Authoritative National Hydrography Dataset (NHD) 1:100k Catchment Layer and Chesapeake Bay Boundary

Sarah McDonald (she/her) [1], Gopal Bhatt [2], Crystal Bloom [3], Deva Borah [3], Peter Claggett [1], Gary Shenk [1], and Renee Thompson [1]

[1] U.S. Geological Survey

[2] Pennsylvania State University

[3] City of Chesapeake Public Works Department – Engineering Division

Scientific, Technical Assessment and Reporting (STAR) Meeting
February 23, 2022

Introduction

- Catchments are a base layer used across many projects in the Chesapeake Bay Program (CBP), and nationally.
  - The Chesapeake Healthy Watersheds Assessment (CHWA)
  - Phase 7 of the Watershed Model
  - Land Use Methods and Metrics Outcome (LUMM)

- Catchments are used to answer science questions surrounding water quality and watershed health.

CHWA 1.0 Web Viewer

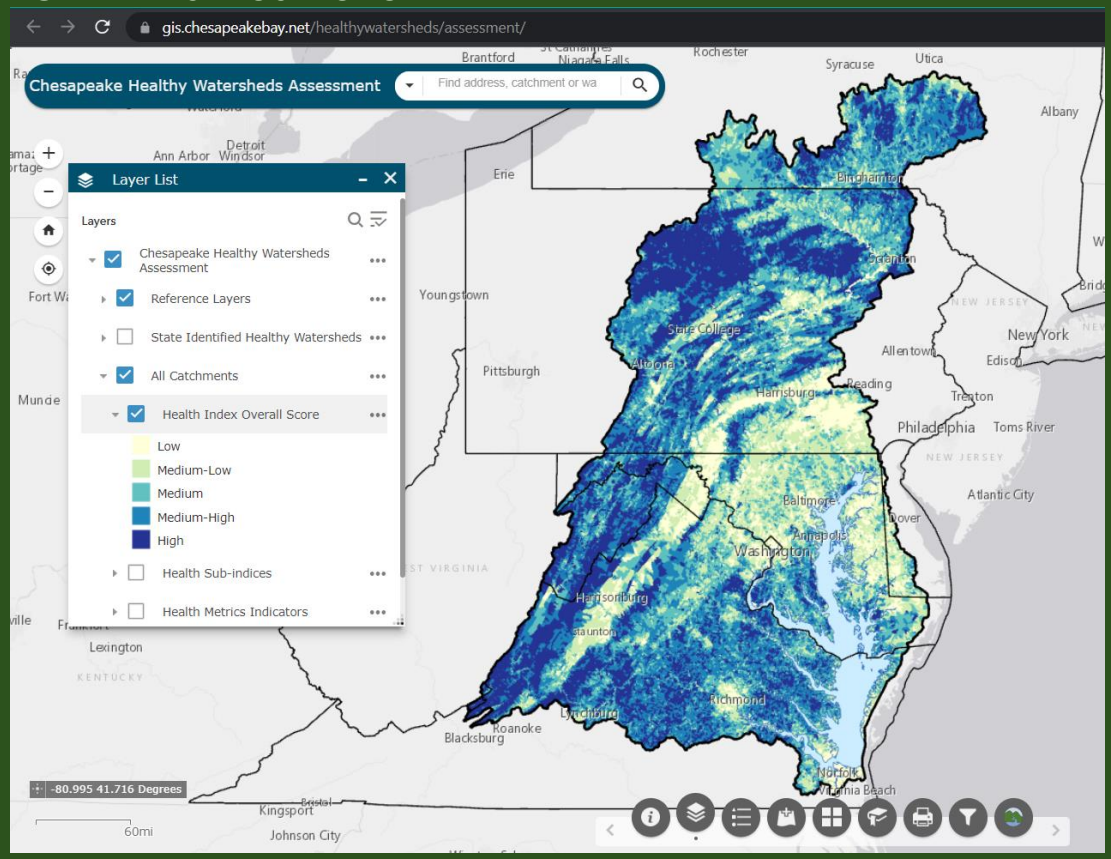


Figure 1: Example of a CBP project at the catchment scale. This screenshot is of the Health Index score of the CHWA 1.0. The web viewer can be accessed here: https://gis.chesapeakebay.net/healthywatersheds/assessment/

Why Update the Catchments and Boundary?

- Upon comparing datasets within the CBP:
  1. the catchments representing the Chesapeake differed.
  2. the catchment layers didn’t nest perfectly into the Bay watershed boundary.

- Some localities possess updated drainage information, specifically in developed areas that humans have altered the flow of water via pumping and sewers.

- **The CBP needs an authoritative catchment layer to ensure:**
  1. **consistency across products.**
  2. **compatibility between products.**
  3. **clear communication with stakeholders.**

What are Catchments?

- Catchments, or "local drainage areas", are areas of land that collect precipitation and flow to the same water source (stream).

- Catchments encapsulate drainage area at the stream reach level.

- Watersheds capture the entire upstream drainage system.
  - Headwater catchments are watersheds!

Example watershed.

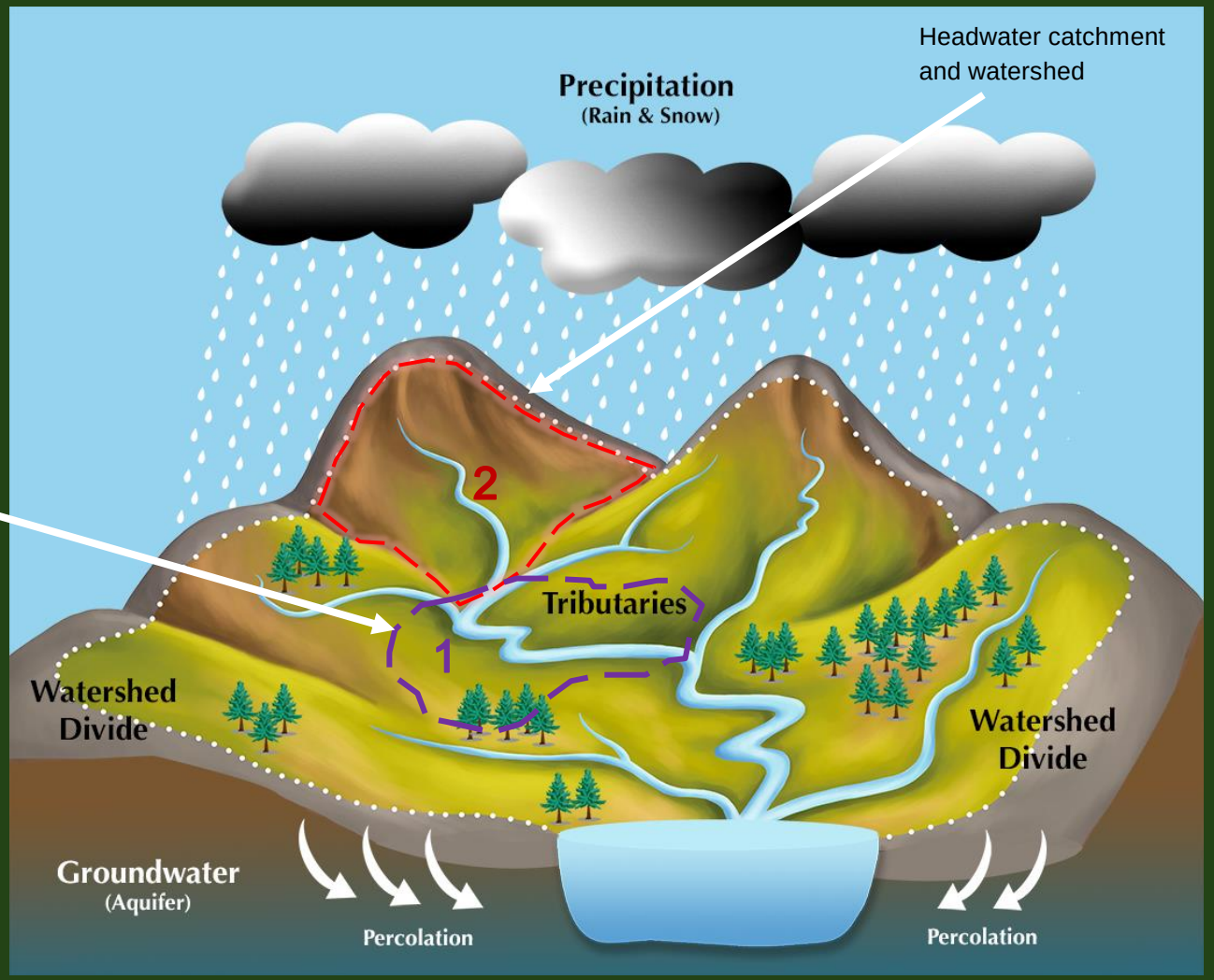
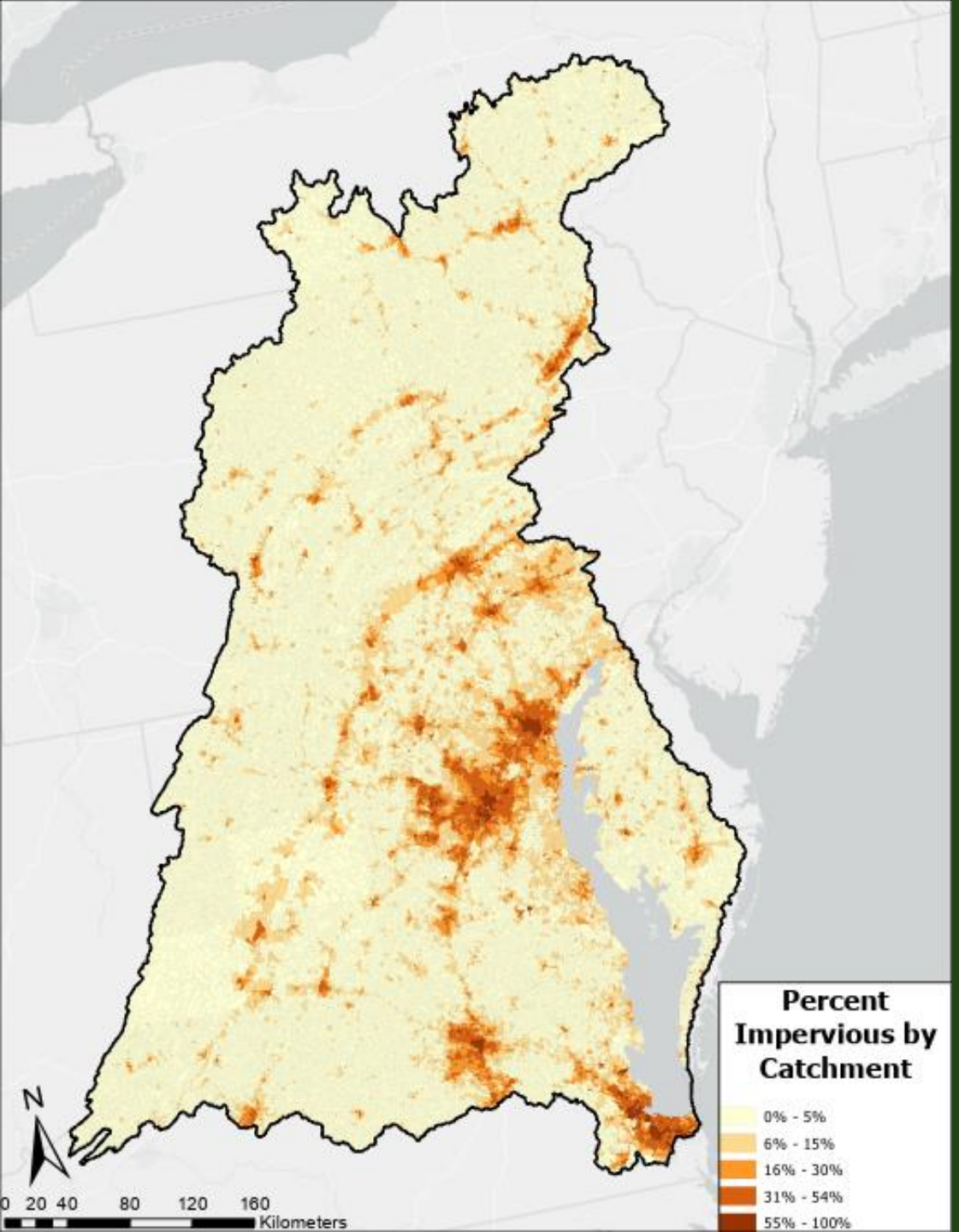


Figure 2: Visualization of a watershed and its interactions with the water cycle. Adapted from "What is a Watershed?" by K. Roberts and the Center for Watershed Protection. Retrieved from https://cwp.org/watershed101/.



NHD 1:100k Catchments and Bay Boundary

- NHD 1:100k catchments are catchments in which water drains to a 1:100k stream.
  - In the Chesapeake Bay watershed, there are over 83,000 catchments.
- The Chesapeake Bay watershed boundary denotes the drainage area in which precipitation flows to the Chesapeake Bay.
  - All 1:100k catchments *should* be nested within the watershed boundary.

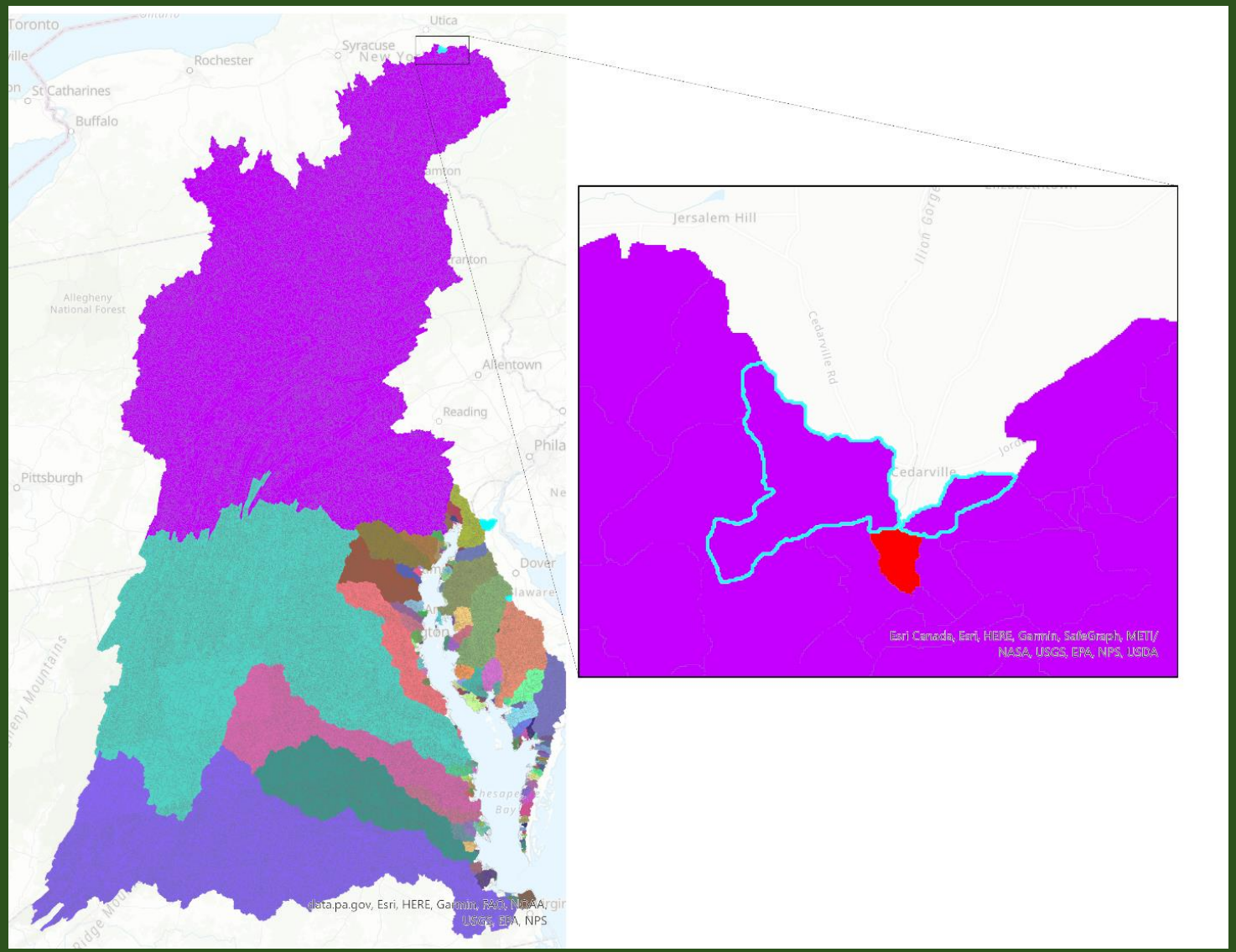


Figure 3: Example of catchments denoted as "in the watershed" but have no flow to the watershed. The red catchment is within the watershed and has 100% flow to the watershed. The blue highlighted catchments have 0% flow to the watershed and were removed.

What Catchments are in the CBW?

- Members of the GIS team, Land Data team, Modelling Team, and Healthy Watersheds GIT met and determined what catchments should be included.

- The criteria for inclusion is any catchment that the drainage information reported at least *some* portion of the flow drained to the Chesapeake Bay watershed.

Incorporating Drainage Information in Chesapeake City, VA

- Stormwater drainage in Chesapeake City, VA was modelled using U.S. EPA's Storm Water Management Model (SWMM).
- The catchments were altered based on this data to add drainage areas where storm sewer ditches and pipes flowed into the watershed.
- Of the 4 sub-watersheds provided, two were included (New Mill Creek 1 & 2, Bells Mill Creek).

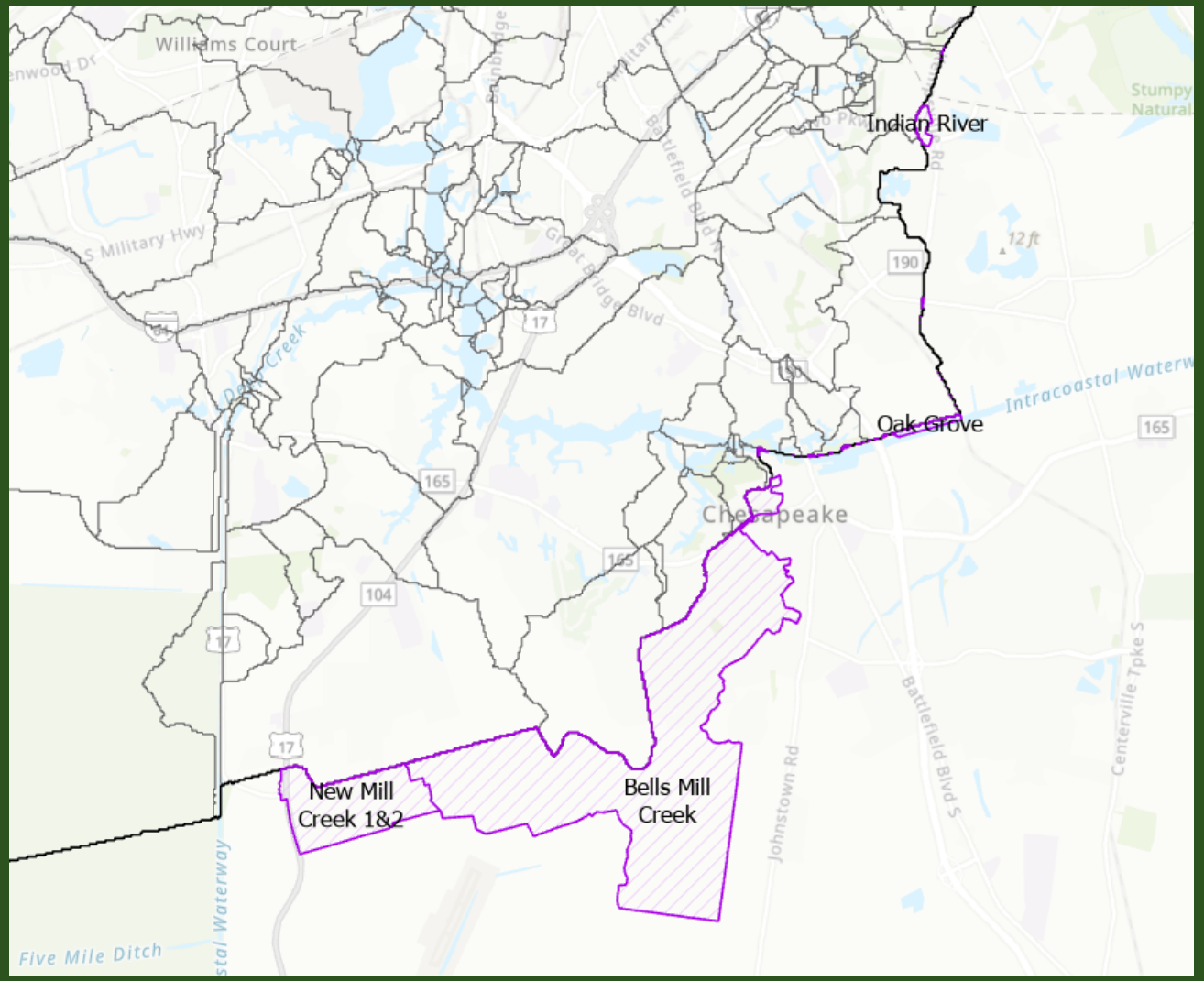


Figure 4: Black lines indicate native NHD 1:100k catchments. Purple indicate areas to be added. New Mill and Bells Mill were included.

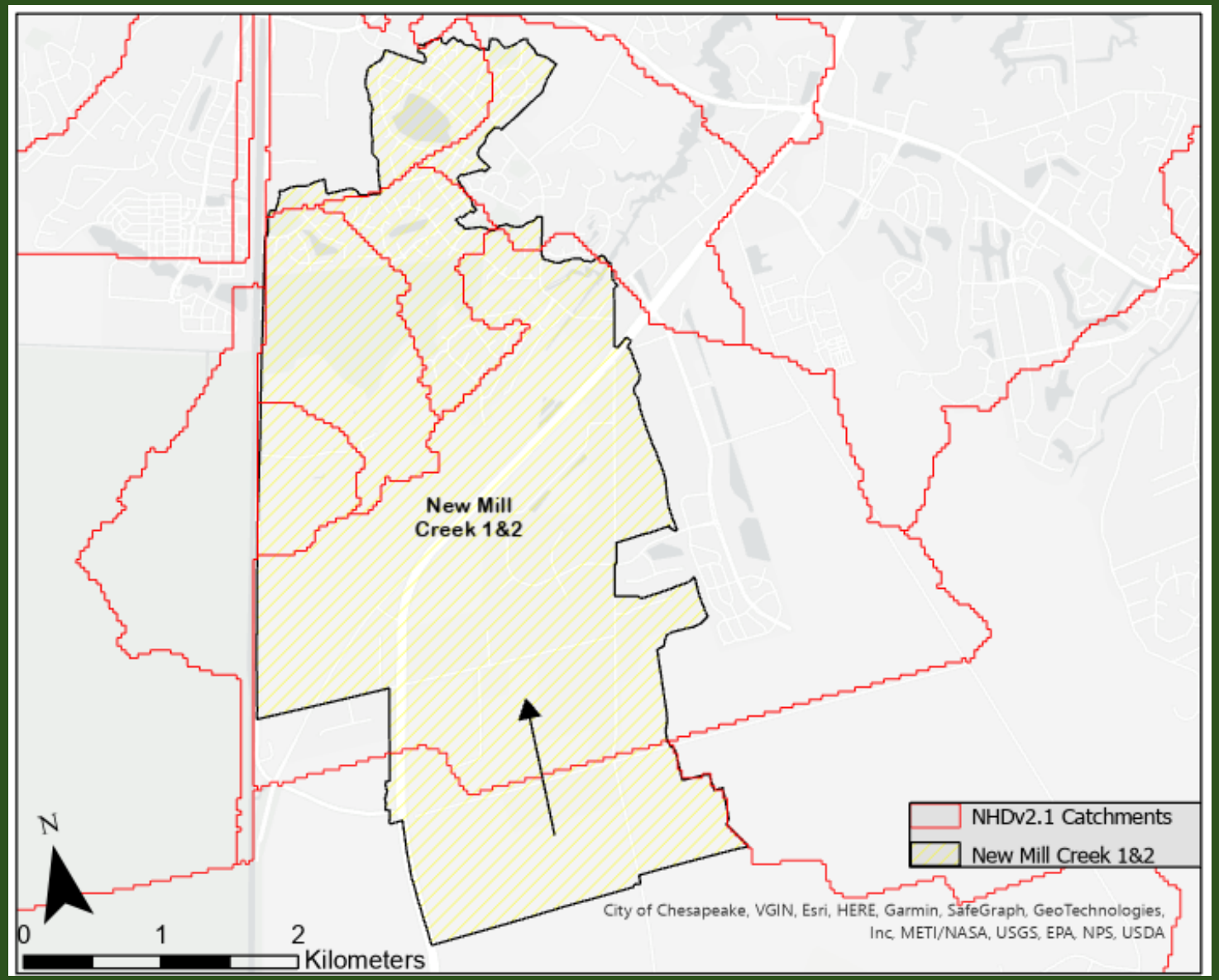
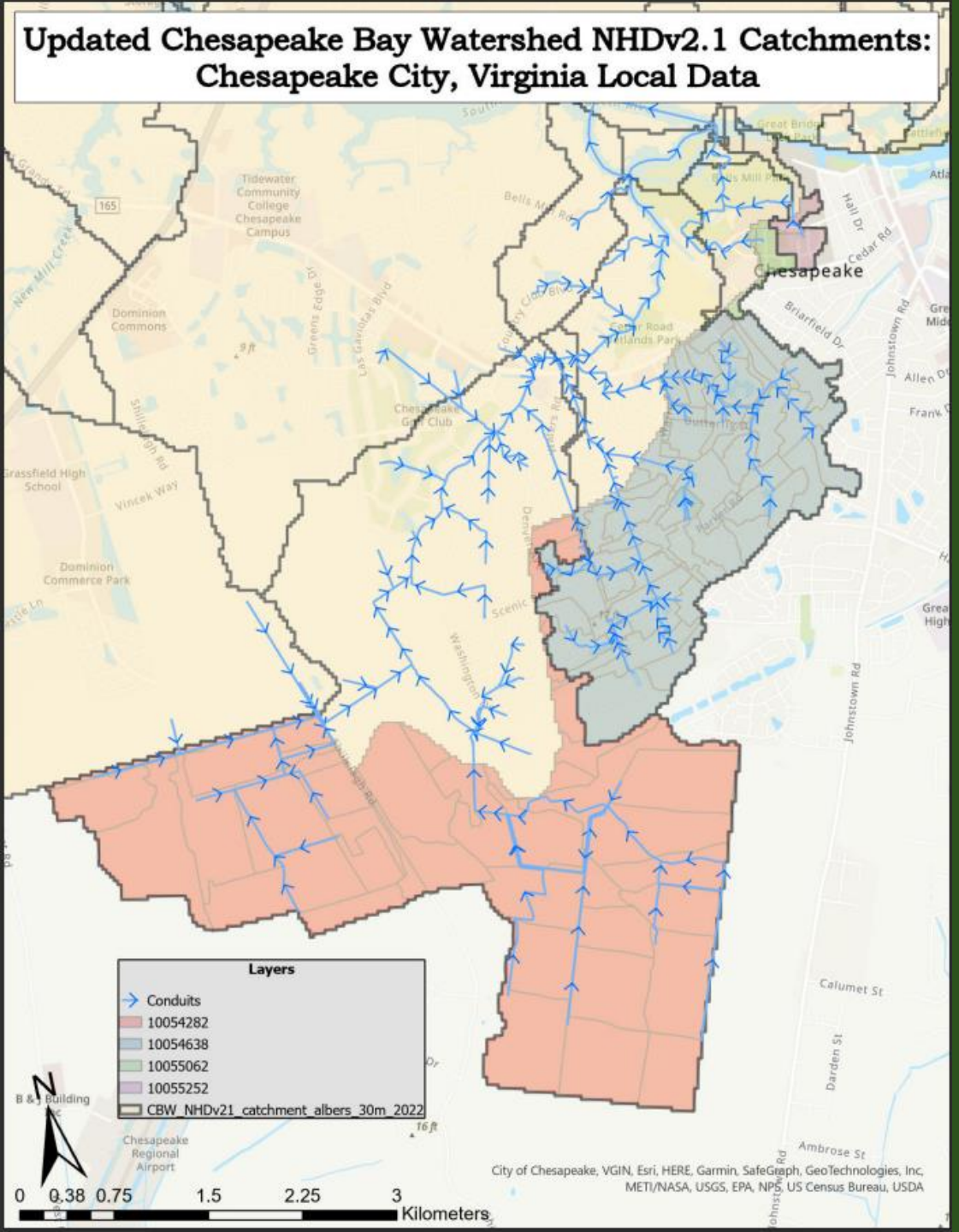


Figure 5: Red lines indicate native NHD 1:100k catchments. Yellow is New Mill Creek. The portion of yellow outside of the red was incorporated into the catchment north, as indicated by the black arrow.

Incorporating New Mill Creek 1 & 2

- The portion of New Mill Creek 1 & 2 outside of the native catchments flows north into a single catchment.
- This area was added to the native catchment.



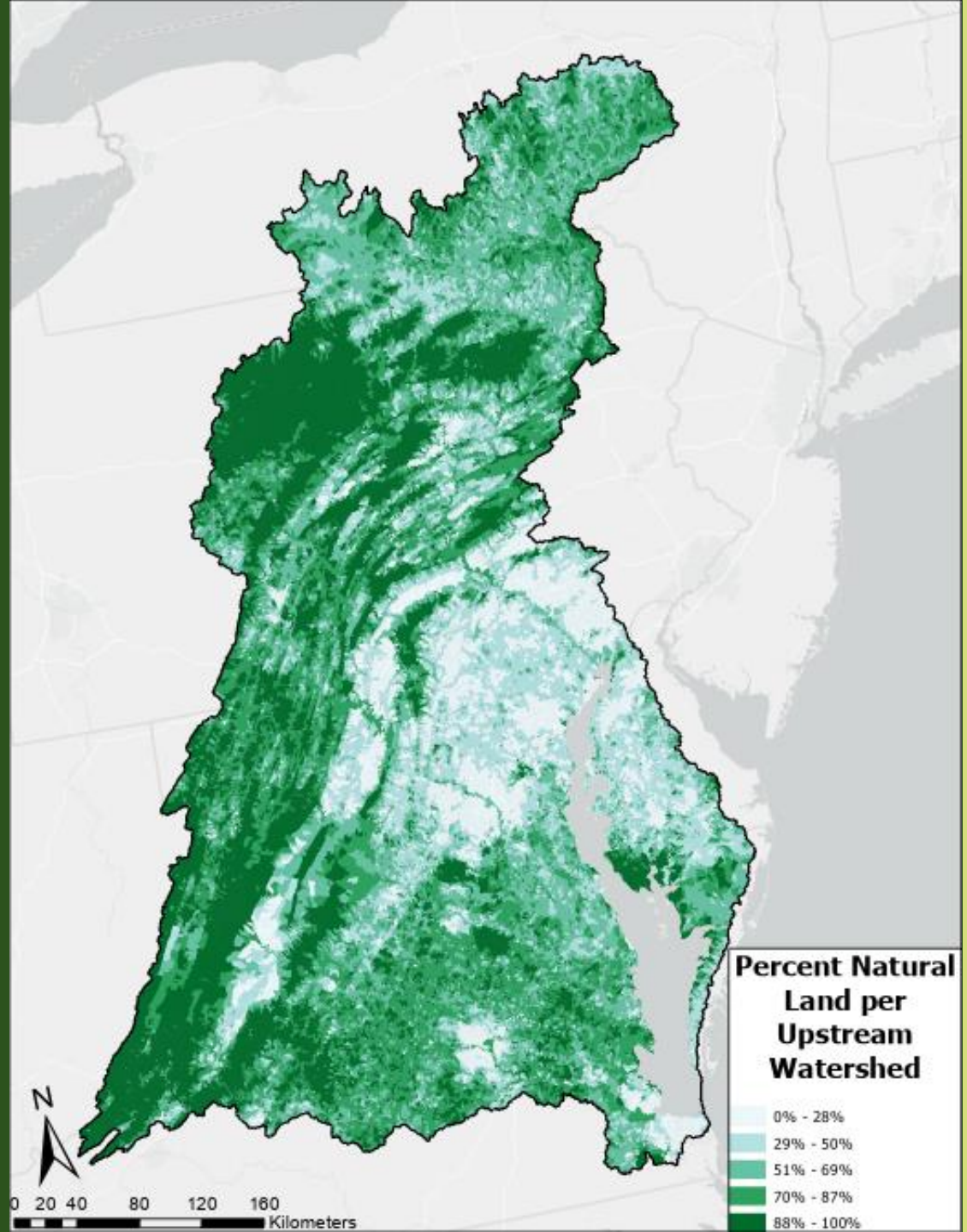
Incorporating Bells Mills Creek

- The drainage information provided by the city (blue arrows) was used to determine how the sub-watershed was incorporated.
- Bells Mills Creek flows into 4 native NHD catchments. Portions of Bells Mills Creek were incorporated into each of these catchments.

Figure 6: Yellow is native catchments. Black outlines are boundaries of the updated catchments. Blue arrows represent drainage direction. The other colors (red, blue, pink, and green) are the portion of Bells Mills Creek that were incorporated.

Results and Next Steps

- The updated Chesapeake Bay watershed Boundary (black outline) was produced by encapsulating the boundary of the updated catchments.
- Catchment layer includes 83,628 catchments and 170,300 square kilometers.
- Boundary layer covers 178,038 square kilometers.
- Next steps: upon approval by STAR, contact USGS NHD team to incorporate updates into native NHD dataset.



Feedback

- Are there any potential limitations to the incorporation of engineered drainage areas into the new catchment layer for any other CBP applications?

Sources

- Roberts, Kim and the Center for Watershed Protection. *What is a Watershed?* Center for Watershed Protection. Retrieved February 21, 2023, from https://cwp.org/watershed101/.
- U.S. Geological Survey (2019, June 8). *Watersheds and Drainage Basins.* Retrieved February 21, 2023, from https://www.usgs.gov/special-topics/water-science-school/science/watersheds-and-drainage-basins.

Contact

Sarah McDonald (she/her/hers)
Geographer
U.S. Geological Survey
smcdonald@chesapeakebay.net
smcdonald@usgs.gov

Chesapeake Bay Program
Science. Restoration. Partnership.

USGS
science for a changing world