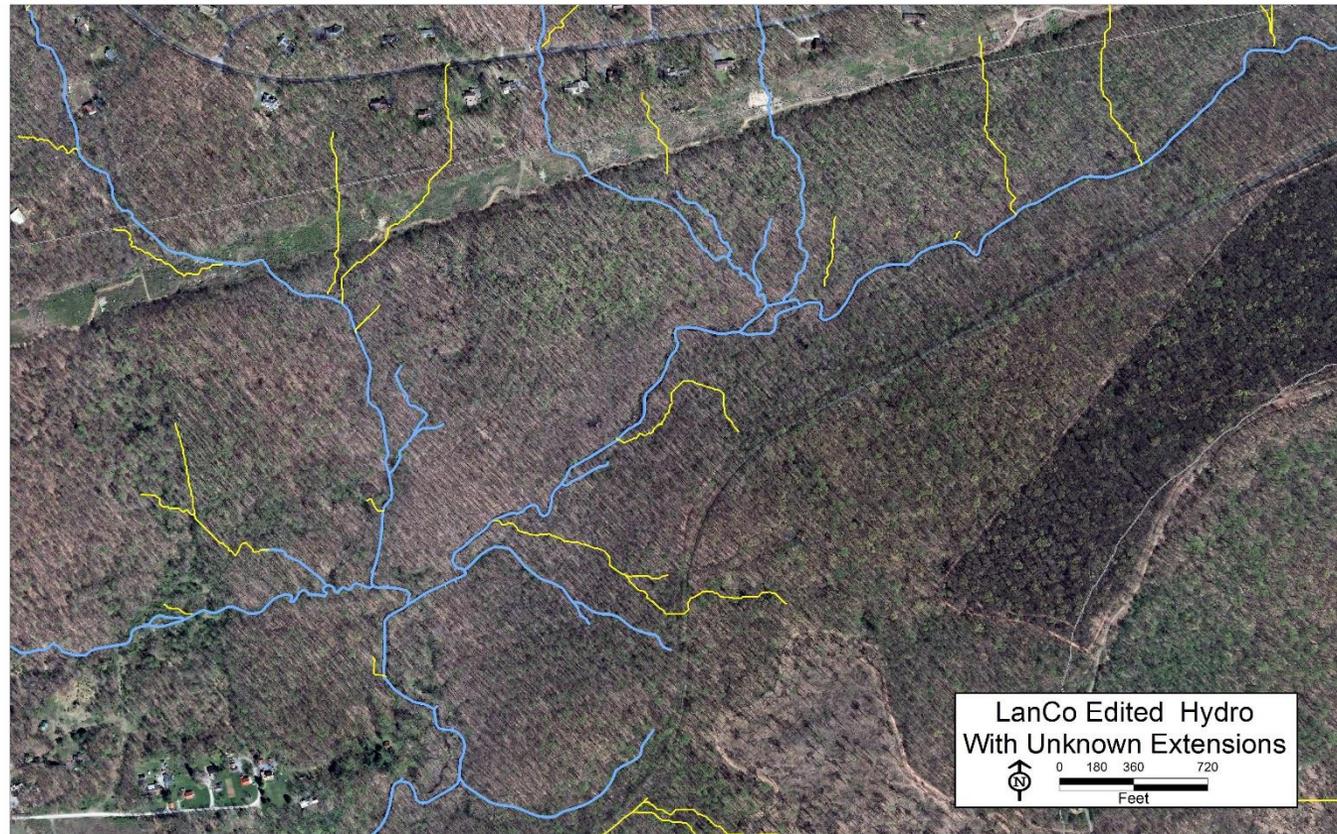
Lancaster County NHD Support Pilot

Chiques – Edited County Hydro



Lancaster County NHD Support Pilot

Chiques – County Hydro w/ Headwater Swales



Lancaster Pilot - Extrapolating Statewide

1. Both the QL2 and QL3 LiDAR yield valuable data, but the statewide QL3 data it is getting older by the day
2. We will not have a valid local resolution hydrography without including the transportation and stormwater management infrastructure.
3. Watersheds rather than counties should be the basis for project phasing.
4. Some field work and local knowledge will always be necessary
5. What is required is a dynamic data management approach and modernized database structure.

QL2 vs. QL3 Workshop (2017)

- PAMAP lidar was 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

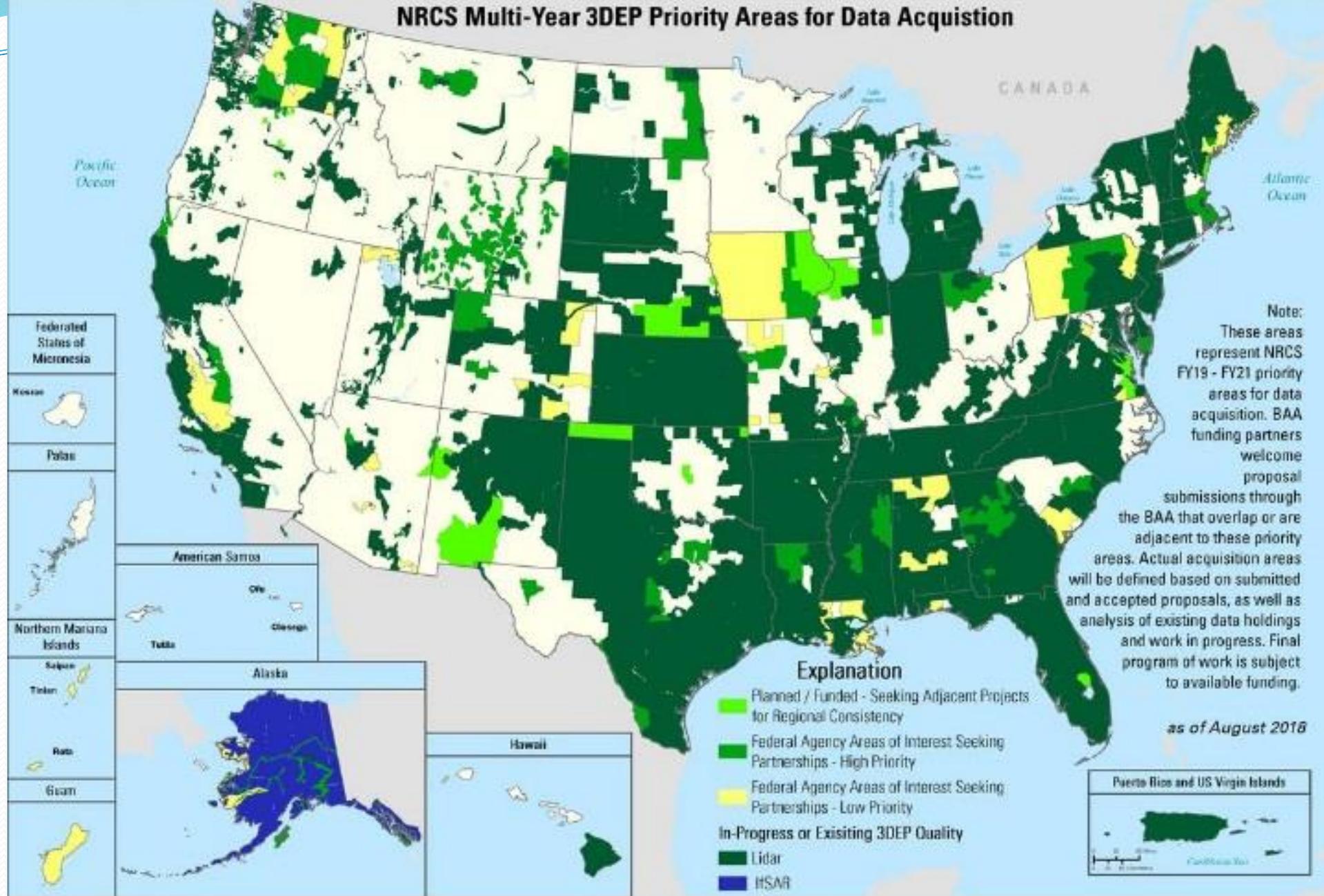
Context – Chesapeake Bay and NRCS QL2 Acquisitions

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>

NRCS Multi-Year 3DEP Priority Areas for Data Acquisition



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

USGS 3DEP Grant Application 2018-2019

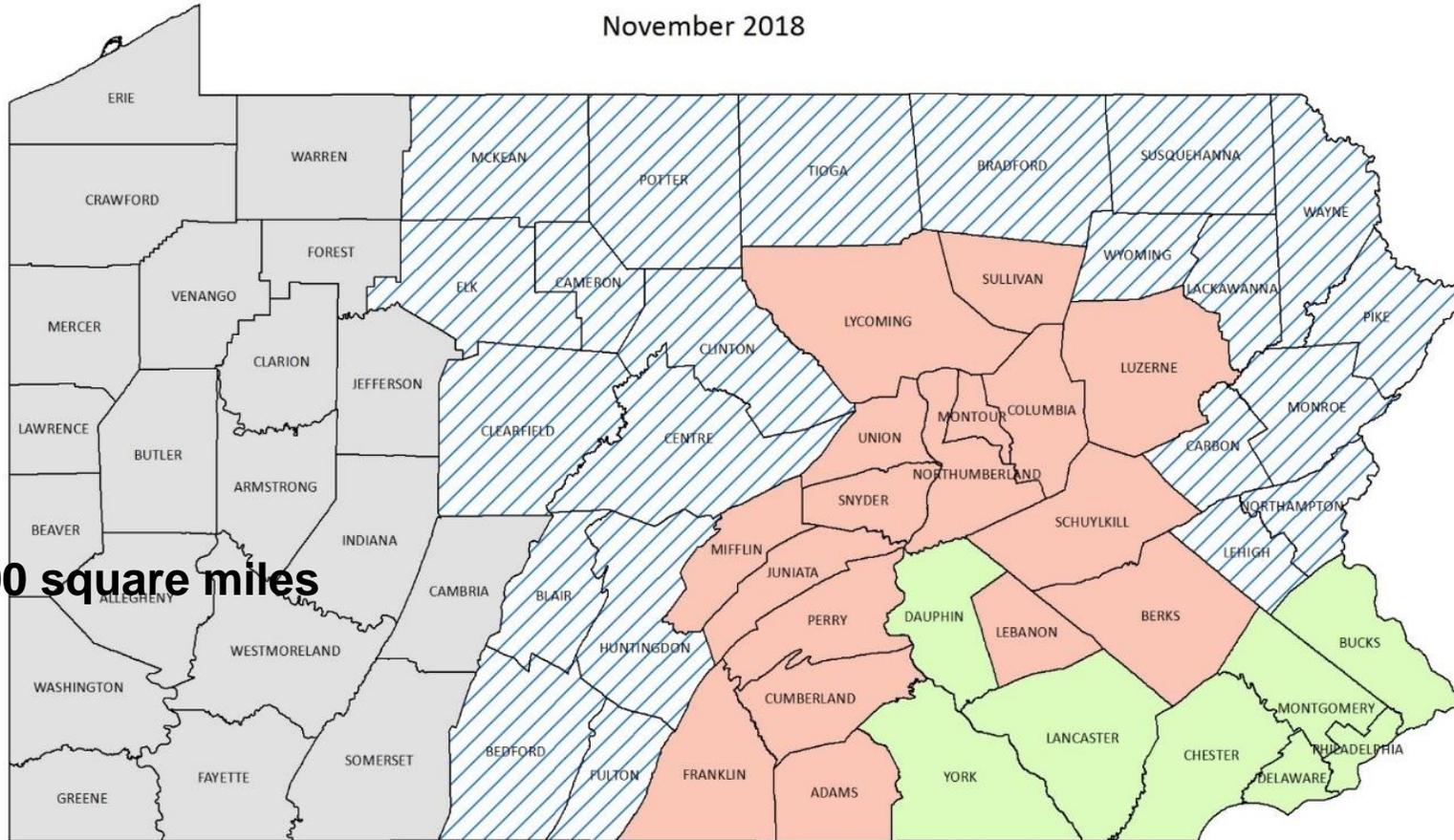
- Application made November 9, 2019
- Lead author is PA Geological Survey
- In-state funding \$2.15M
 - DCNR \$500K
 - DEP \$500K
 - PEMA \$500K
 - SRBC \$50K
 - PTC \$200K
 - DOT \$400K

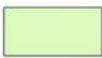


Proposed Acquisition of Quality Level 2 (QL2) Lidar Data

November 2018

+/- 15000 square miles



 QL2 lidar acquired 2014-2016
various funding sources

 QL2 lidar acquired 2017-2018
NRCS, 3DEP

 Proposed to 3DEP BAA 2018-2019

Defining the Plan Workshop (2018)

- Critical Path - Standards and processes - #1 in importance
 - Integrate the data we have as a starting point
- Data Model Considerations
 - #1 Single standardized geometry – one stream layer for state
 - #2 Hydrography vector data model – cannot be separated from supporting modified topo/DEM
- Promotional Concepts
 - Design an iterative process in terms of legislative support funding
 - One person ultimately responsible

Context First time in both Harrisburg and Pittsburgh!!

Low ebb in state environmental consciousness

PaMAGIC/DCNR Partnership (2018)

- *Different Rhythm for Project*

- Lidar Working Group for data acquisition (20 people)
- Core group every 3 months for technical advancements (6-8 people)
 - Data Model
 - Statewide Steering discussions
- Additional promotion
 - GeoBoard exposure
 - DRWI



Accelerate the Plan (2019)

- **Refine Concepts**

- Program Management
- Data Structure
- Data Development and Enhancement

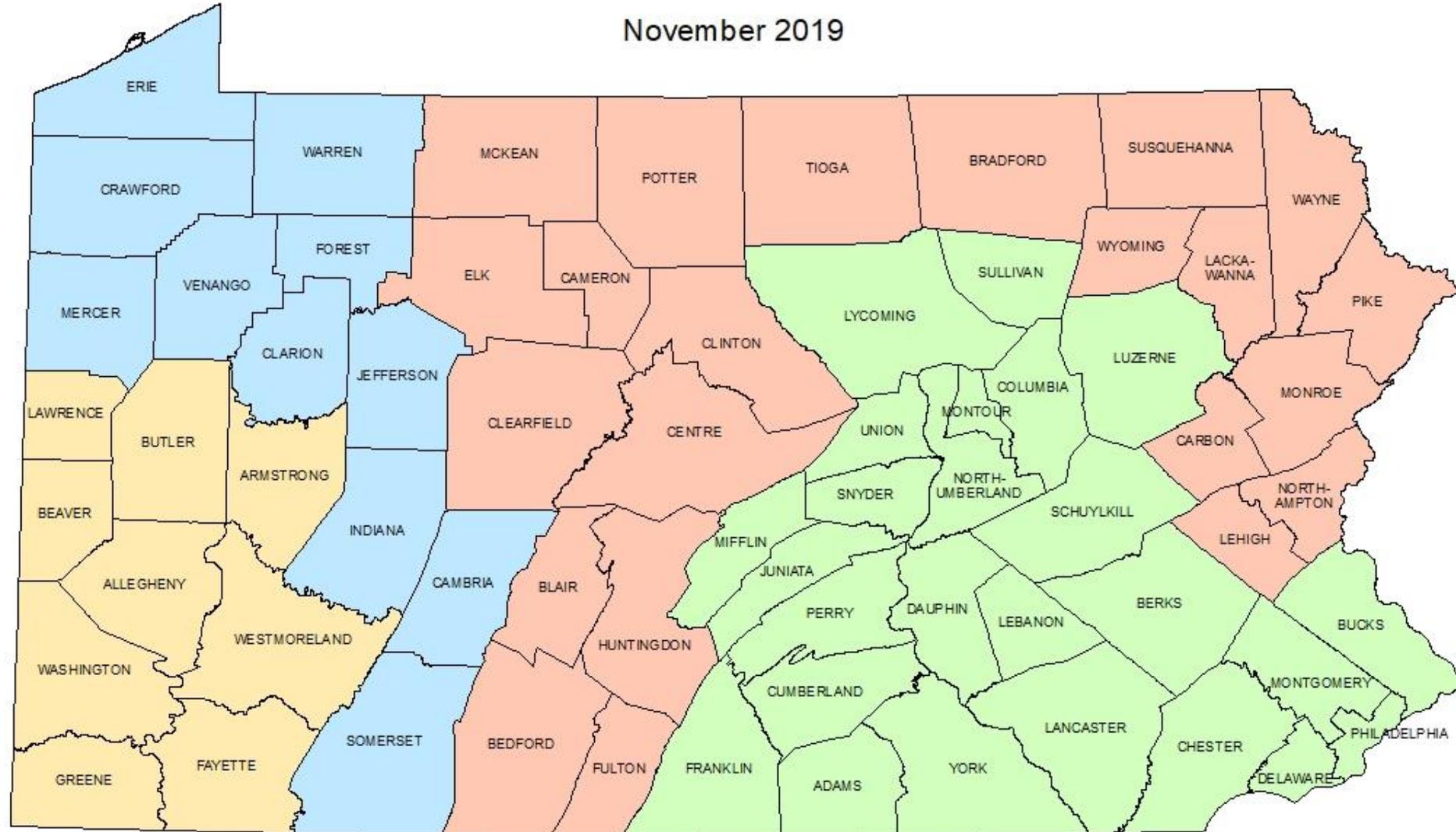
- **2019 Goals**

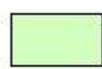
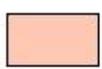
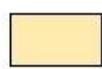
- Hire a senior-level geologist to lead the hydrography program at PAGS
- Regional Steering Teams in place
- Statewide QL2 Lidar Funding assured and Sequencing complete



Current Status of Quality Level 2 (QL2) LiDAR Data in Pennsylvania

November 2019



 Acquired 2014-2018  Acquired 2019 Delivery Spring 2020  Planned Acquisition FEMA 2019-2020  Planned Acquisition NRCS 2019-2020

Approaching a Dynamic NHD (2019)

(NHD or Not NHD?)

Original Concept

- Level 1 - Natural perennial and intermittent watercourses NHD waterbodies integrated, all vectors 3D
- Level 2 – All cartographic and network functionality supported, channelheads further defined by field checks, additional waterbodies suitable for logical connections of wetlands and stormwater systems
- Level 3 - NHD and WBD Integration



• Summer Concept

- Level 1 – Carto-Hydro
- Level 2 - Ele-Hydro
- Level 3 – Geo-Hydro (aspirational)



Approaching a Dynamic NHD (2019)

- **Characteristics of Modernized Hydrography include:**
 - Basis is QL2 Lidar or better and less than eight years old
 - Watershed boundaries and flowlines are integrated from common data
 - Represents perennial and intermittent features
 - Database enables relationships to existing reach codes and other legacy data and mapping
 - Supports reference and modeling of wetlands and headwater datasets
 - Supports reference and modeling of stormwater infrastructure data



Approaching a Dynamic NHD (2019)

- NHD provides starting point in multiple areas
 - Flowlines suggest where to expect streams in lidar
 - Waterbodies taken directly and used until proven spatially inadequate
 - GNIS and Reach Codes favored
- PA can operate more empirically than USGS NHD Program can, and is a reasonable laboratory and partner



Approaching a Dynamic NHD (2019)

- PA can operate more empirically than USGS NHD Program can, and is a reasonable laboratory and partner
 - Dedicated Program Manager
 - Topographic and Geologic synergy and knowledge
 - Full lidar coverage
 - Possible trial for hydroenforcement specs
 - Trial of more dynamic maintenance and access



Future Water Priorities for the Nation: Directions for the U.S. Geological Survey Water Mission Area

- *“Over the next 25 years, new opportunities will emerge that will allow for observations that come from an array of sources, are more affordable, offer data from previously inaccessible locations, provide “fit-for-purpose” temporal and spatial resolution, and deliver measurements of new parameters.”*
- *“Associated with the wide adoption of those technologies is a need to develop systems (e.g., hardware, software, management frameworks, protocols) that can rapidly collect data from disparate sources, assess those data for quality, store and process them, and share them in near real-time in formats that are informative and accessible for users.”*

Defining Data and Workflows for PA Hydro (2020)

- **Basic Concept** - a single, shared authoritative and dynamic dataset of elevation-derived hydro
- **Engagement** – we need to be constantly available, and able to respond to opportunities quickly
- **Promotion** – we can't do this alone, need voices in support
- **Technology** – is as dynamic as the resource we are modeling and managing