

Estimated Groundwater Availability in the Delaware River Basin

Water Management Advisory Committee

February 17th, 2022

Sara Sayed

Water Resource Scientist,

DRBC Water Resource Planning Section

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Outline

- 1. Introduction**
- 2. Previous Groundwater Work**
- 3. Hydrologic Setting**
- 4. Methods**
- 5. Results**
- 6. Next Steps**

Introduction

Authority

Delaware River Basin Compact Section 3.6 (1961)

- “(c)Conduct and sponsor research on water resources...and collect, compile, correlate, analyze, report and interpret data on water resources and uses in the basin”

Water Resources Plan KR1, Goal 1.3 (2004)

- Ensure there is an adequate and reliable supply of water given the current demands in each water use sector, as well as future demands based on projections of future water use.

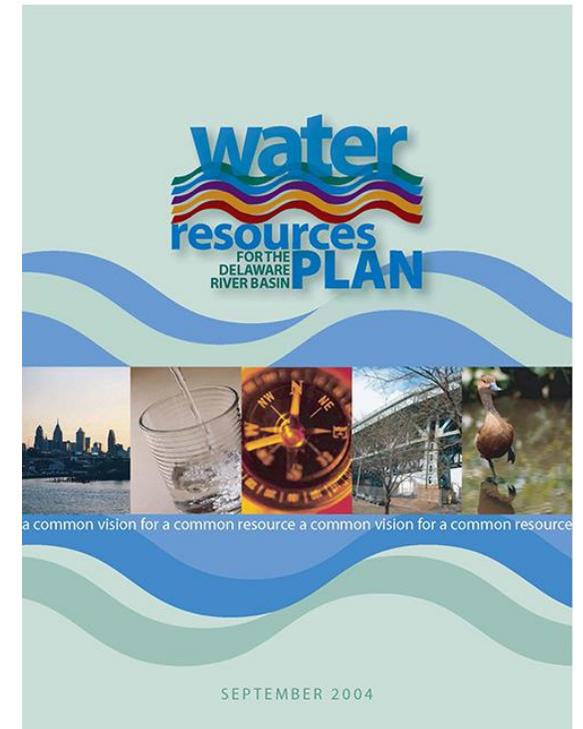
DELAWARE RIVER BASIN COMPACT



1961

Reformatted 2020

Delaware River Basin Commission
25 Cosey Road
P.O. Box 7360
West Trenton, New Jersey
08628-0360
Telephone: (609) 883-9500 / Fax: (609) 883-9522
Web Site: www.drbc.gov



Authority

Water Resources Program Section 2.1.1.1 (2021)

- “Detailed and comprehensive analysis of water demand, availability and sufficiency through 2060” &
- Compare projected groundwater withdrawals against the recurrence intervals developed by Sloto & Buxton on the 25- and 50-year recurrence intervals using the basin-wide and Southeastern Pennsylvania Groundwater Protected Area (SEPA-GWPA) scales



2060 Sustainable Water Supply Plan



Goal: Provide projections of future average annual water use in the Delaware River Basin, through the year 2060, to be used in future planning assessments.

Represent each water use *sector* at the Basin-wide scale. ✓



Apply GW results to the 147 subbasins (Sloto & Buxton, 2006) and the sub-watersheds of SEPA-GWPA. ★



Relate results to regulatory approvals.



Apply SW results at the source level for future availability analyses.

Purpose

- Analyze groundwater availability for the Delaware River Basin and provide projected availability estimates to the year 2060 in support of water supply planning.

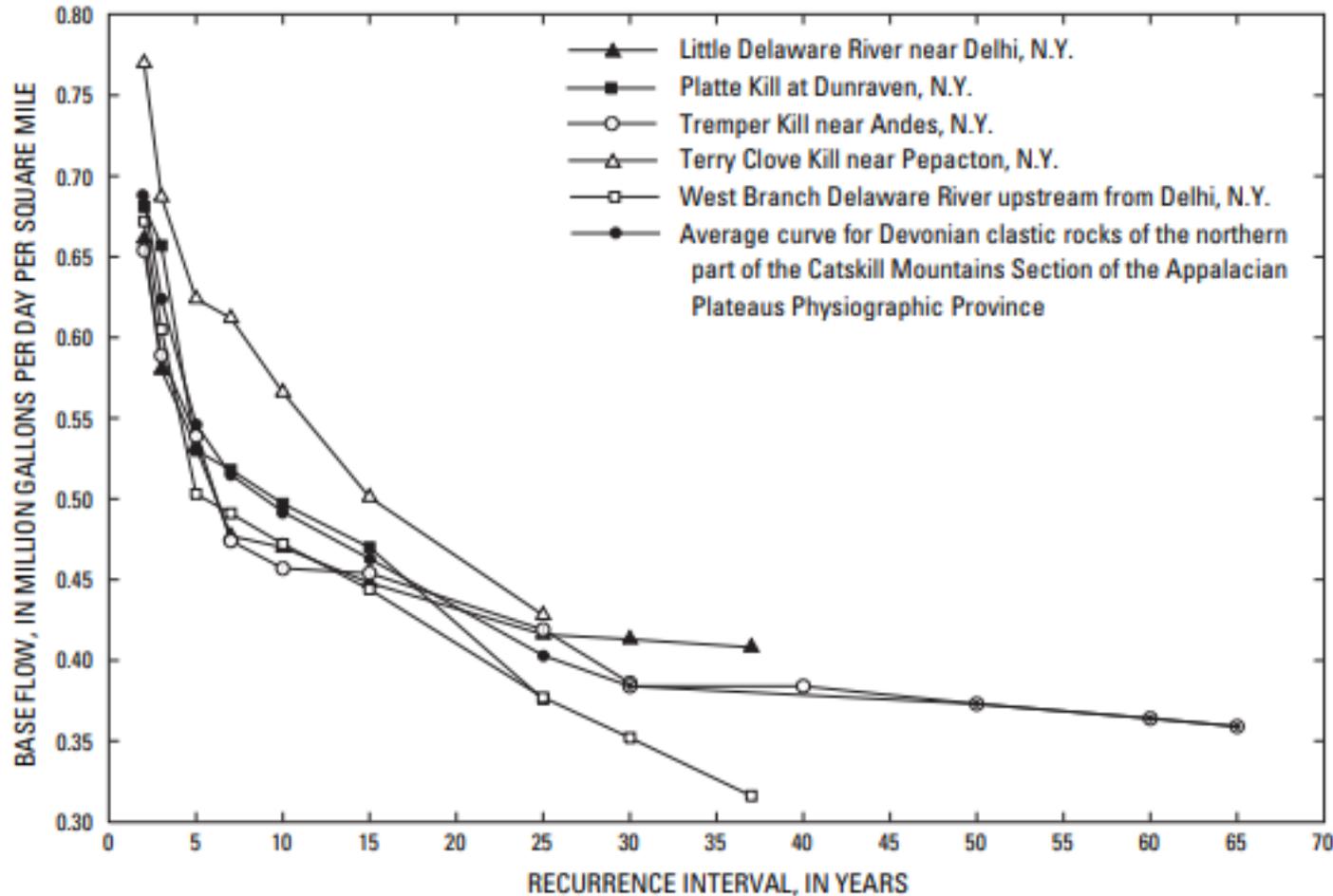


Previous Groundwater Work

Sloto & Buxton, 2006

- Assesses baseflows in each of the 147 subbasins
- Groundwater availability was determined using methods appropriate for the geology of each subbasin
- Groundwater withdrawals from confined coastal aquifers are not applicable to this screening tool due to potential regional influences

Sloto & Buxton, 2006



Recurrence Interval

Probability that an event will equal or exceed a given discharge

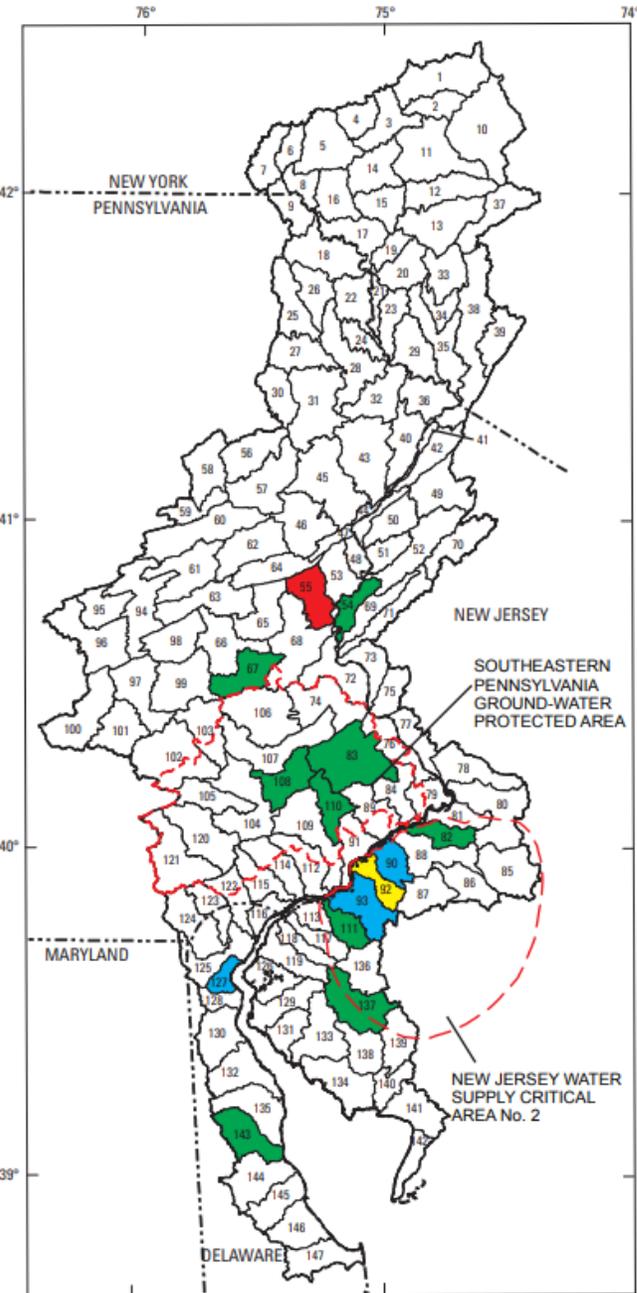
1/25

Baseflow for a dry year

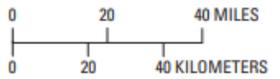
Importance

First Study to calculate baseflow recurrence intervals for all 147 subbasins

Sloto & Buxton, 2006

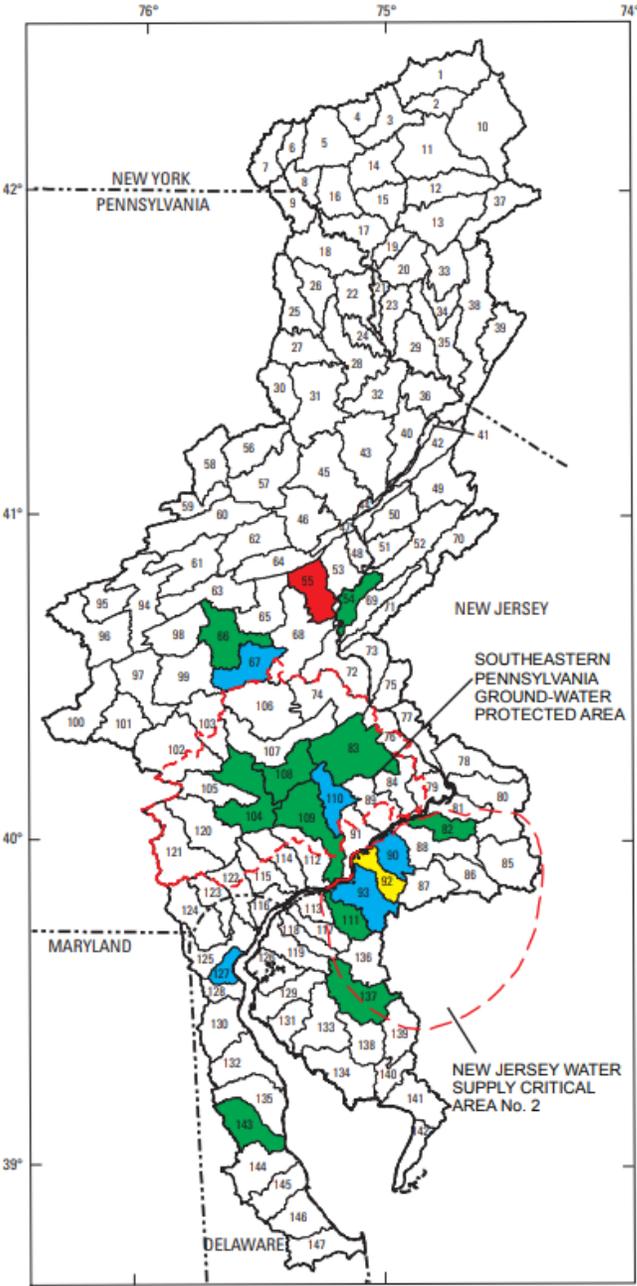


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- WATERSHED AND IDENTIFICATION NUMBER- Prefix DB is omitted
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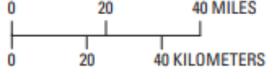


25-year
baseflow
recurrence

Base from U.S. Geological Survey digital data, 1972, 1:2,000,000 Albers Equal-Area Conic Projection. Standard parallels 29°30'N, central meridian 75°00'W.

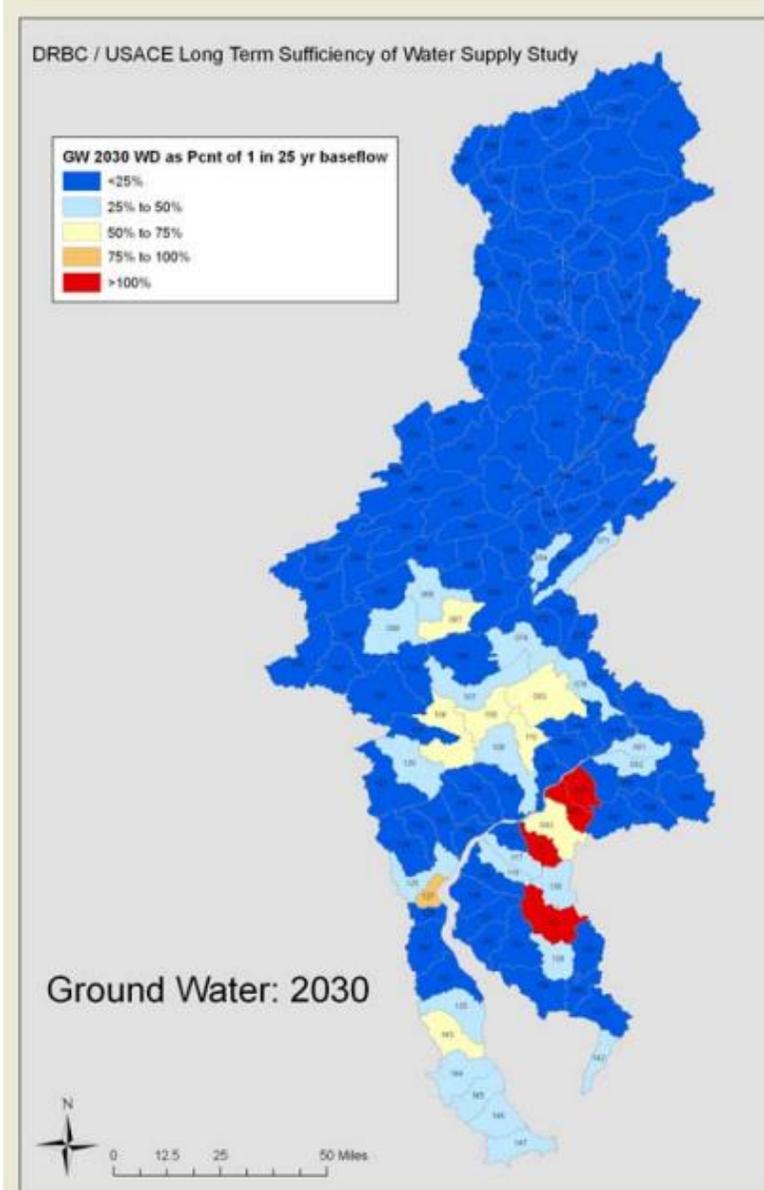
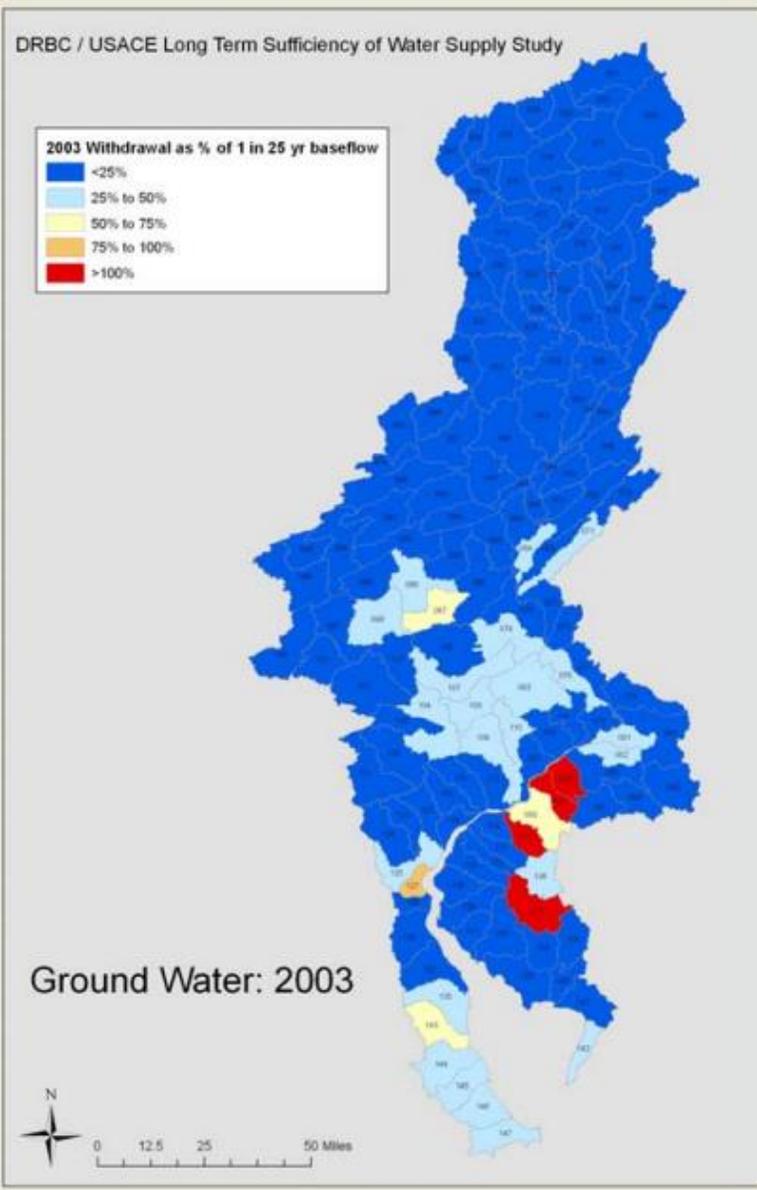


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50-year
baseflow
recurrence

Base from U.S. Geological Survey digital data, 1972, 1:2,000,000 Albers Equal-Area Conic Projection. Standard parallels 29°30'N, central meridian 75°00'W.



Multijurisdictional Report, 2008

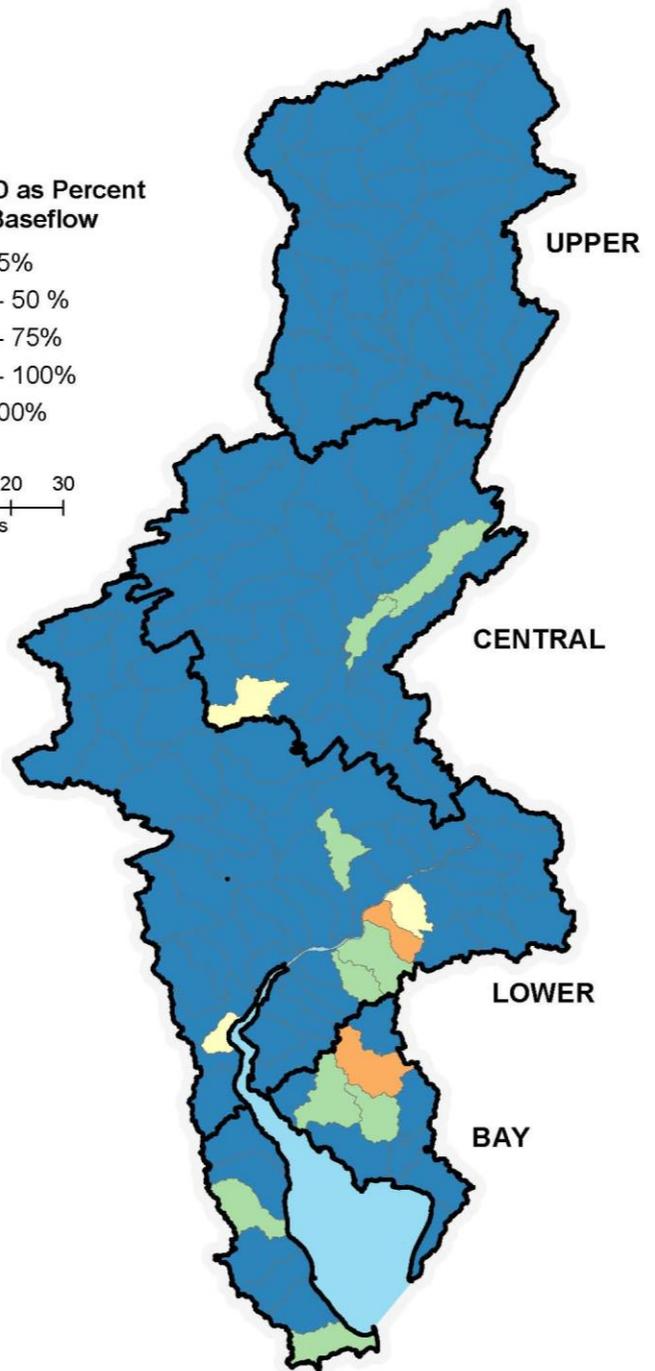
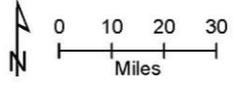
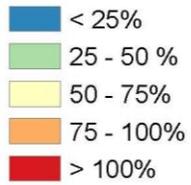
2003 Withdrawals used to estimate water use

Peak Projected monthly water supply and demand to 2030

Problem Did not account for Basin's 1961- 1967 Drought of Record

State of the Basin, 2019

2016 GWWD as Percent of 25 Year Baseflow



1/25

Baseflow Recurrence Interval Used

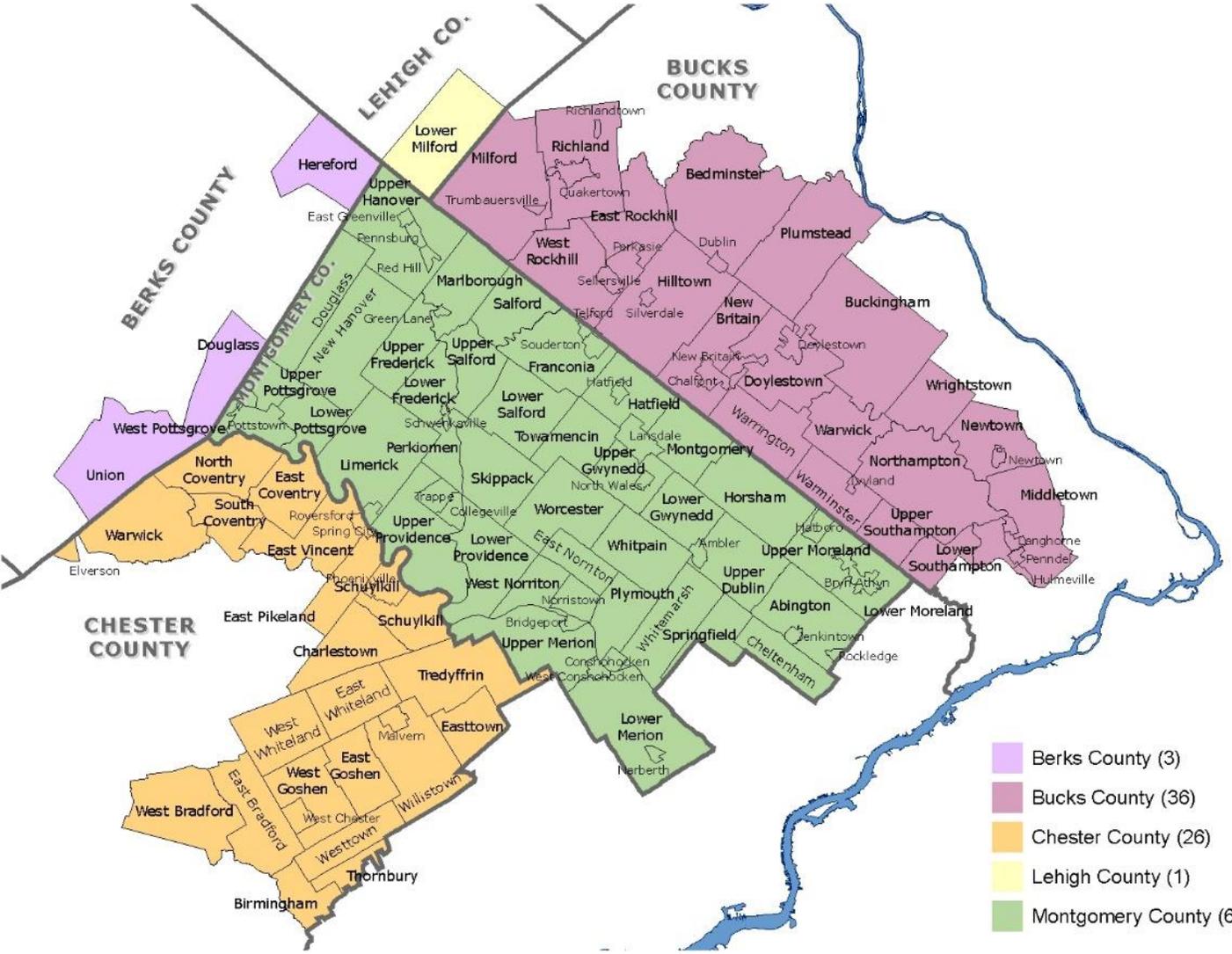
Success

Recovery in SEPA-GWPA & Critical Area 2

Purpose

Benchmark conditions and track progress towards water resource management goals using CY2016 withdrawals

Southeastern Pennsylvania Groundwater Protected Area (SEPA-GWPA)



76 Subbasins in SEPA-GWPA

1/25 Withdrawal limit for each subbasin

Stressed Basins that use 75% or more of the withdrawal limit

Schreffler, 1996

Water-Use Analysis Program for the
Neshaminy Creek Basin, Bucks and
Montgomery Counties, Pennsylvania

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 96-4127

Prepared in cooperation with the
DELAWARE RIVER BASIN COMMISSION



Pilot Program

First program to analyze water use in SEPA-GWPA

Baseflow

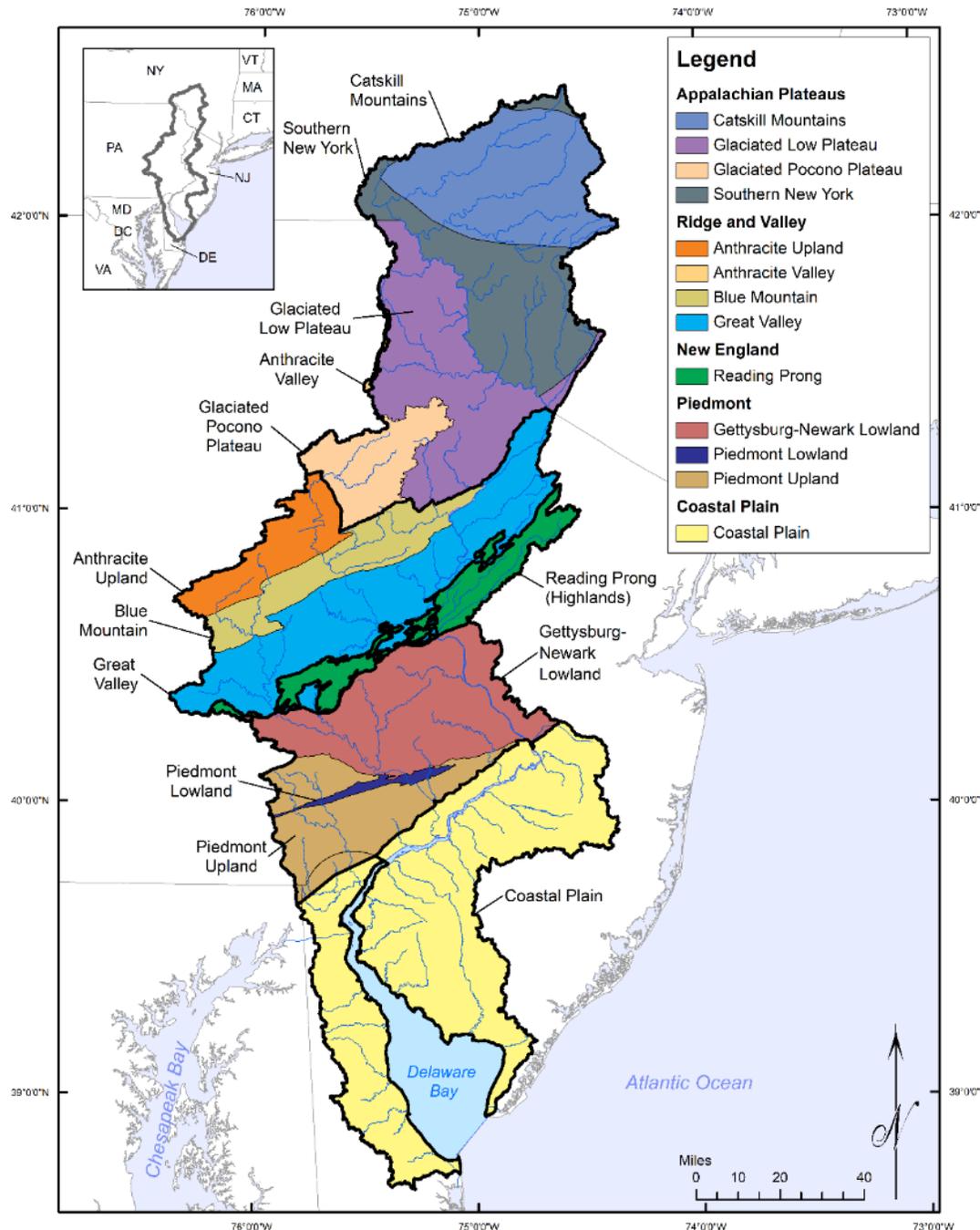
Recurrence intervals calculated for 2-, 5-, 10-, 25- & 50-year intervals

1998

Withdrawal limits created based on 1/25 yr recurrence intervals

Hydrologic Setting

Basin Hydrology



- DRB is divided into two physiographic provinces: the Appalachian Highlands & the Atlantic Coastal Plain
- The Highlands are underlain by fractured bedrock and have high-energy streams and rivers
 - Store less groundwater than unconsolidated sediments
- The Coastal Plain underlain by unconsolidated sediments made of sand, clay and gravel
 - Baseflows tend to be higher here than in the Highlands

Water Withdrawals

95% Surface water withdrawals

PWS Greatest withdrawer of groundwater

17% Average consumptive use of groundwater



Methods

Data Sources

1

Groundwater Baseflow Data, Basin Wide

- 147 subbasins
- Sloto & Buxton baseflows

2

Groundwater baseflow data, SEPA-GWPA

- 18 CFR Part 430

3

Groundwater withdrawal data

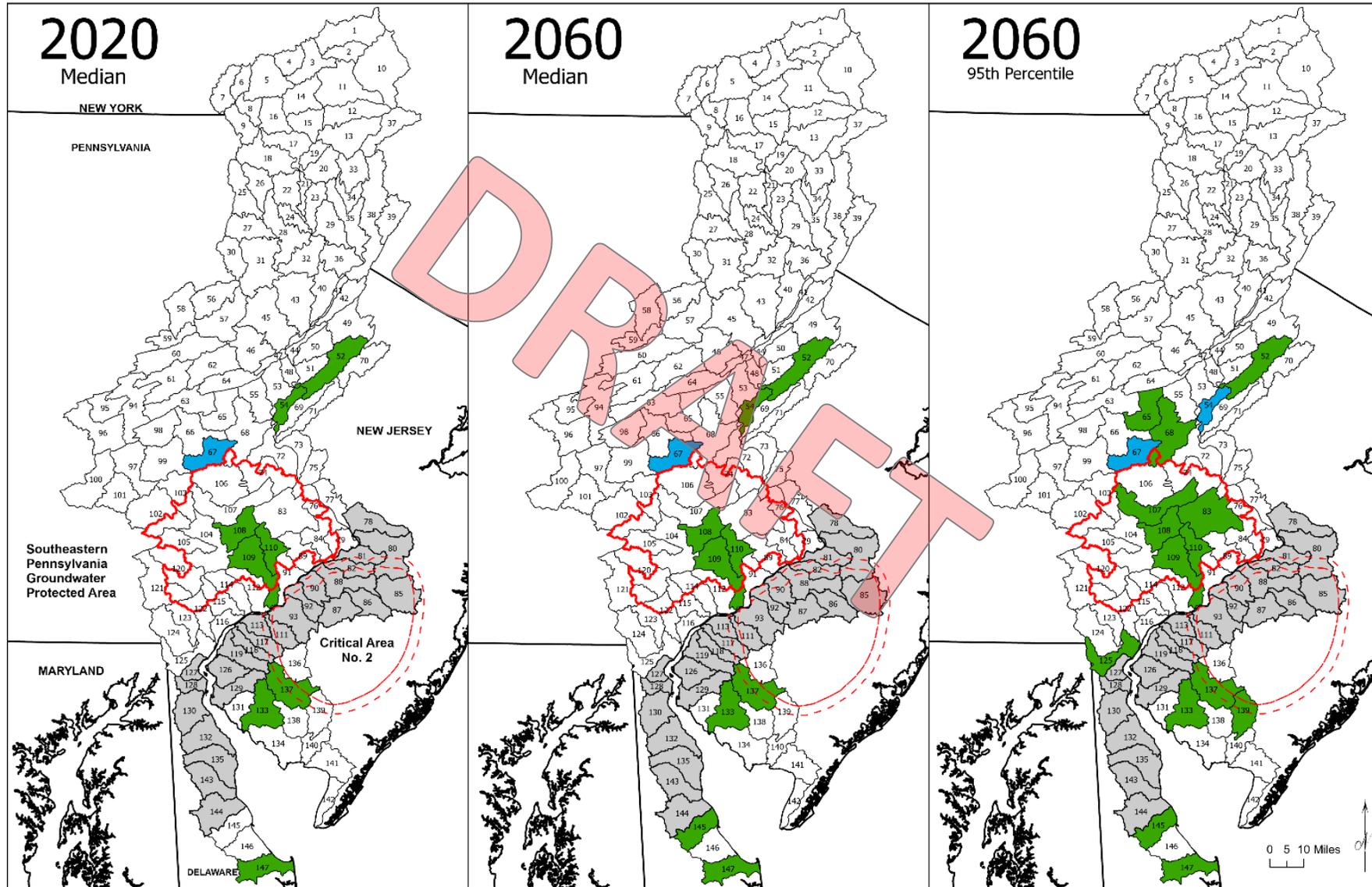
- Water Withdrawal and Consumption Use Estimates for the Delaware River Basin (1990-2017) With Projections through 2060 (Thompson & Pindar, 2021)

Availability Analysis

Basin ID	25-year Recurrence Interval (MGY)	50-year Recurrence Interval (MGY)	Modeled Withdrawals (MGY)					Percent of 25-year Recurrence Interval					Percent of 50-year Recurrence Interval				
			2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060
DB-001	1,274	1,192	131	141	152	163	173	10%	11%	12%	13%	14%	11%	12%	13%	14%	15%

Results

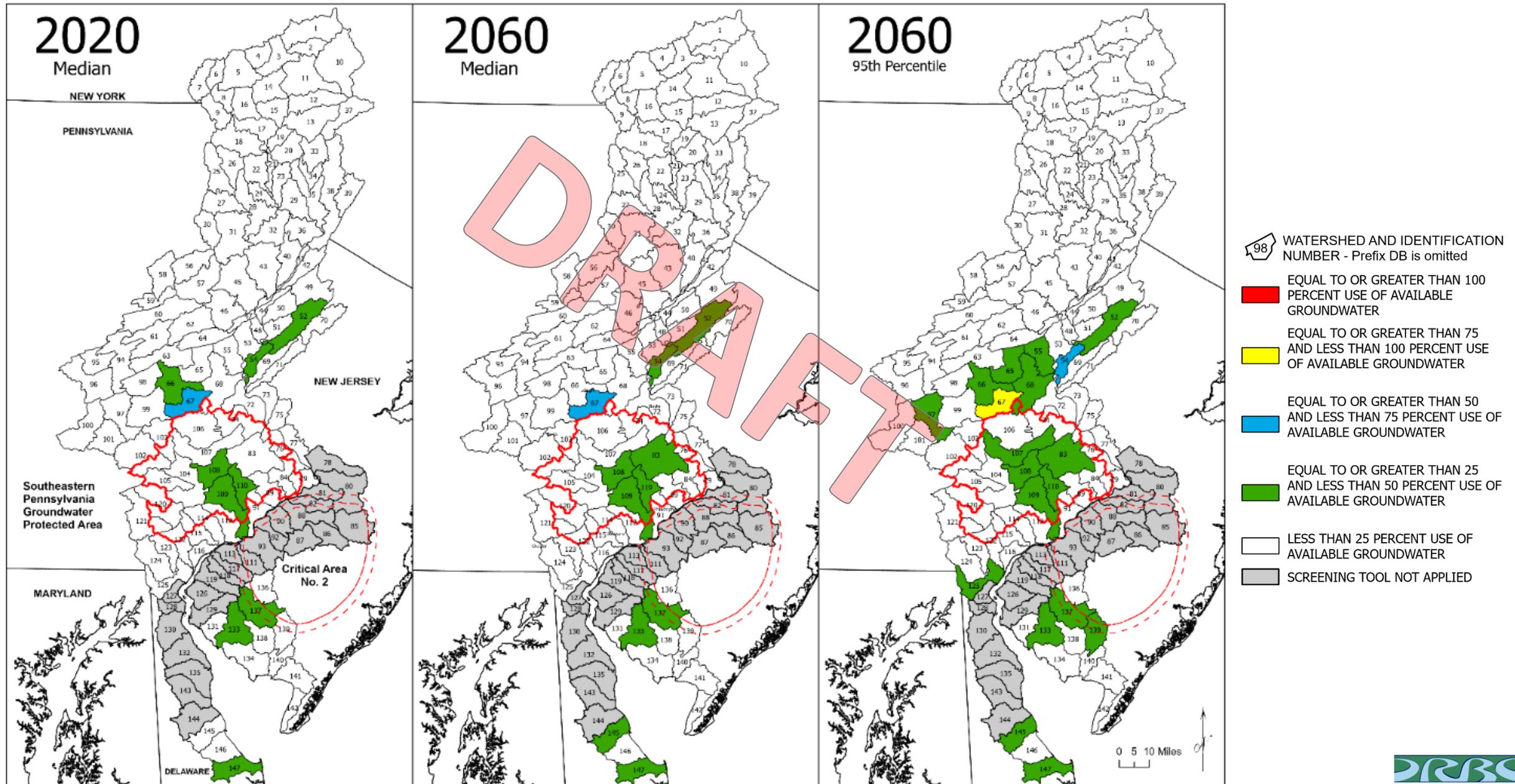
Percent Groundwater Use for 25-Year Annual Baseflow Recurrence



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-  LESS THAN 25 PERCENT USE OF AVAILABLE GROUNDWATER
-  SCREENING TOOL NOT APPLIED

Sloto, Ronald A., and Debra E. Buxton. "Estimated Groundwater Availability in the Delaware River Basin, 1997-2000." USGS Scientific Investigations Report, 25 May 2007, doi:10.3133/sir20065125.

Percent Groundwater Use for 50-Year Annual Baseflow Recurrence



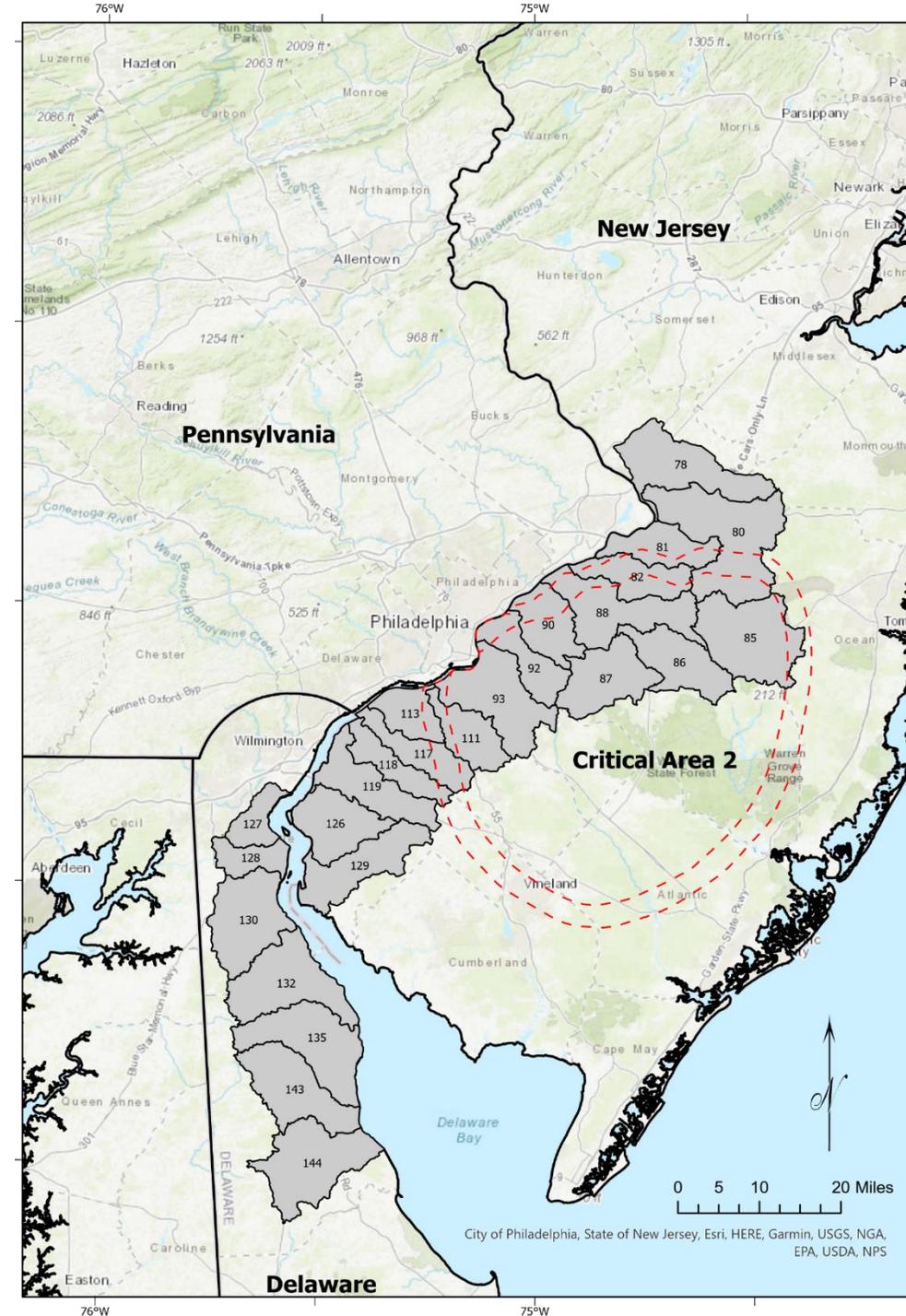
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Coastal Plain

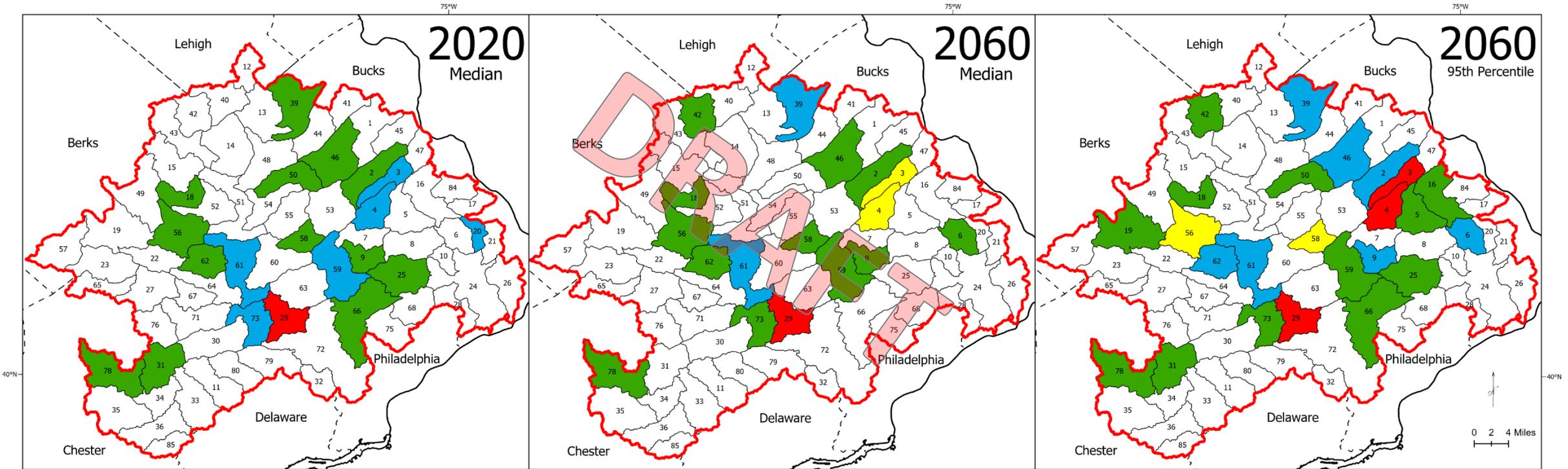
- *“The watershed approach and equating availability to stream base flow is not suited for estimating confined aquifer groundwater availability. Determining the source of groundwater withdrawals in a confined system is a complex regional issue. The effects of pumping can extend well beyond watershed boundaries and even beyond the Delaware River Basin.”*
- DB-092 initially exceeded availability
 - Wells in this basin are drilled below surficial aquifer into confined aquifers
 - Disqualified based on Sloto & Buxton assumption

Coastal Plain

- 18 subbasins are not appropriate for DRBC's availability tool
- Regional work by basin states is being done to better understand groundwater availability in the coastal plain

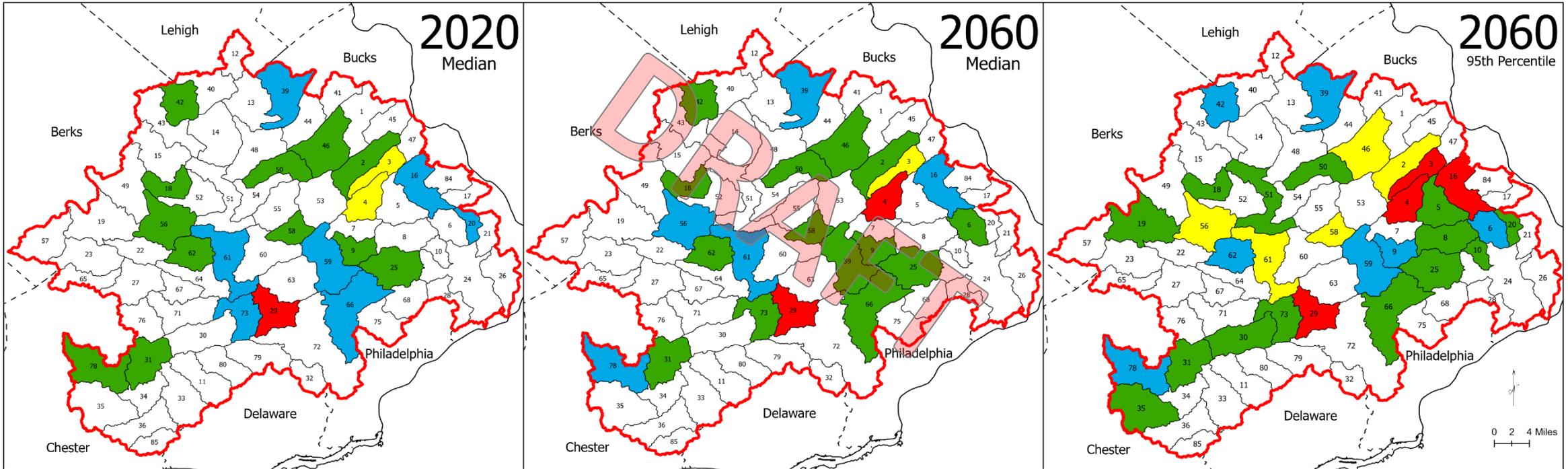


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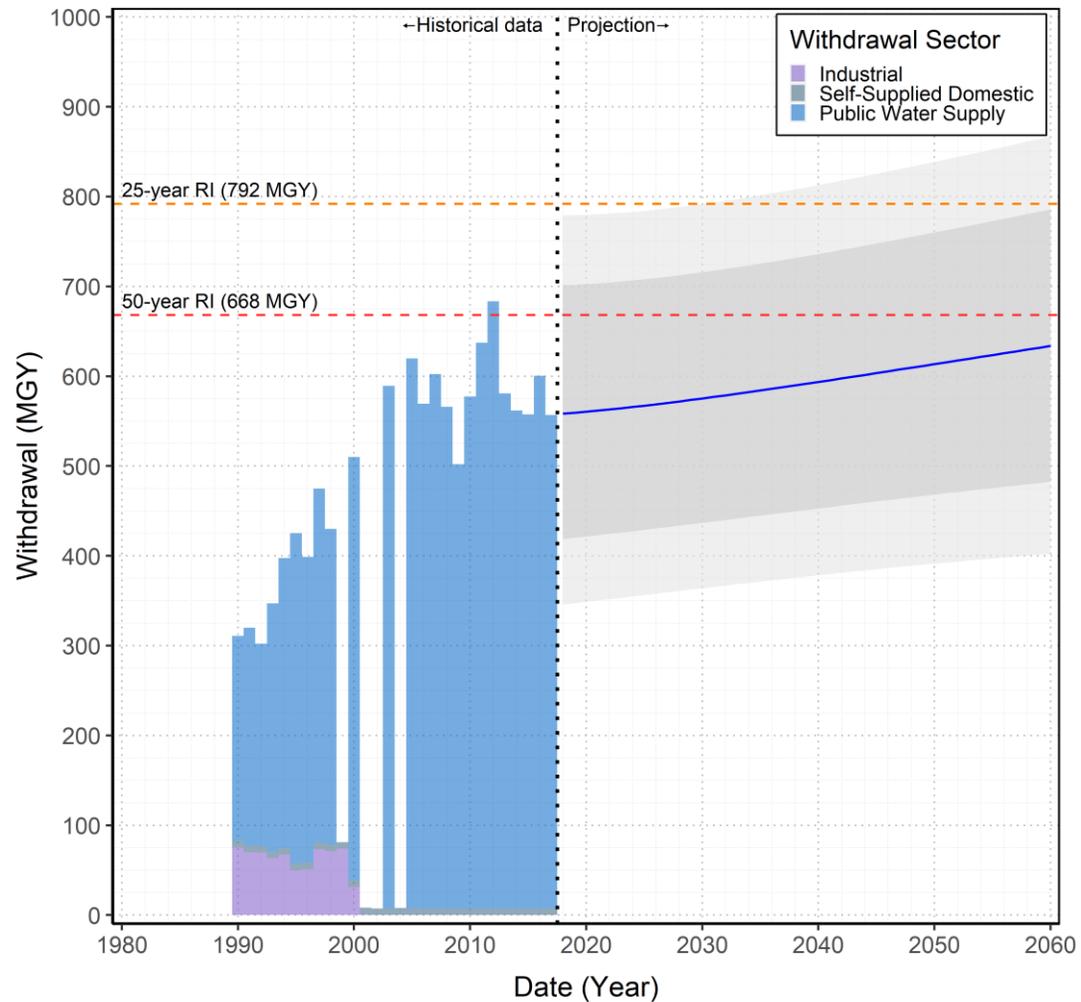
Percent Groundwater Use for 50-Year Annual Baseflow Recurrence



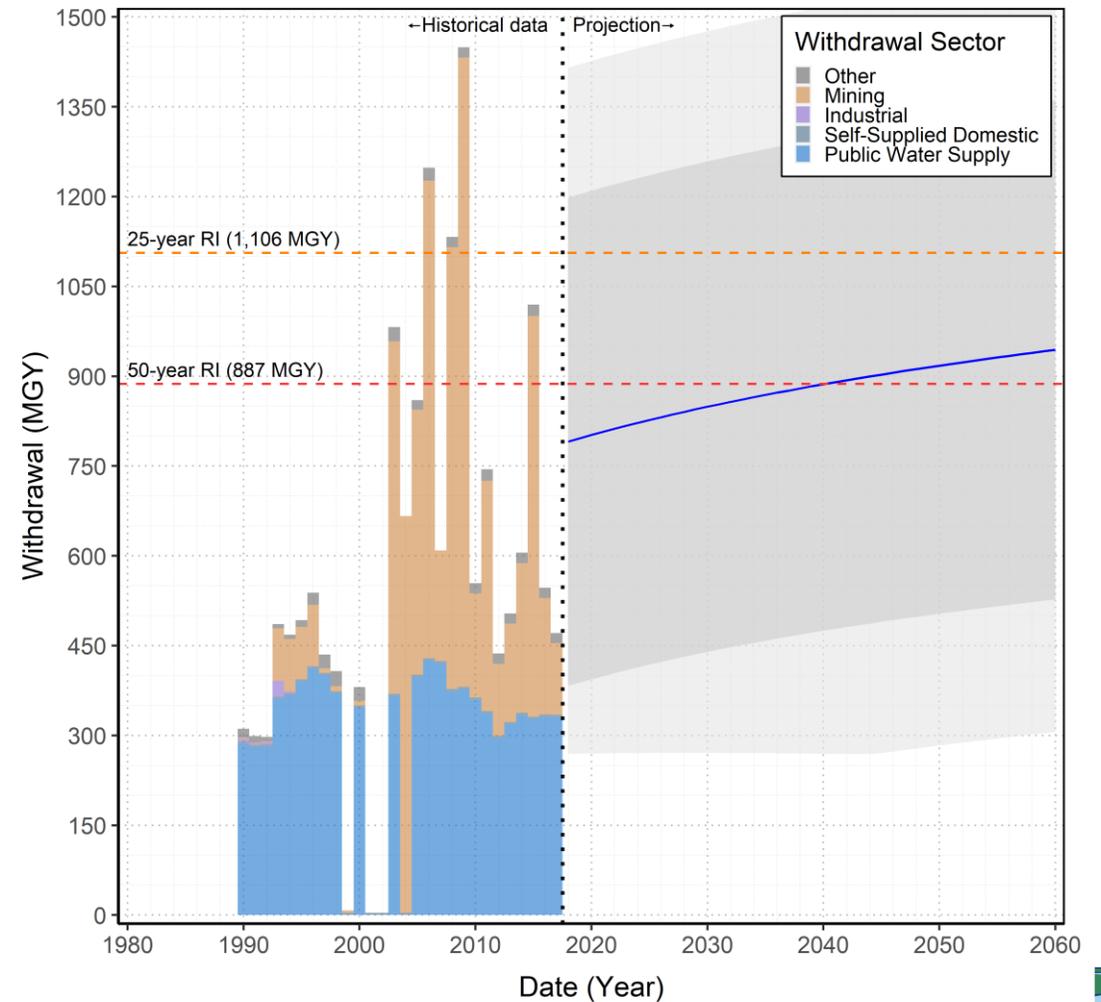
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SEPA-GWPA Basins of Concern (SG-03 & SG-04)

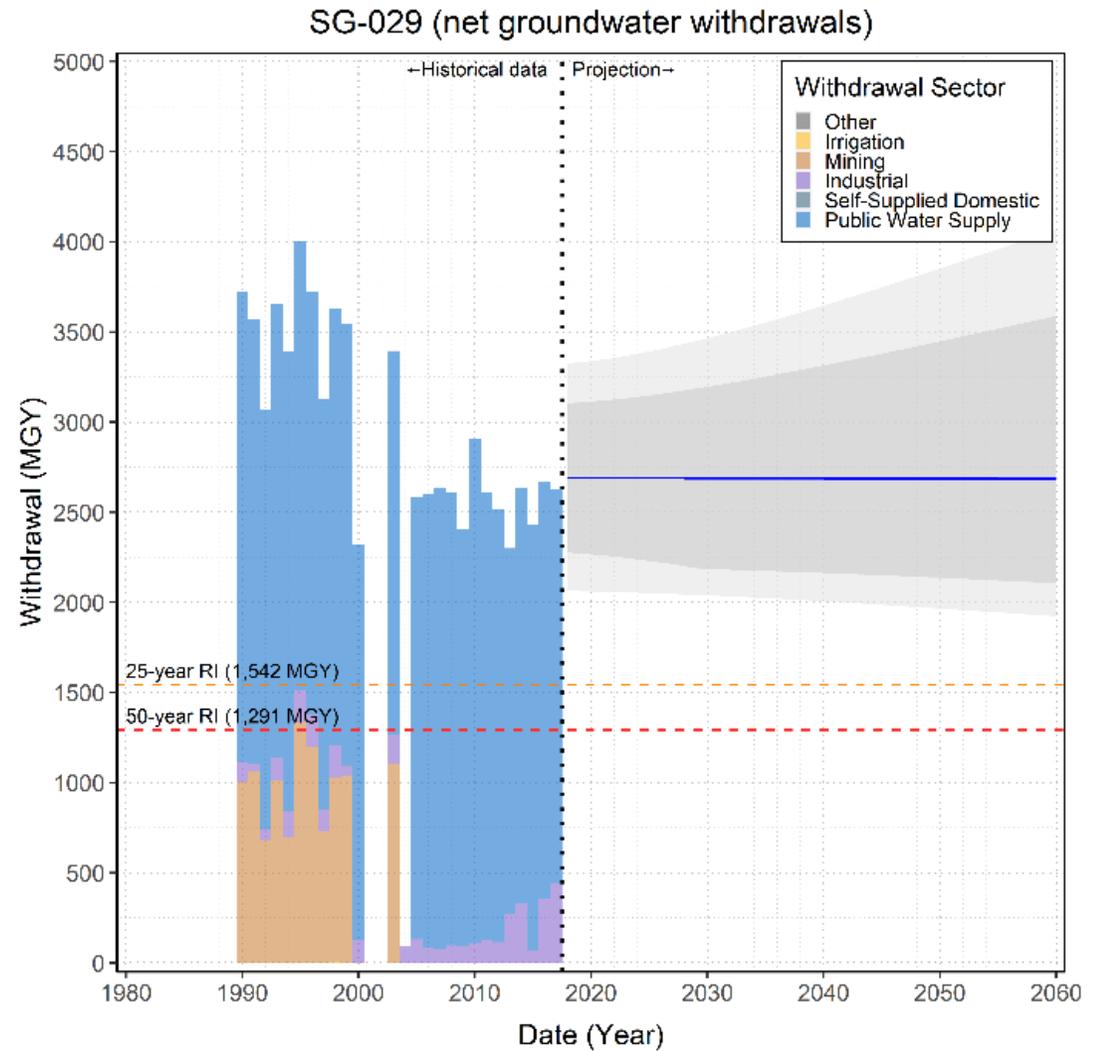
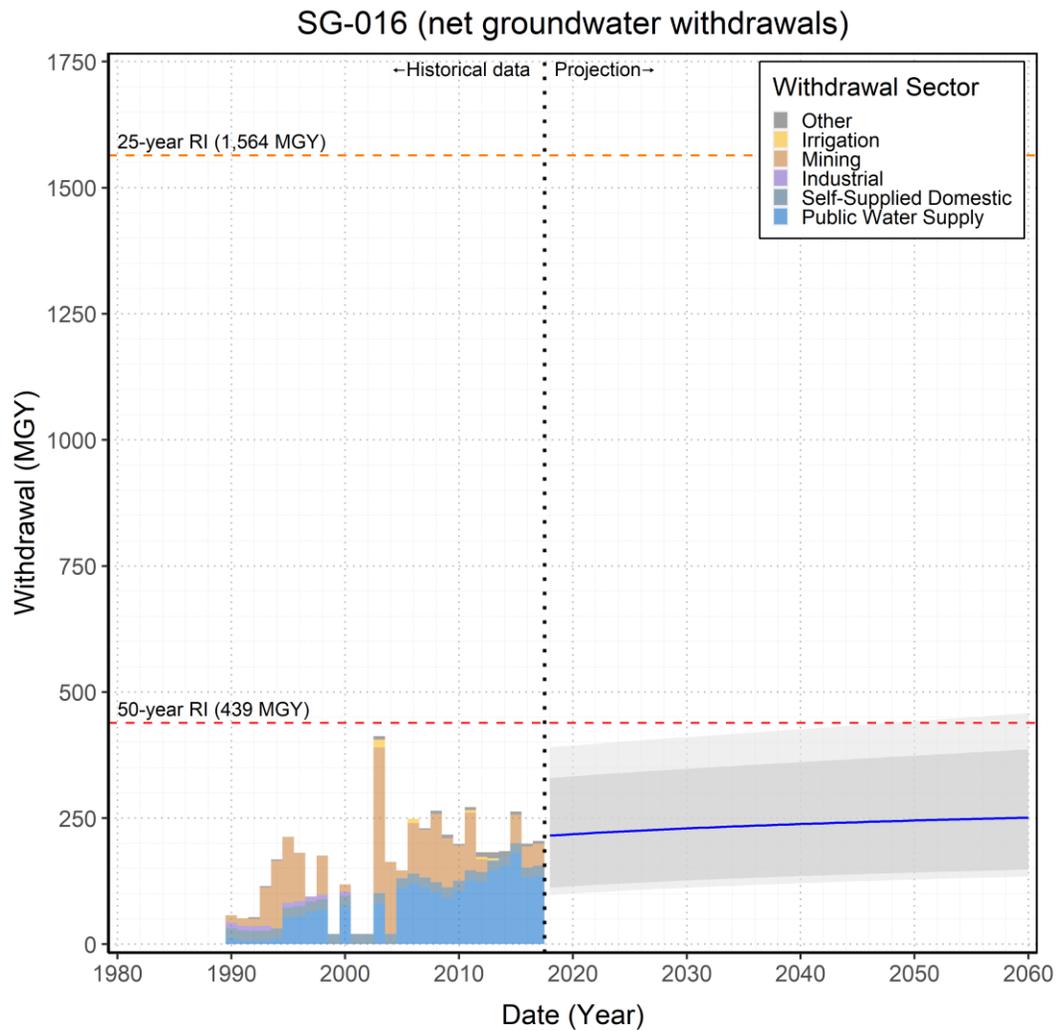
SG-003 (net groundwater withdrawals)



SG-004 (net groundwater withdrawals)



SEPA-GWPA Basins of Concern (SG-016 & SG-029)



Next Steps

Next Steps

- Technical Report to be published in **early 2022**
- Recommended areas for further exploration:
 - Impacts to groundwater availability from climate change
 - Coastal Plain geology & groundwater availability
 - Seasonality of use and availability



Questions?



Sara Sayed
Water Resource Scientist

Delaware River Basin Commission
E: Sara.Sayed@drbc.gov



Michael Thompson, P.E.
Water Resource Engineer

Delaware River Basin Commission
E: Michael.Thompson@drbc.gov



Chad Pindar, P.E.
Manager – Water Resource
Planning Section

Delaware River Basin Commission
E: Chad.Pindar@drbc.gov