Surface Water Availability in Select Tributaries of the Delaware River Basin



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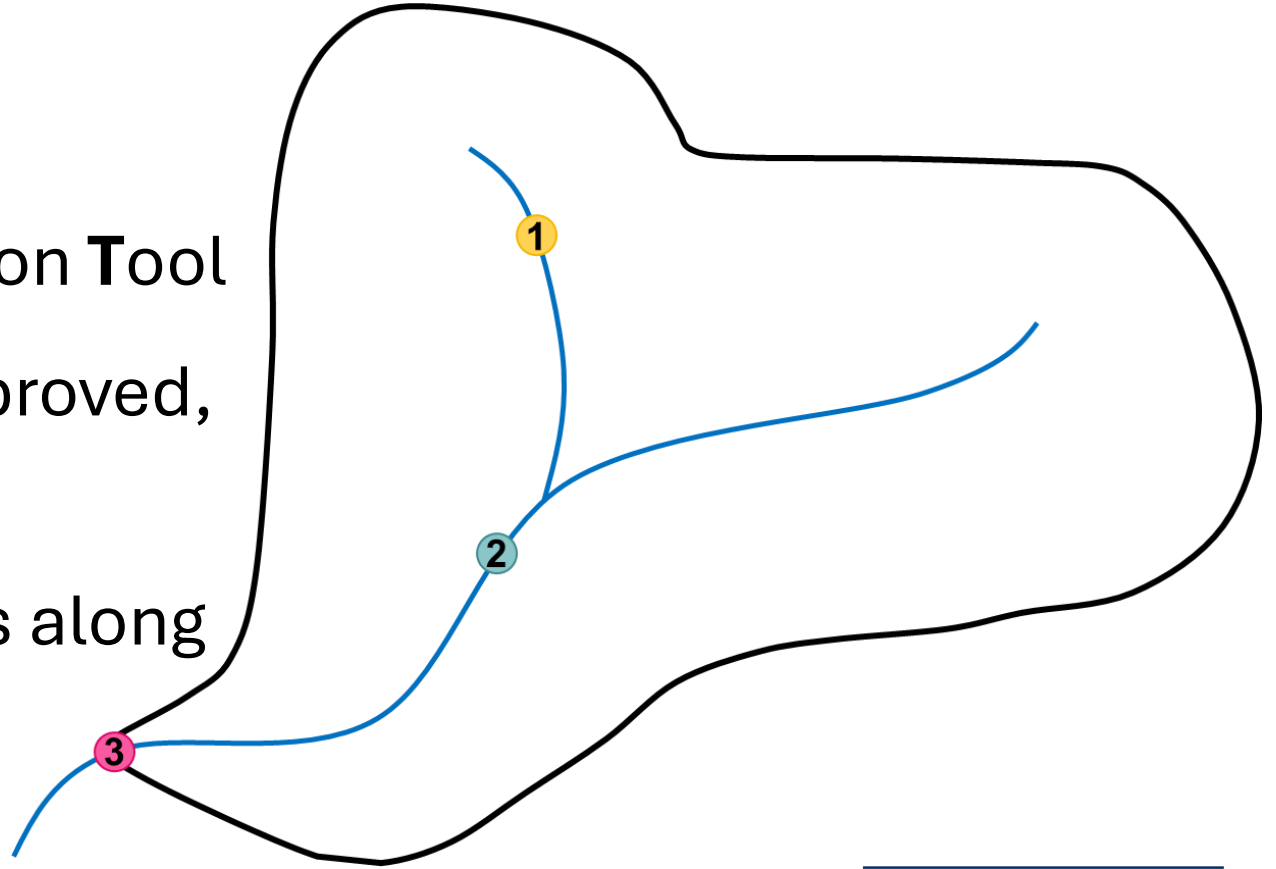
Would there be enough surface water during a repeat of the drought of record?

Using **2060** as a planning horizon

1. Current and projected future water demand: published Oct. 2021
2. Current and future groundwater availability
   - Annual evaluation: published Dec. 2022
   - Seasonal evaluation: ongoing
3. Evaluating additional storage sites
   - Phase 1 - Scoping study: 2023
   - Phase 2 - Evaluating options: ongoing
4. Current and future surface water availability: published **Sept. 30, 2026**

SWEET evaluates surface water availability at individual withdrawal points

- **S**urface **W**ater **E**valuation & **E**stimation **T**ool
- Existing DRBC tool was updated, improved, and refined starting in 2023
- Focus on availability during dry times along select PA & DE tributaries



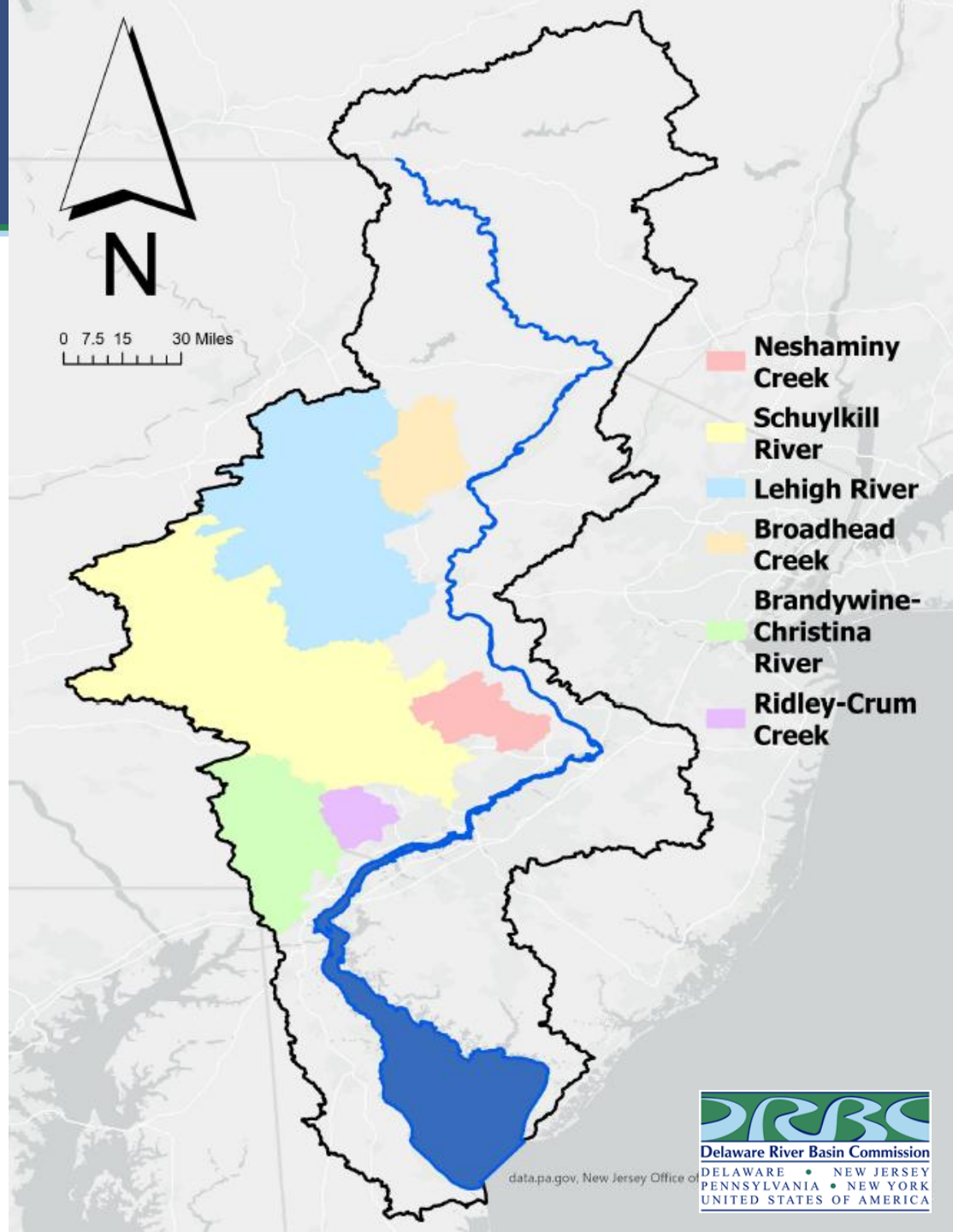
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Methodology



Six Identified Watersheds

- These watersheds represent the majority of surface water withdrawals on **non-tidal tributaries**
- Screen for possible availability issues over a repeat of hydrologic conditions from WY1960–2010
  - Focus on the drought of record (1961–1967) and 1998–2002 drought
- **Set the groundwork for a basin-wide analysis**
  - (non-tidal, non–main stem)



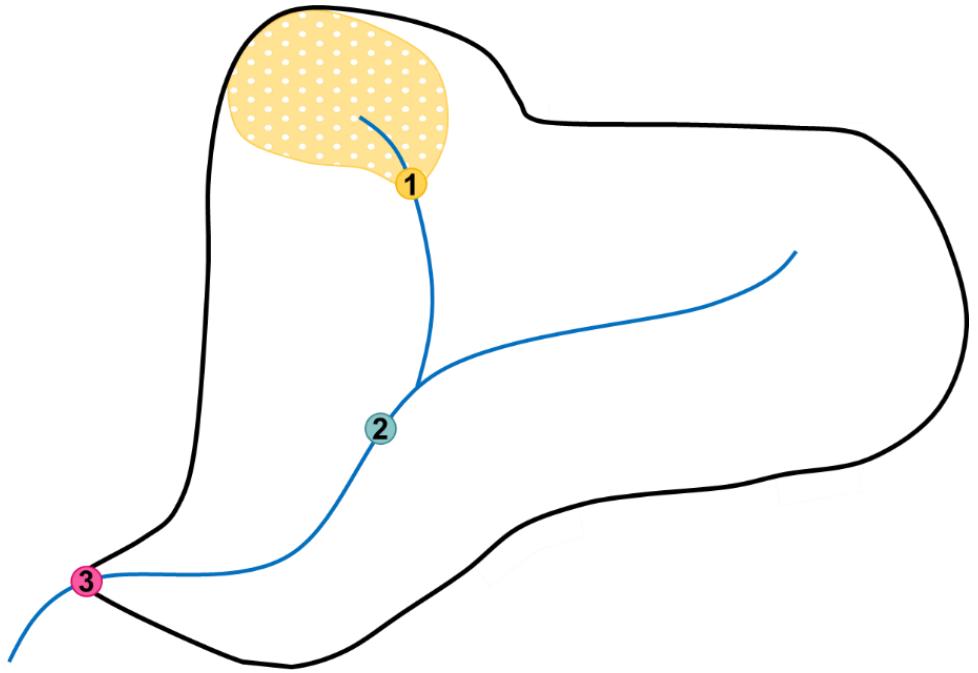
Surface water availability is evaluated at individual withdrawals

1. Flow In (Available Water)

- Unaltered streamflow
  - USGS: DRB-SET
- Returns
  - EPA: NPDES
- Groundwater withdrawals
  - DRBC aggregation

1. Withdrawal Calculation

- Intended withdrawal
  - DRBC projection
- Pass-by flow requirement
  - If applicable
- Flag when intended withdrawal cannot be taken



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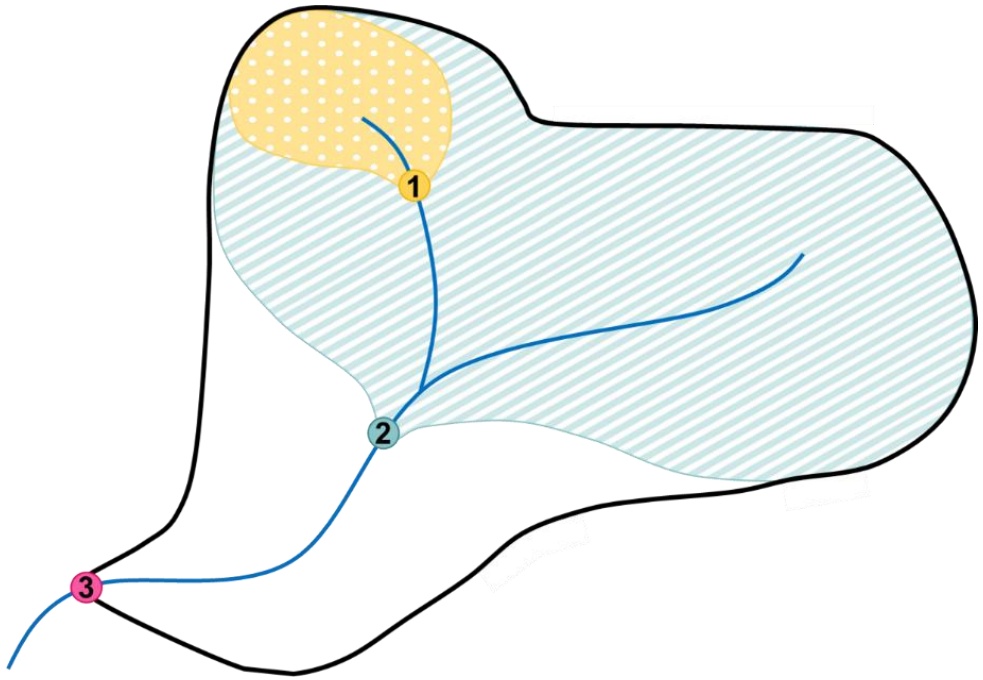
Surface water availability is evaluated at individual withdrawals

2. Flow In (Available Water)

- Unaltered streamflow
  - USGS: DRB-SET
- Returns
  - EPA: NPDES
- Groundwater withdrawals
  - DRBC aggregation

1. Withdrawal Calculation

- Intended withdrawal
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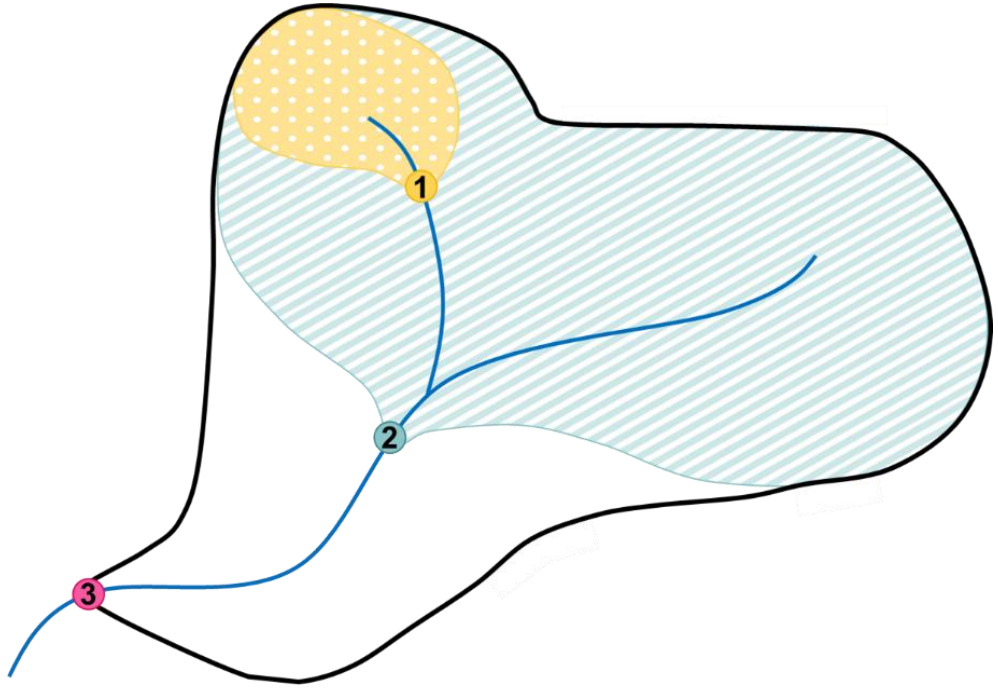
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2. Flow In (Available Water)

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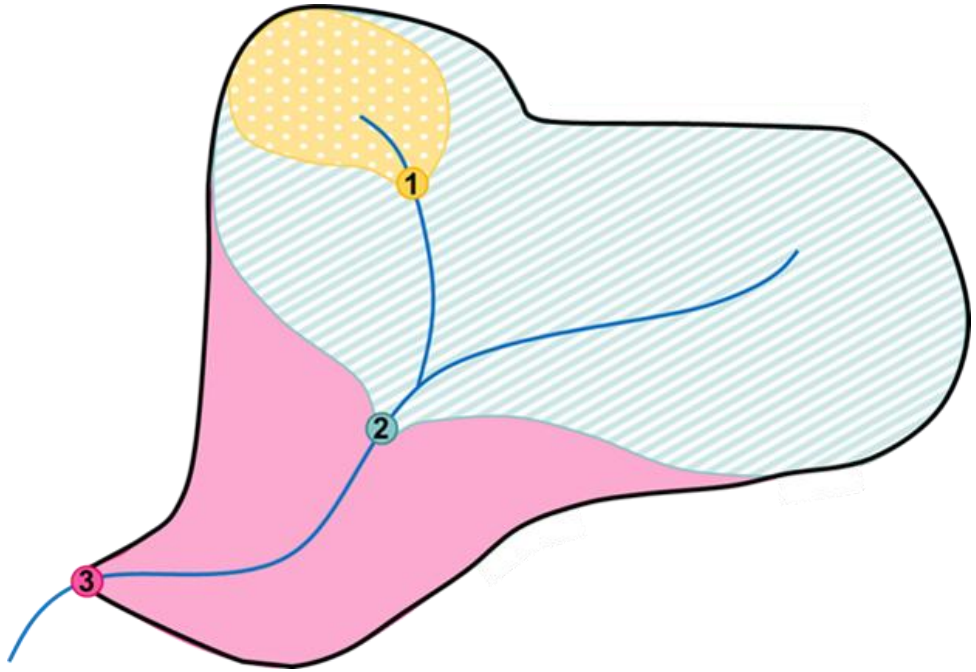
Surface water availability is evaluated at individual withdrawals

3. Flow In (Available Water)

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2. Withdrawal Calculation

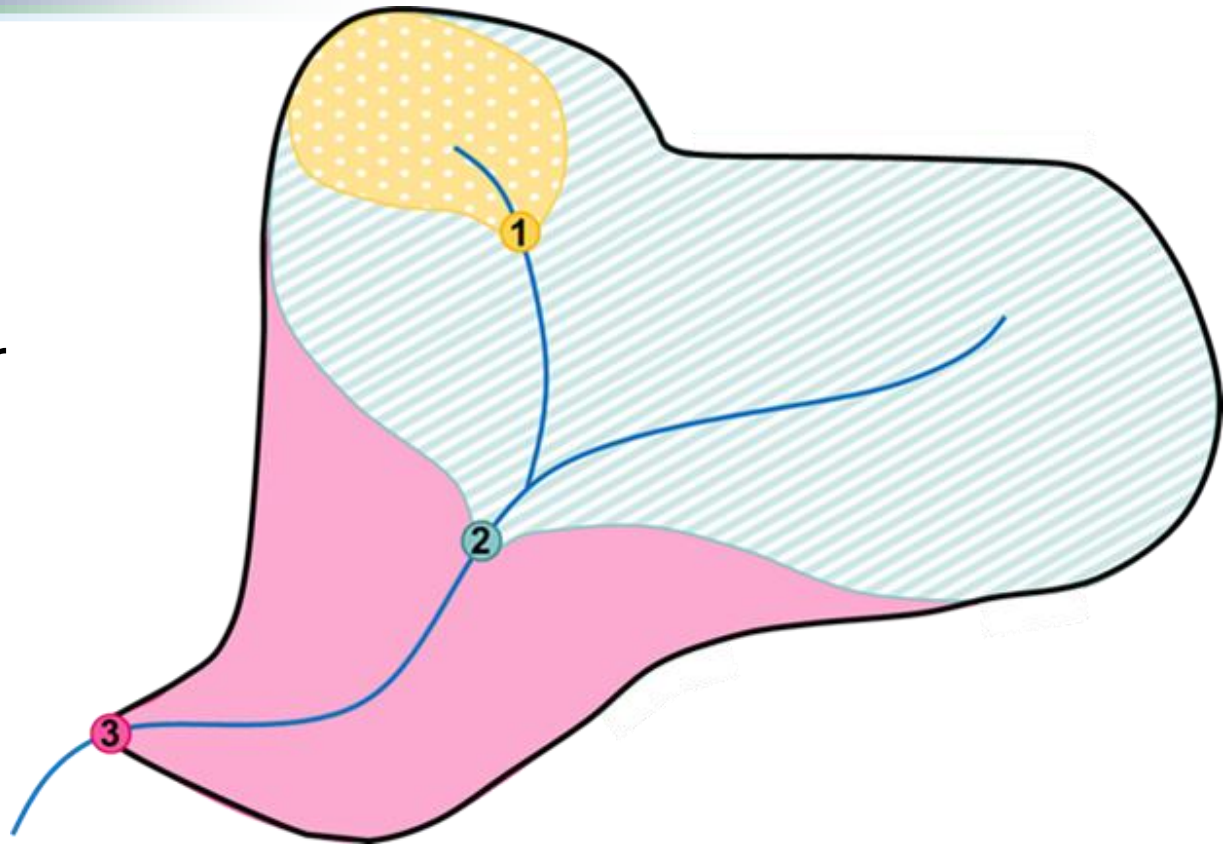
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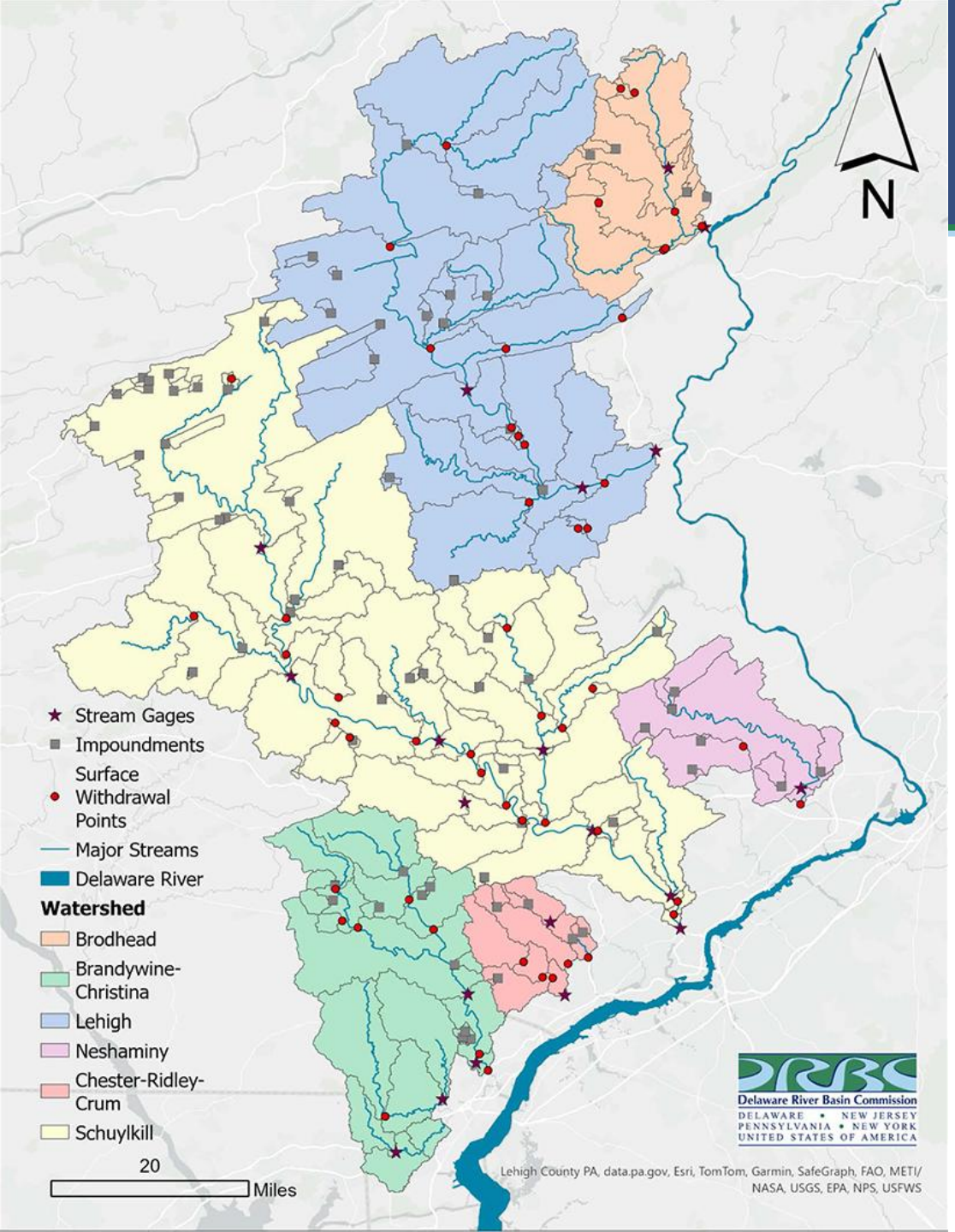
SWEET as a screening tool

- Conservative model assumptions
- Cannot model reservoir operations or tidal fluctuations
  - When possible, reservoirs use a “worst-case” scenario during the driest times, using their conservation release
- Limited by accuracy of input data
  - DRB-SET, NPDES, withdrawals, etc.

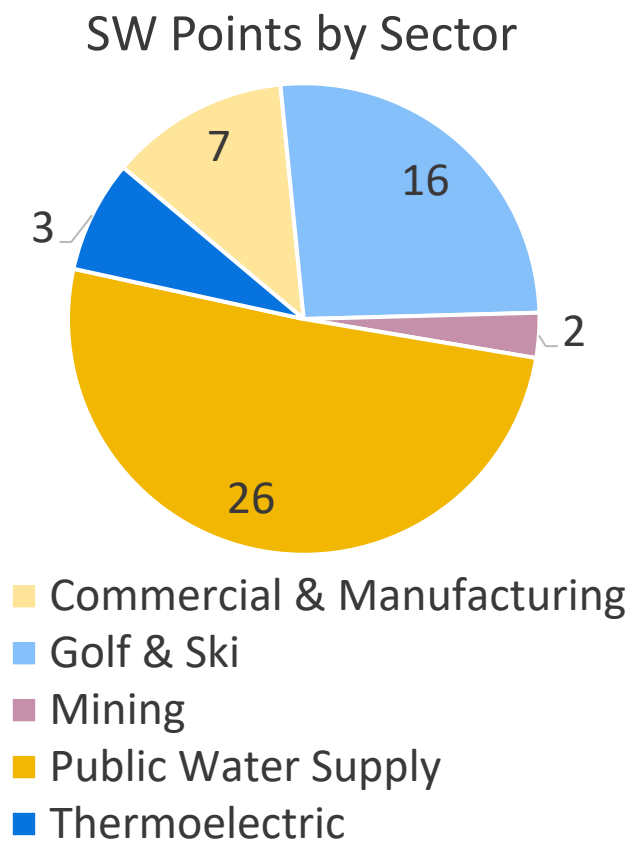


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148 Evaluated Points



- **SW Points**: 54
  Where availability is evaluated
- **Impoundments**: 74
  Included for completeness, but availability not evaluated
- **Stream gages**: 21
  USGS gages used for “validation”



Results

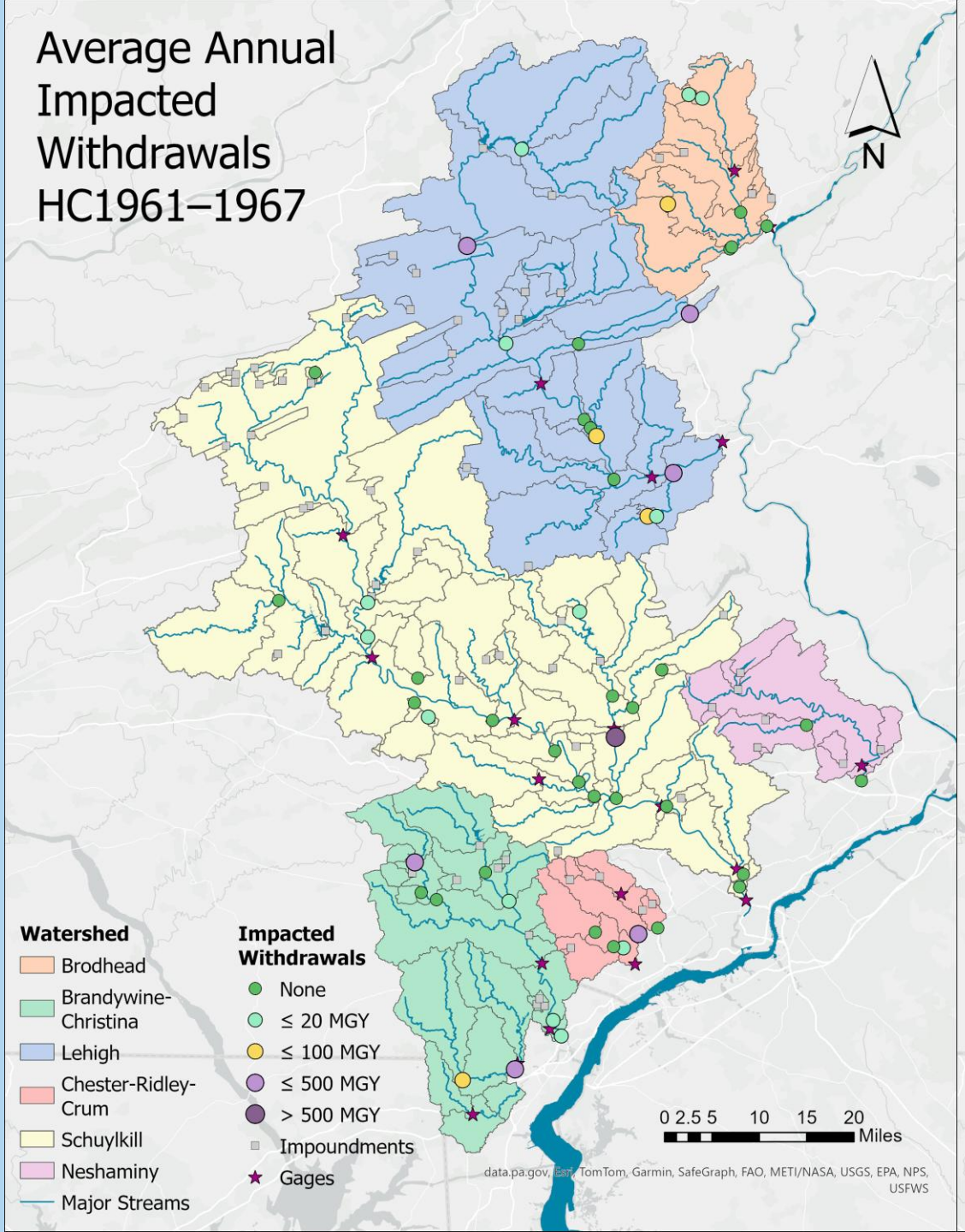

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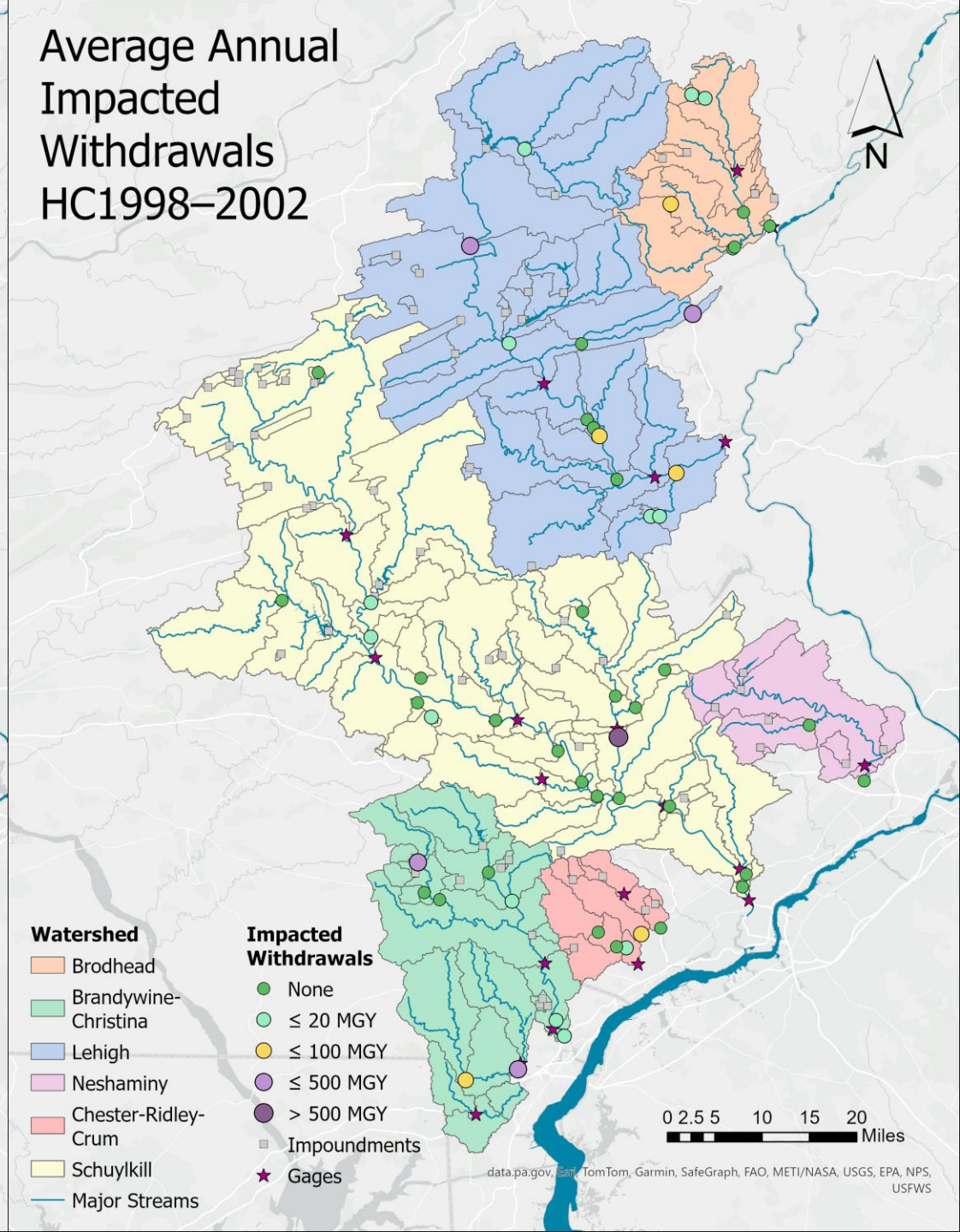
Impacted Withdrawals (IW)

- Definition: the volume of water that could not be withdrawn due to limited availability.
  - Intended withdrawal volumes calculated via average of recent withdrawal data (2018-2022)
- If intended withdrawal is greater than the available streamflow on any day, that withdrawal point is “flagged” for potential surface water availability challenges.
  - Highly dependent on PBFs

SW with IW in Tributaries	
Lehigh	10
Schuylkill	4
Brodhead	3
Brandywine	3
CRC	2
Neshaminy	0

Impacted Volumes



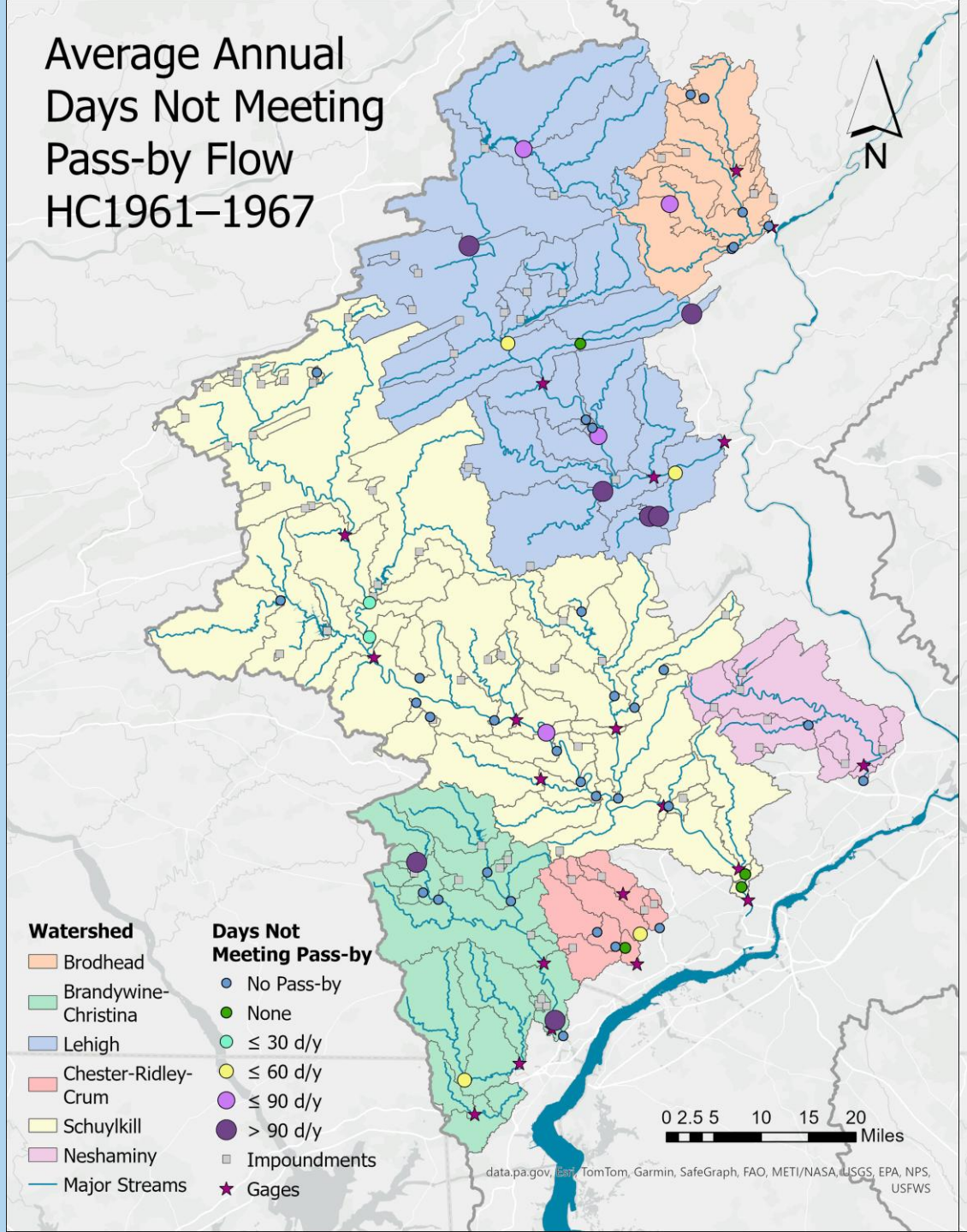


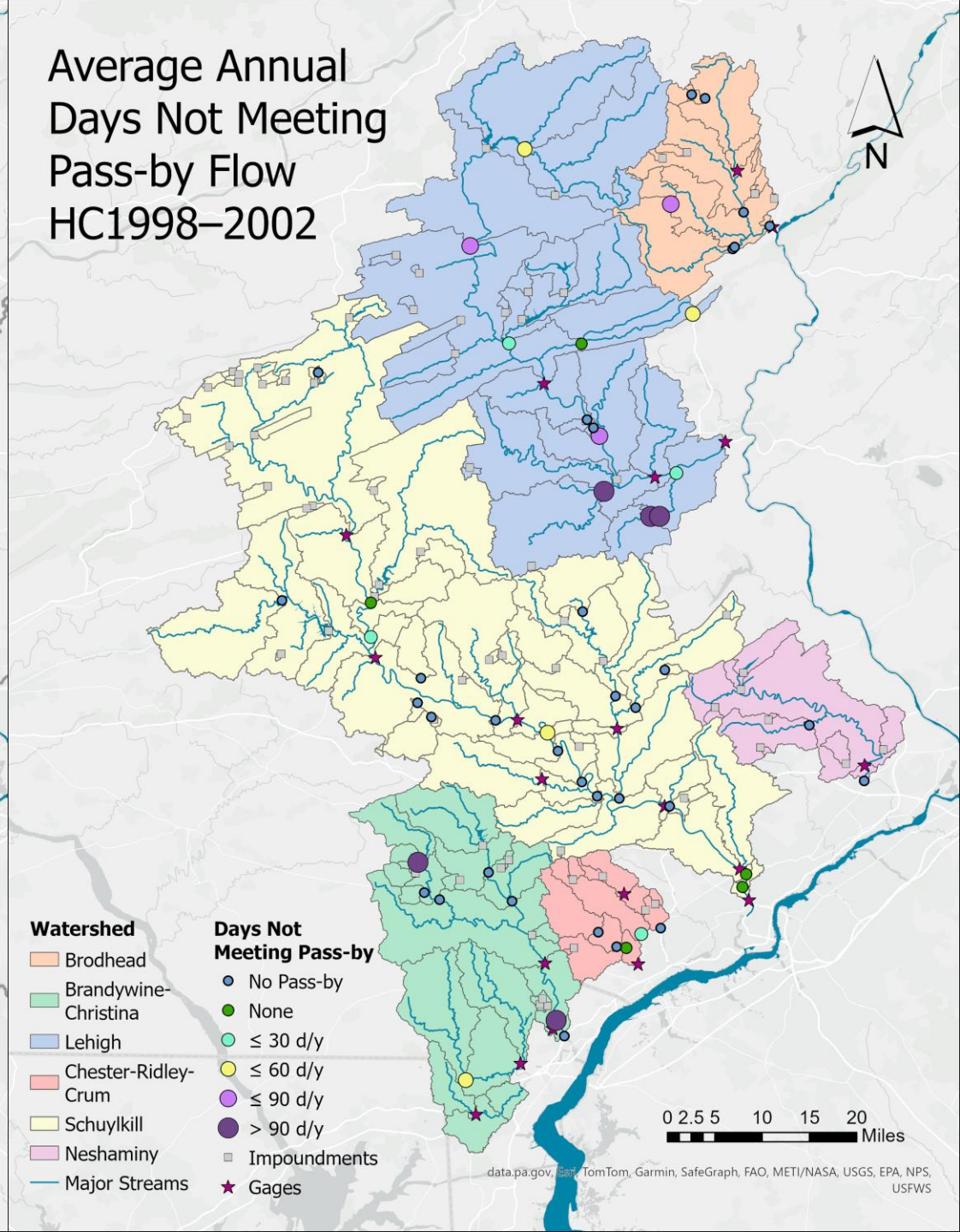
Days not meeting PBF

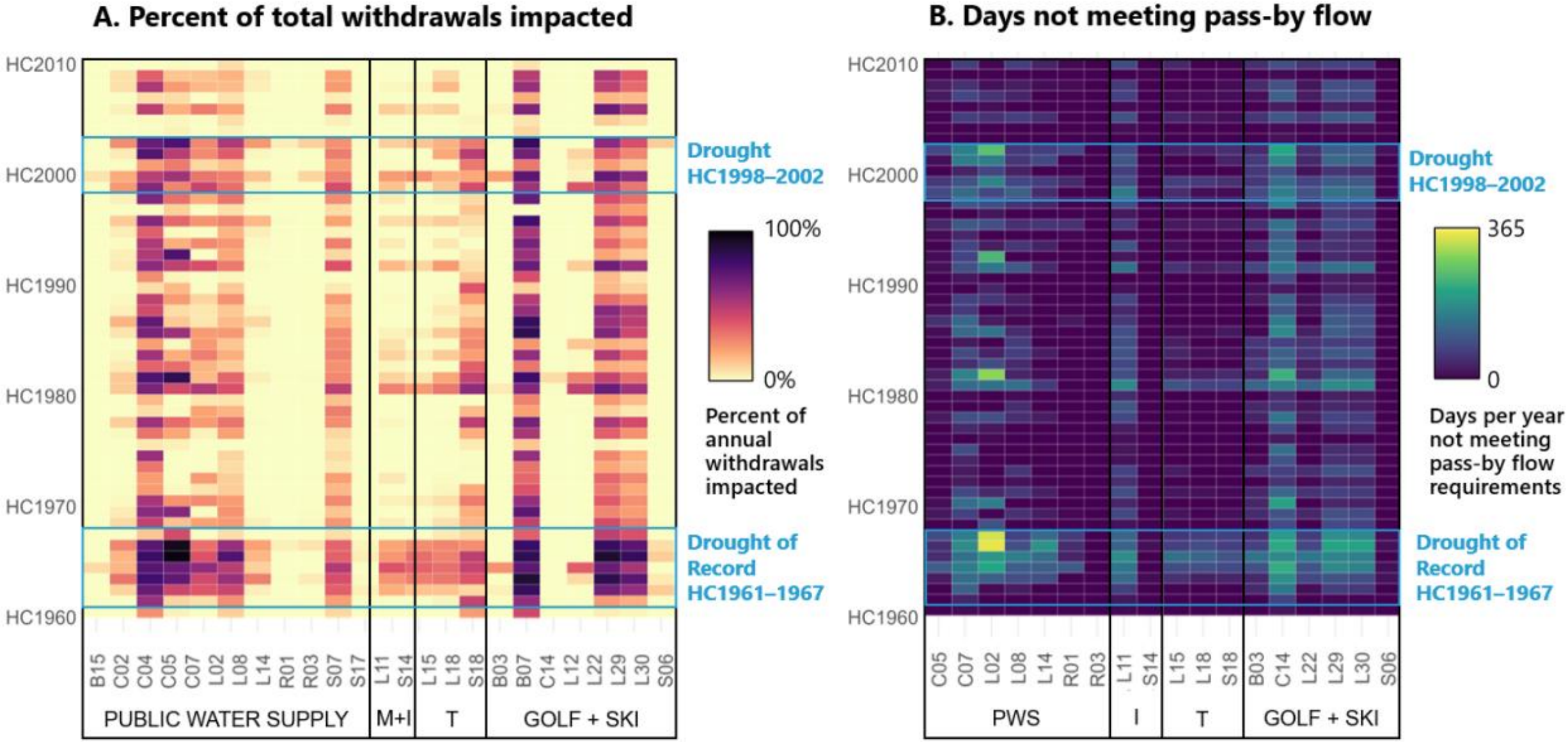
- Definition: a volume of streamflow that should be allowed to "pass by" after a withdrawal is taken
- If streamflow approaches the PBF value, a limited withdrawal amount may be taken to preserve streamflow at or above the PBF value
- If streamflow drops below the PBF value, no water should be withdrawn

PBF Dynamics		
54 SW Points	32 no PBFs	All met their current withdrawal volumes on every modeled day under repeated hydrologic conditions (HC) from 1960 to 2010
	22 PBFs	All but 2 SW points unable to take their intended daily withdrawal volume at least some of the time during HC1960–2010.

Days not meeting PBF






A. Percent of total withdrawals impacted
HC2010
HC2000
HC1990
HC1980
HC1970
HC1960
B15 C02 C04 C05 C07 L02 L08 L14 R01 R03 S07 S17
L11 S14
L15 L18 S18
B03 B07 C14 L12 L22 L29 L30 S06
PUBLIC WATER SUPPLY
M+I
T
GOLF + SKI
Drought HC1998–2002
100%
0%
Percent of annual withdrawals impacted
Drought of Record HC1961–1967
B. Days not meeting pass-by flow
HC2010
HC2000
HC1990
HC1980
HC1970
HC1960
C05 C07 L02 L08 L14 R01 R03
L11 S14
L15 L18 S18
B03 C14 L22 L29 L30 S06
PWS
I
T
GOLF + SKI
Drought HC1998–2002
365
0
Days per year not meeting pass-by flow requirements
Drought of Record HC1961–1967

Several public water suppliers were flagged

Flagged Suppliers
Aqua
Hazleton
LCA
Newark
PAWC
Veolia
Birdsboro
Buck Hill Falls

- If a point is flagged, it is the **starting point for a more detailed analysis** for that individual point, **not a prediction**.
- These suppliers had one or more flagged withdrawal points
  - In all cases, these impacts were due to pass-by flow requirements.
  - PWD withdrawal points have pass-by requirements but also no flag
- **Transparency** before publication—met with each supplier to:
  - Address suppliers' questions, comments, and concerns
  - Inform our interpretation of results with real-world data from suppliers

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Conclusions

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Geologic challenges in the Lehigh Valley

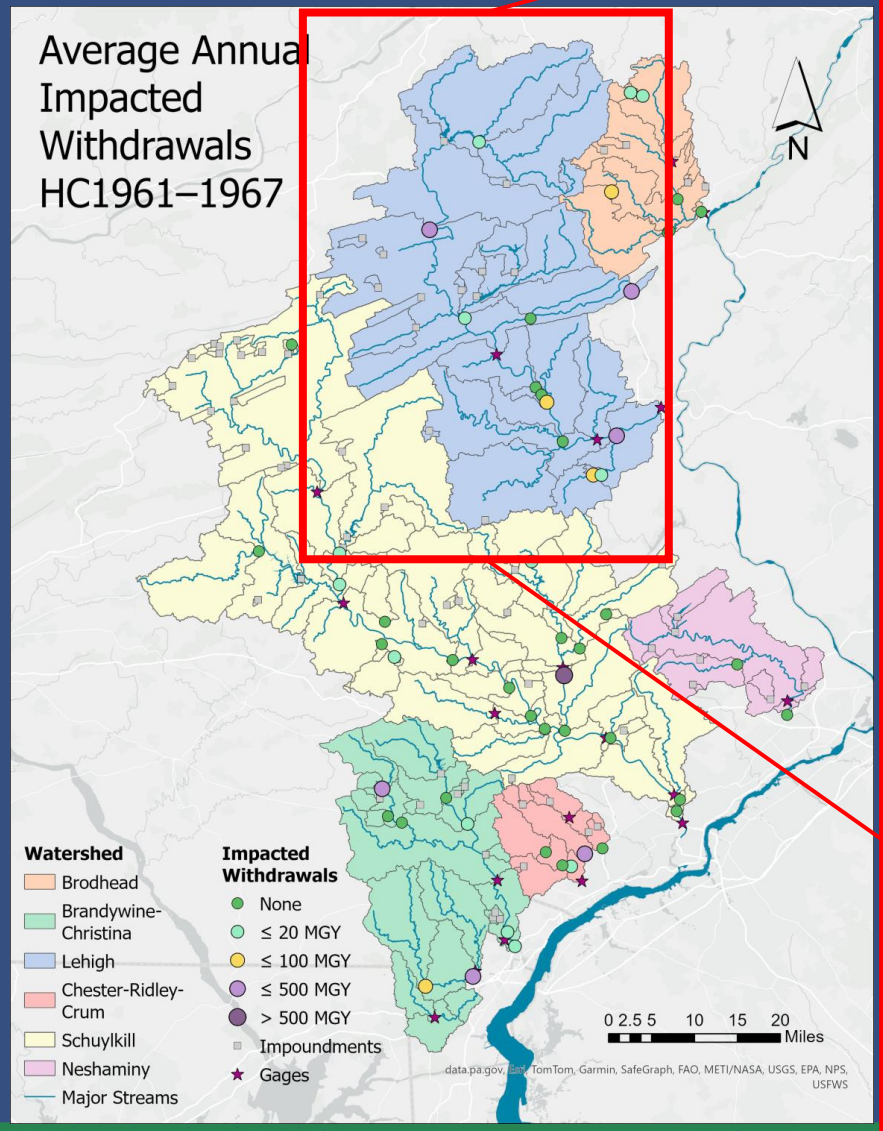


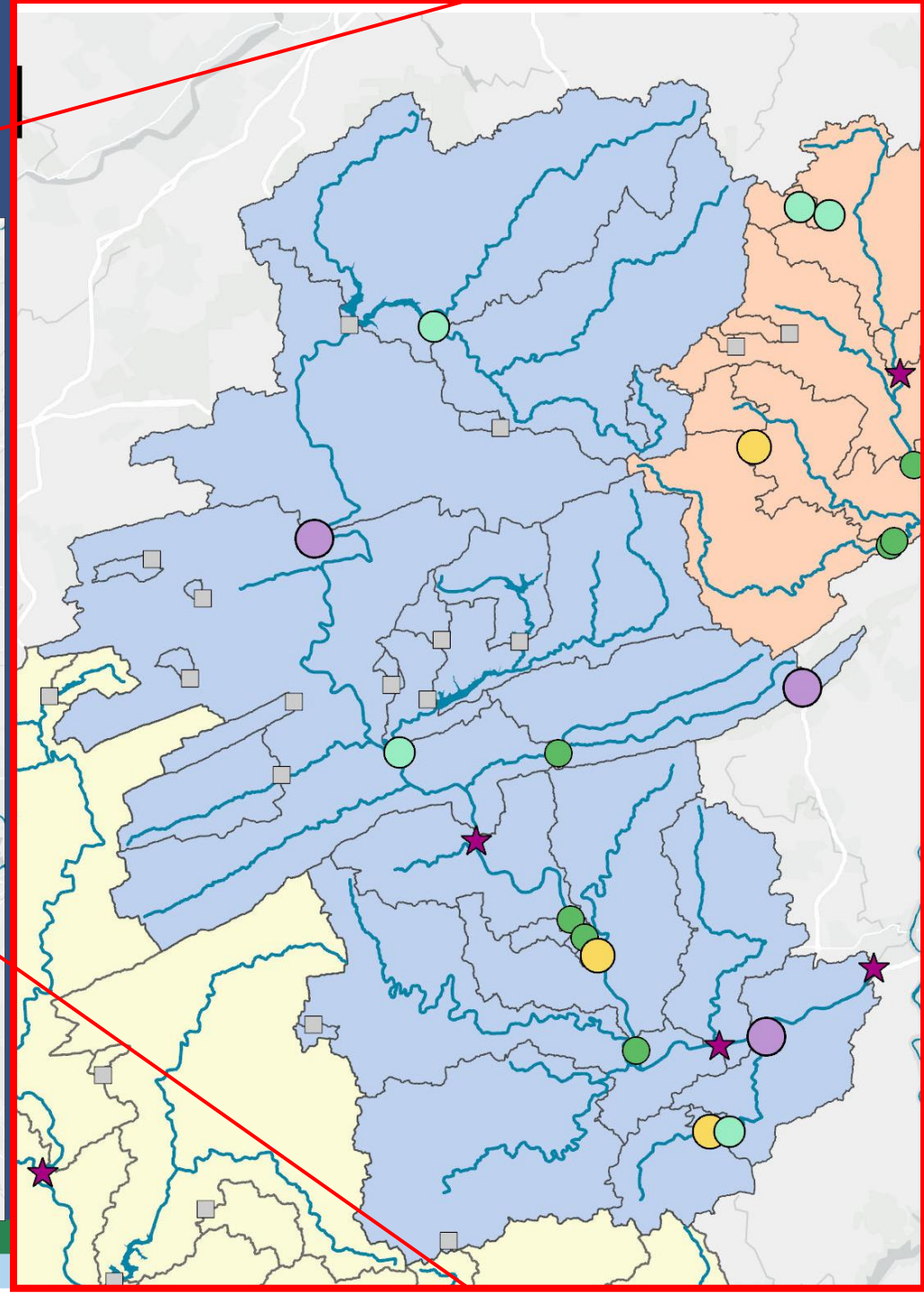
- Multiple flagged PWS SW points in the Lehigh watershed
  - PWS organizations were met with and are thoroughly aware of the impact of dry conditions
- Previous 2060 planning work by DRBC has indicated similar findings regarding long term availability concerns
- Karst geology complicates the hydrology modelling
  - Further study of this would improve accuracy

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Impacted Volumes in the Lehigh

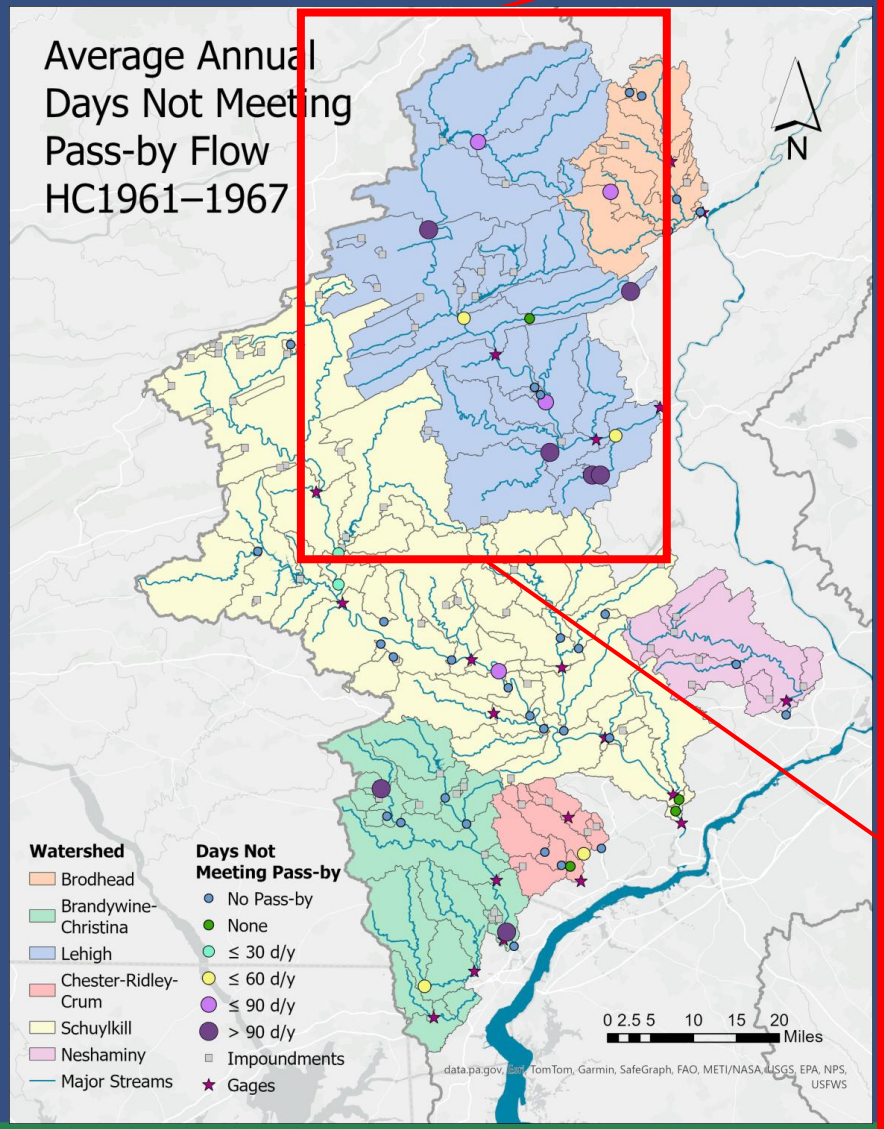
Watershed with the highest concentration of significantly impacted withdrawal volumes

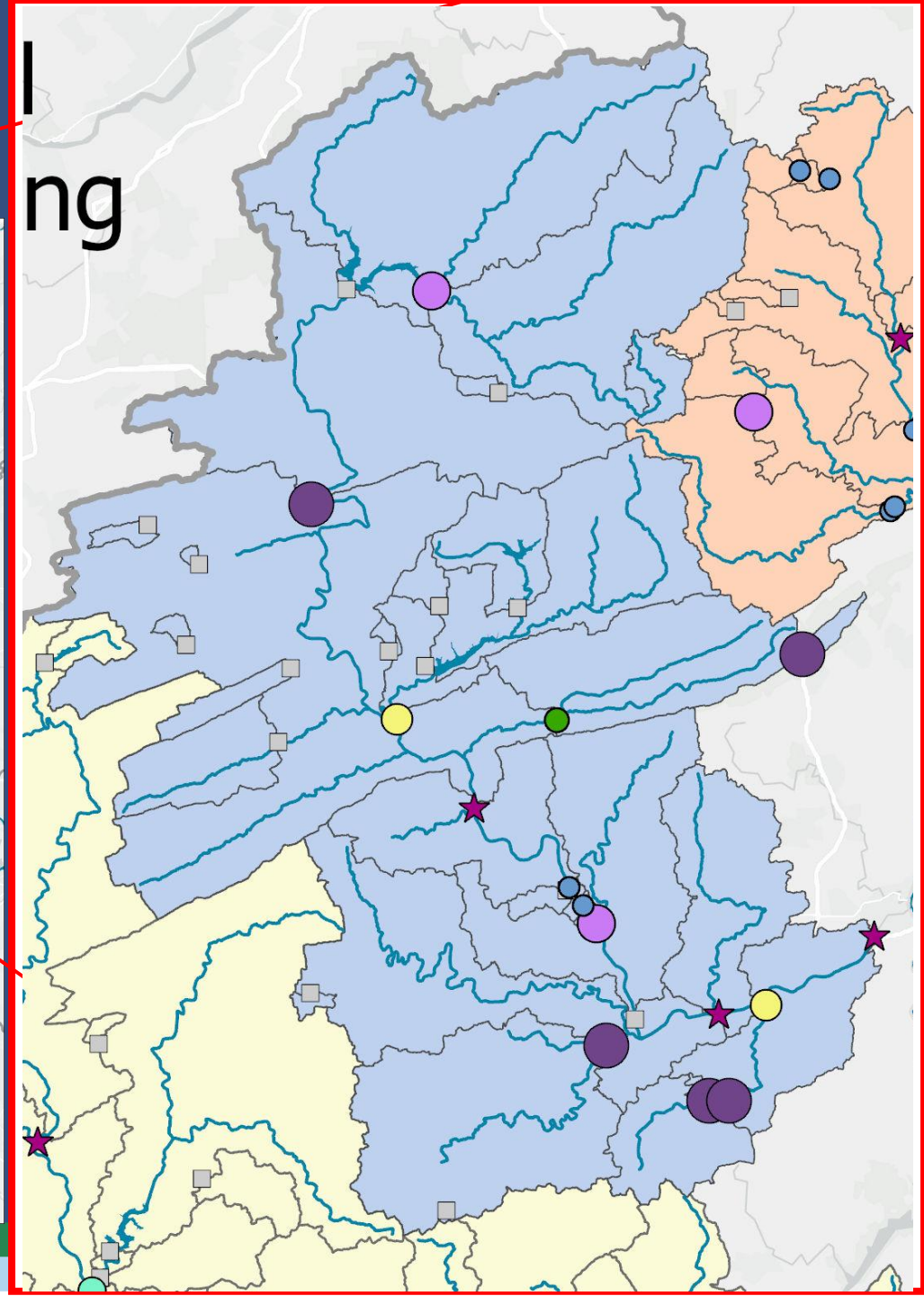




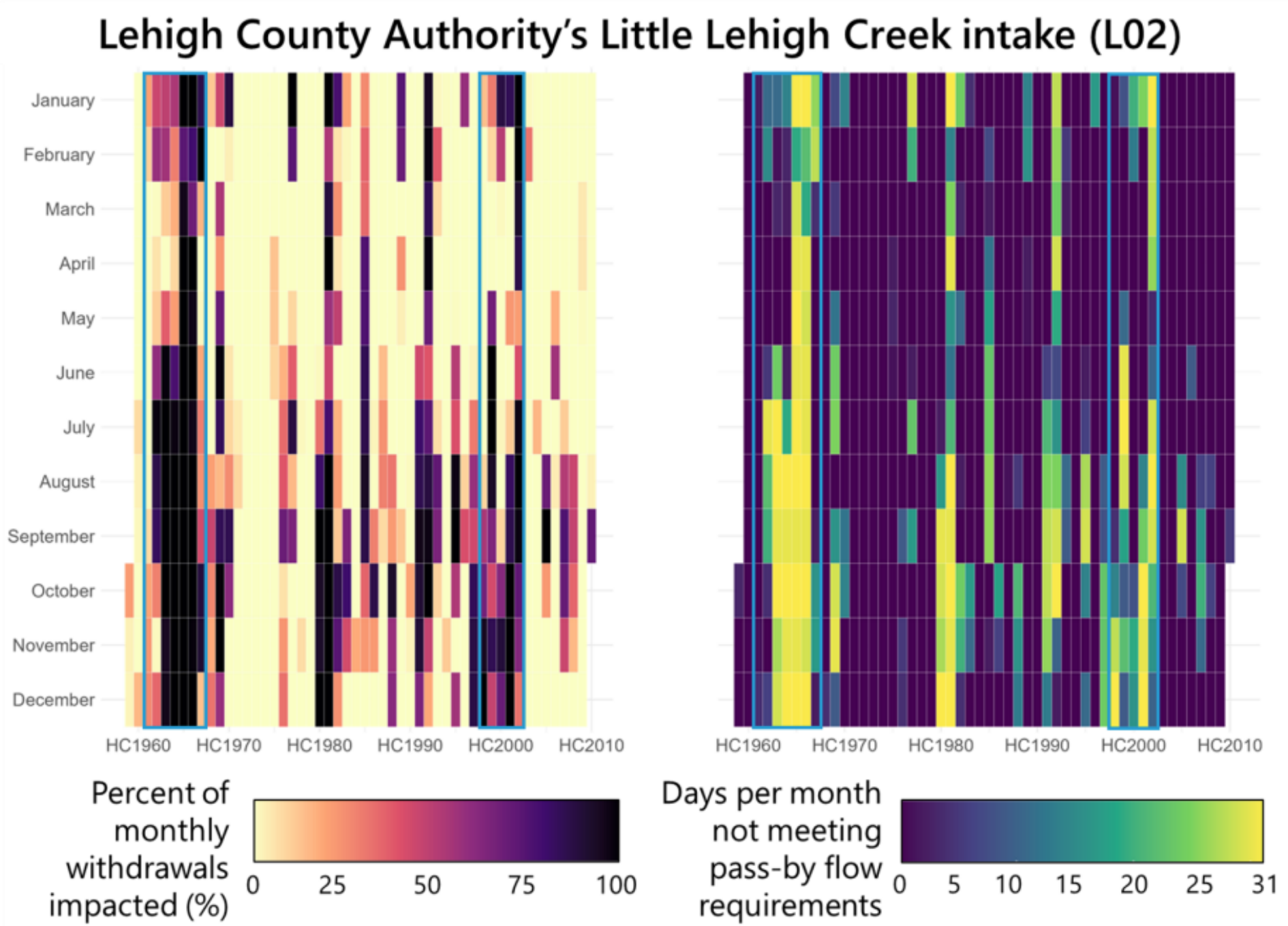
Impacted PBF Days in the Lehigh

Watershed with the highest concentration of significantly impacted days not meeting PBF



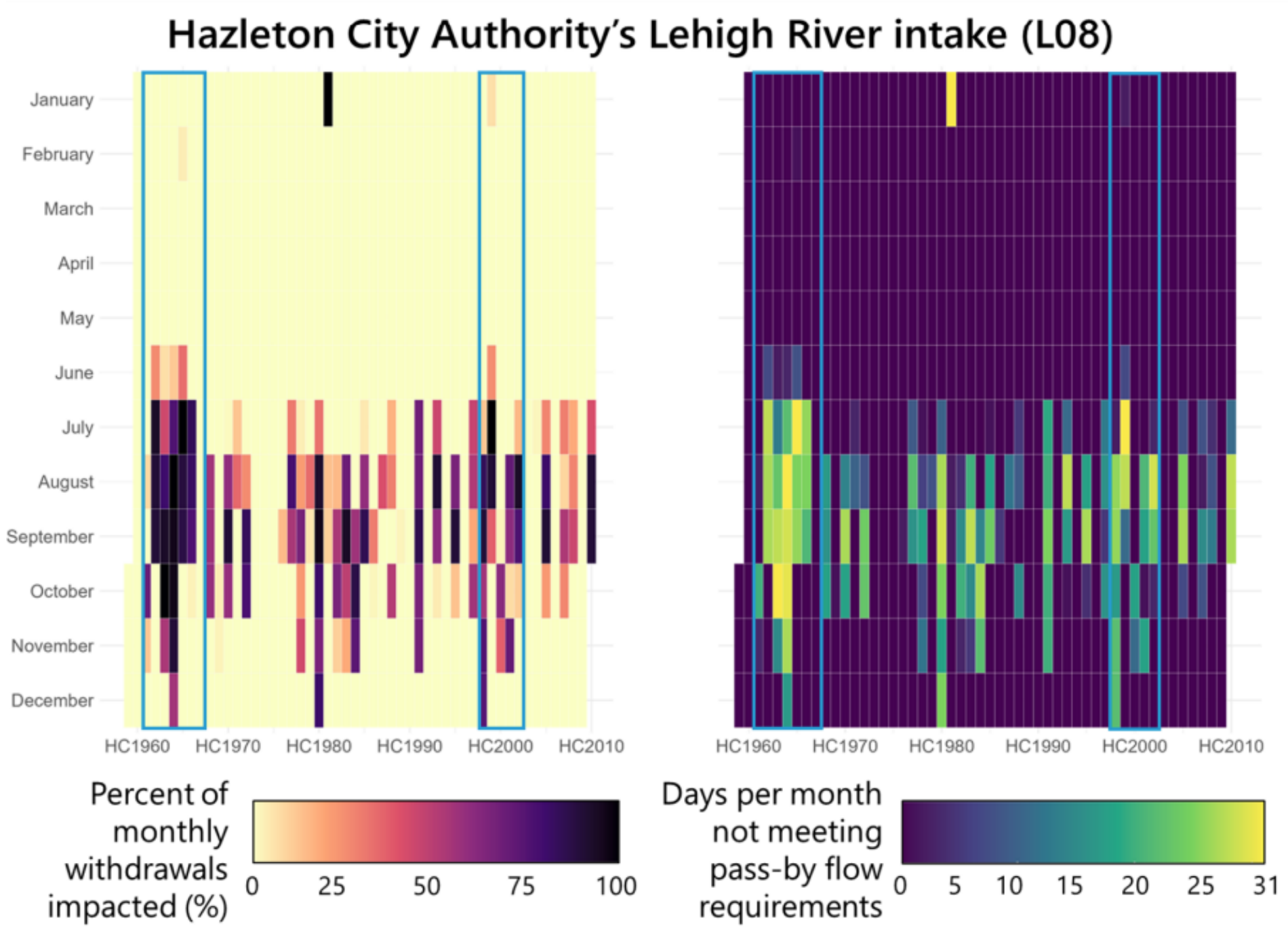


Individual SW point analysis: LCA

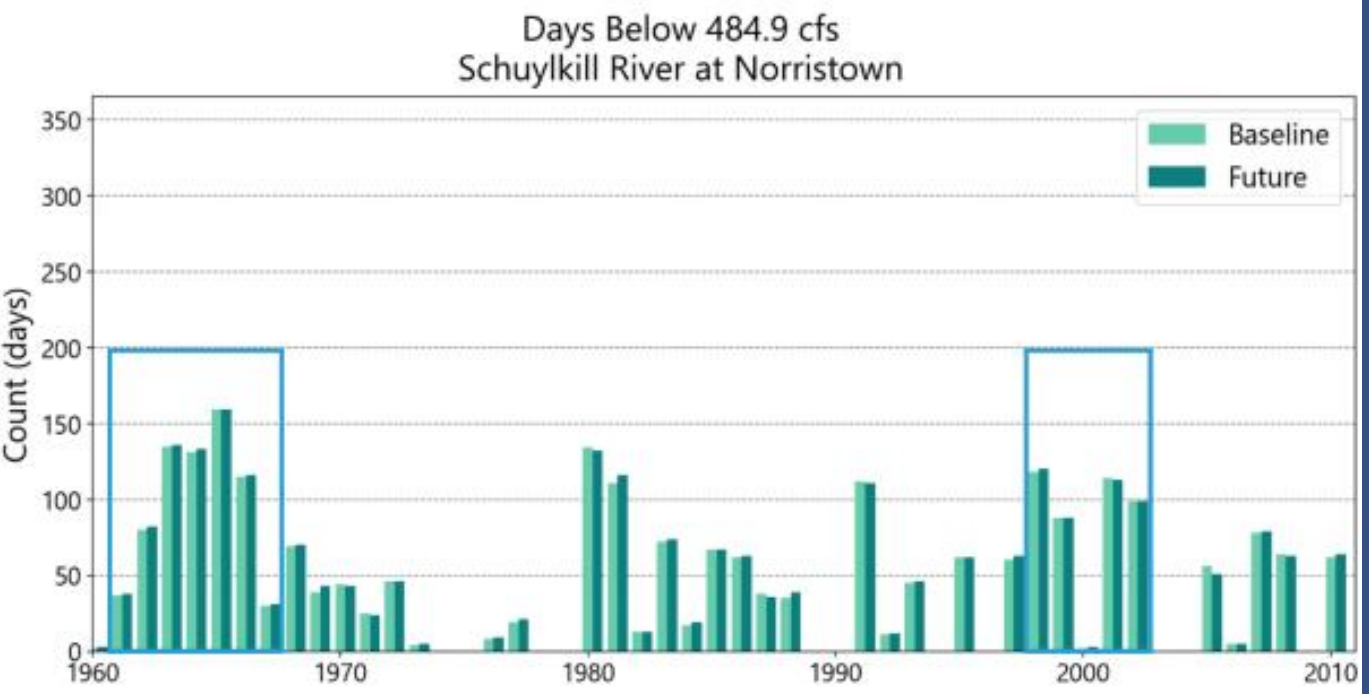


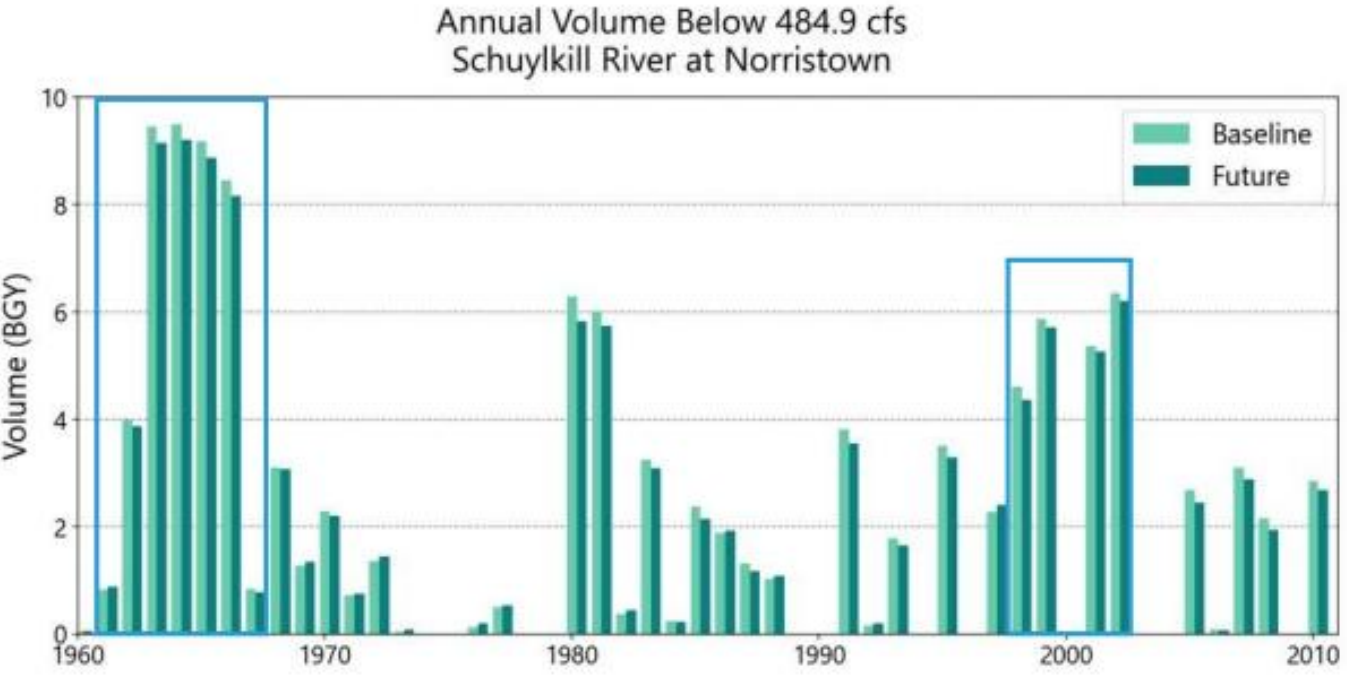
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Individual SW point analysis: Hazleton



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PWD Analysis

Threshold description	Value (cfs)	Maximum annual volumetric shortfall (BG)
PBF + Maximum demand + safety factor	484.9	9.5
PBF + 15% reduced demand + safety factor	442.25	6
PBF + 15% reduced demand + 50% reduced safety factor	392.25	2.6
PBF + 15% reduced demand + no safety factor	342.25	0.6

- Current PBF 100cfs at Fairmount
- Modelled PBF 484.9cfs at Norristown (10 miles upstream)
  - SWEET predicts PBF met 87% of the time

“SWEET results from the baseline scenario show that the majority of run-of-river public water supply withdrawals from non-tidal tributaries to the Delaware River would likely be able to maintain supply during a repeat drought of record.”

Recommendations

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Expansion

- *Additional storage*
- *Water conservation*

Maintenance

- *2024 Drought*
- *Cumulative Impact*

Improvements

- *Update DRB-SET*
- *Groundwater relationships*

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https://tinyurl.com/DRBC-SWEET



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