Chesapeake Bay Restoration

CAST Urban Fertilizer Application Rates

Jeff Sweeney

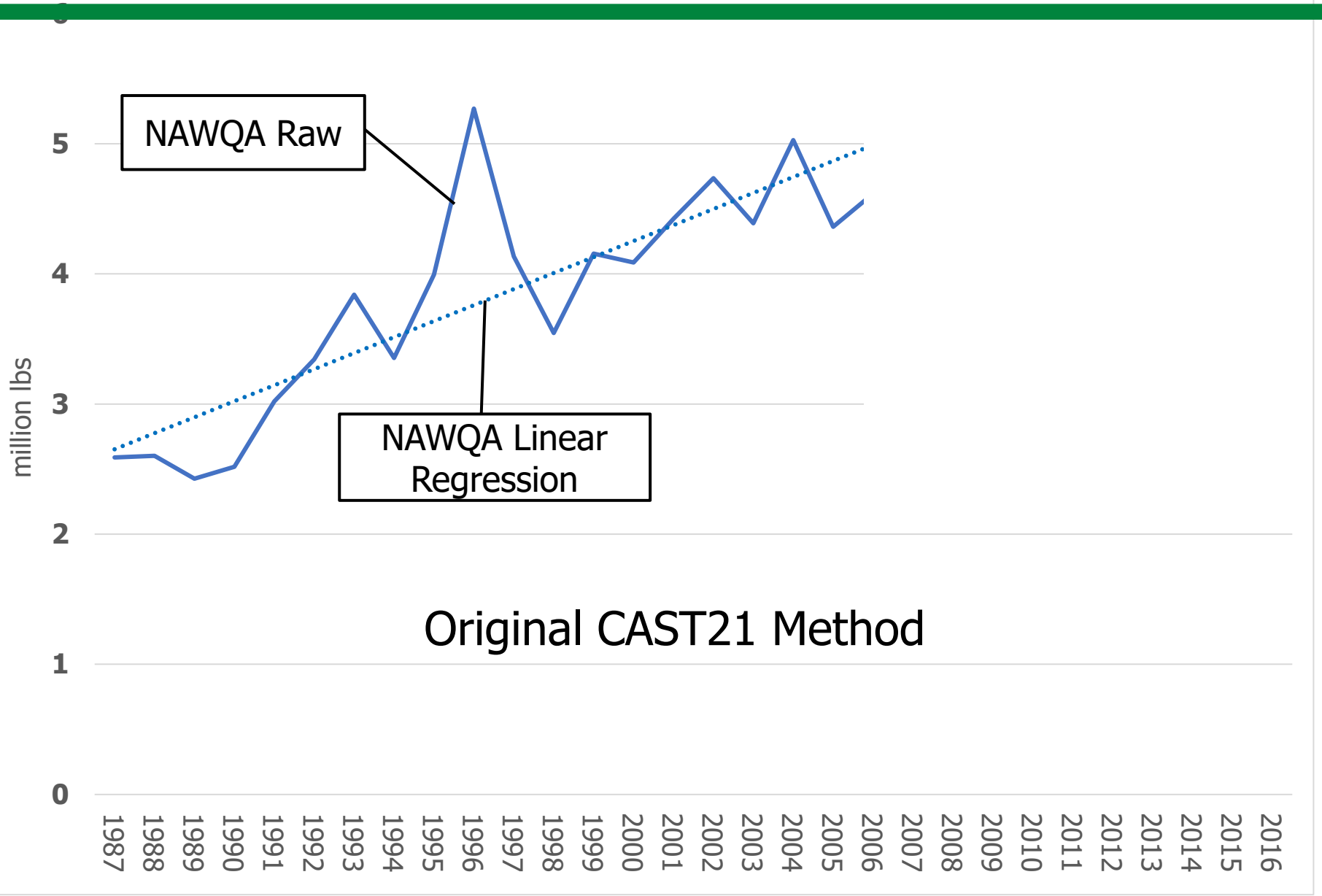
EPA, Chesapeake Bay Program Office

Urban Nutrient Management Task Force Meeting

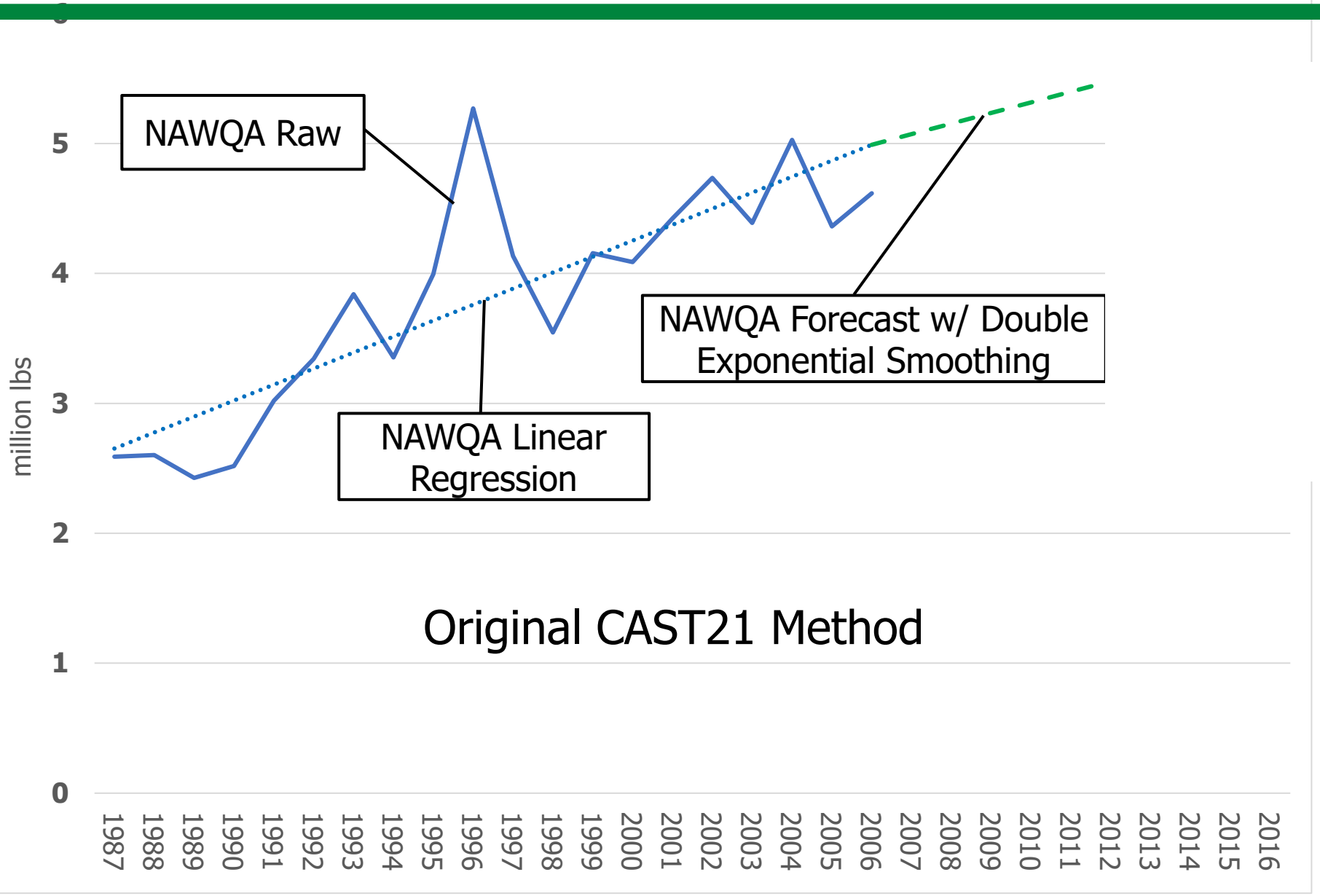
May 3, 2023

Original CAST21 Turfgrass Nutrient Applications

Virginia Phosphorus Applications (lbs)

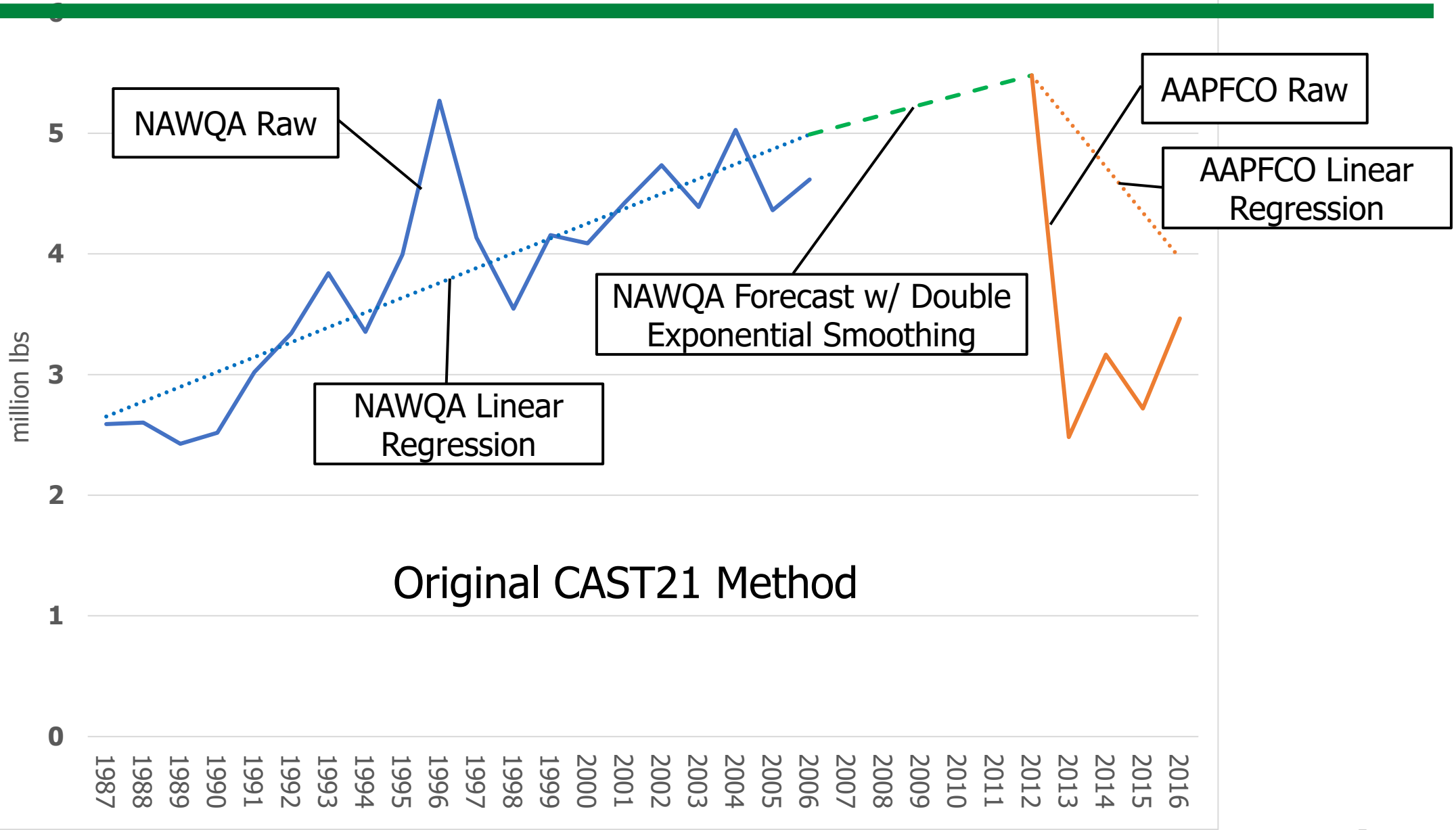


Virginia Phosphorus Applications (lbs)

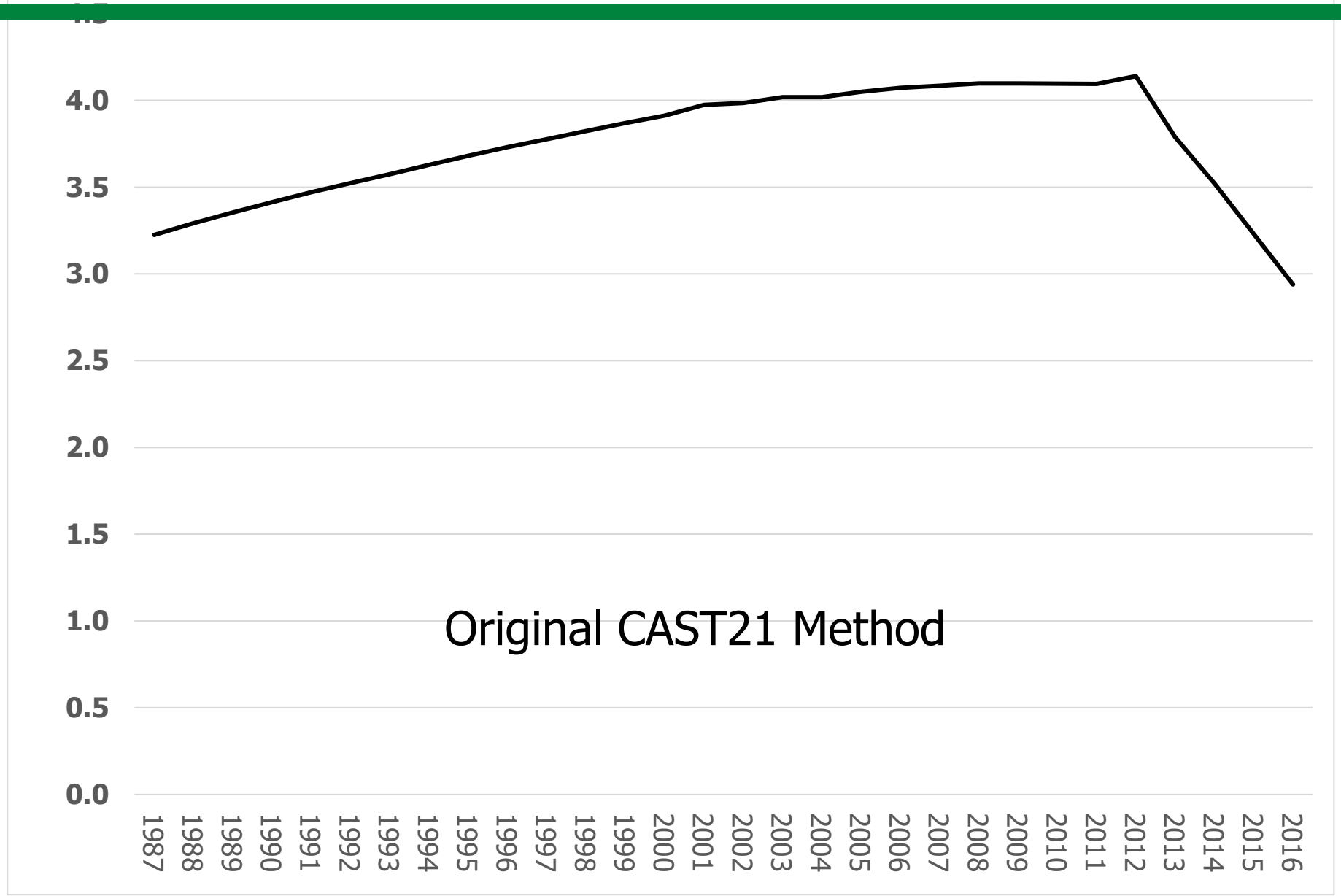


Original CAST21 Method

Virginia Phosphorus Applications (lbs)



Virginia Phosphorus Application Rates (lbs/acre)



Turfgrass Nutrient Application Rates

- AAPFCO non-farm fertilizer sales data by county reported to AAPFCO by each state from the late 1980's to 2016.
- Urban method uses mass of fertilizer nutrients for each state distributed to one "crop" type = turfgrass
- Additional credit for practices that make up nutrient management depending on high-risk, low-risk, blended

Turfgrass Nutrient Application Rates

- Two components to turfgrass application rates:
  1) Fertilizer mass data
  2) Turfgrass acres – For CAST21, high-resolution land cover w/ approved change-product from 2013 to 2017
- Non-farm fertilizer mass ÷ turfgrass acres = turfgrass application rate (lbs. per acre)

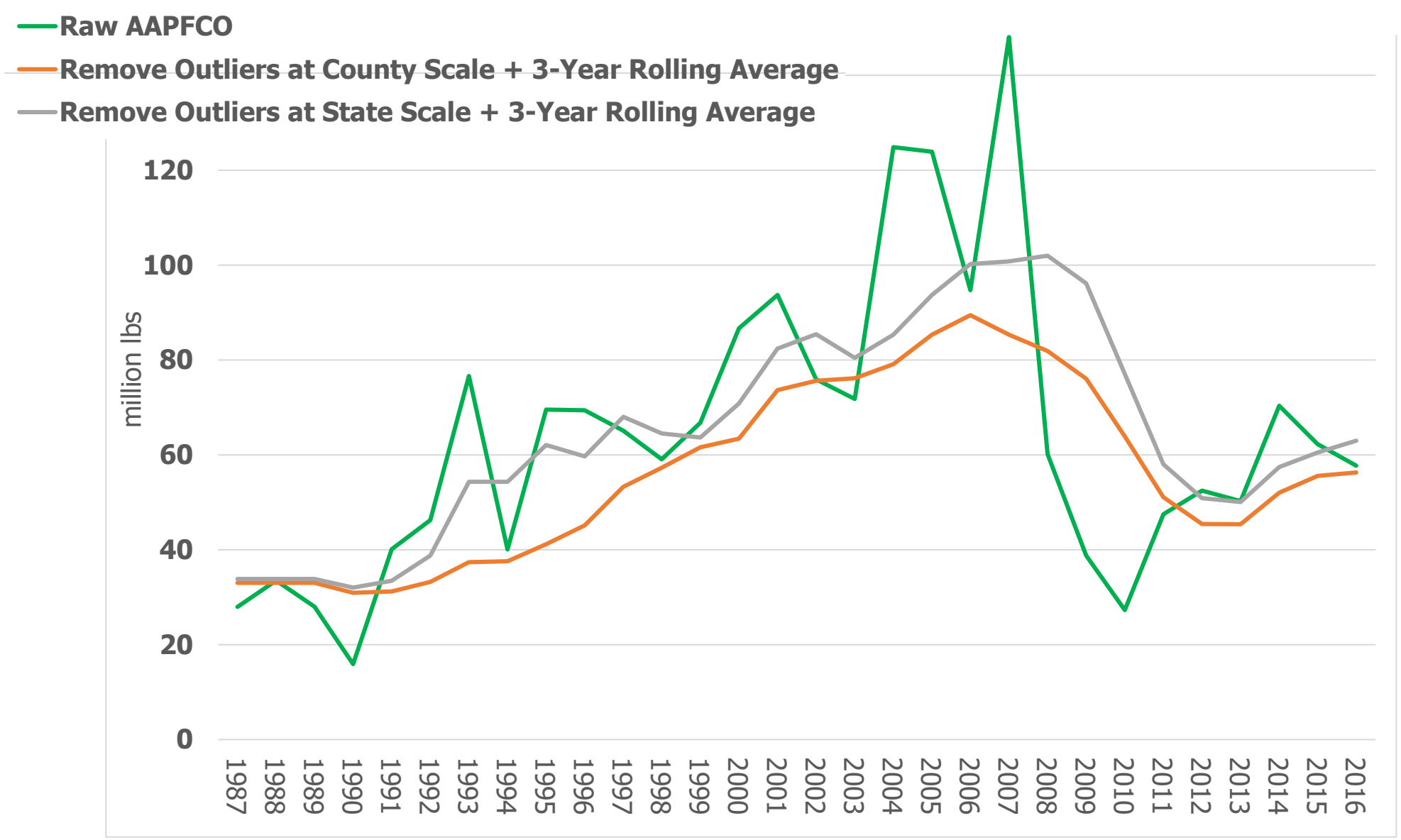
TURFGRASS NITROGEN APPLICATIONS

Turfgrass Nutrient Application Rates

1) Current Method
   - Approved by USWG on 6/21/16, including varying applications by jurisdiction and through time.
   - Linear regression through 2012-2016 data points.

- Proposed Methods
  2) Use all AAPFCO data through the history.
  3) Remove Outliers and 3-Year Rolling Average at the State Scale.
  4) Remove Outliers and 3-Year Rolling Average at the County Scale.

Chesapeake Bay Watershed Nitrogen Applications (lbs)



Turfgrass Nutrient Application Rates

Proposed Method

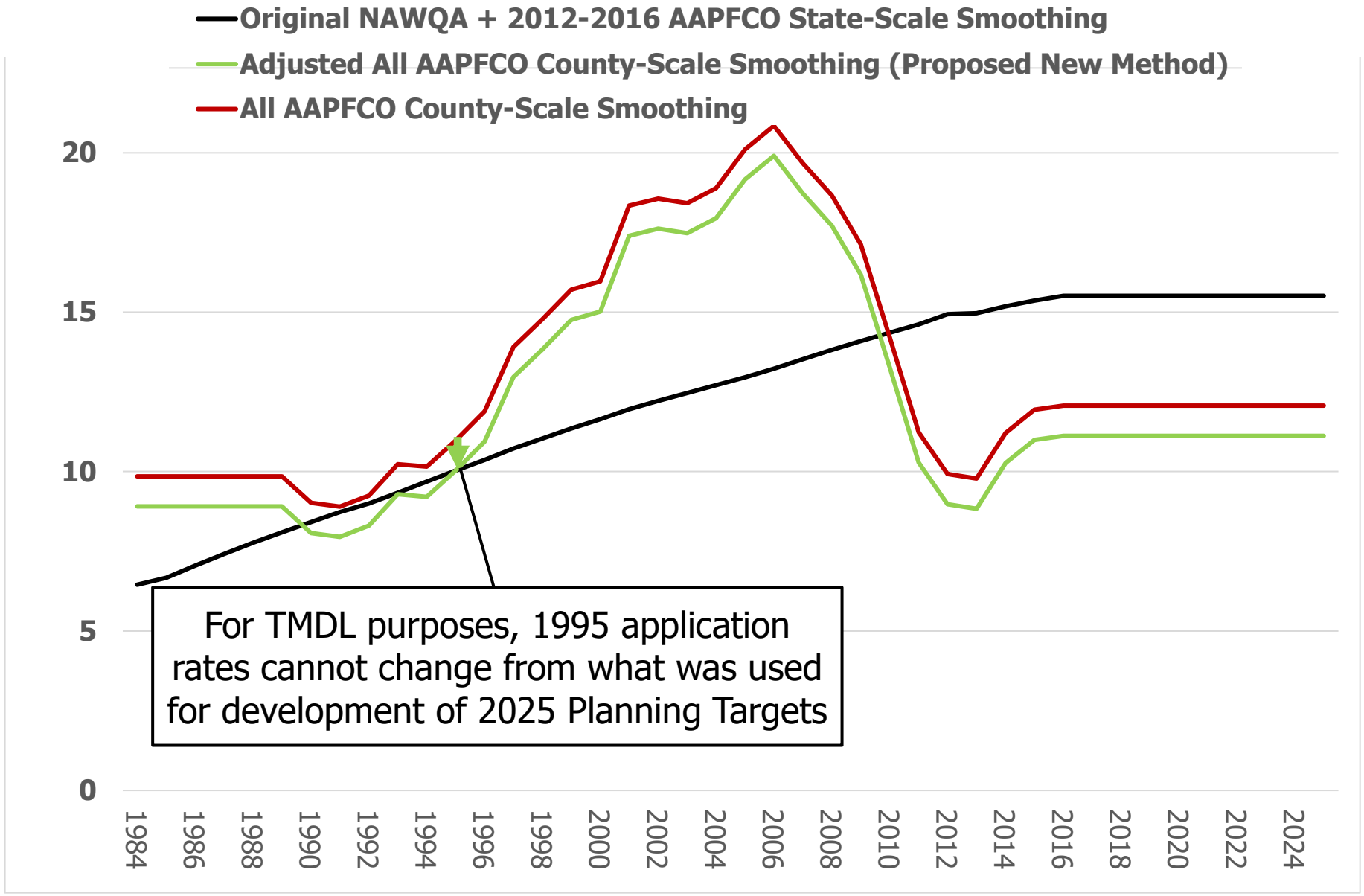
- Reduce the variability through time of county-scale fertilizer nutrient sales data:
  1) Remove fertilizer mass outliers at the county scale – replace data that fall outside of two standard deviations from the median for the county over all years for which data were recorded.
     - Outliers are replaced by taking the average of the two years of available sales data closest in time to the outlier year – or interpolation if more than one outlier in a row
  2) Calculate a three-year rolling average of the product of #1.

Turfgrass Nutrient Application Rates

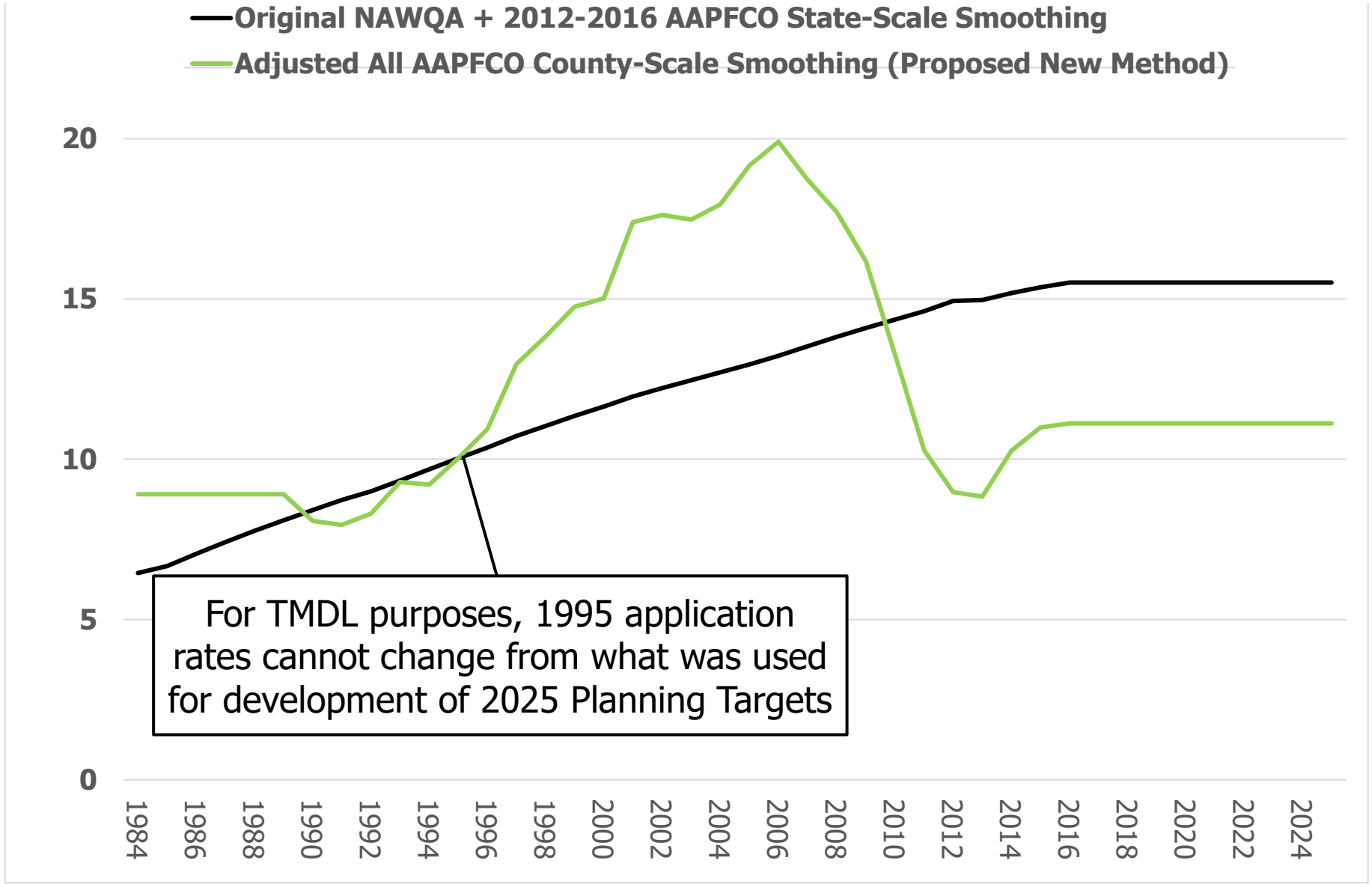
Proposed Method (continued)

- Sum county-level data to the state scale.
- Divide the smoothed mass by the turfgrass acres for each year to determine the application rate (lbs/acre).
- Shift the time series of application rates so that 1995 application rates are equal.
  - This is necessary to maintain the original model estimate of the level-of-effort needed to meet water qualtiy standards – dissolved oxygen in the mainstem of the CB which is measured over the 1993-1995 period.

Chesapeake Bay Watershed Nitrogen Applications (lbs/acre)

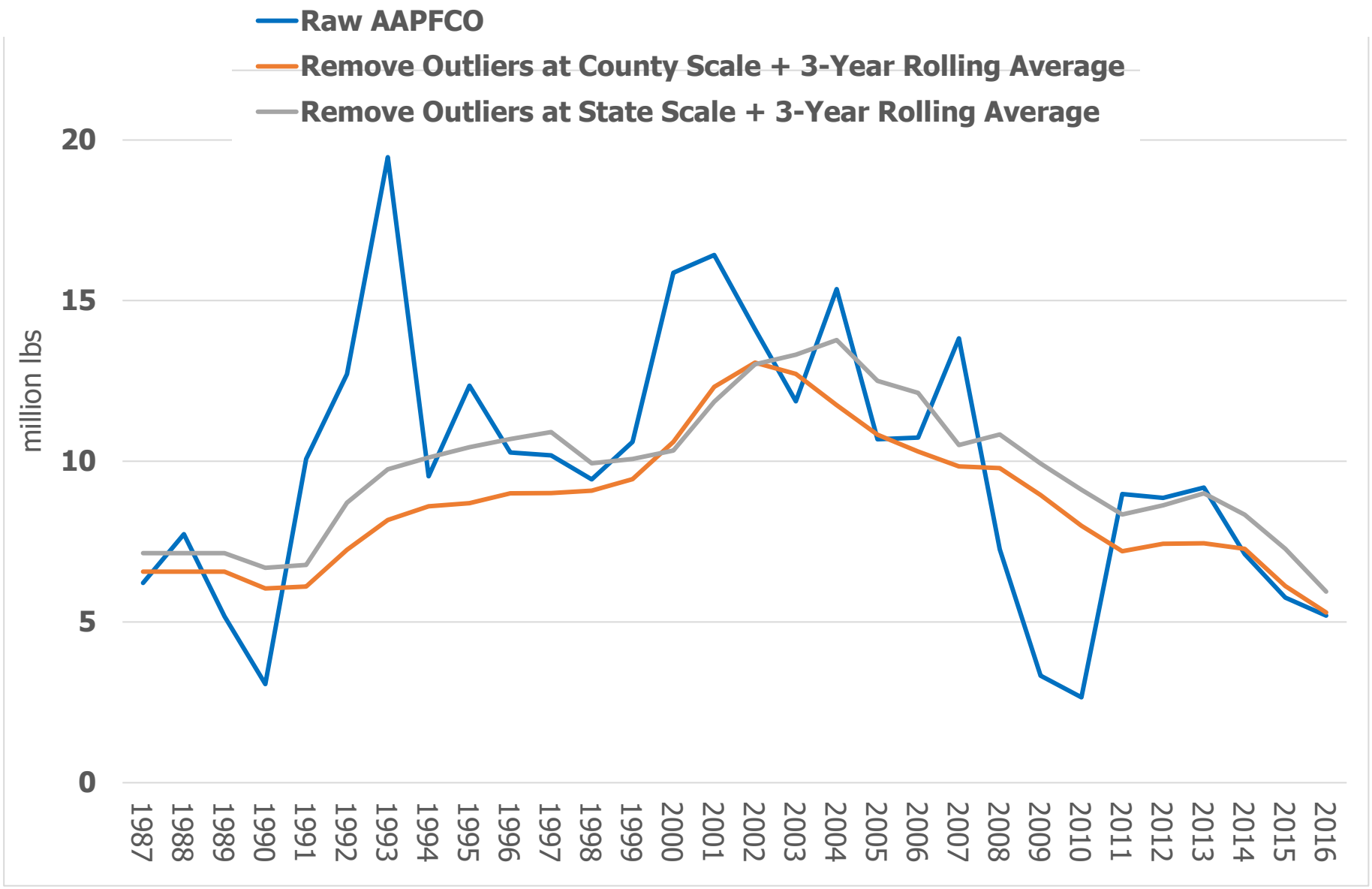


Chesapeake Bay Watershed Nitrogen Application Rates (lbs/acre)

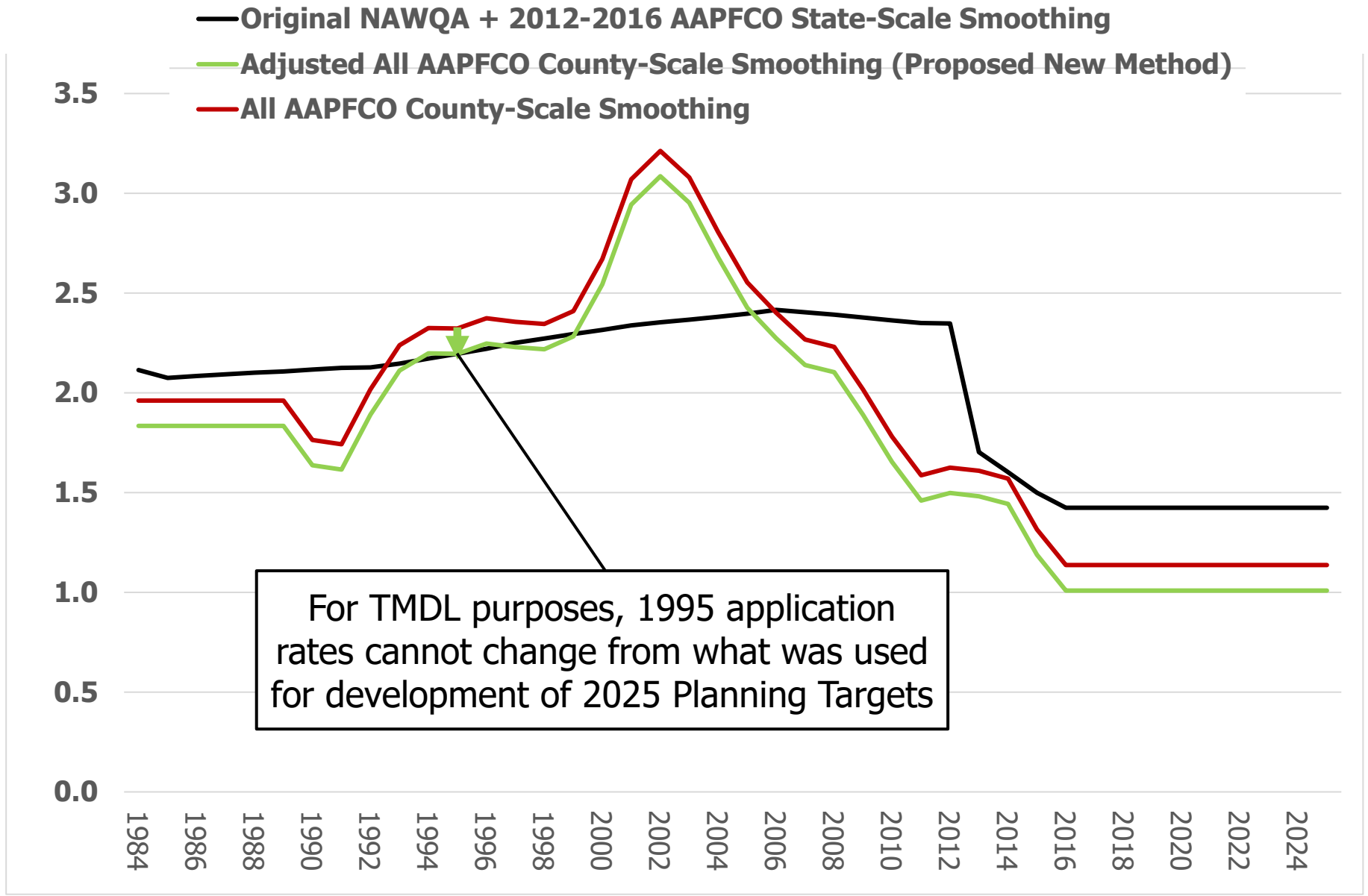


TURFGRASS PHOSPHORUS APPLICATIONS

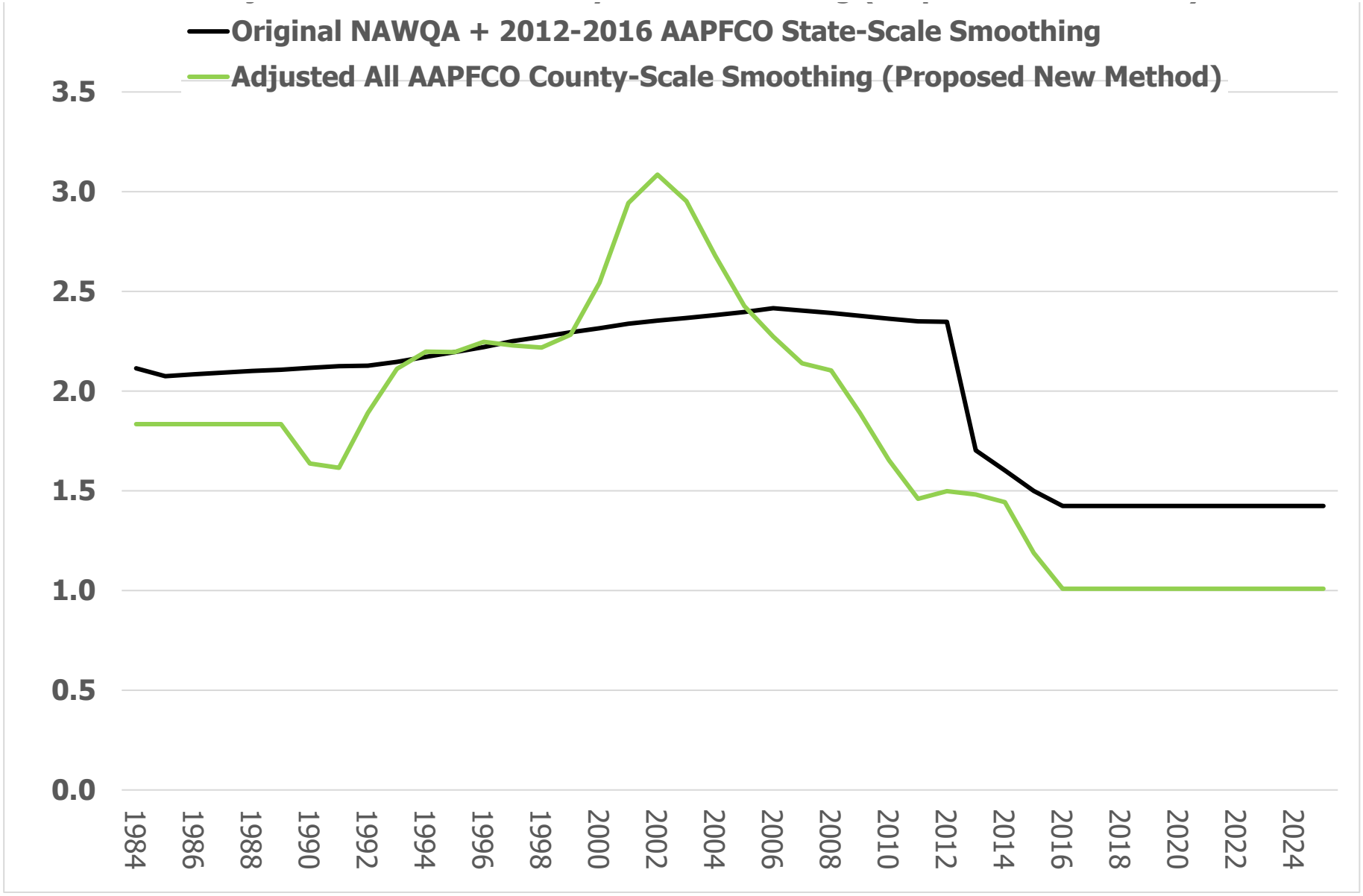
Chesapeake Bay Watershed Phosphorus Applications (lbs)



Chesapeake Bay Watershed Phosphorus Application Rates (lbs/acre)



Chesapeake Bay Watershed Phosphorus Application Rates (lbs/acre)



Discussion and Questions

TURFGRASS NITROGEN APPLICATIONS (lbs)

Post-2016 Data

Turfgrass Nutrient Application Rates

- How should we build in post-2016 fertilizer data from four states?
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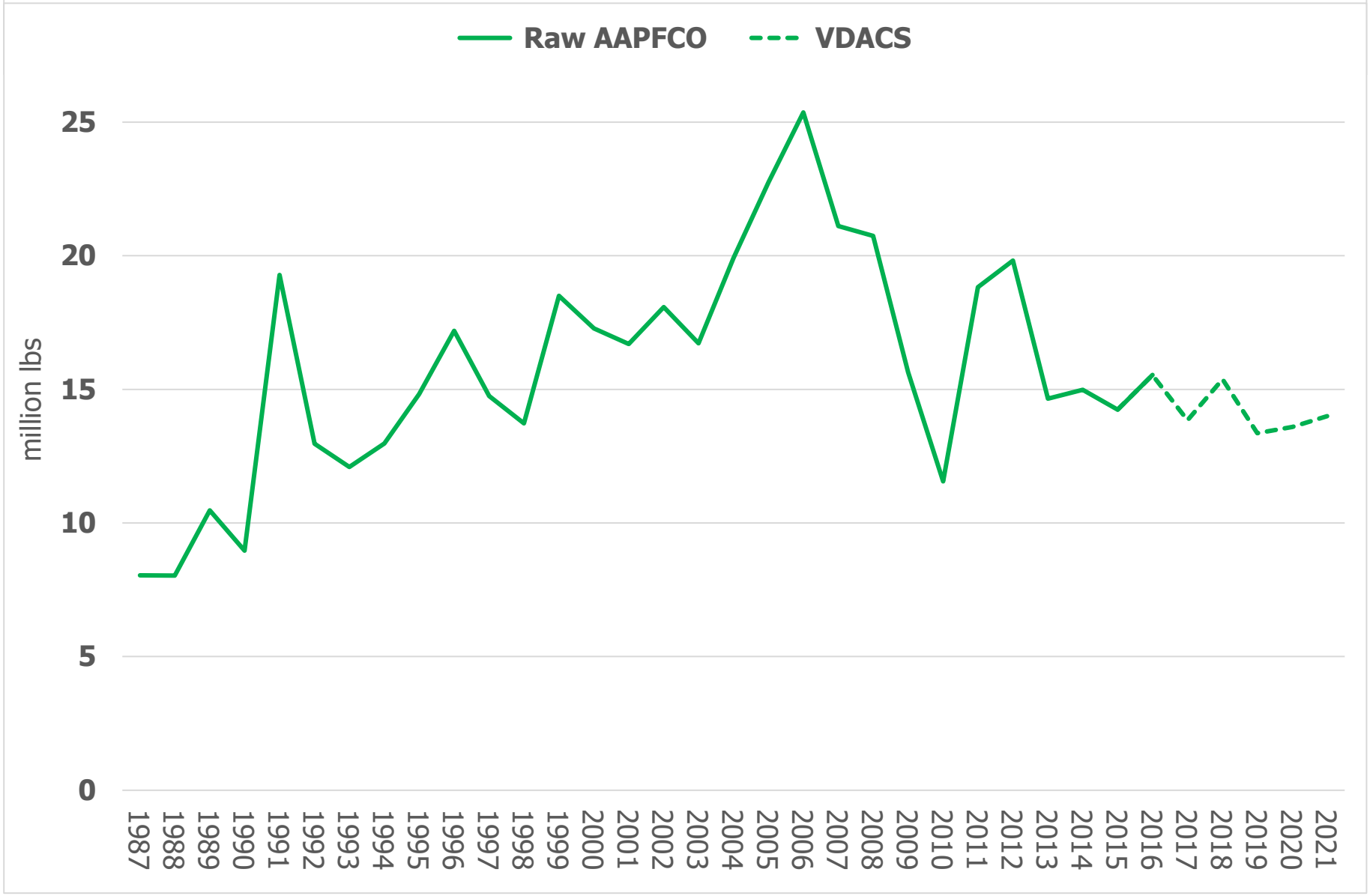
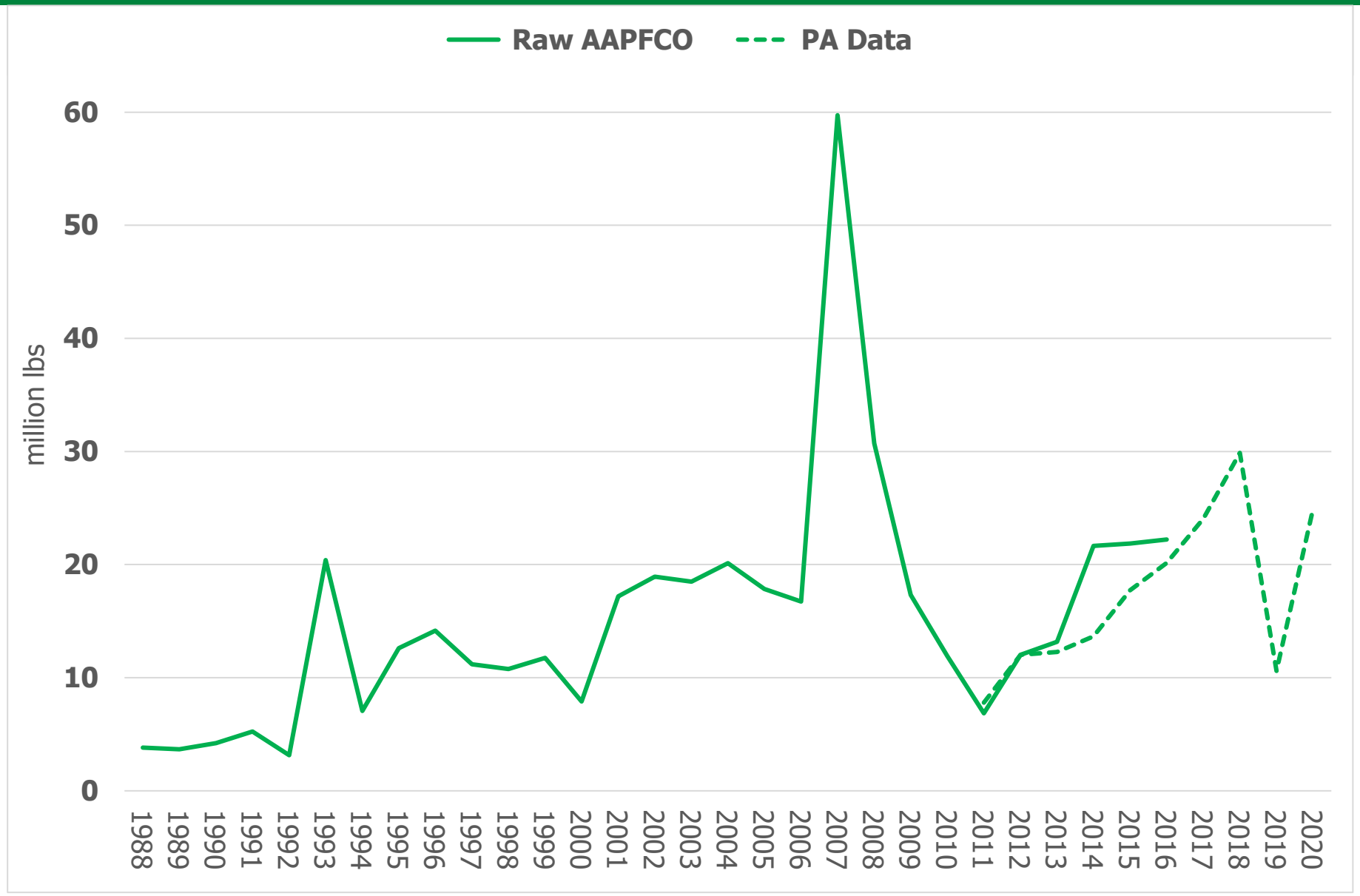
  - Pennsylvania = 2011–2020
  - Delaware = 2000–2021
  - Maryland = 2011-2020

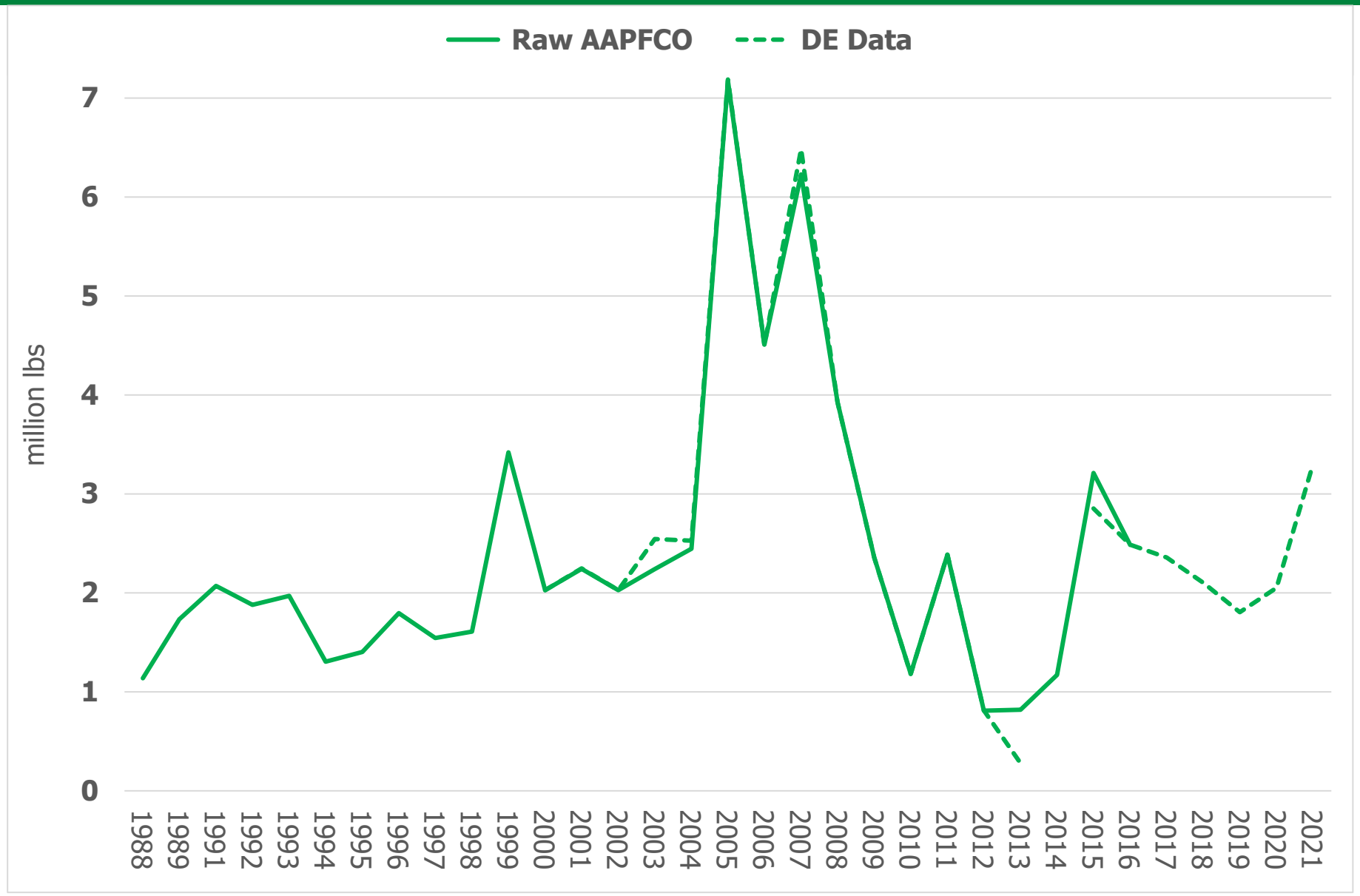
Virginia Nitrogen Applications (lbs)



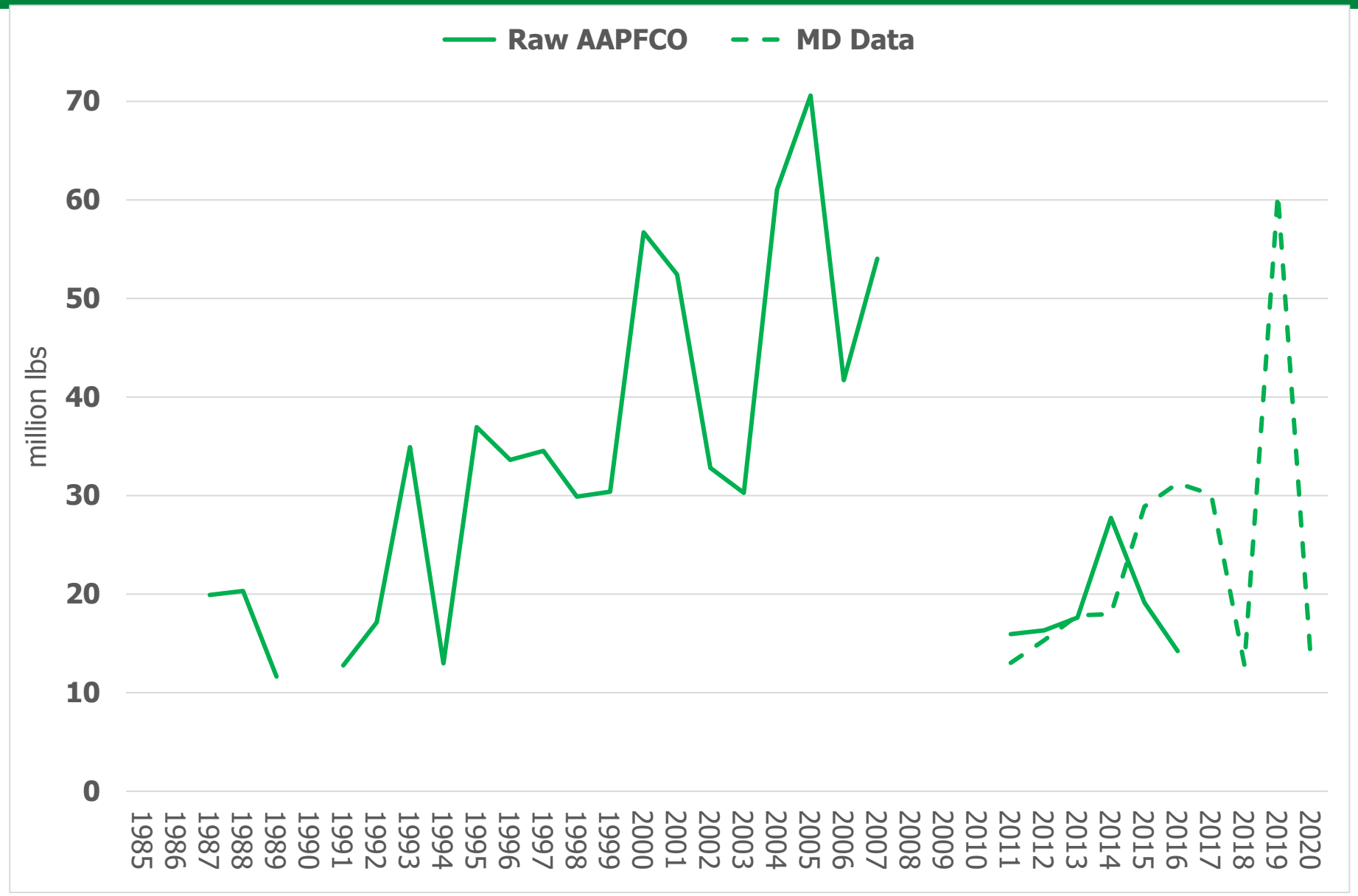
Pennsylvania Nitrogen Applications (lbs)



Delaware Nitrogen Applications (lbs)



Maryland Nitrogen Applications (lbs)



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TURFGRASS PHOSPHORUS APPLICATIONS

(lbs)

Post-2016 Data

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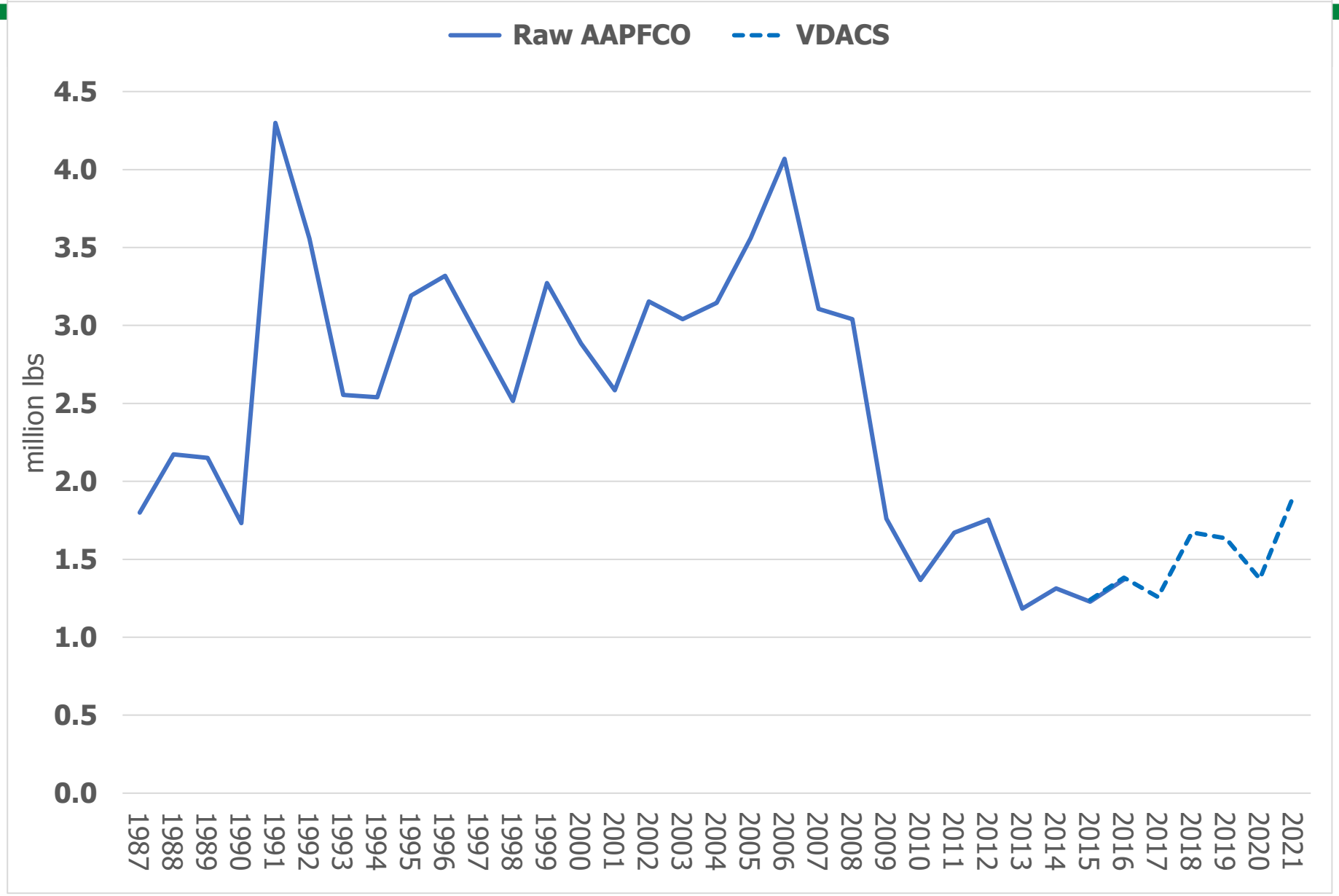

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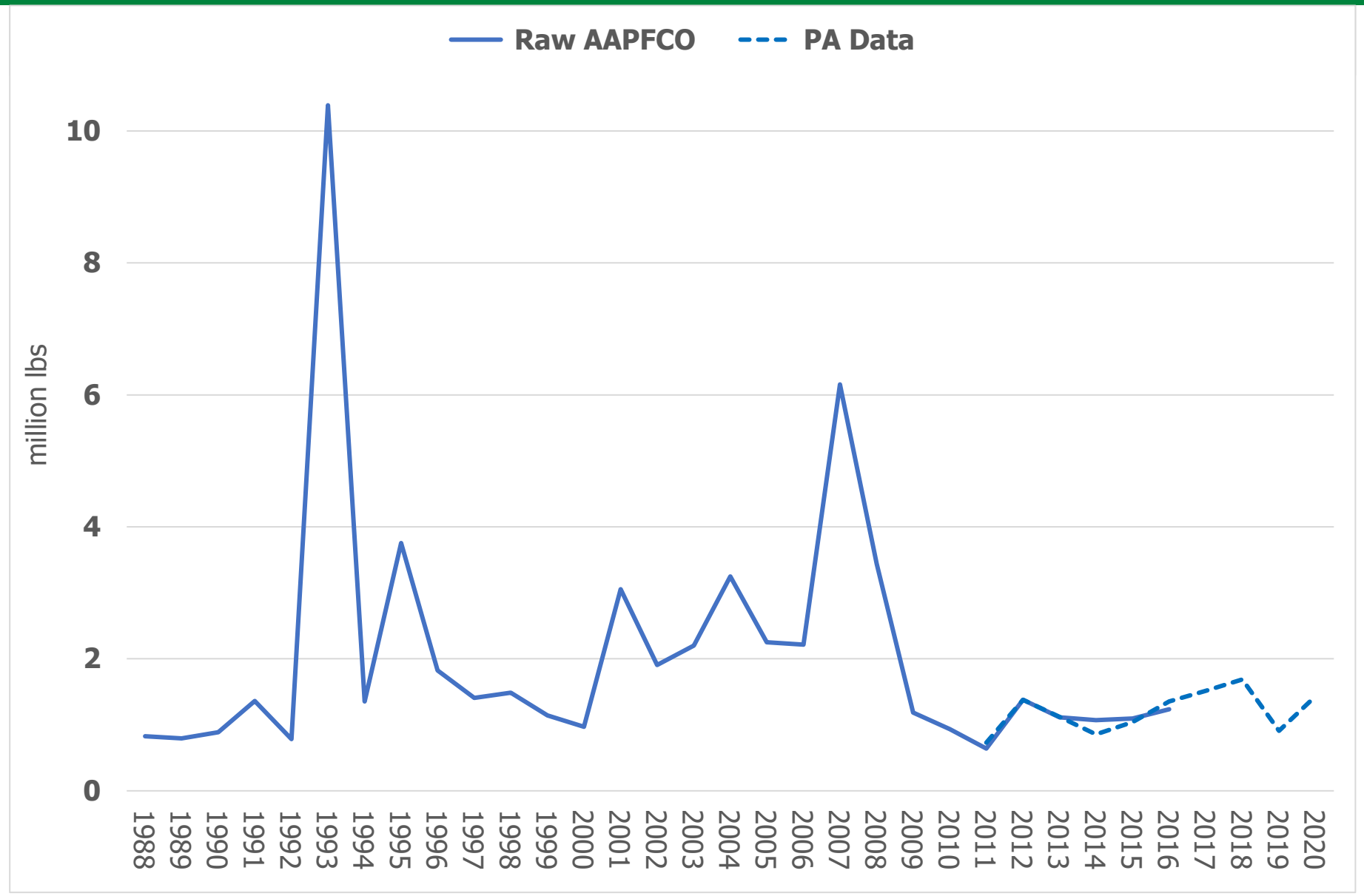

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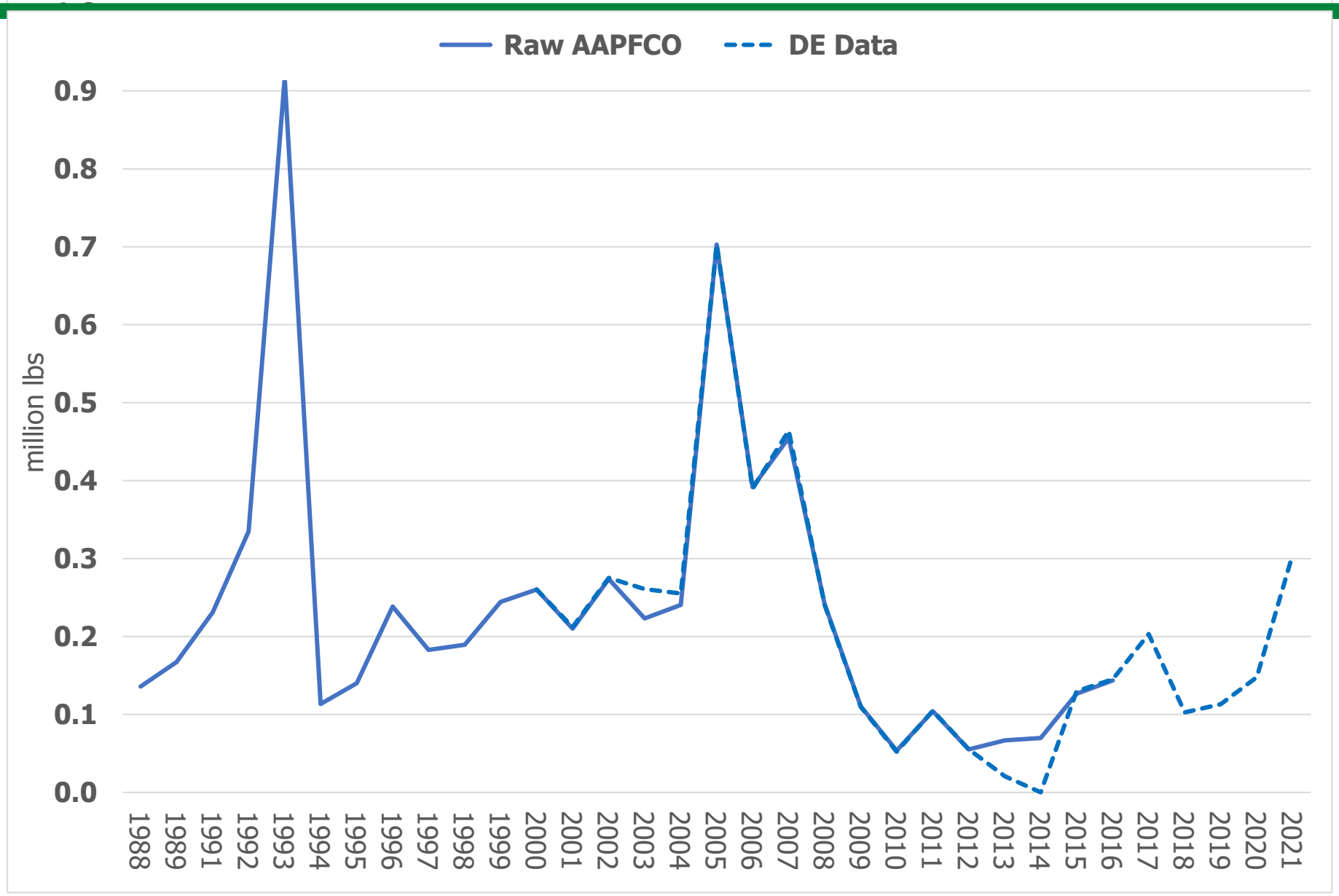

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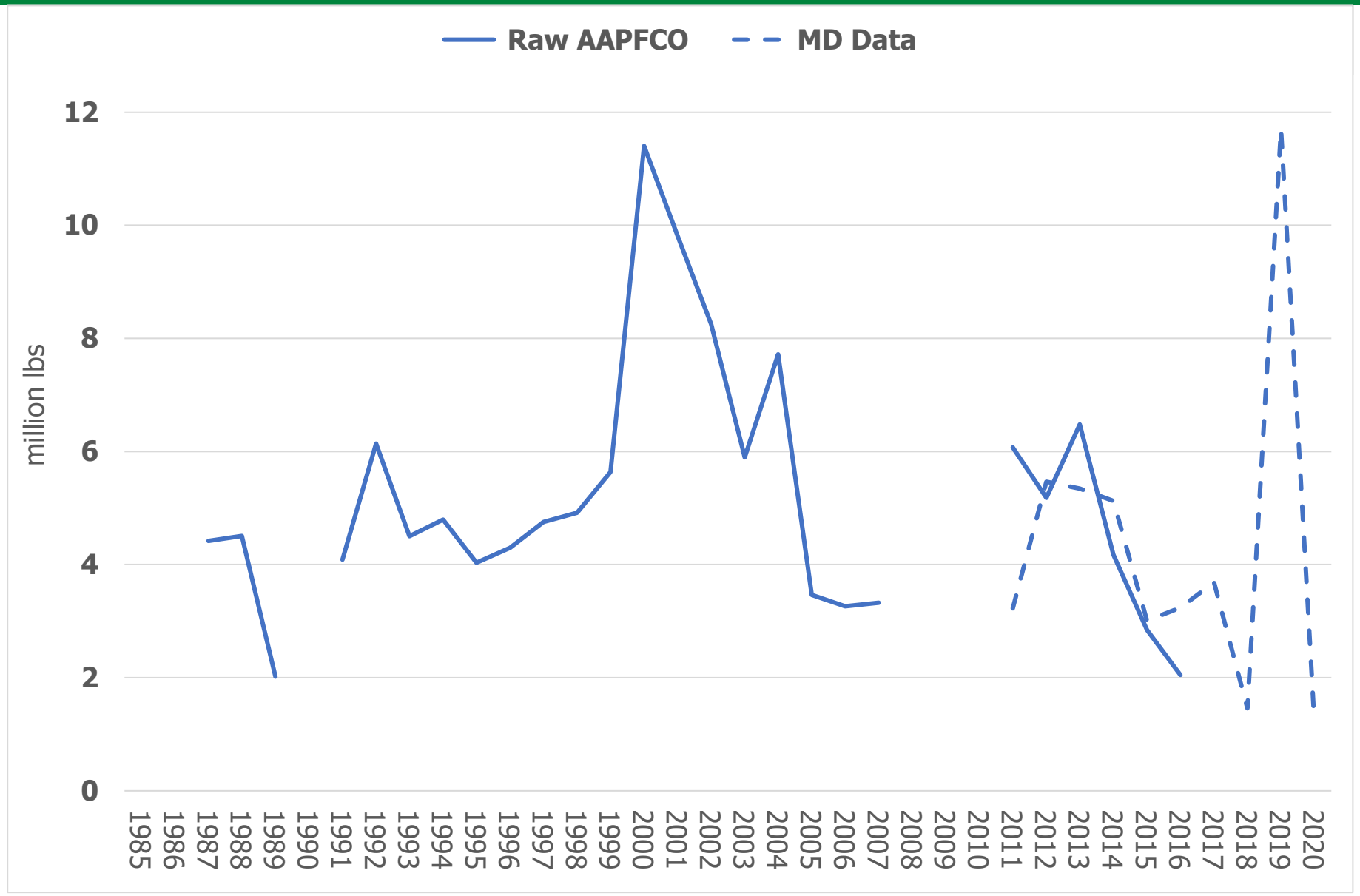

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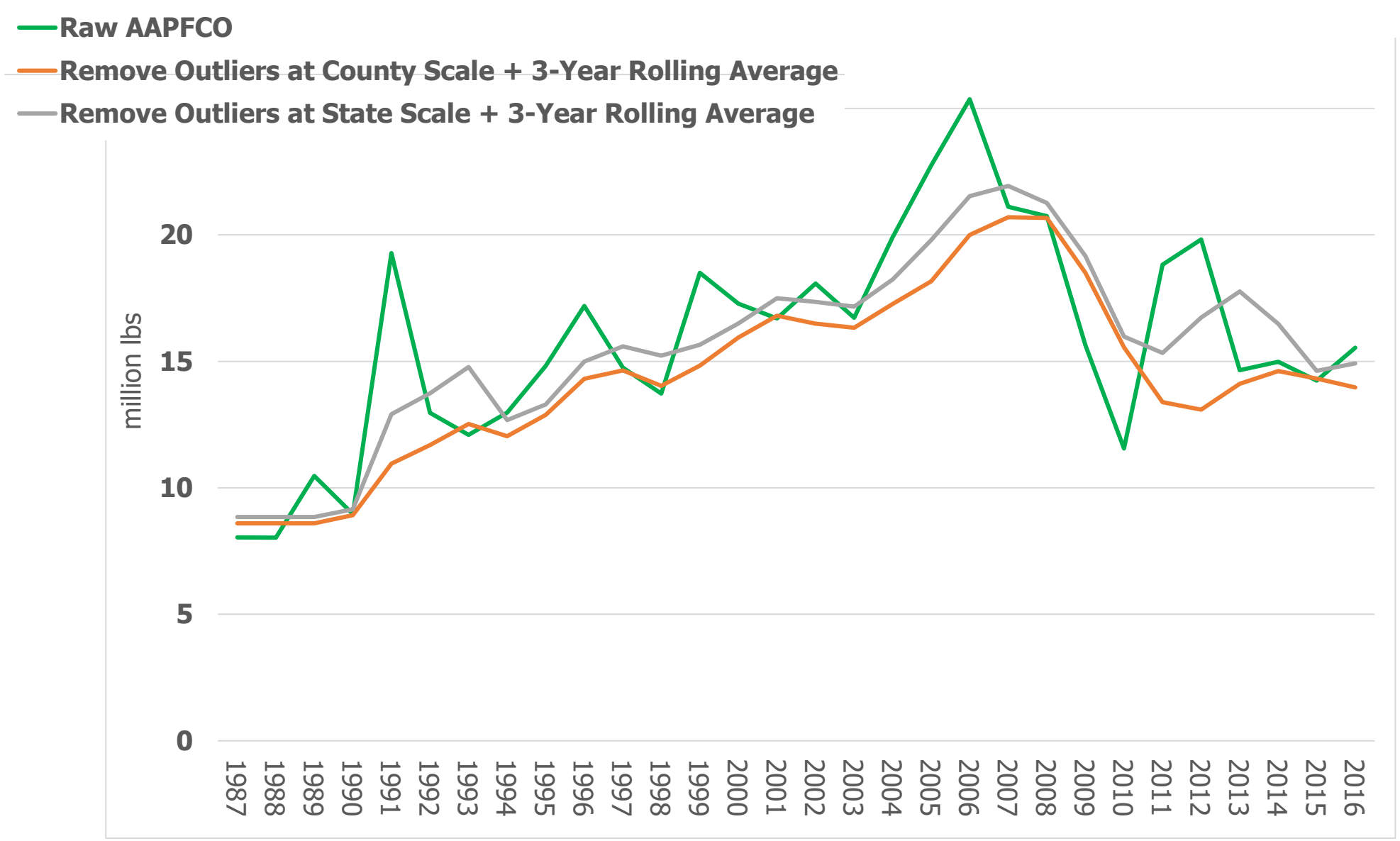
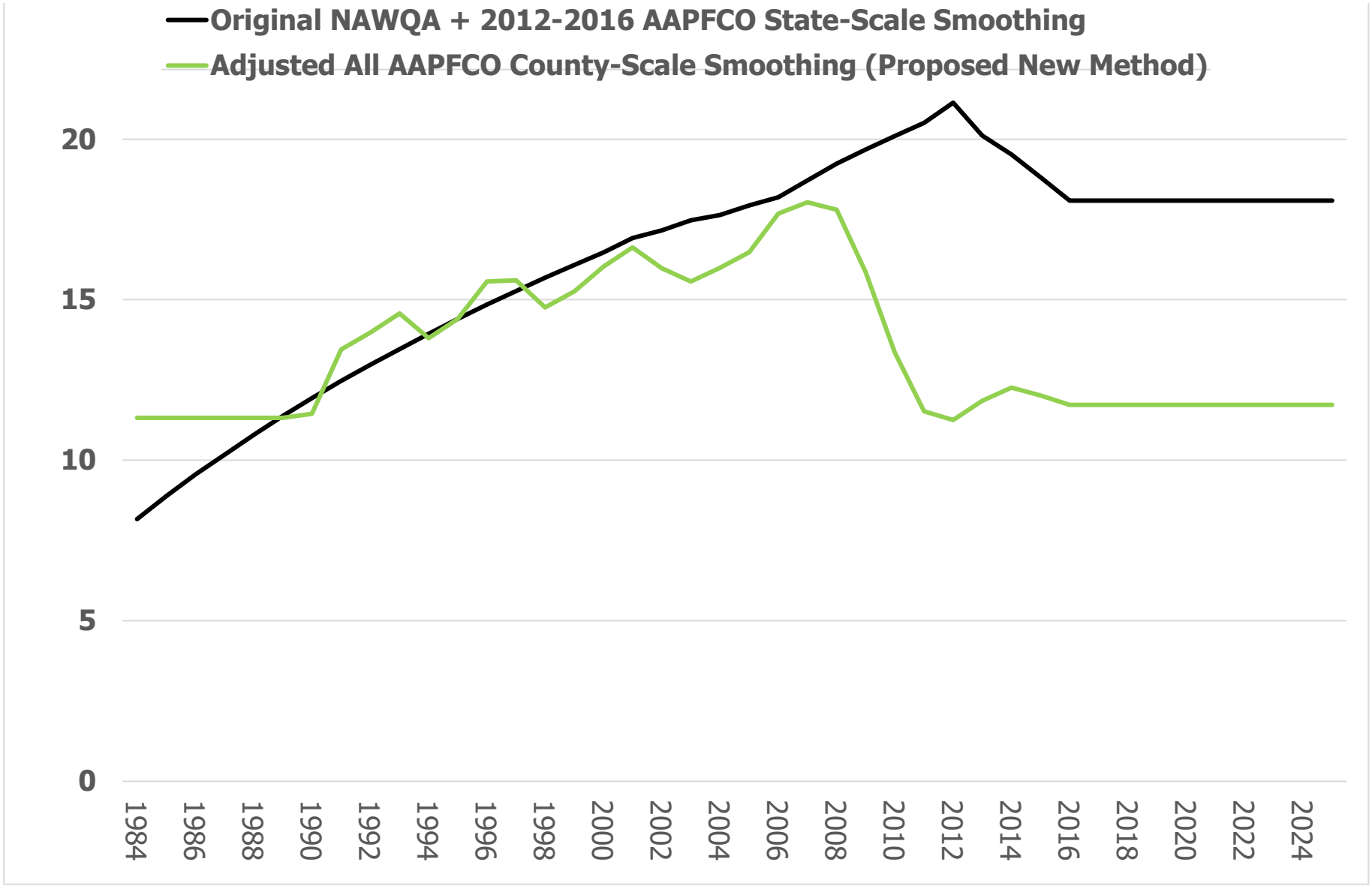


Virginia Nitrogen Application Rates (lbs/acre)



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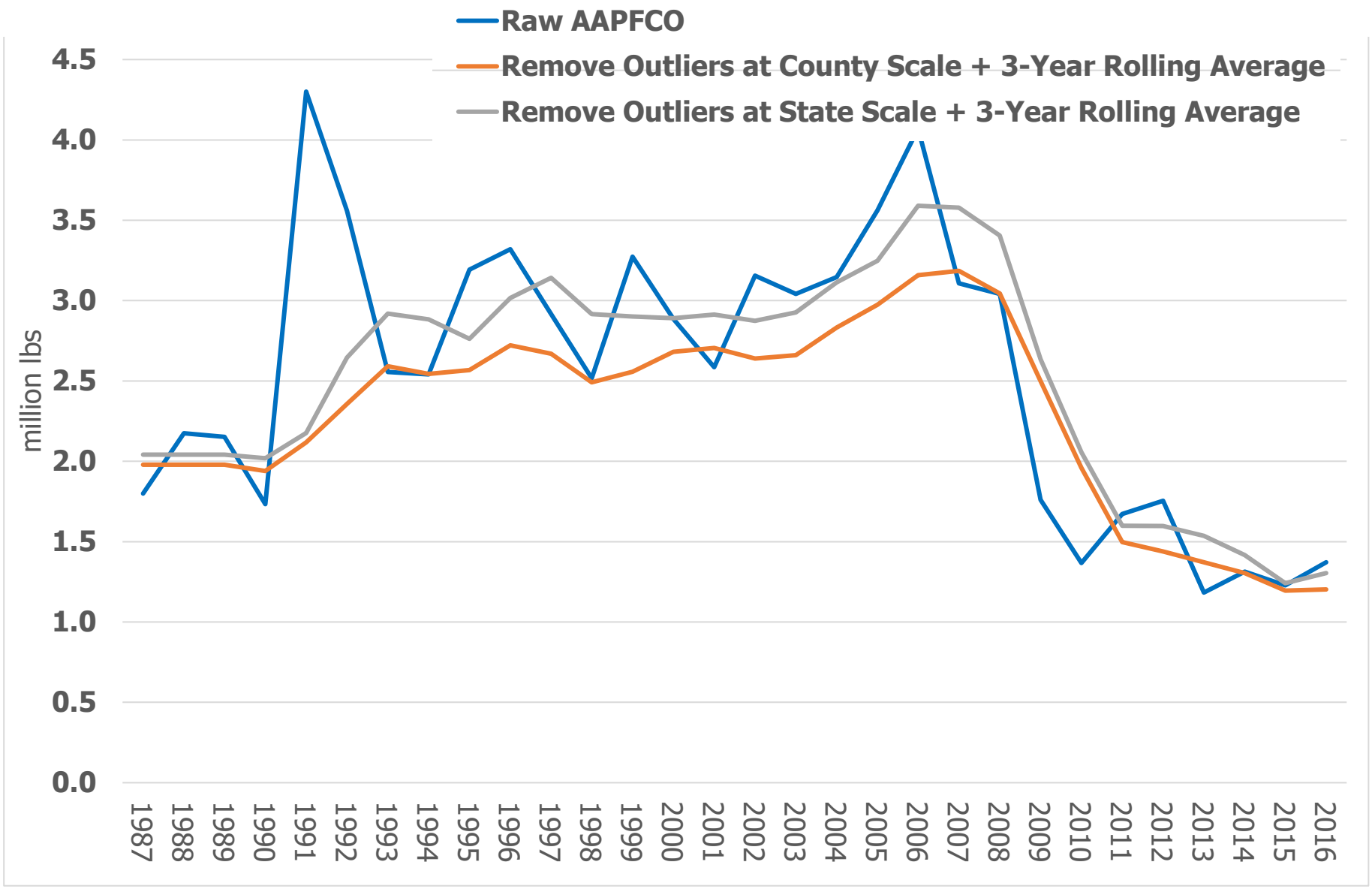

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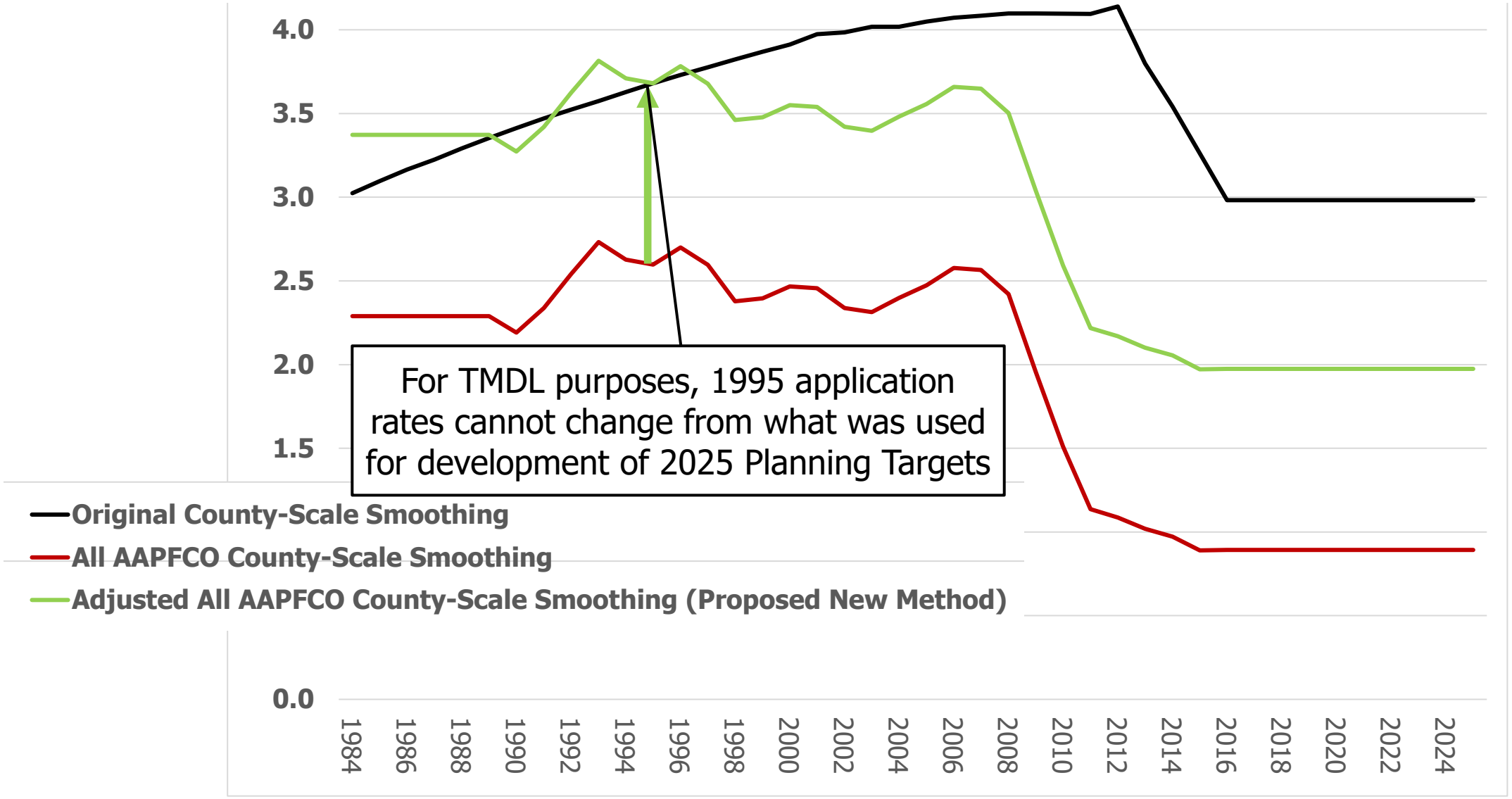

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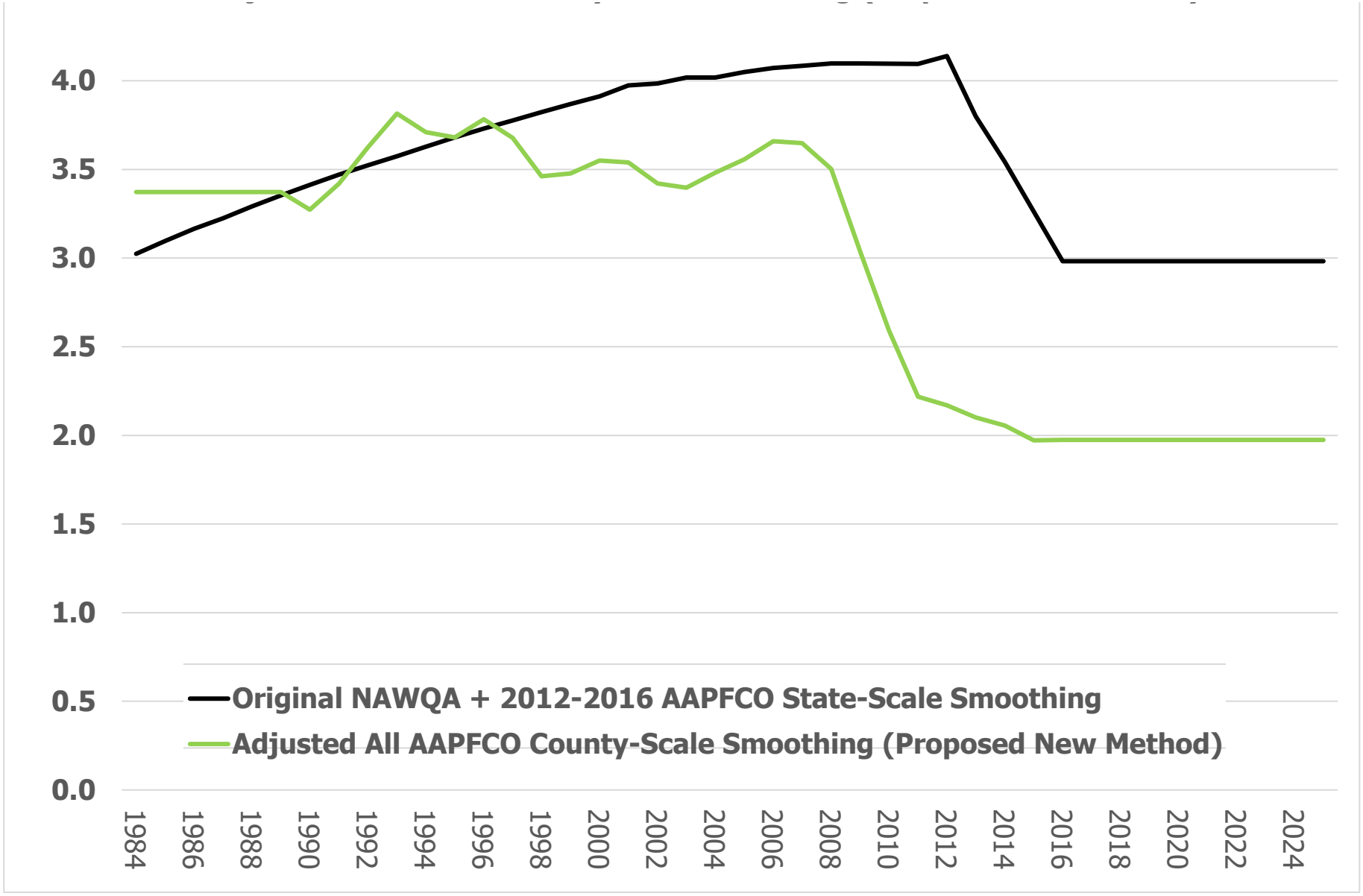

PENNSYLVANIA

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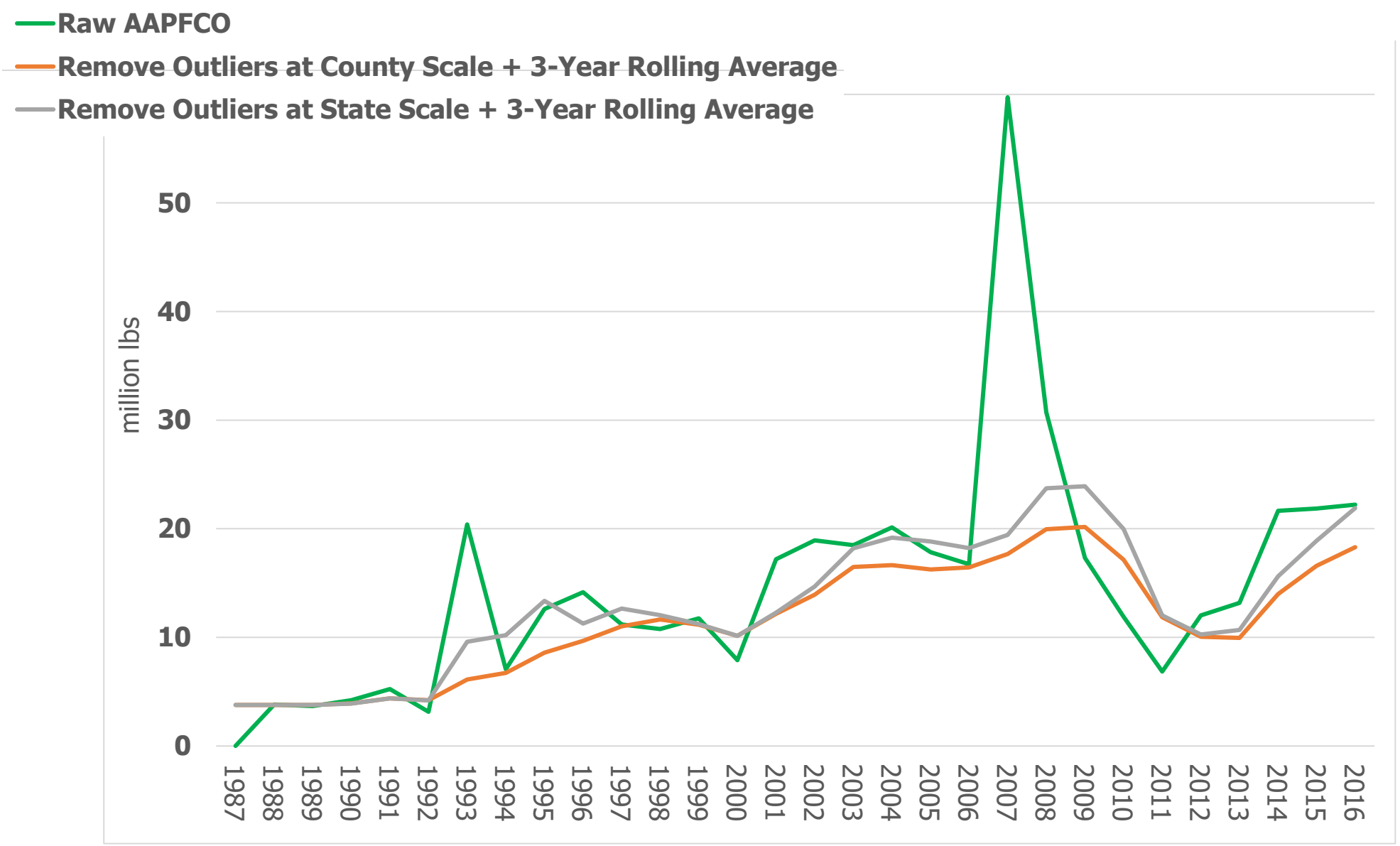

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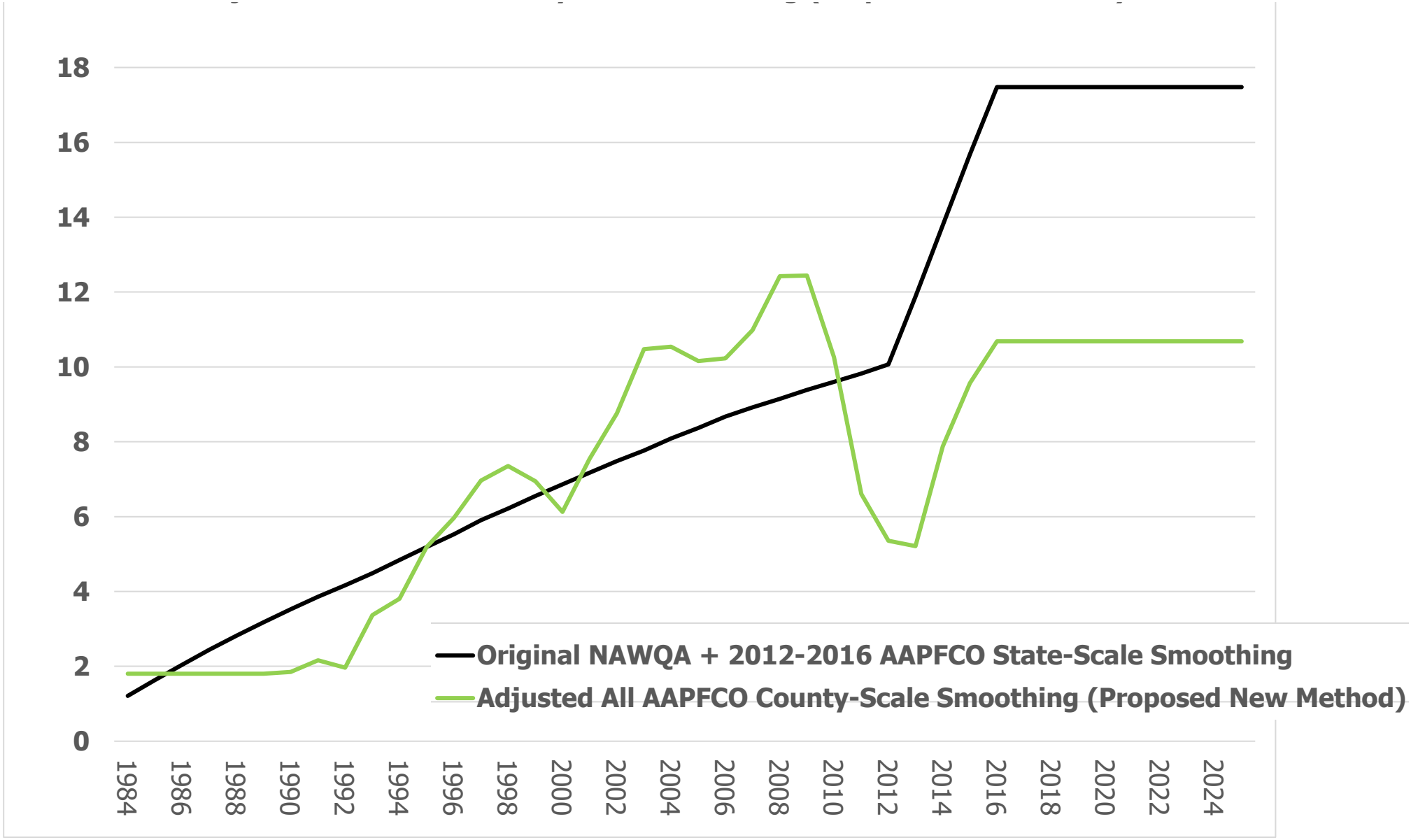

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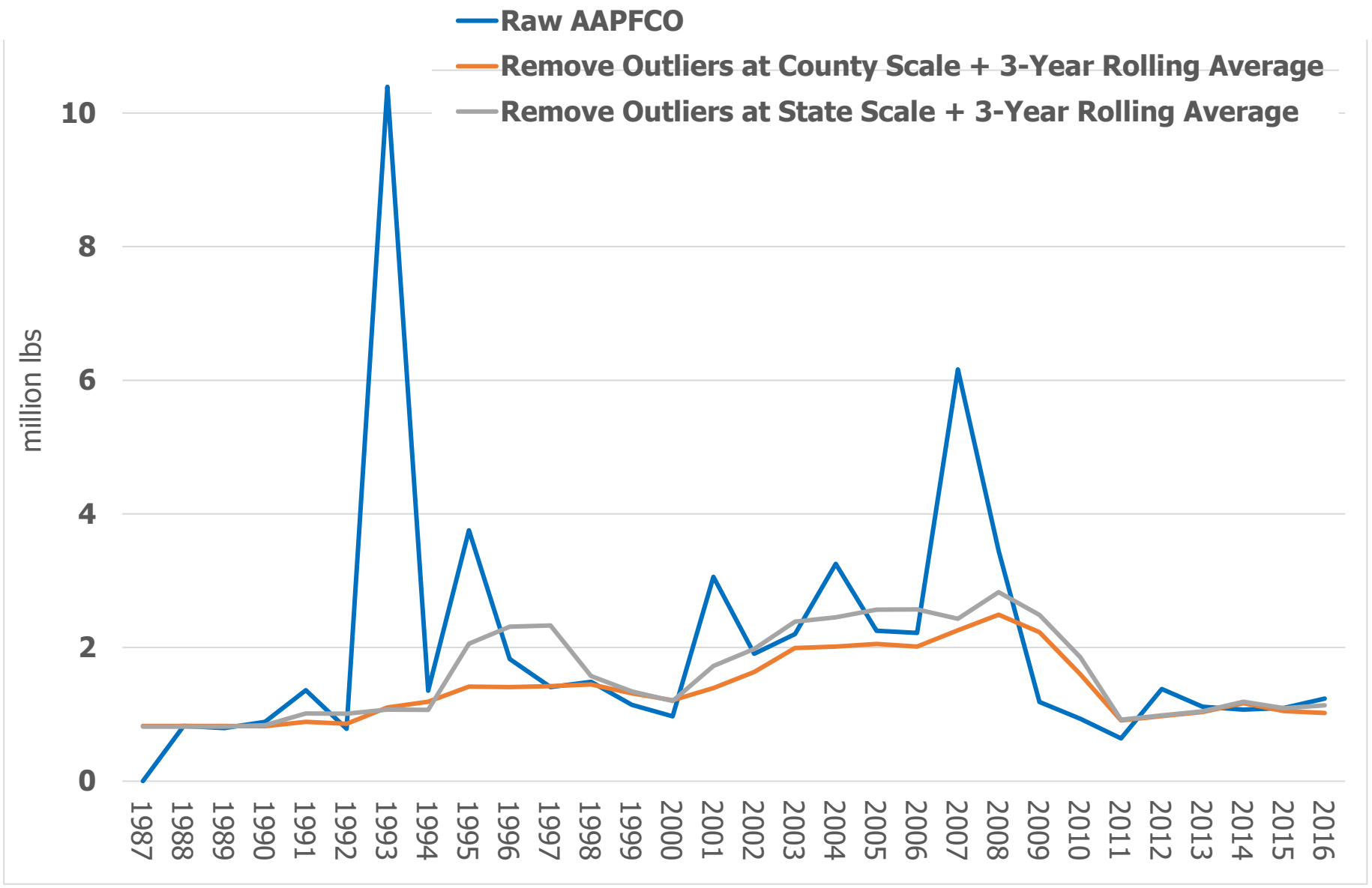

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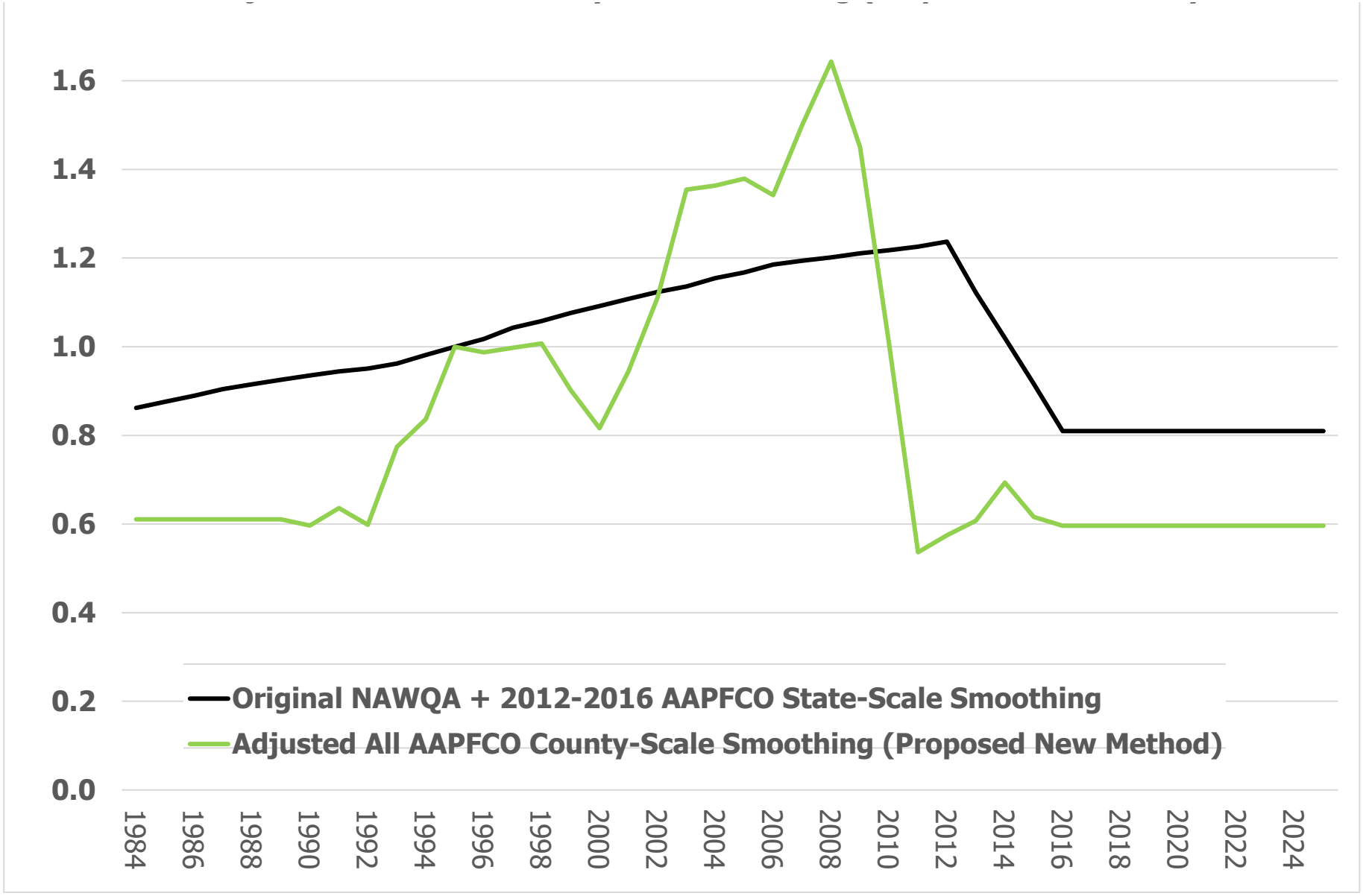

MARYLAND

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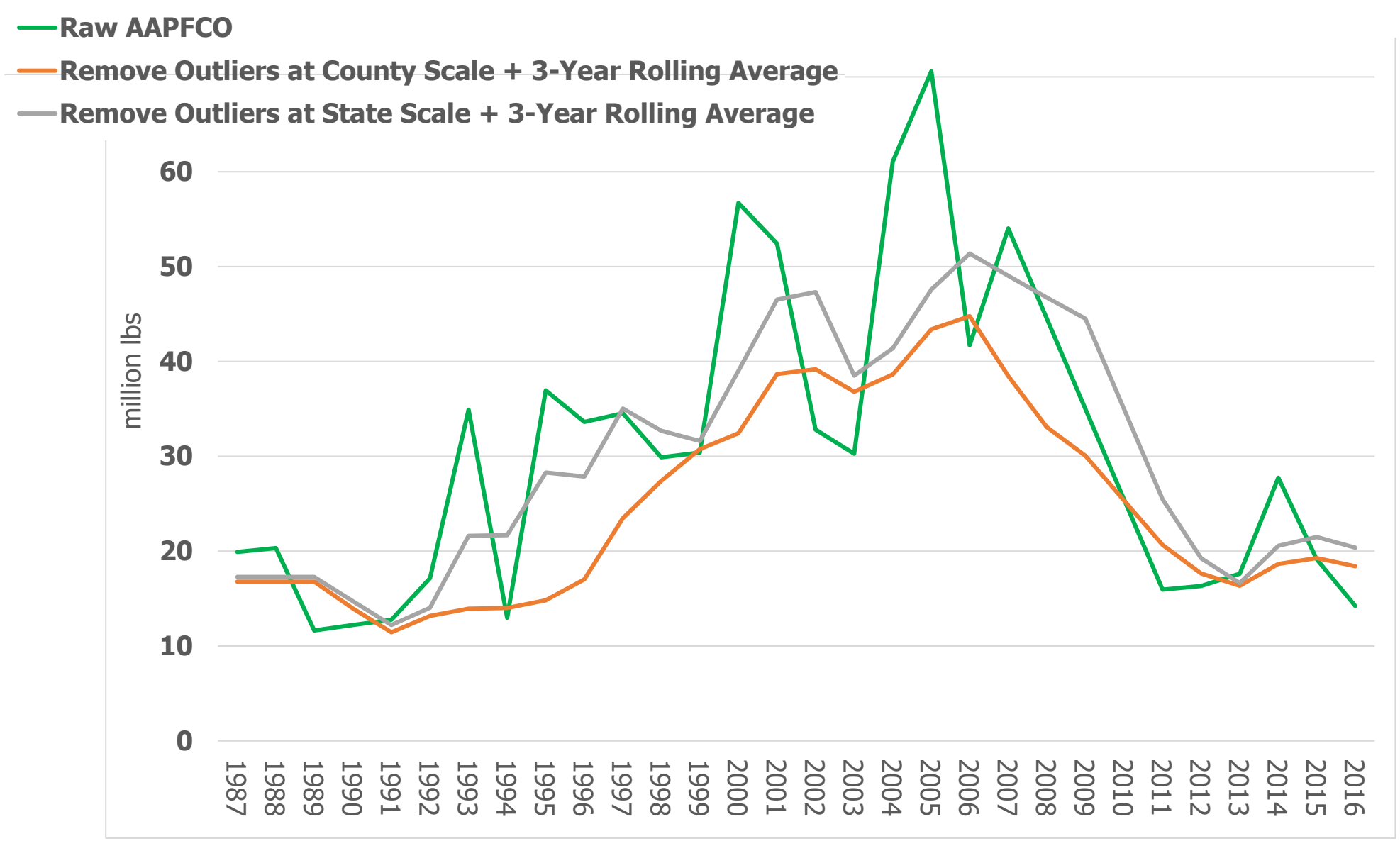

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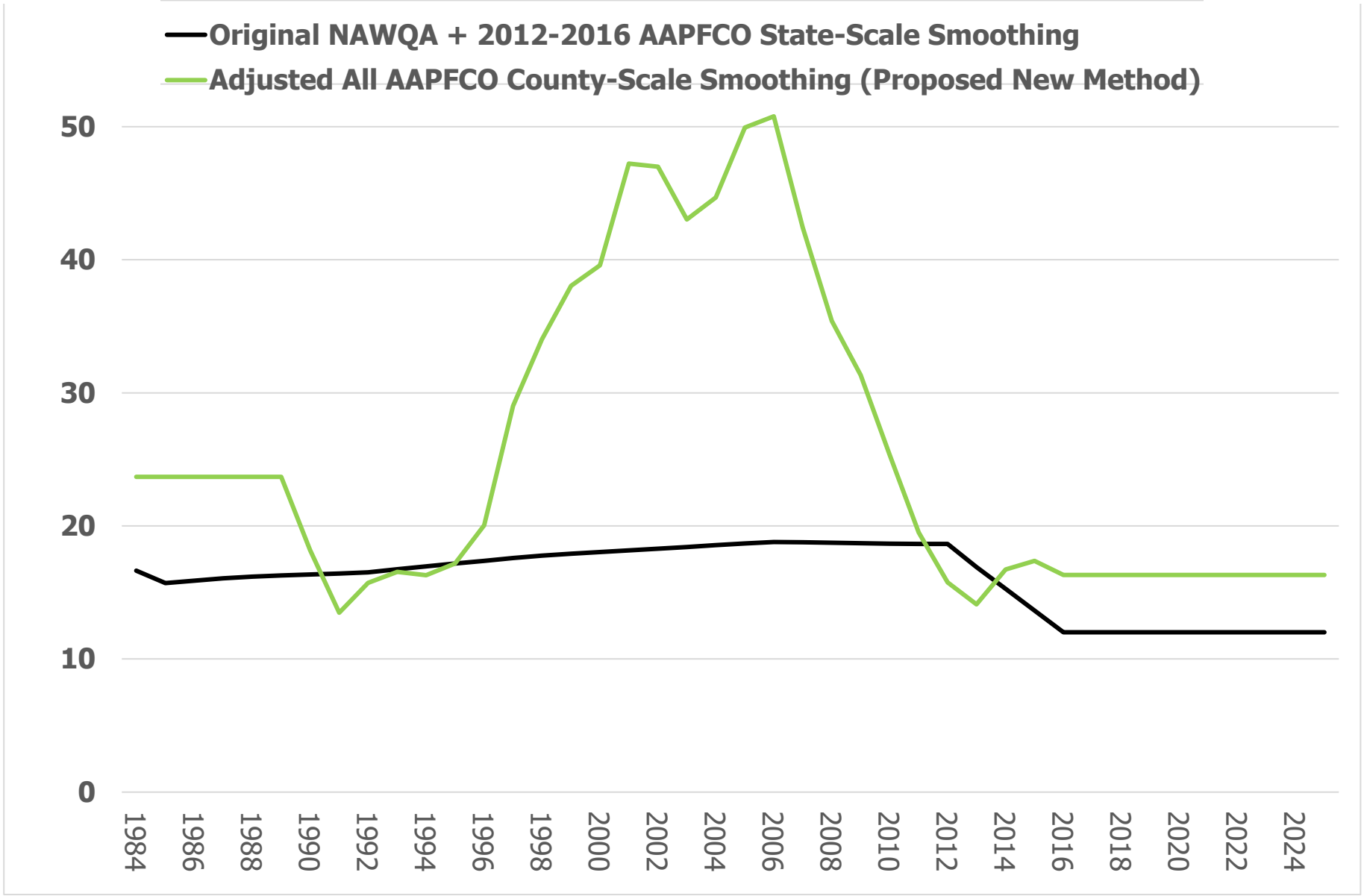

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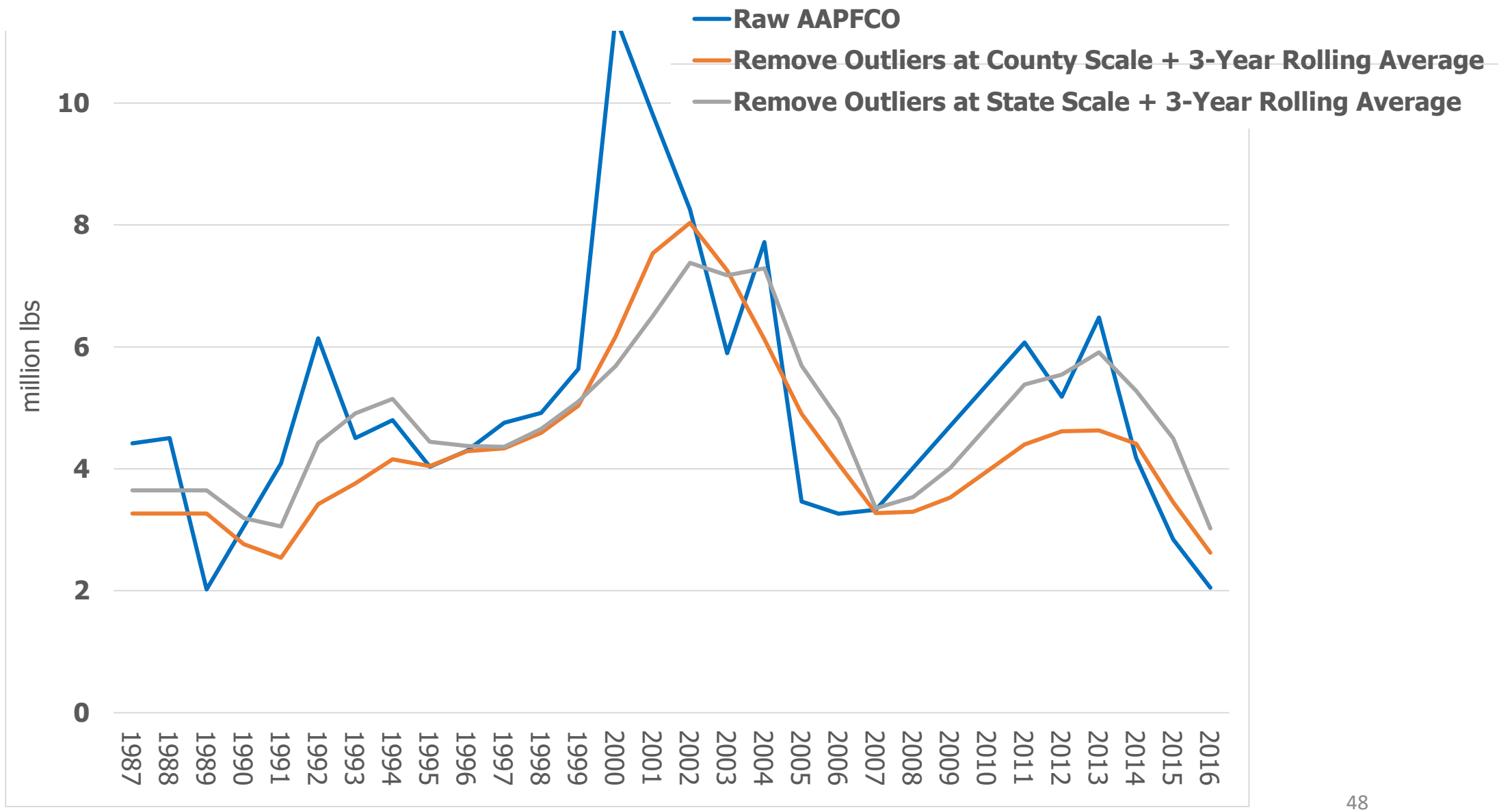

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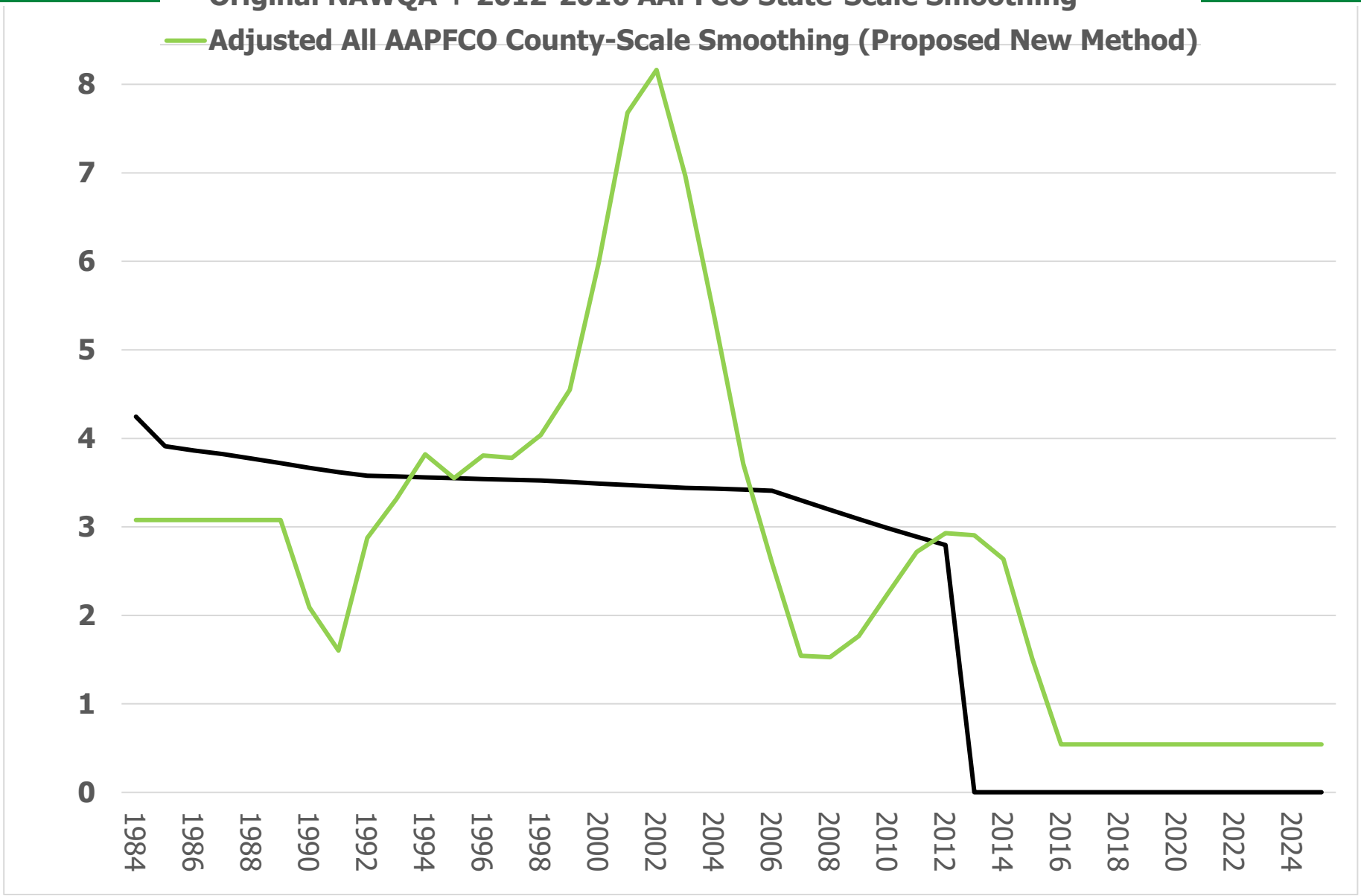
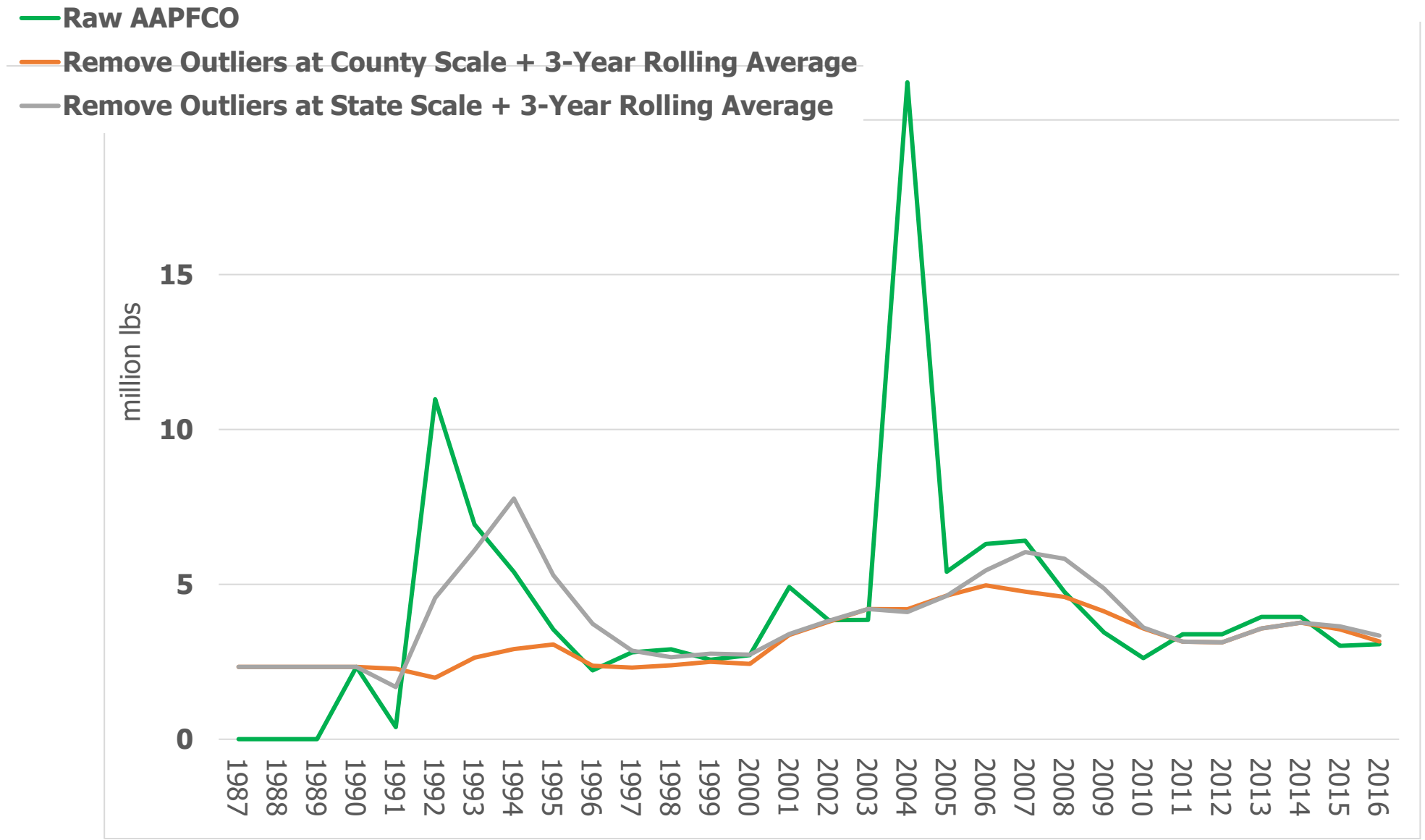
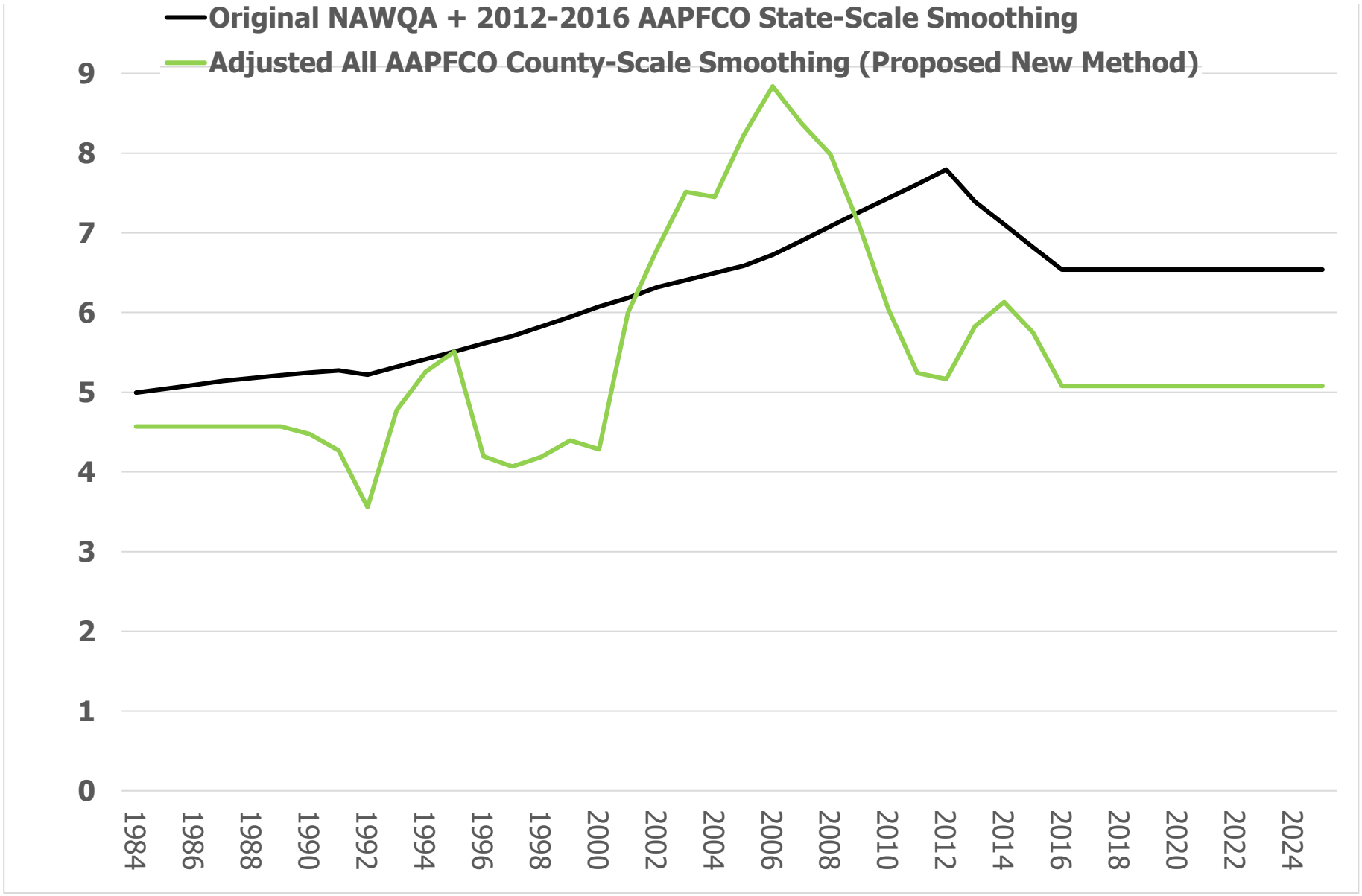


NEW YORK

New York Nitrogen Applications (lbs)



New York Nitrogen Application Rates (lbs/acre)



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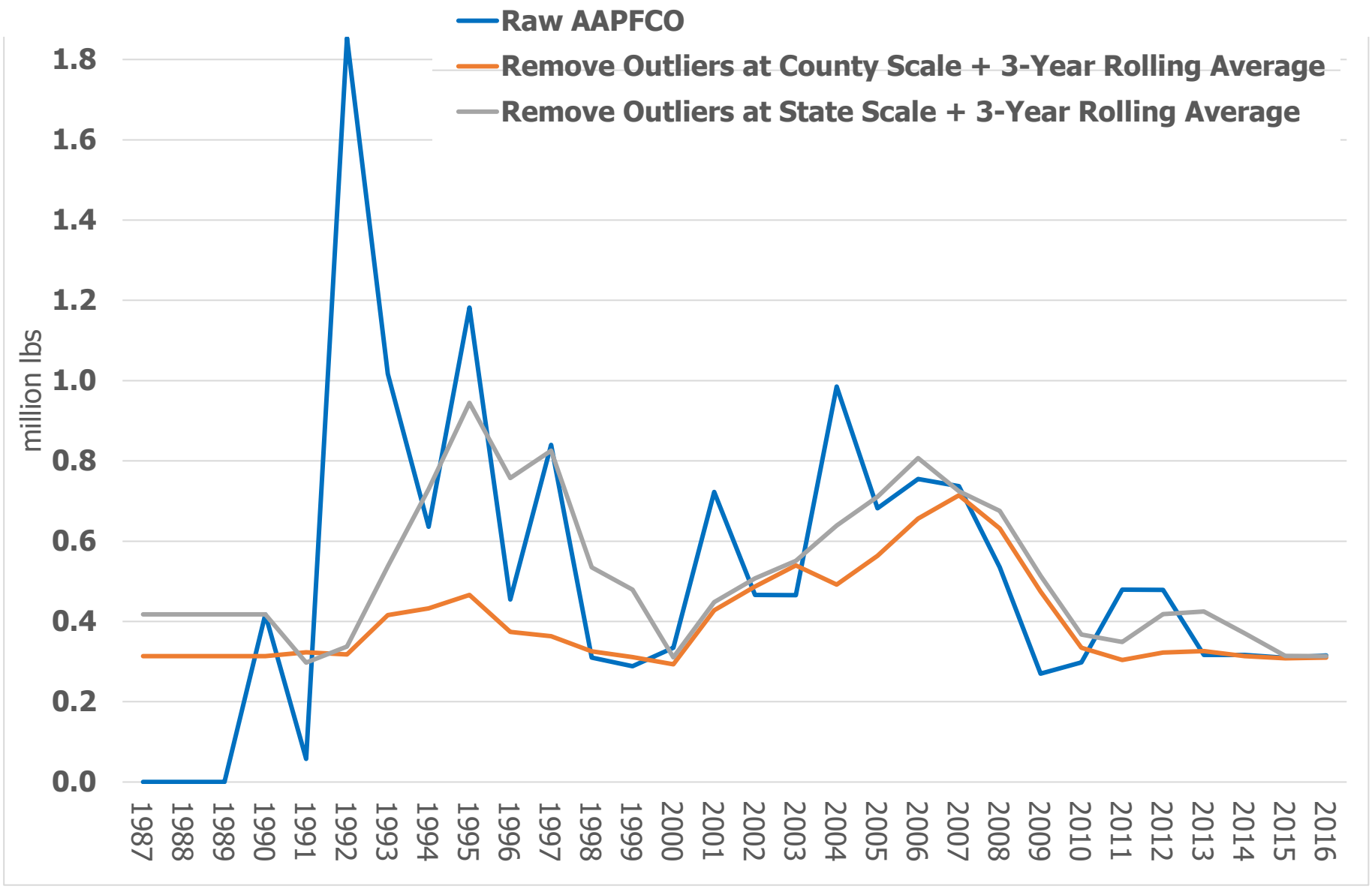

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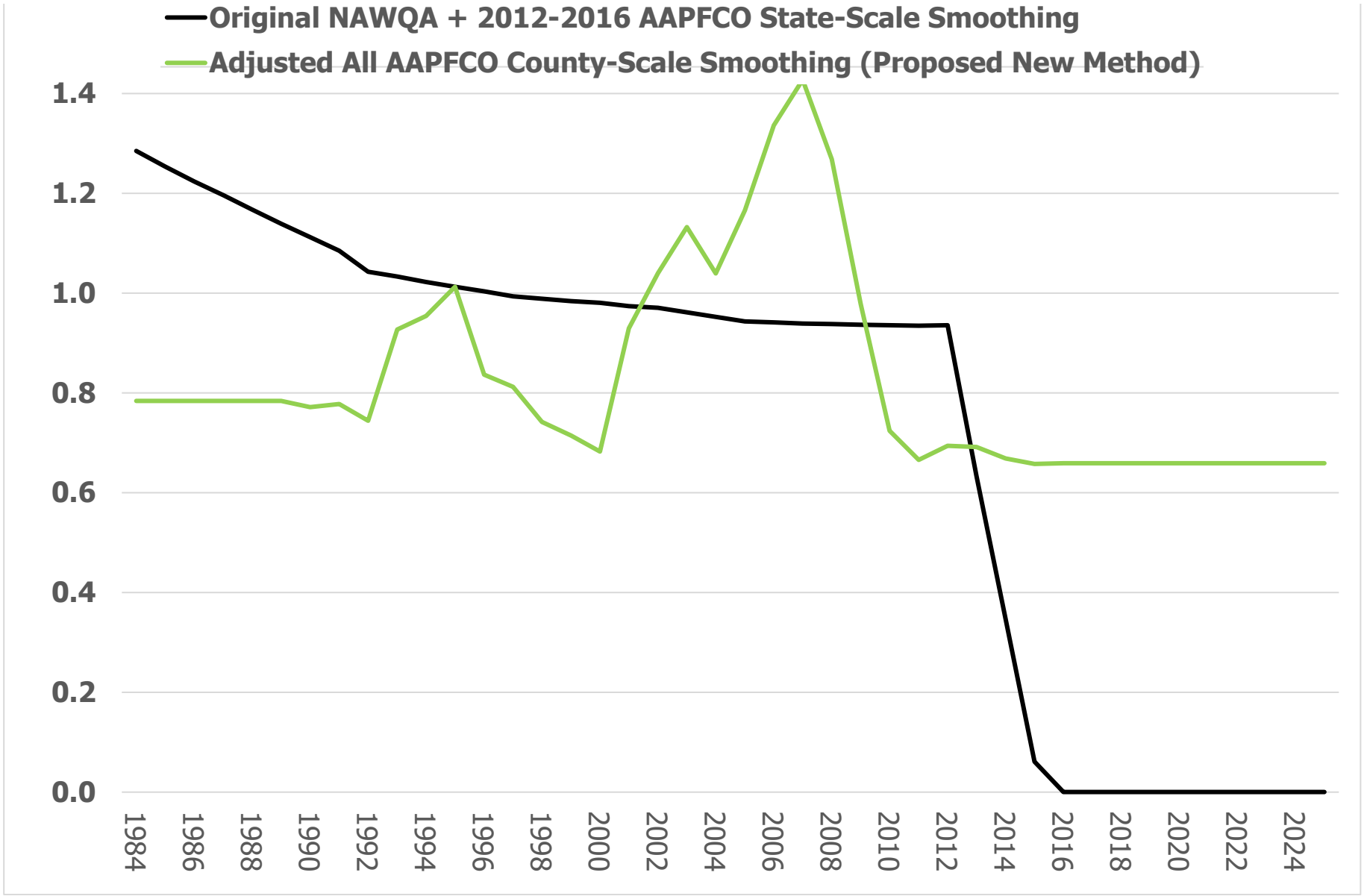

WEST VIRGINIA

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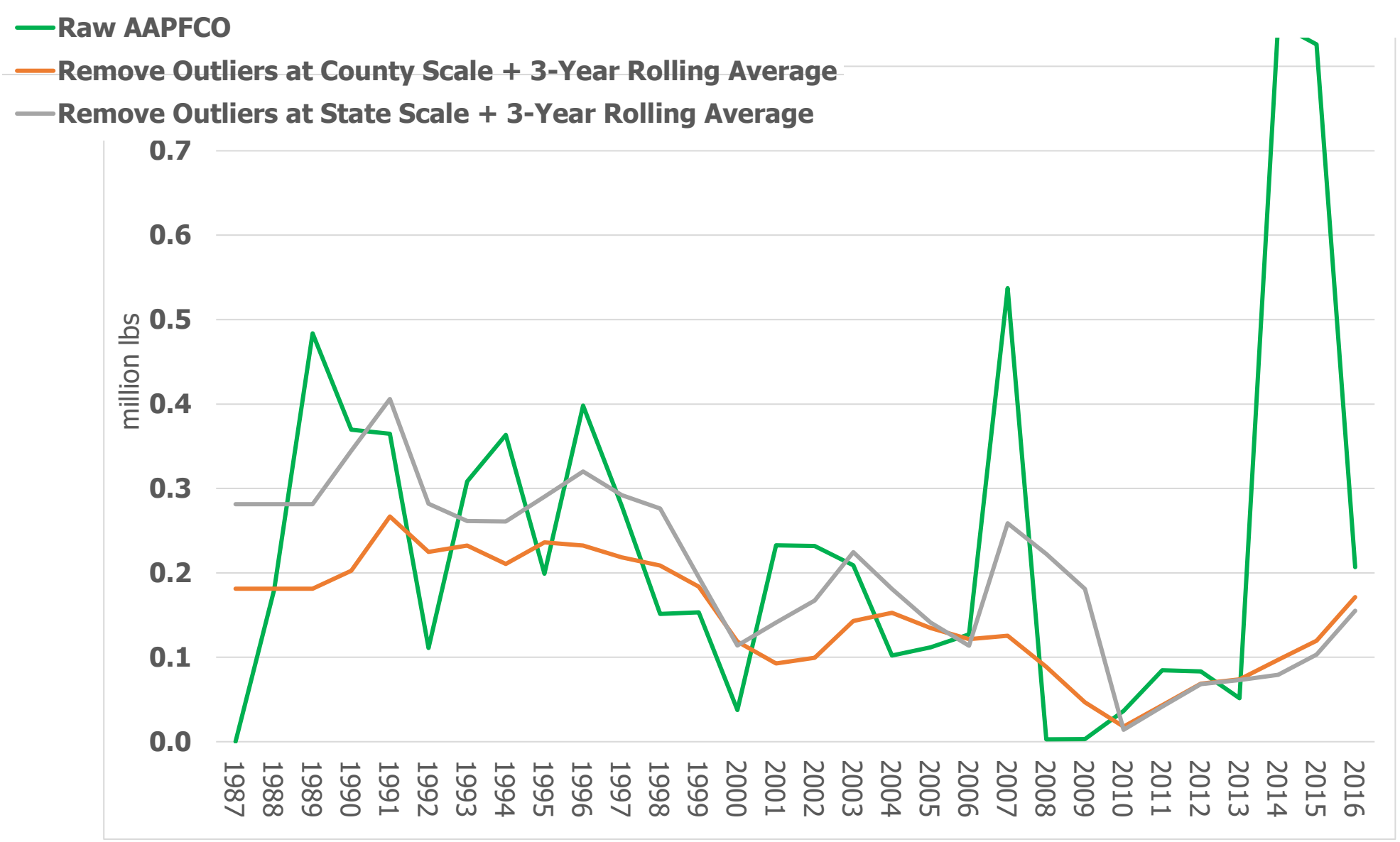

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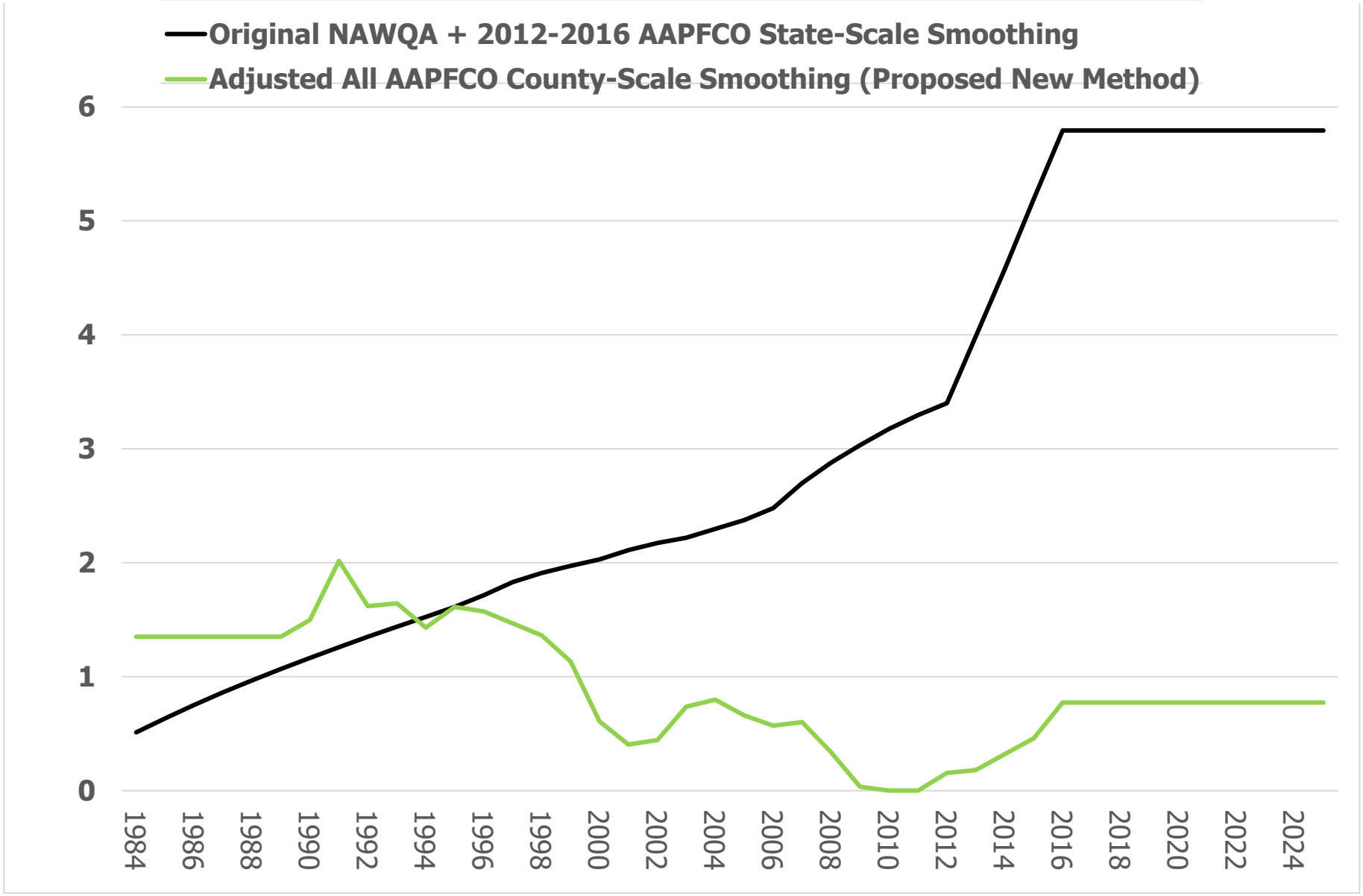

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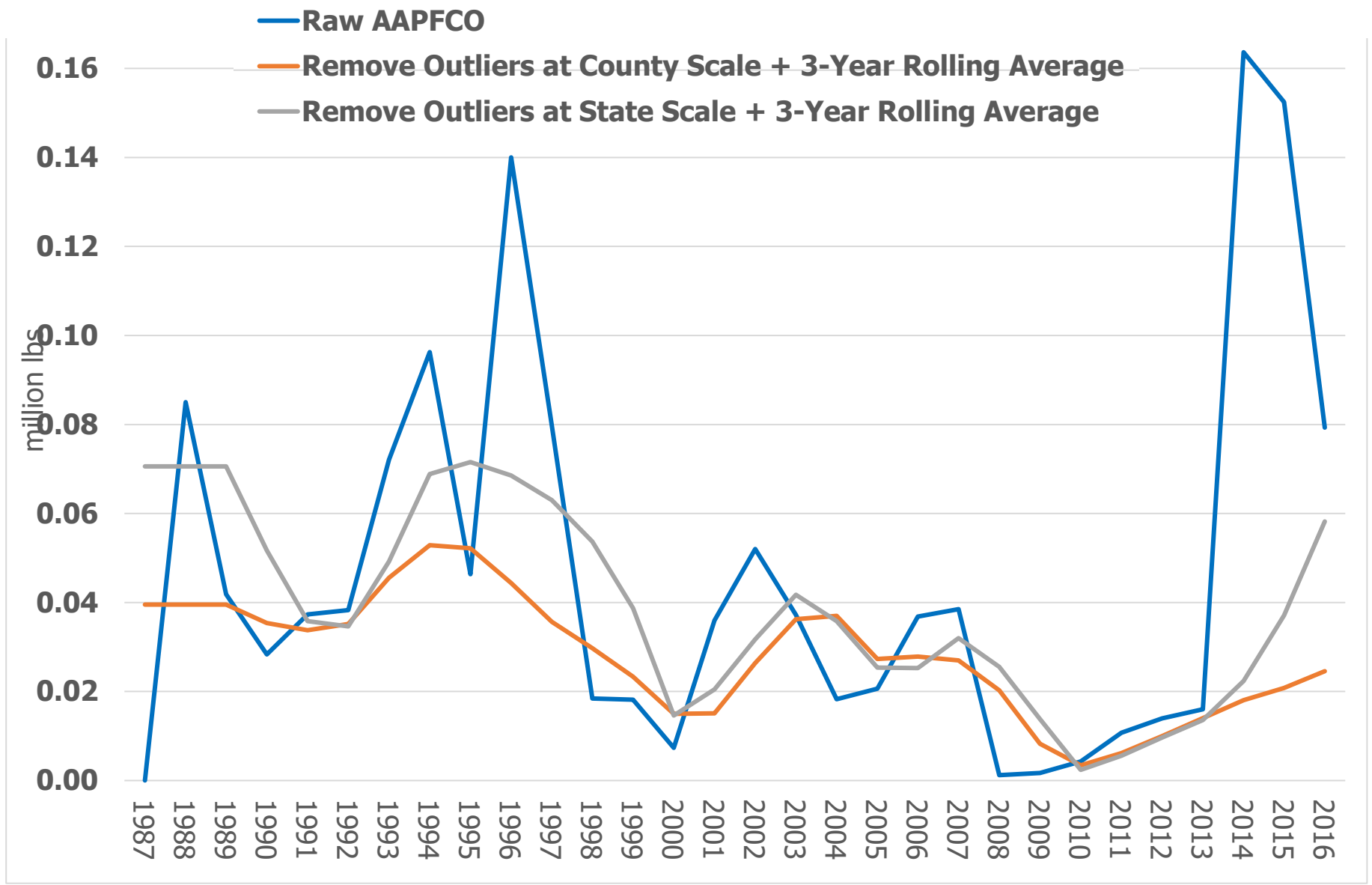

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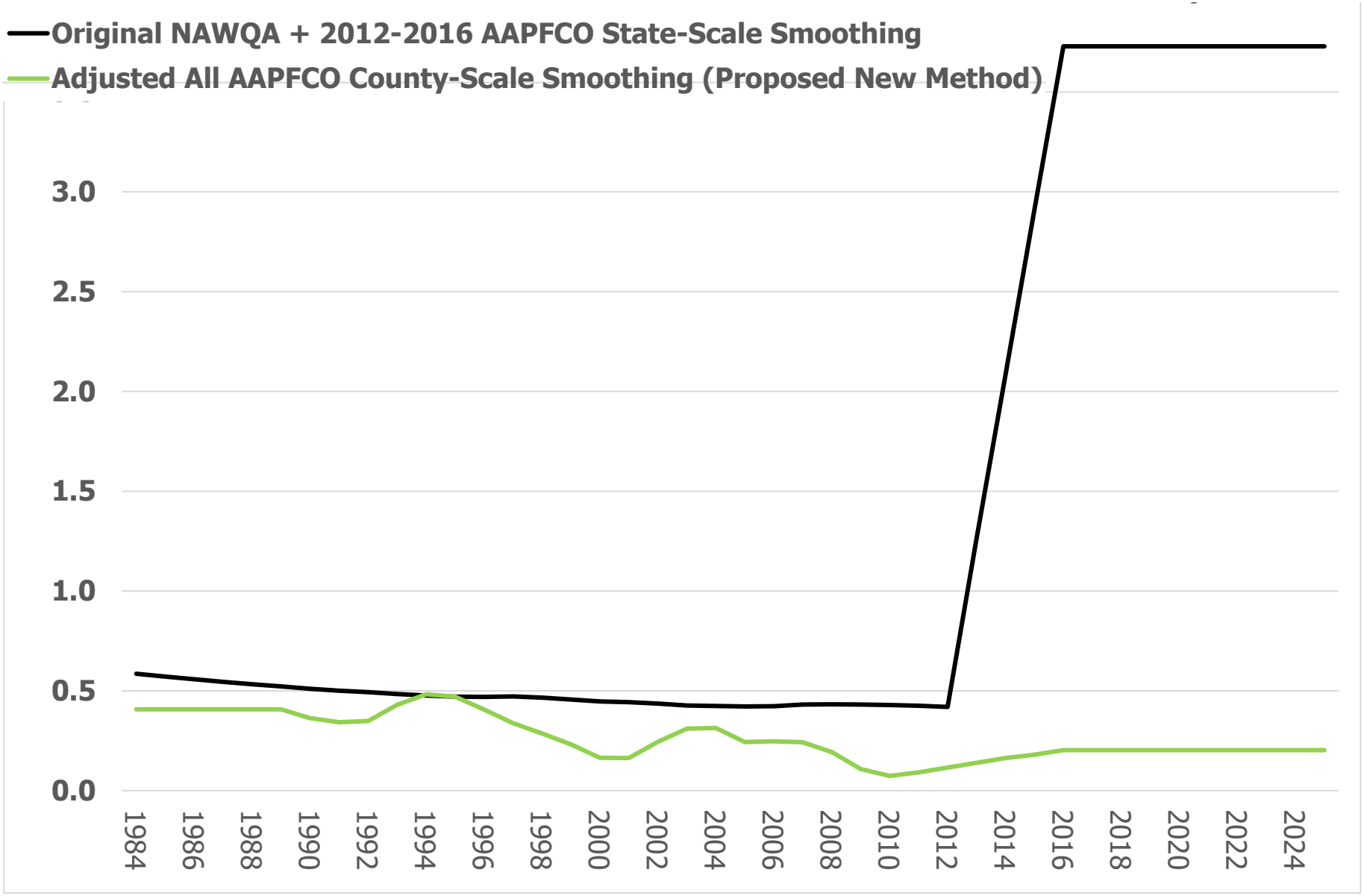
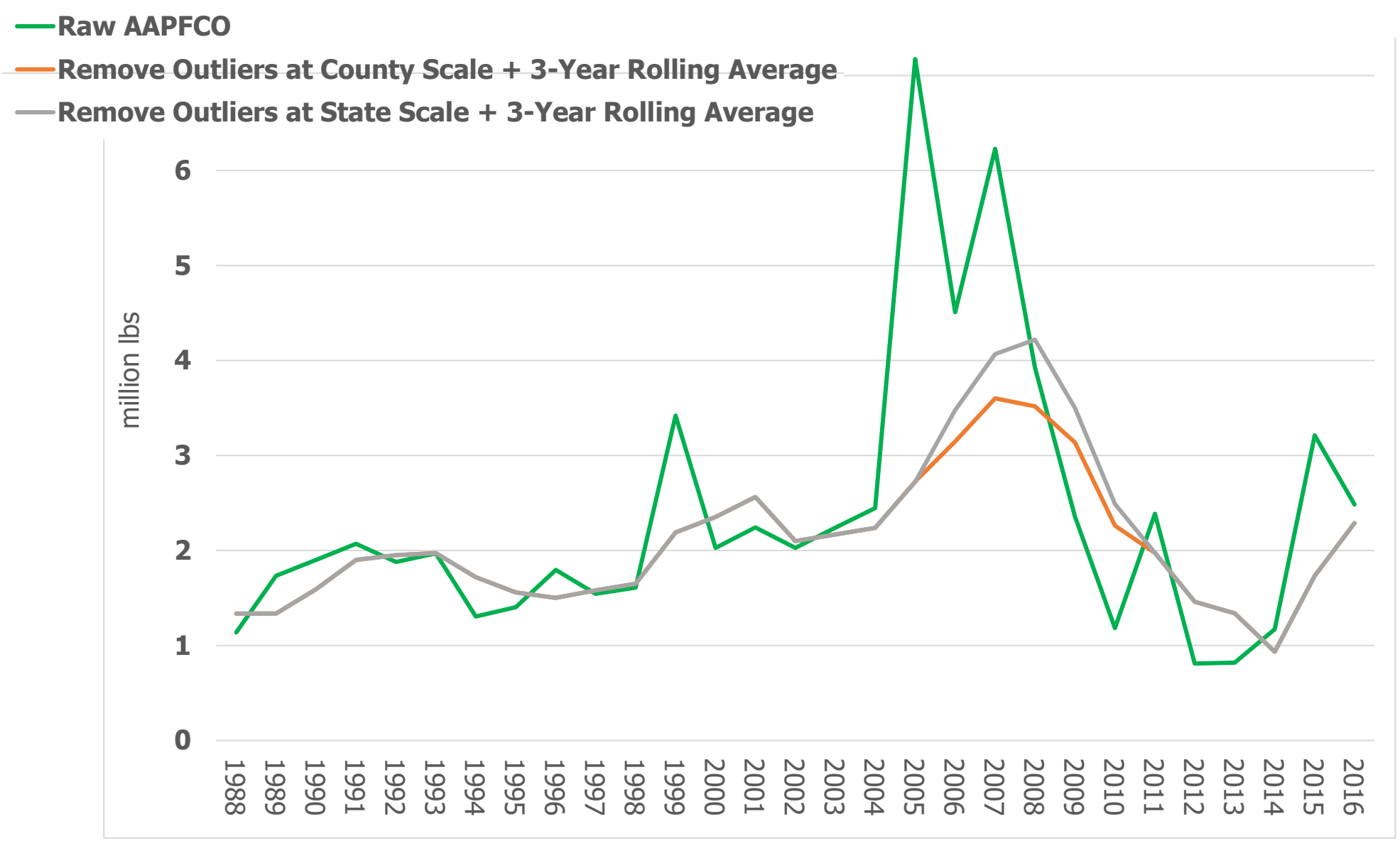
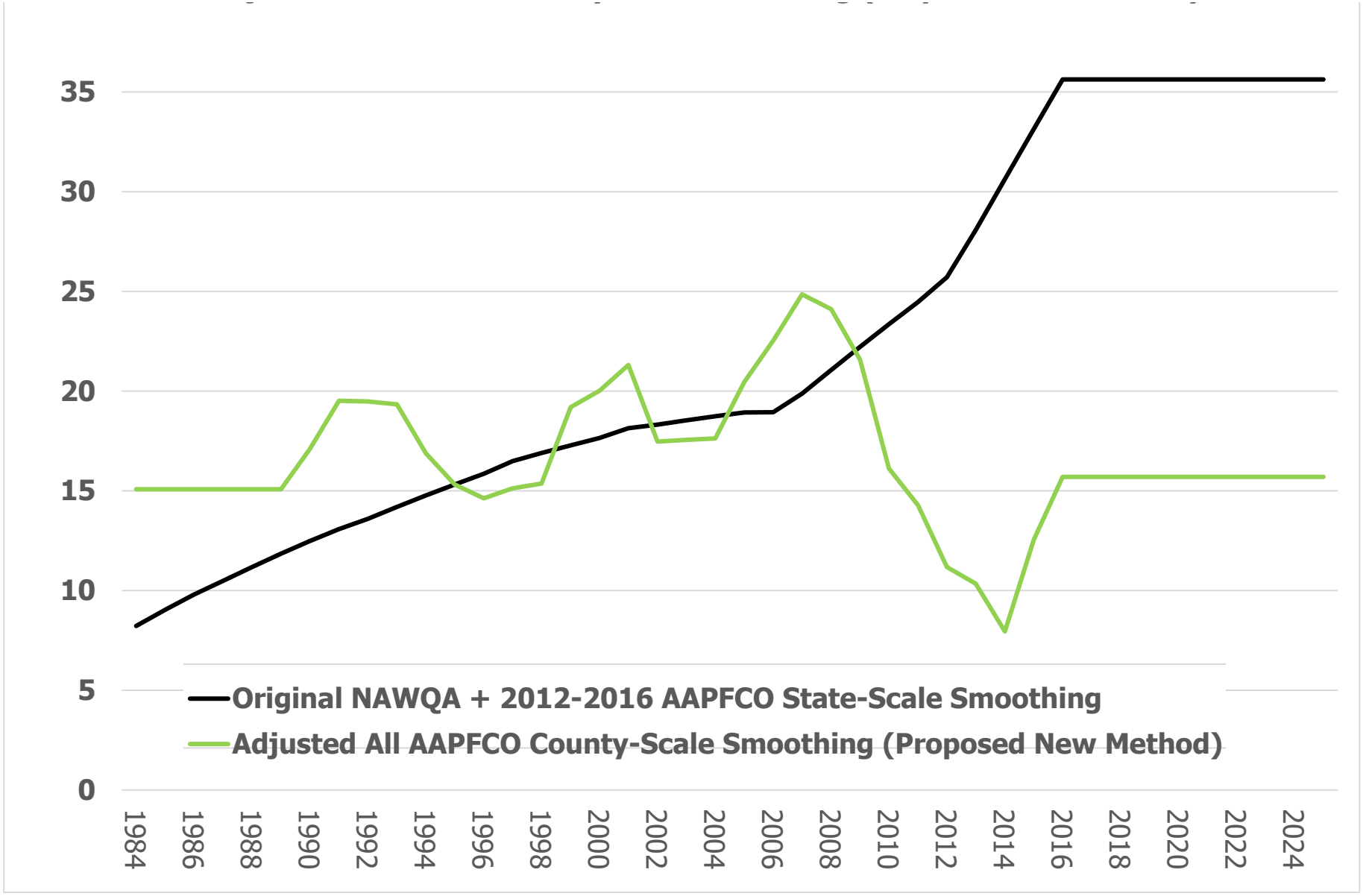


DELAWARE

Delaware Nitrogen Applications (lbs)



Delaware Nitrogen Application Rates (lbs/acre)



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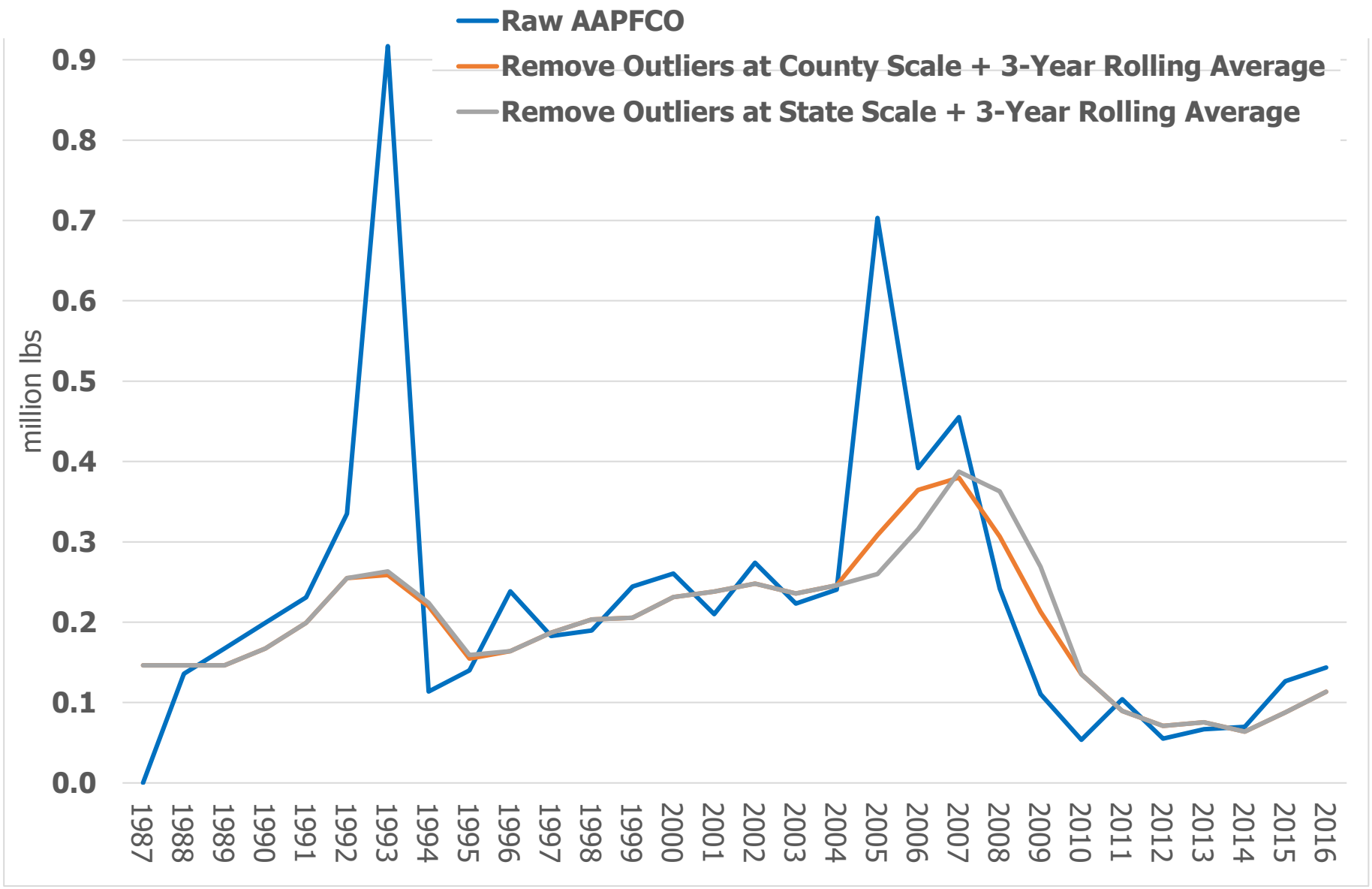

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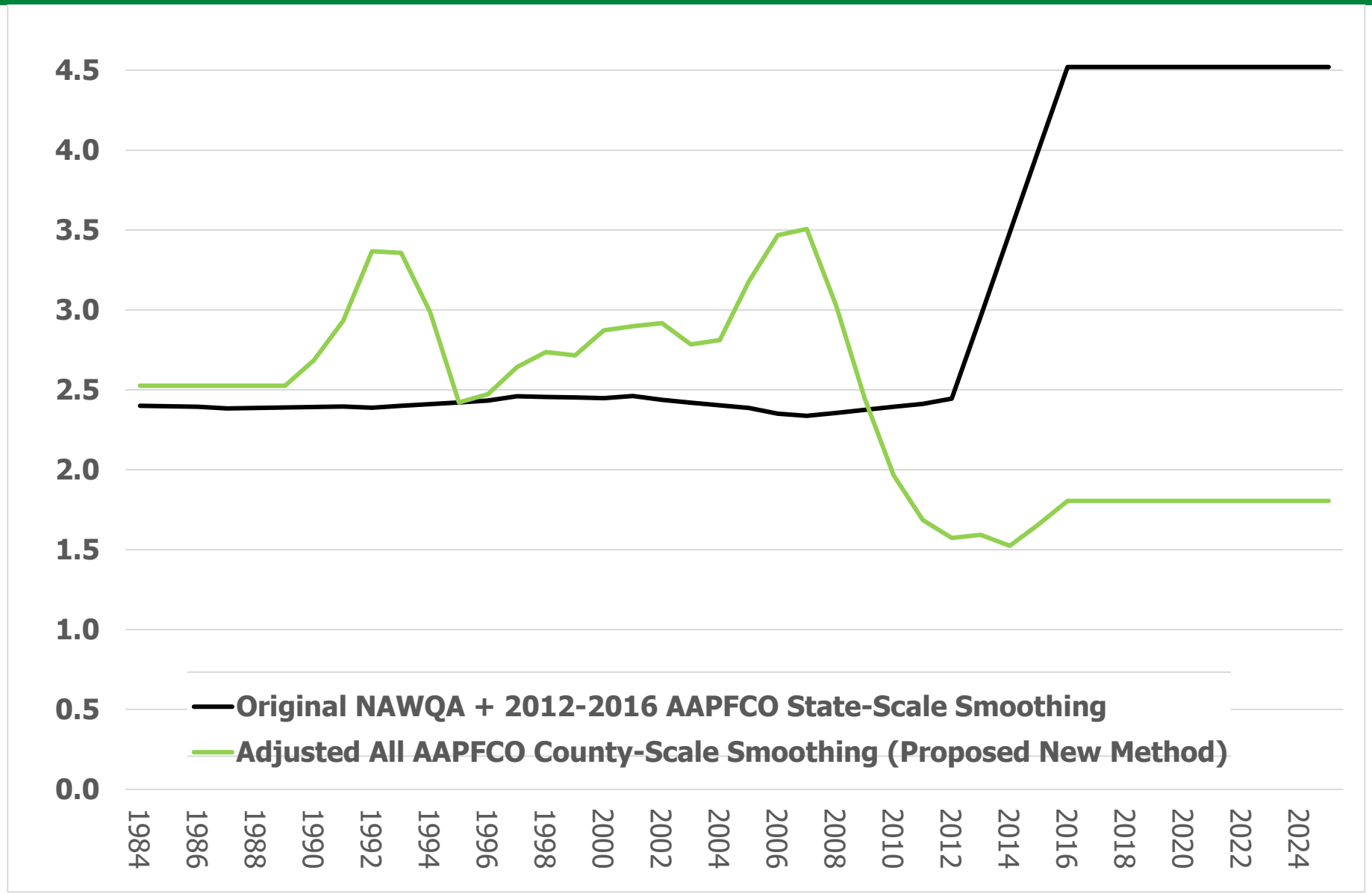
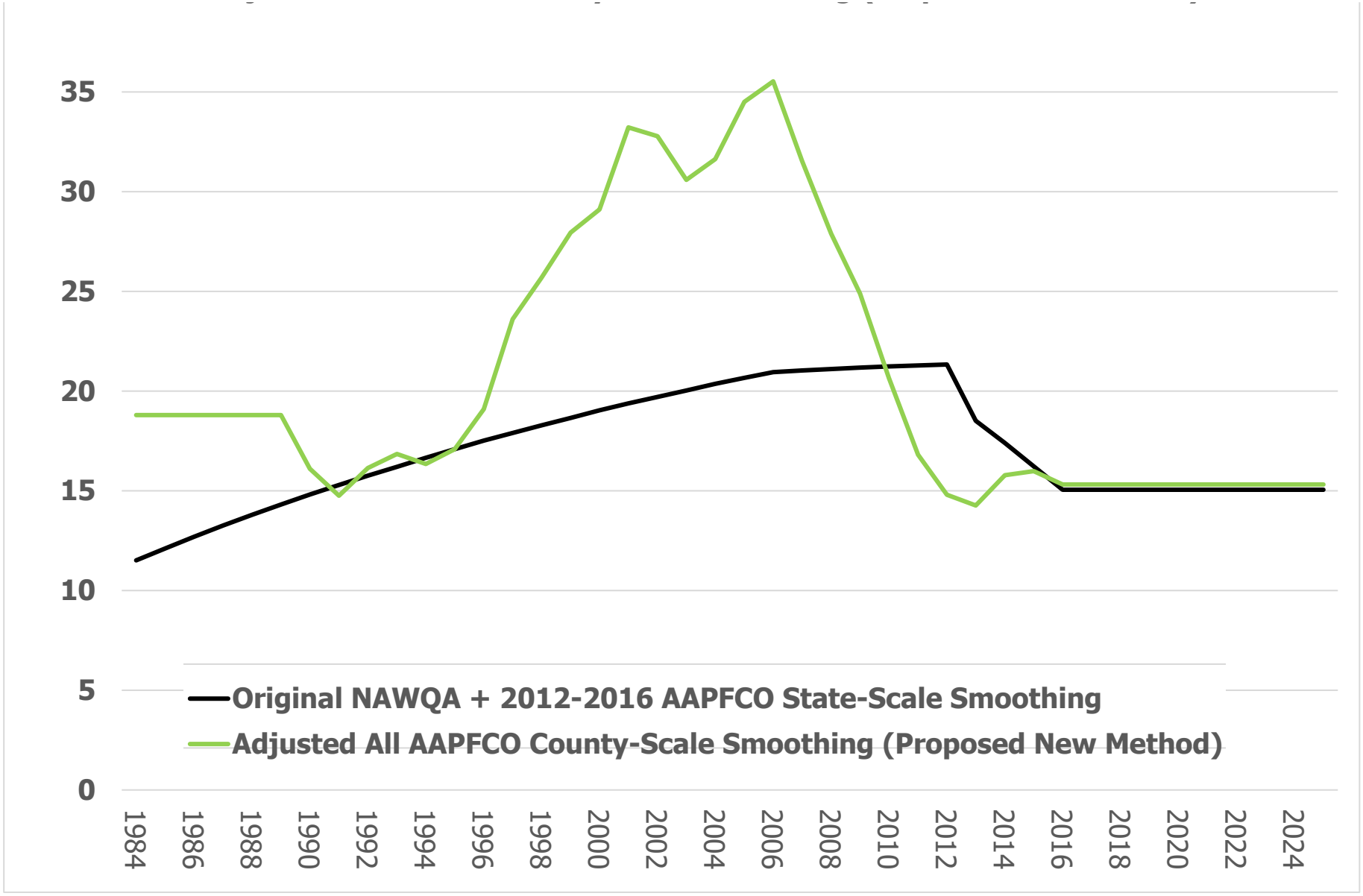
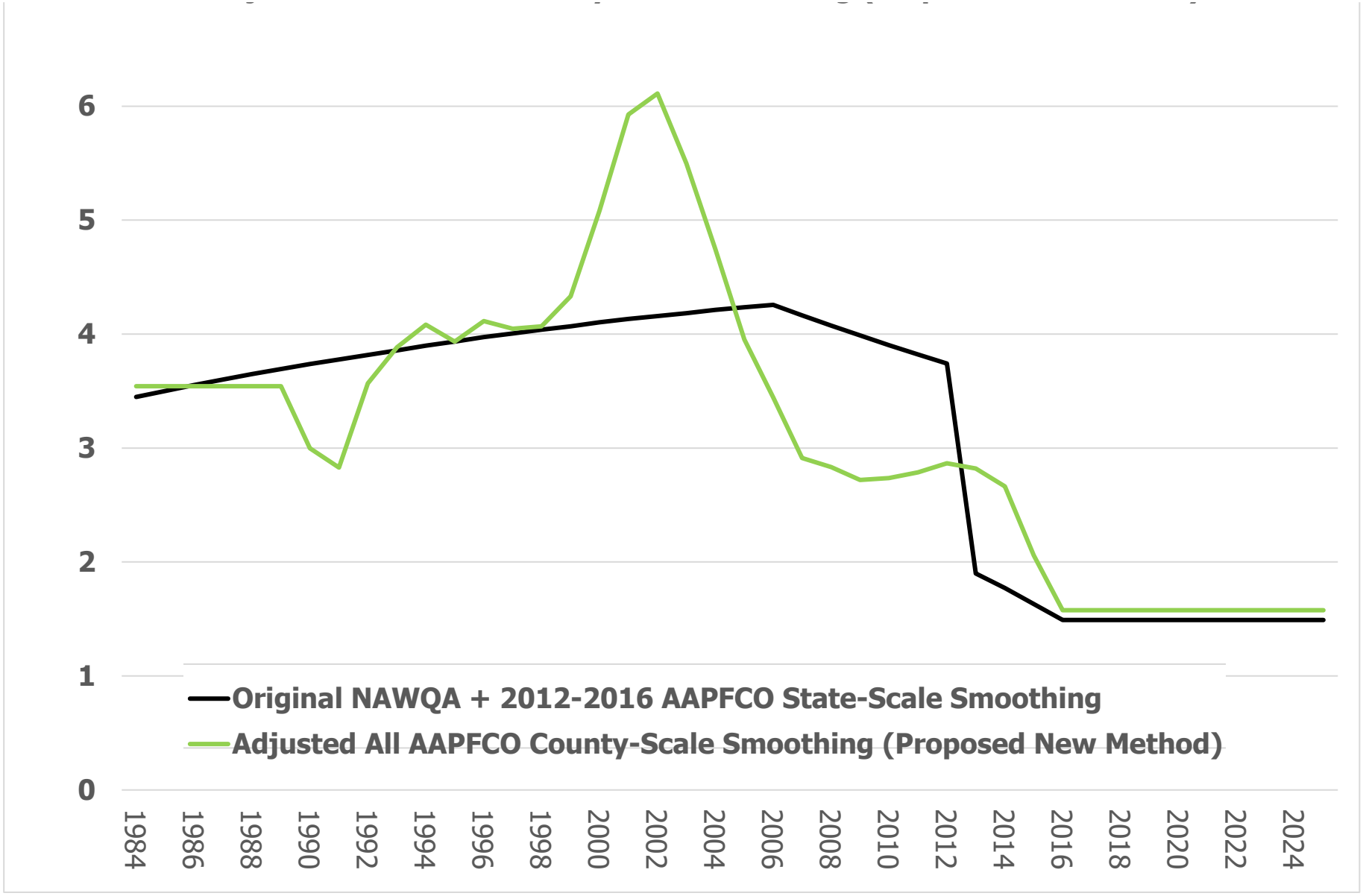


DISTRICT OF COLUMBIA

District of Columbia Nitrogen Application Rates (lbs/acre)



District of Columbia Phosphorus Application Rates (lbs/acre)