

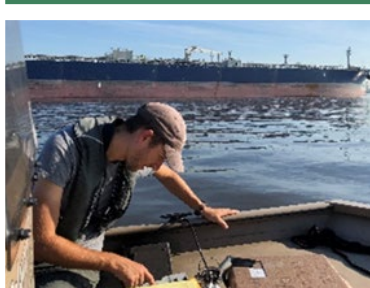
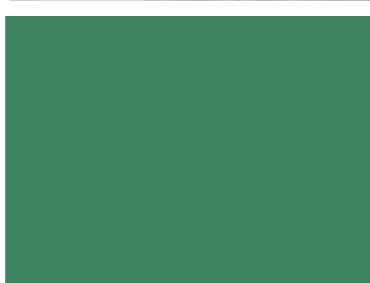
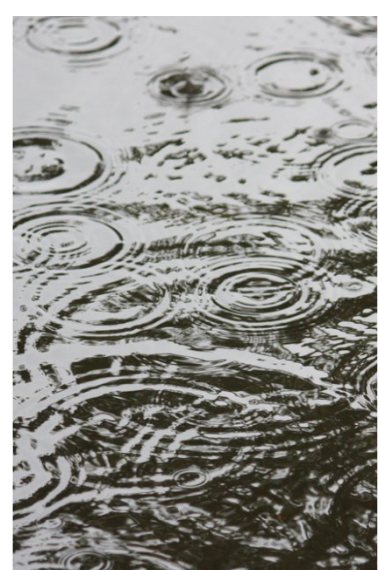
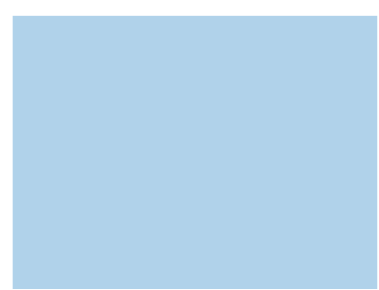
Presented to an advisory subcommittee of the DRBC on May 14, 2026.  
Contents should not be published or re-posted in whole or in part without  
permission of the presenter or the DRBC.

# FRAZIL ICE

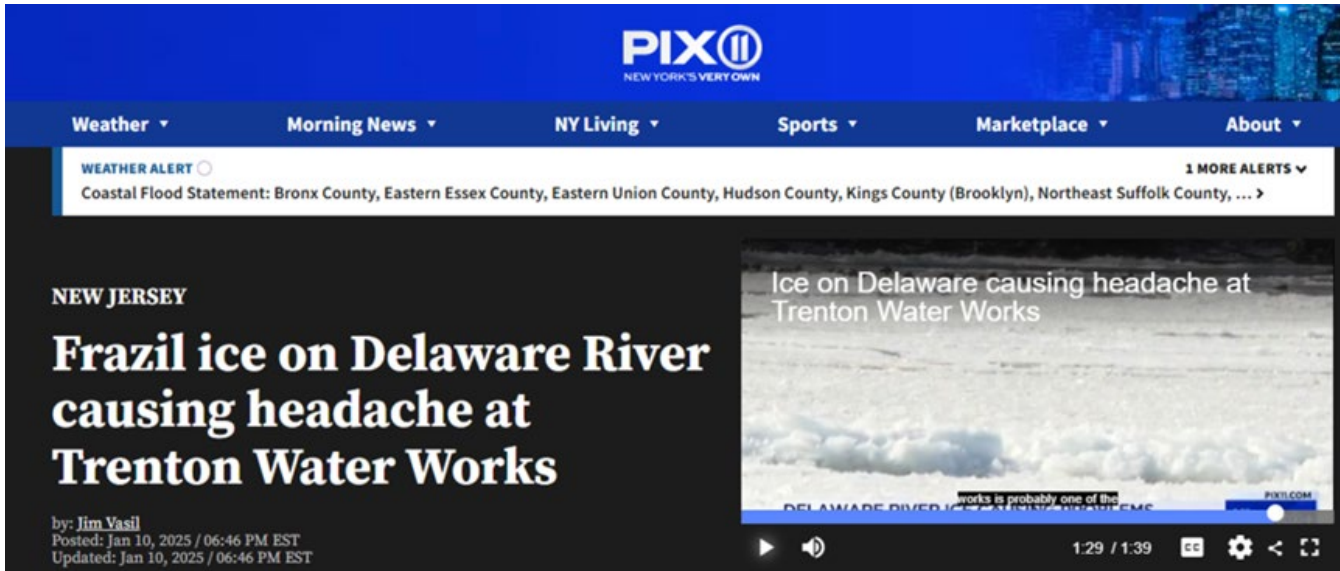
## Prediction Tool

John Yagecic (retired), Jake Bransky, Elaine Panuccio  
and Namsoo Suk, Ph.D.

**May 14, 2026**  
**Subcommittee on Source**  
**Water Protection**



# Motivation to Develop Frazil Ice Prediction Tool



PIX11  
NEW YORK'S VERY OWN

Weather Morning News NY Living Sports Marketplace About

WEATHER ALERT 1 MORE ALERTS

Coastal Flood Statement: Bronx County, Eastern Essex County, Eastern Union County, Hudson County, Kings County (Brooklyn), Northeast Suffolk County, ...

NEW JERSEY

## Frazil ice on Delaware River causing headache at Trenton Water Works

by Jim Vasil  
Posted: Jan 10, 2025 / 06:46 PM EST  
Updated: Jan 10, 2025 / 06:46 PM EST

Ice on Delaware causing headache at Trenton Water Works

DELAWARE RIVER... works is probably one of the



## Trenton issues an official water conservation advisory after frazil ice reported

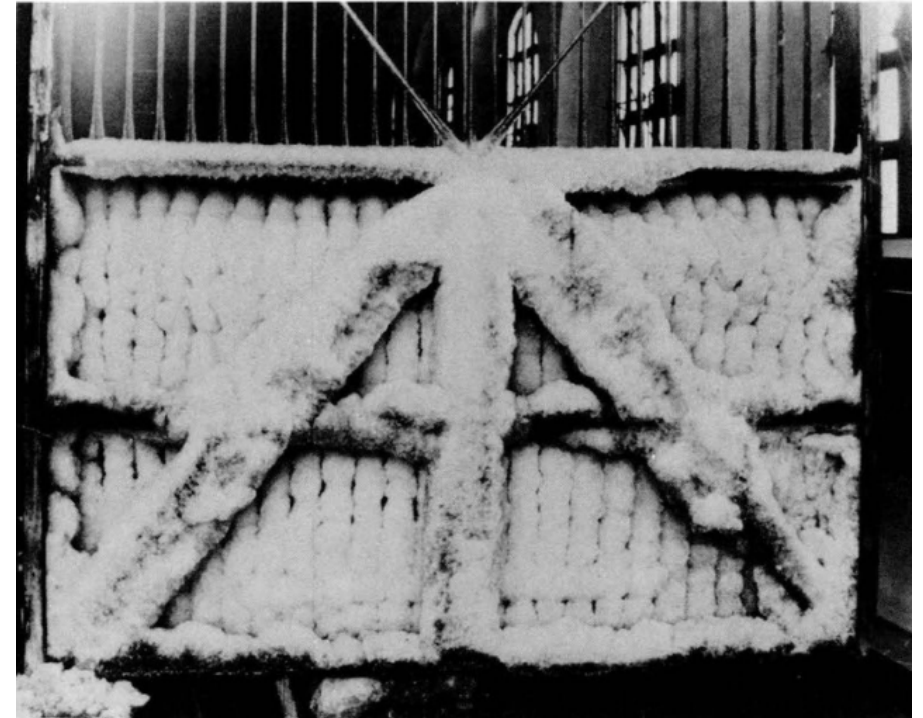
BY JOHN BERRY  
December 18, 2025 at 8:27 p.m.

Trenton Water Works (TWW) is asking all customers to cut back on water usage. The...



# What Is Frazil Ice?

- Frazil ice formed by supercooled water due to large heat loss from low air temperature (about  $-6^{\circ}\text{C} \approx 21^{\circ}\text{F}$  or lower).
- Turbulent flow condition prevents the formation of stable ice, but ice crystals remain in the water column as loose and slushy mixture.
- Fresh frazil ice (active frazil ice) has a tendency to adhere to metals and other materials before stable ice cover has formed.



Formation of frazil ice back of the trash rack of intake when lifted up.

Source: Steven Daly (1991)

# How Can We Predict Conditions for Frazil Ice Formation?

- Reference: Engel, C., Giovando, J., & Halvorson, G. (2023). Analysis of Paxton Siphon Frazil Ice Blockage Event during January 2022. (Report No. ERDC/CRREL TR-23-4). Vicksburg, MS: [U.S. Army Engineer Research and Development Center](#)
- Water temperature near freezing and net heat flux on the order of **-250 to -300 W/m<sup>2</sup>**

$$q_{net} = q_{sw} + q_{atm} - q_b + q_h + q_l$$

Where,

$q_{net}$  = net heat flux (watts/meter<sup>2</sup>)

$q_{sw}$  = downwelling shortwave radiation from solar input

$q_{atm}$  = downwelling longwave radiation from the atmosphere

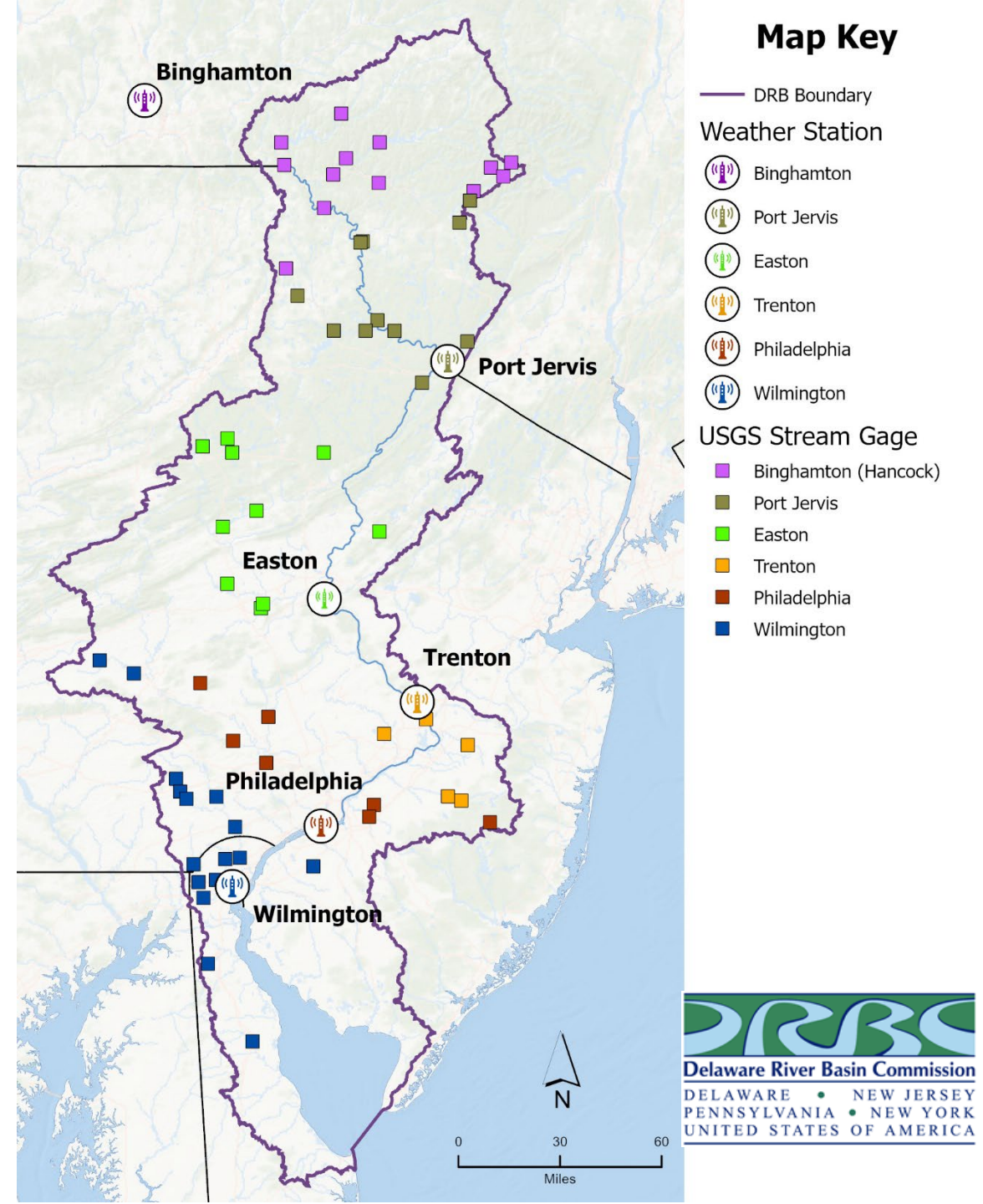
$q_b$  = upwelling longwave radiation from the water body

$q_h$  = the sensible heat flux from air to water, and

$q_l$  = latent heat

# Net heat flux calculation using local information

- Hourly, 8-day weather forecasts from the National Weather Service from Binghamton (used for Hancock), Port Jervis, Easton, Trenton, Philadelphia, Wilmington
  - Air temperature, dew point, wind speed, cloud cover, relative humidity
- Water temperature from 77 USGS gages in the basin
  - Median water temperatures of previous day for six regions were calculated and used for 8-day prediction
- Assumed no ice cover on the River
- Updated everyday during winter season on DRBC's WQ portal

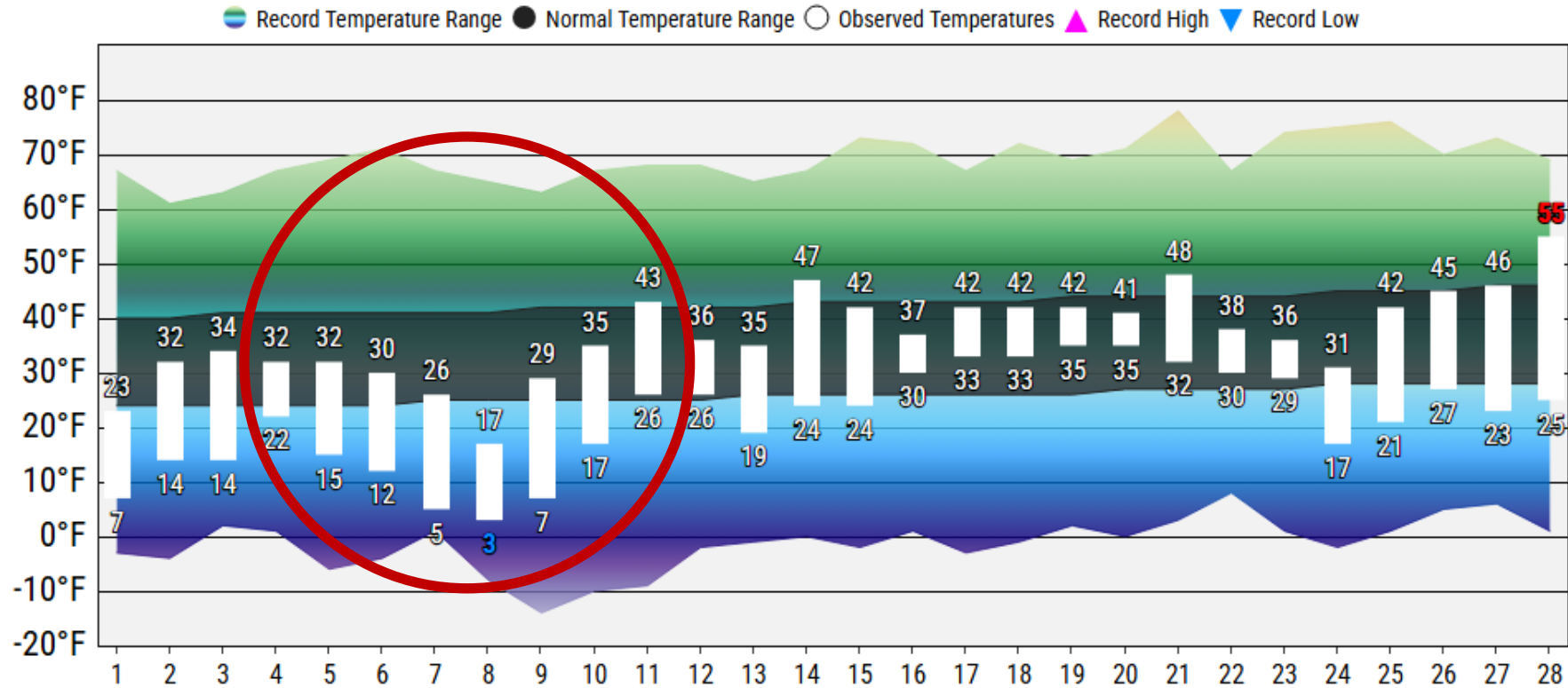


# Persistent cold air temperatures in early February 2026



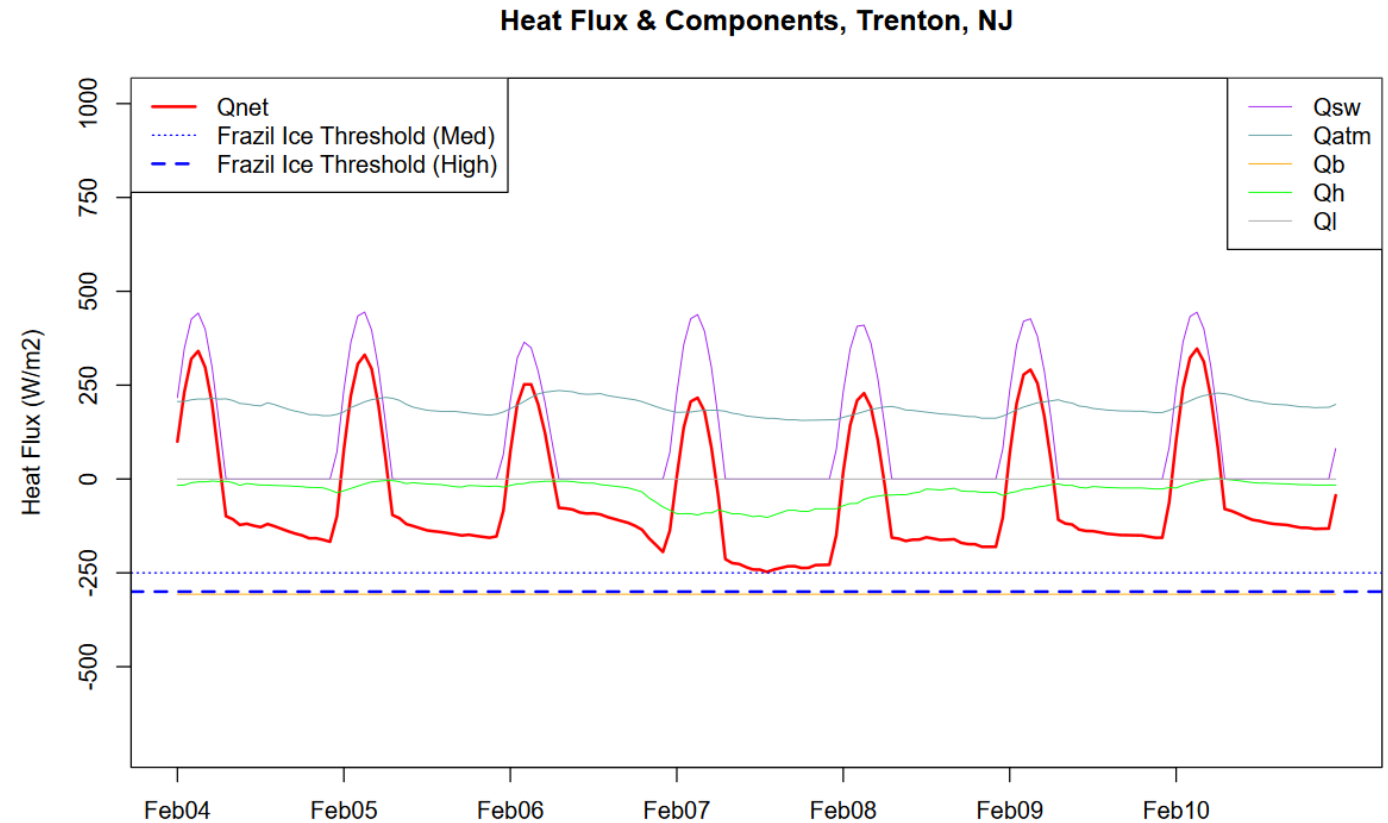
## February 2026 Weather Stats at Trenton, NJ

DAILY HIGHS AND LOWS with normal and record temperatures



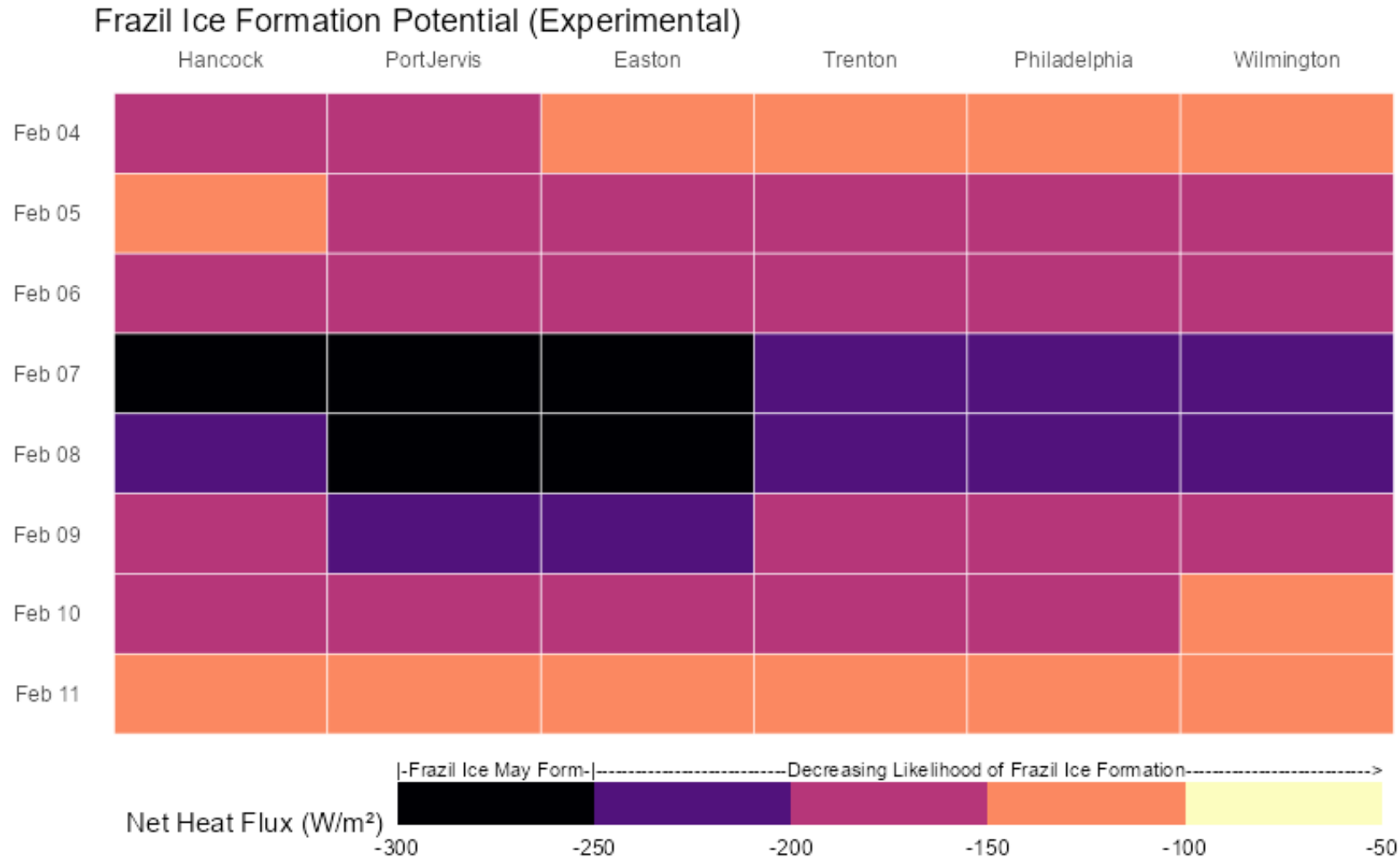
# Frazil ice formation condition:

Water temperature near freezing and net heat flux on the order of **-250 to -300 W/m<sup>2</sup>**



**Delaware River Basin Commission**  
DELAWARE • NEW JERSEY  
PENNSYLVANIA • NEW YORK  
UNITED STATES OF AMERICA

# Output from Prediction Tool on DRBC's Water Quality Portal





**Delaware River Basin Commission**

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UNITED STATES OF AMERICA

# Questions?

Contact: [Namsoo.Suk@drbc.gov](mailto:Namsoo.Suk@drbc.gov)

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Credit:

John Yagecic, Jake Bransky and Elaine Panuccio

DRBC web page: <https://www.nj.gov/drbc/>

Water Quality: <https://drbc.net/Sky/waterq.htm>

