How the Chesapeake Bay Watershed Model Simulates Construction Land

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Chesapeake Bay Program
A Watershed Partnership

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

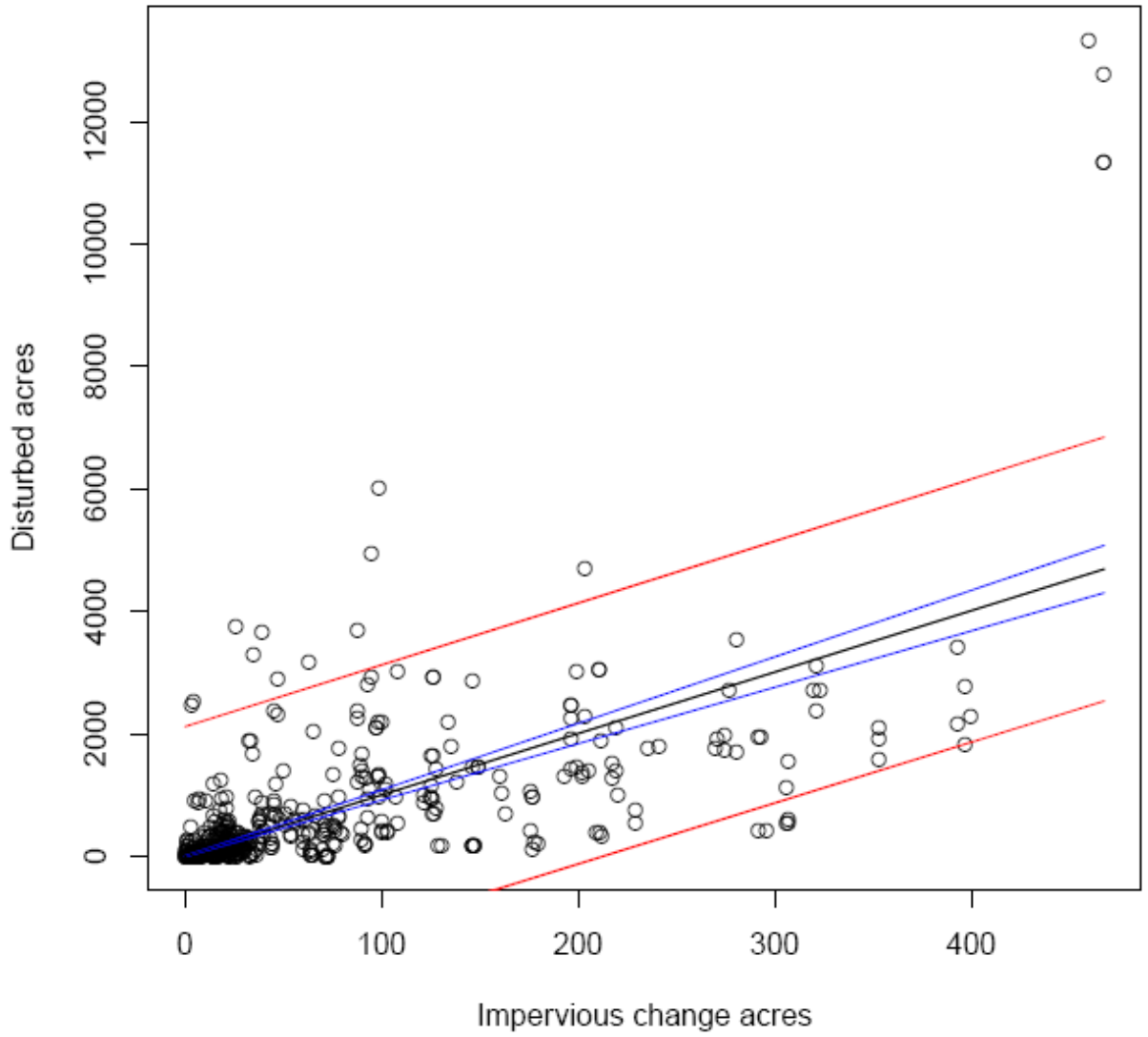
CBWM Calibration Construction Landuse

- Bare-construction lands are not measured with satellite imagery in the latest version of the CBW model.

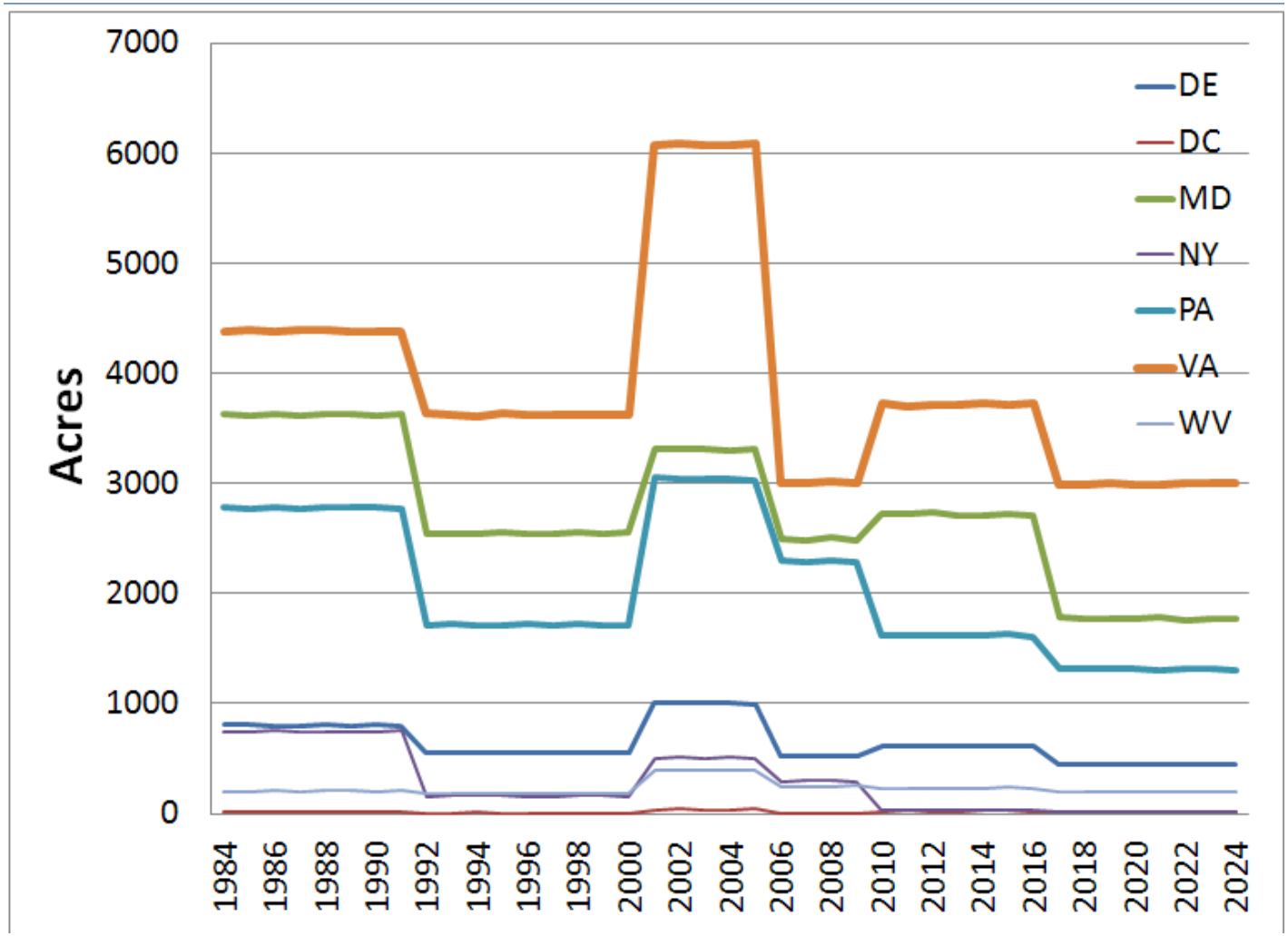
- County permitted-disturbed acres were gathered (Only PA and MD provided permitted acres for several years and WV only for 2010).

- Permitted acres are proportional to the annual change in impervious surfaces (nid+rid+cid) in a watershed model segment.

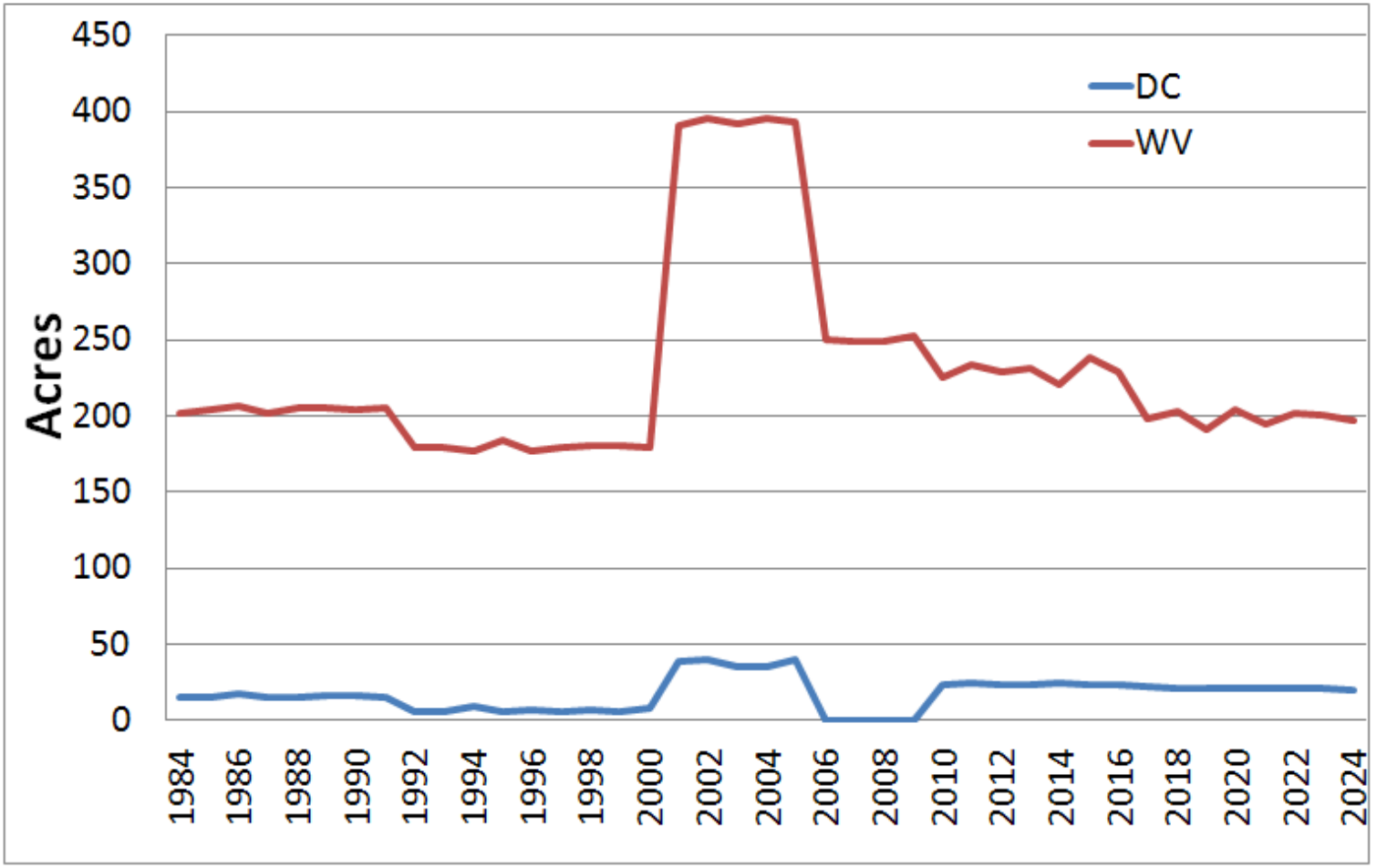
CBWM Calibration Construction Landuse



Annual Impervious Surface Change



Annual Impervious Surface Change



CBWM Calibration Construction Landuse

- The ratio of permitted acres to impervious change was used to calculate construction acres.
- The state median ratio and the bay median ratio were used if information was not submitted.
- Construction acres were calculated from 1982 to 2025.

Ratios

	Median Ratio
CBW	***7.6***
MD	**11.8**
PA	**7.1**
WV	**61.1**

FIPS	MEDIAN COUNTY RATIO
24003	4.4
24005	8.5
24009	10.3
24013	18.2
24015	4.0
24017	26.5
24019	32.8
24021	6.8
24025	17.8
24027	5.6
24029	2.1
24031	14.7
24033	25.8
24047	20.3
24510	13.2
42001	10.5
42009	6.3
42011	1.3
42013	10.3
42015	8.7
42021	6.9
...	
54027	26.2
54031	132.5
54037	51.3
54057	125.2
54065	22.2

CBWM Calibration Construction Landuse

- ***regulated construction (rcn)*** = ratio * (impervious $_{year2}$ – impervious $_{year1}$)

impervious =nonregulated impervious developed(nid)+regulated impervious developed(rid)

- ***combined construction (cnn)*** = ratio * (cid $_{year2}$ - cid $_{year1}$)

cid = combined impervious developed

Only cid and cpd are adjusted to match the total css.

Forest is also adjusted in SB to incorporate the new landuse rcn.

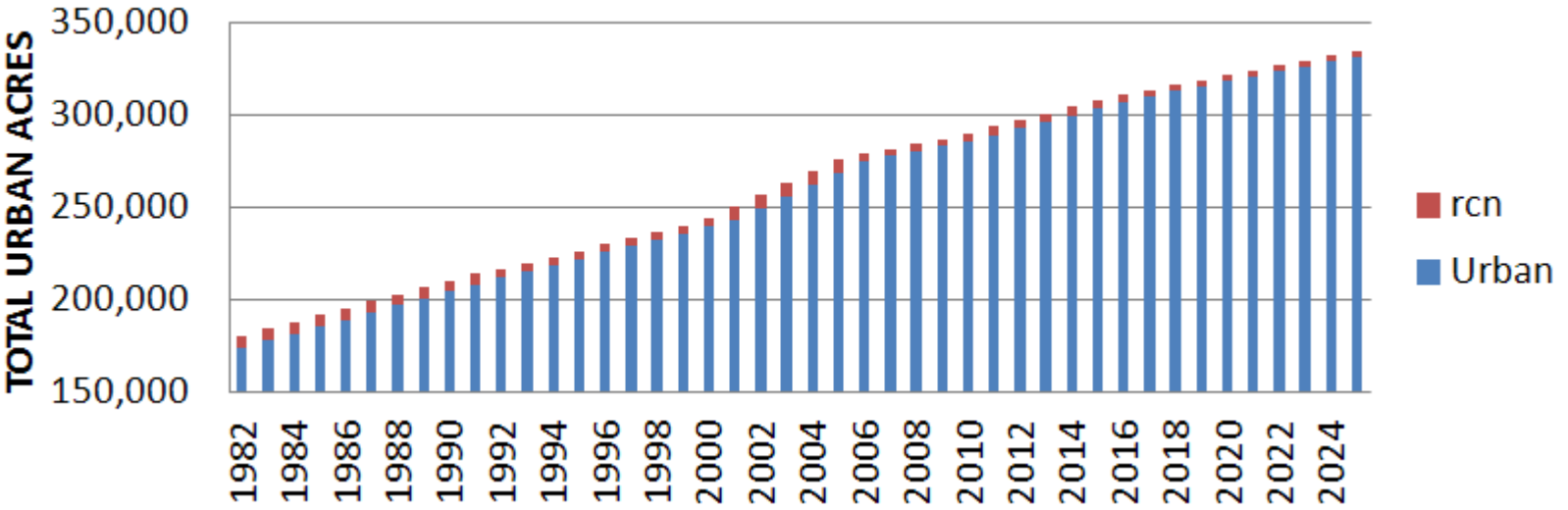
- ***Adjausted land uses:***

cid fraction = cid / (cid+cpd)

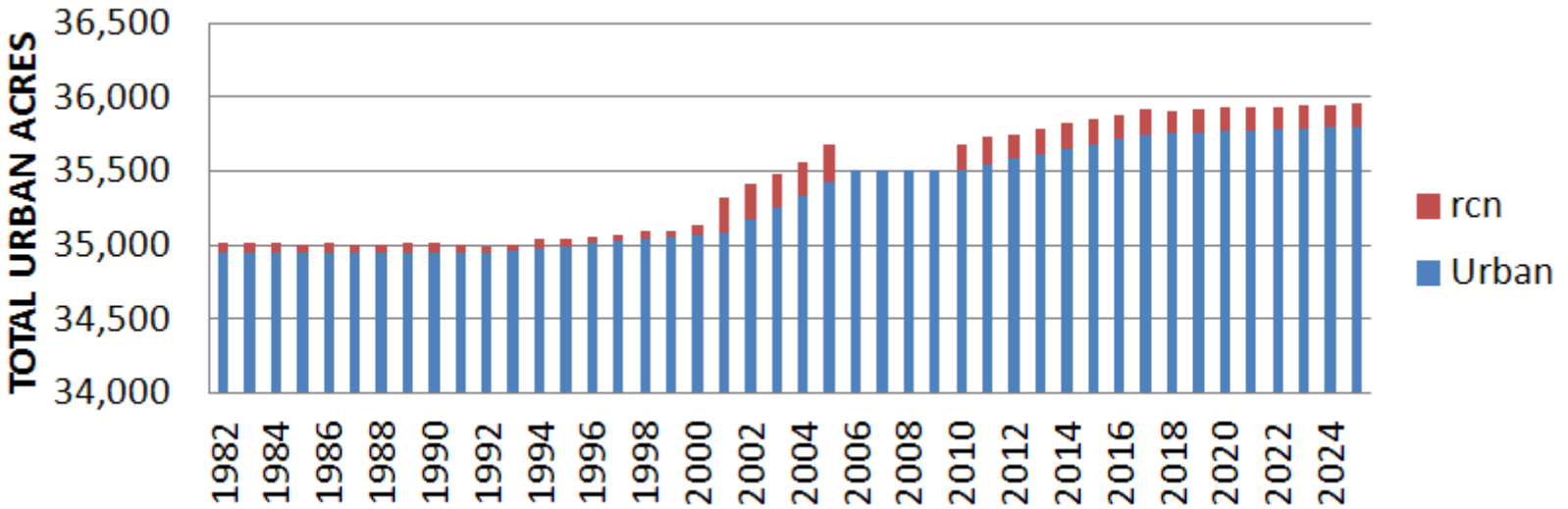
NEW cid = cid – cid fraction * ccn

NEW cpd = Peter_total – (NEW cid + ccn + cex)

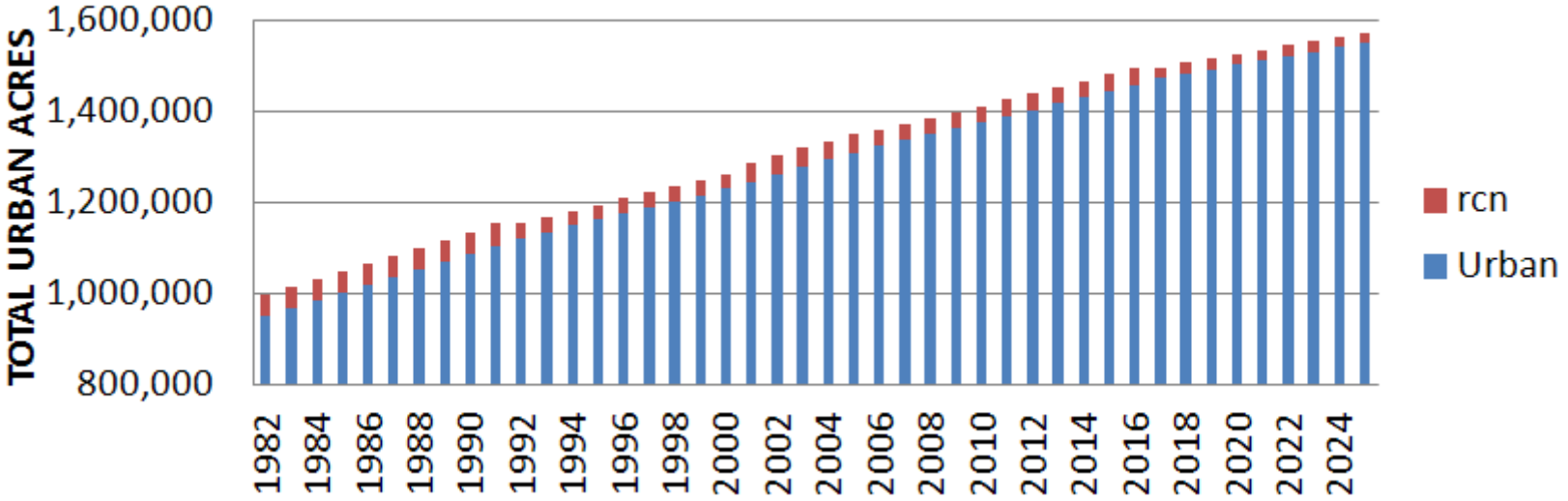
Delaware


TOTAL URBAN ACRES
350,000
300,000
250,000
200,000
150,000
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
rcn
Urban

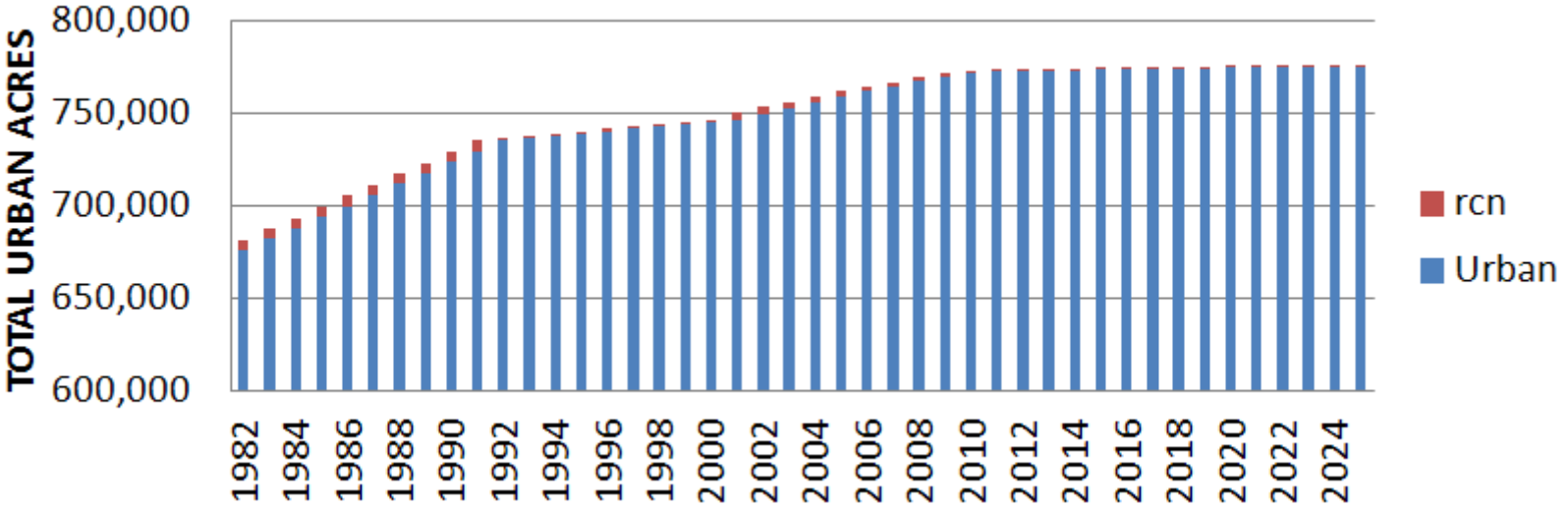
DC


TOTAL URBAN ACRES
36,500
36,000
35,500
35,000
34,500
34,000
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
rcn
Urban

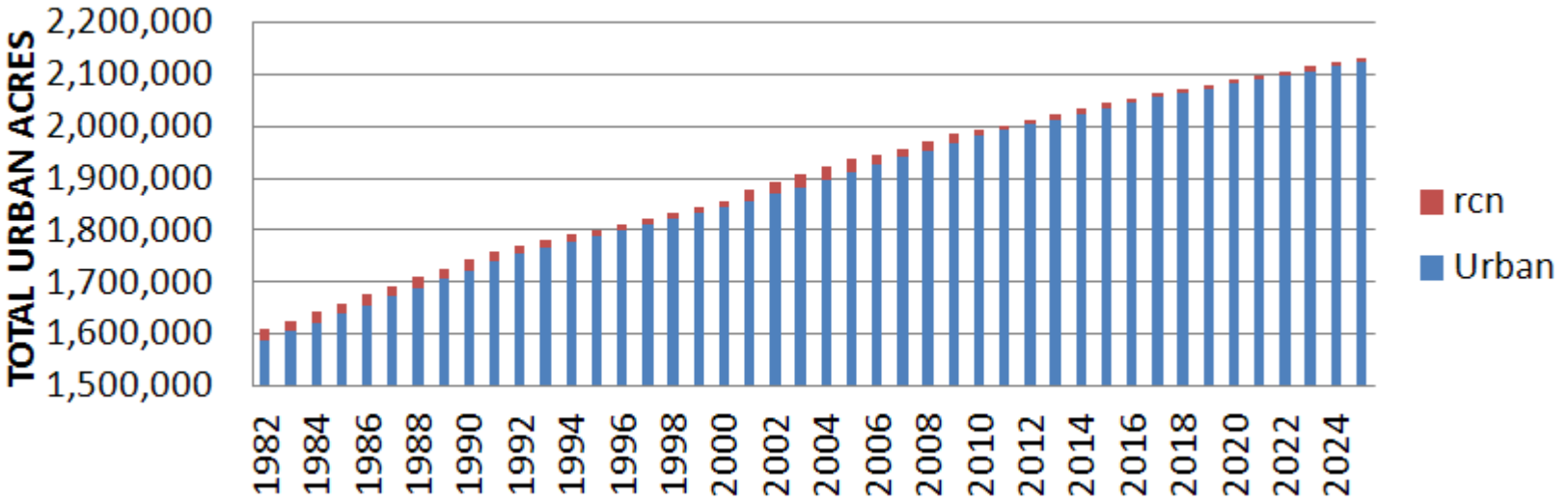
Maryland



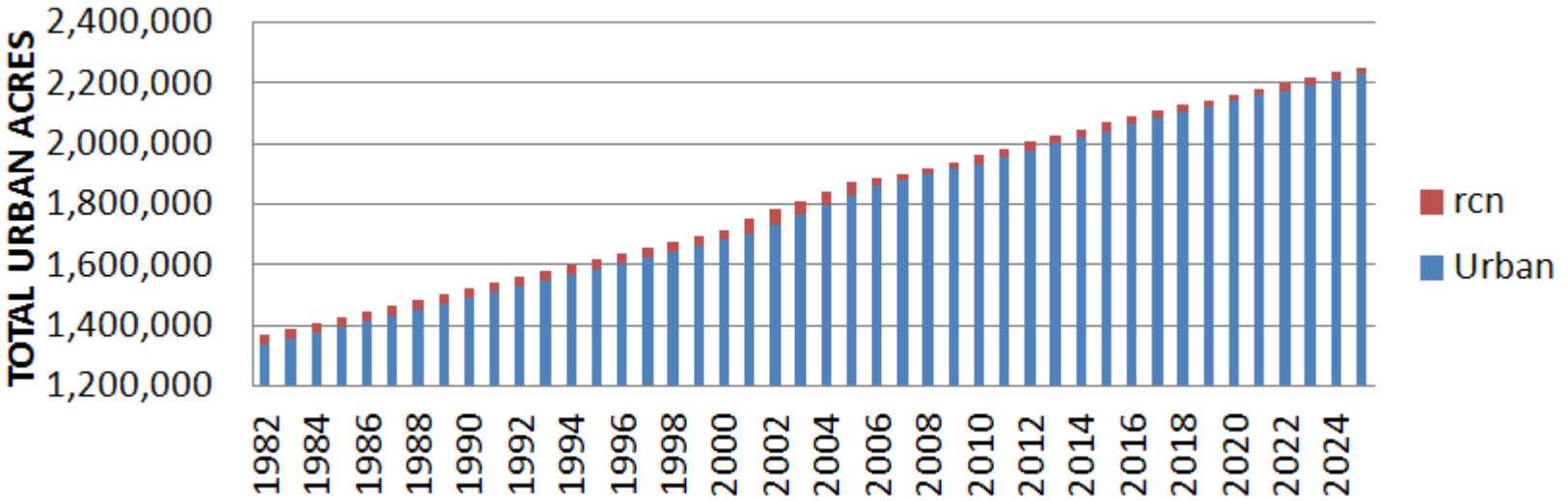
New York



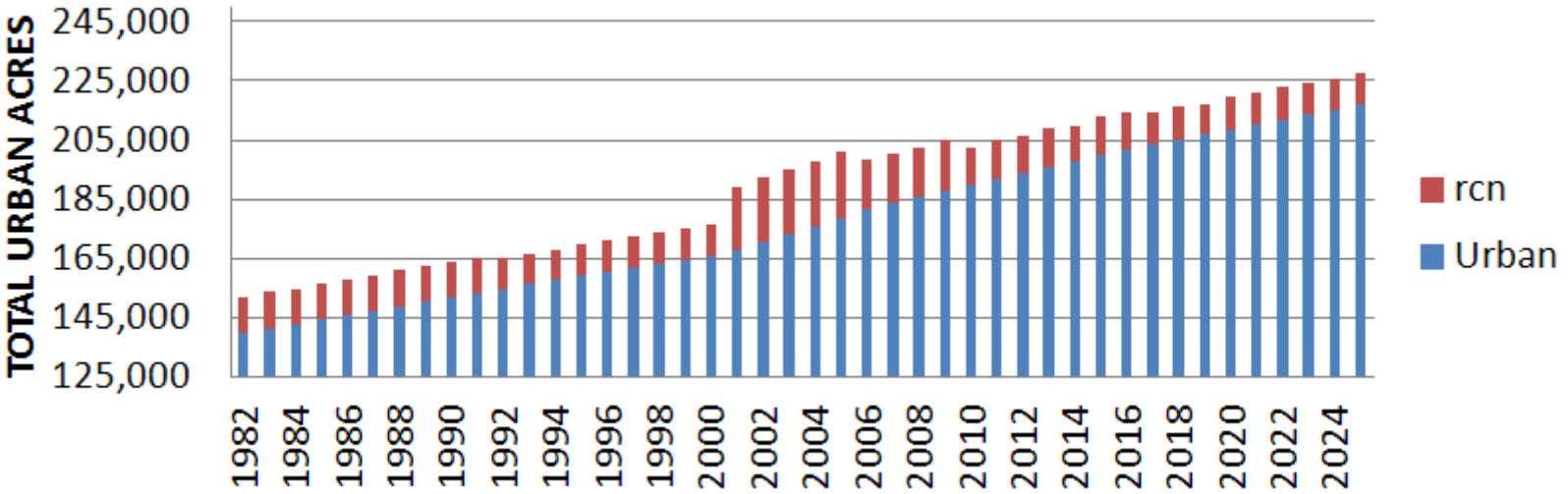
Pennsylvania



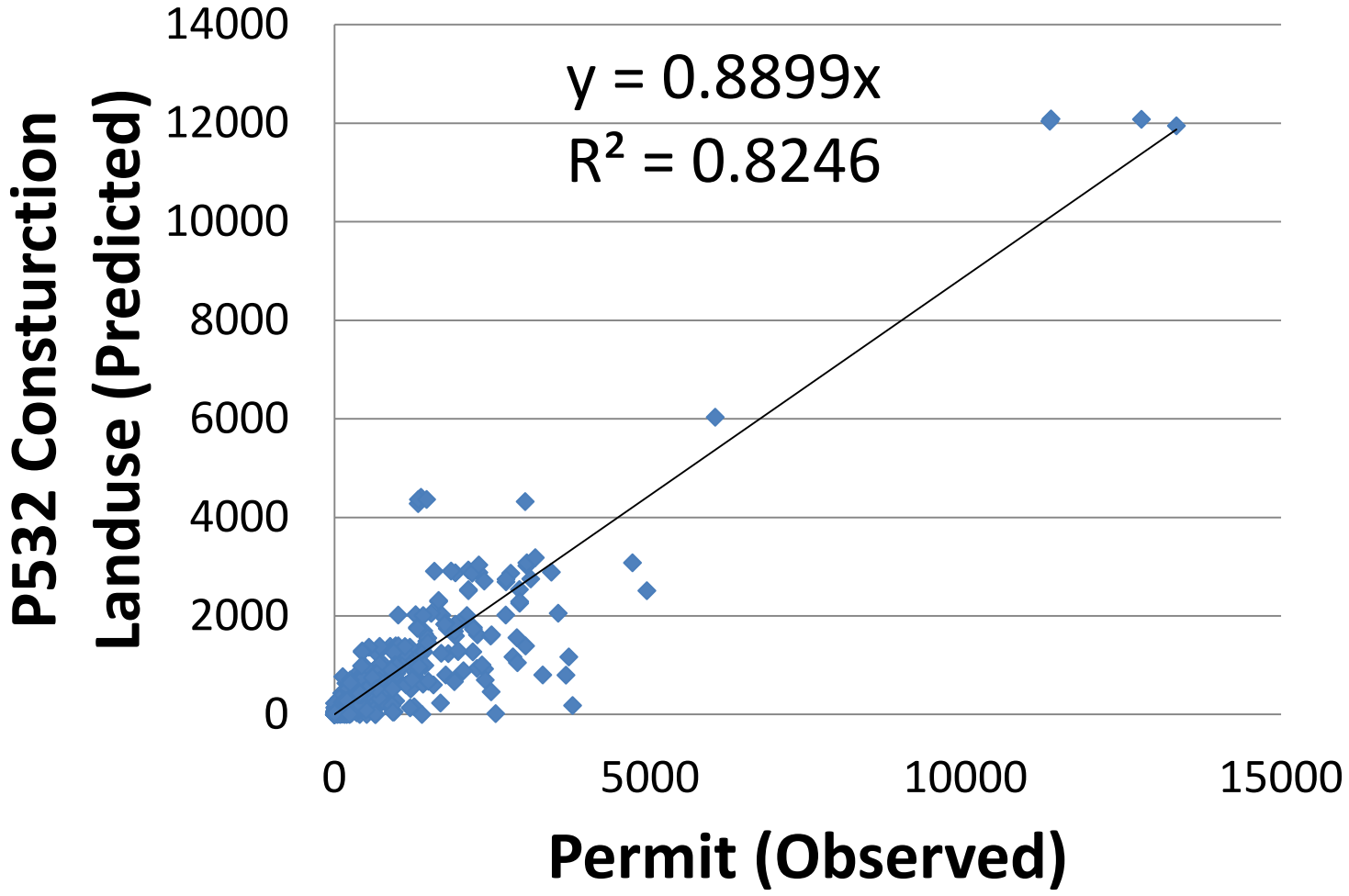
Virginia



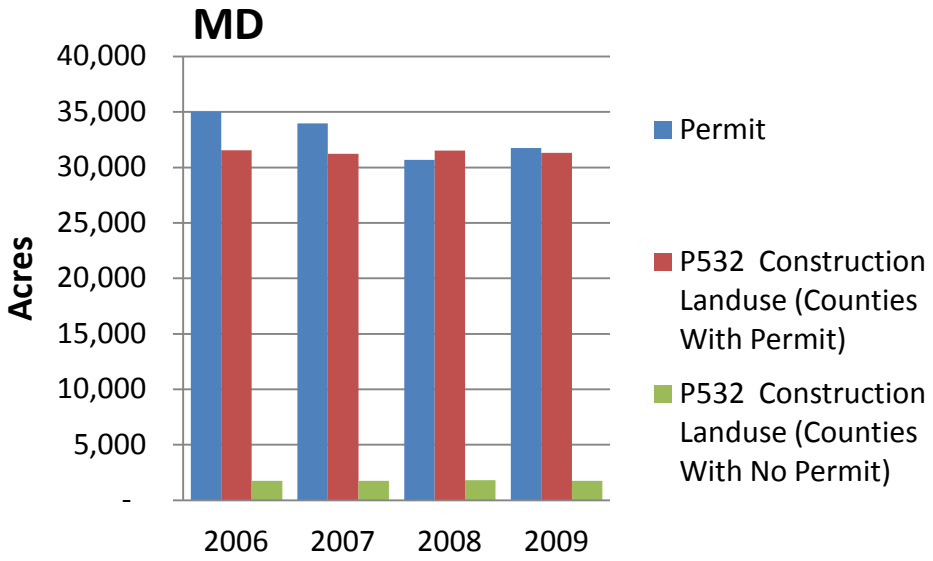
West Virginia

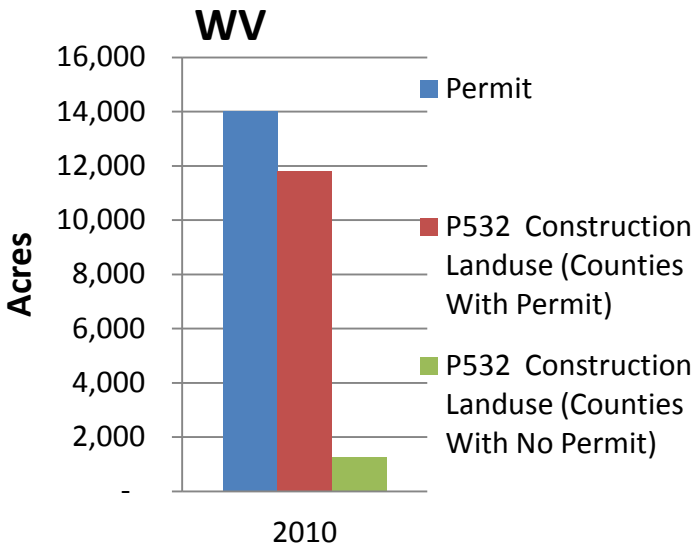


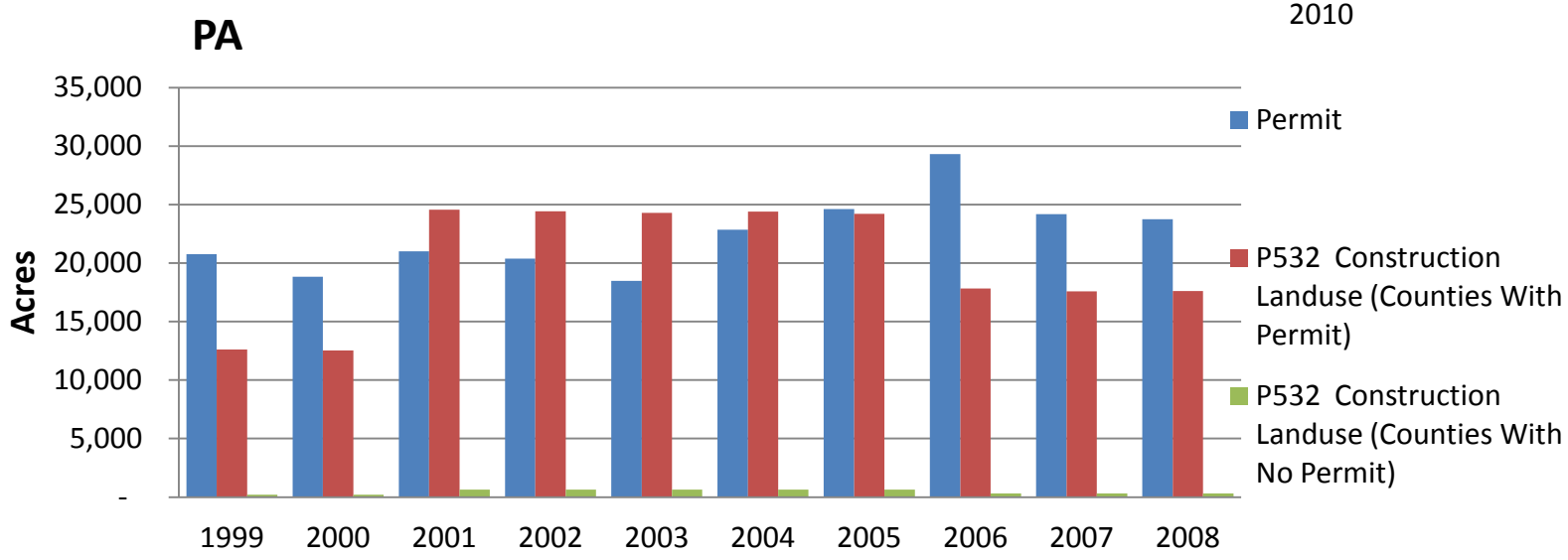
Predicted Construction Landuse (MD, PA and WV only)



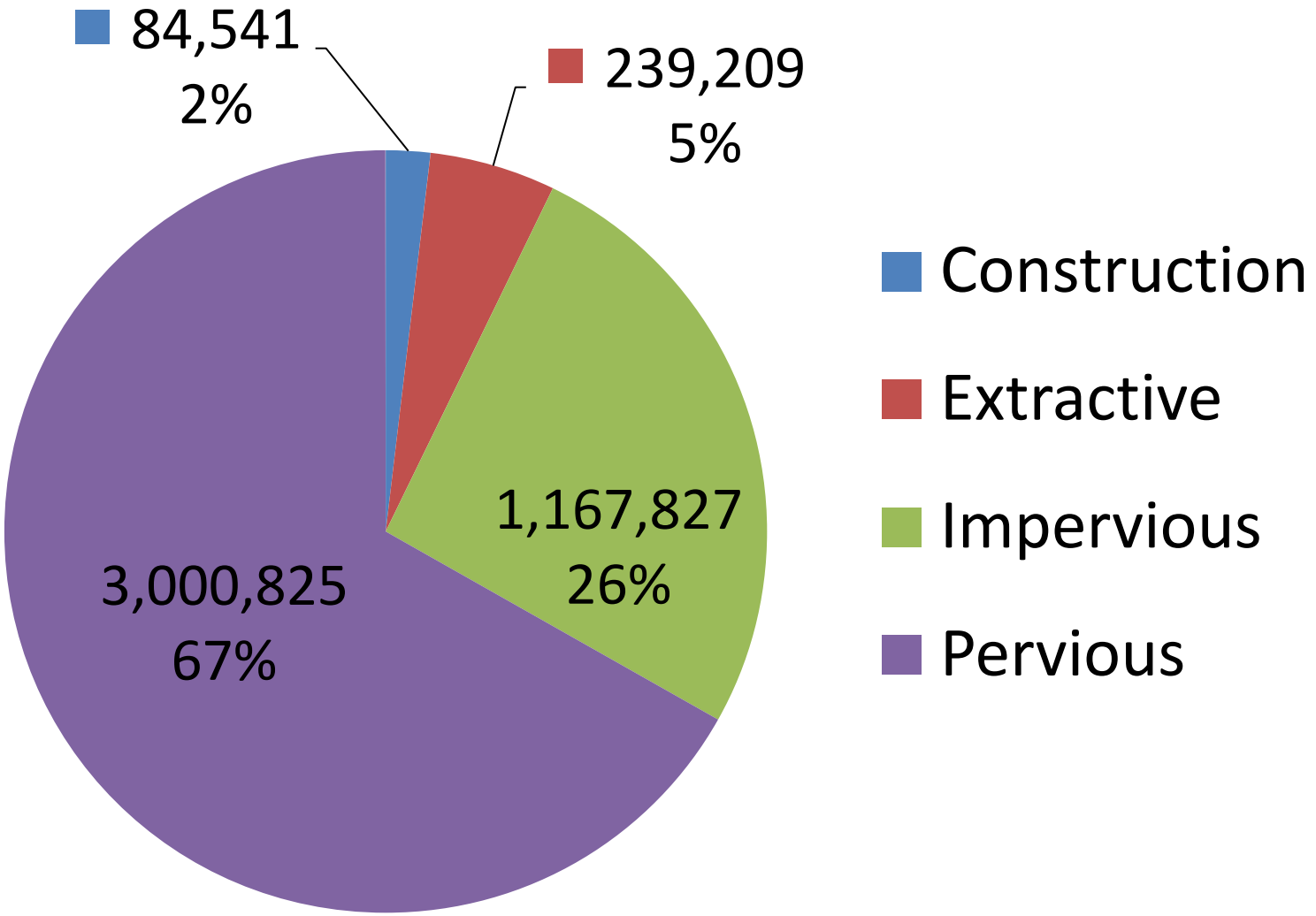
Predicted Construction Landuse (MD, PA and WV only)



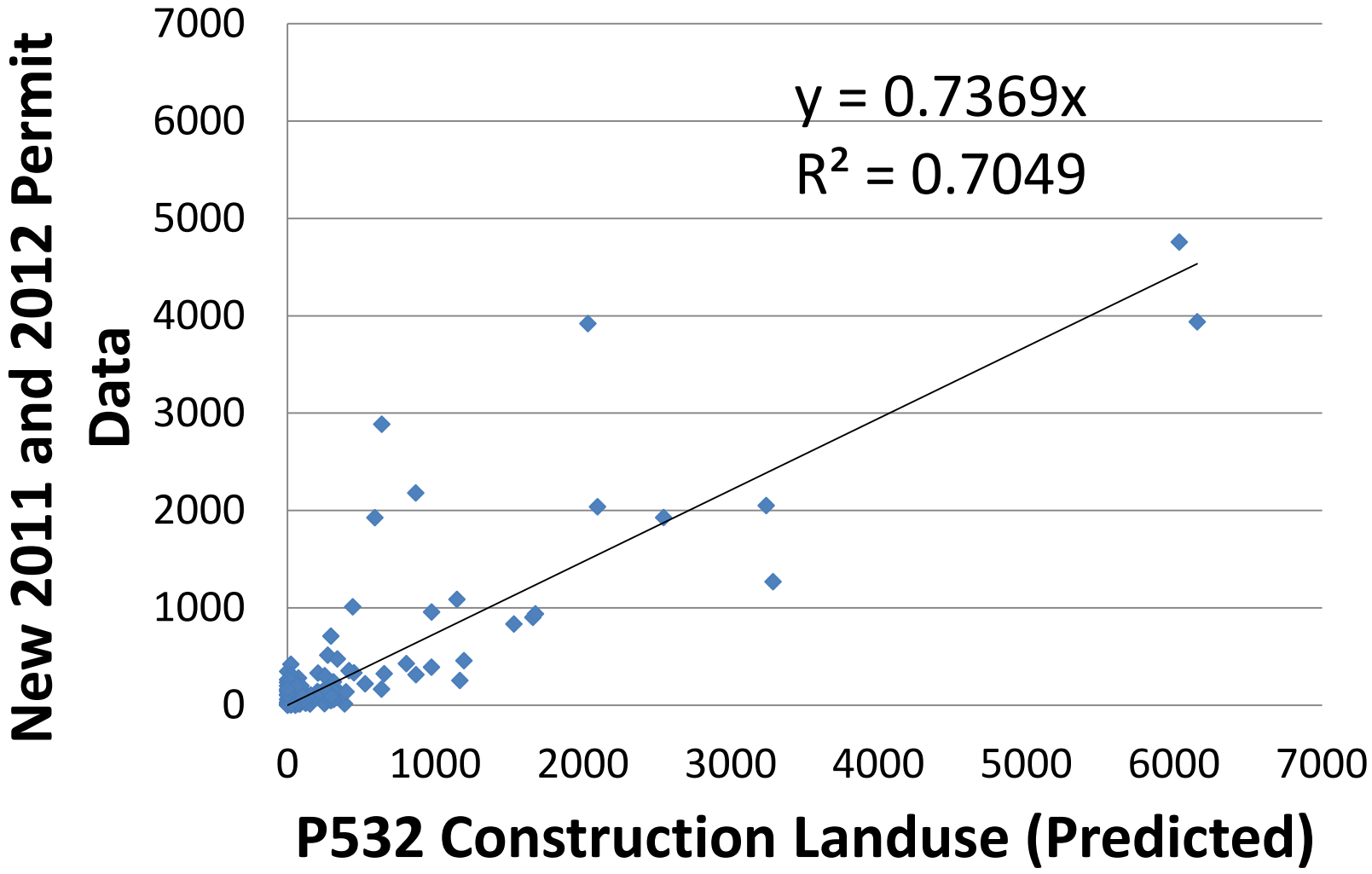




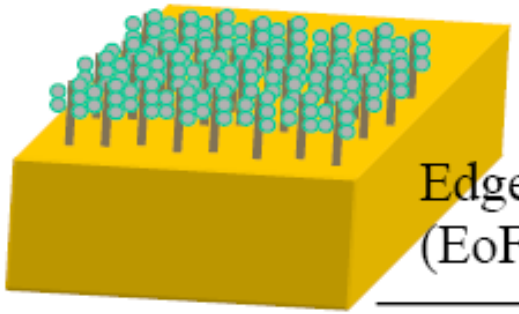
CBWM Calibration Urban Landuse (acres)



Validation (VA and WV counties only)



CBWM Sediment Simulation



Edge-of-Field (EoF) Sediment

Sediment BMP Factor

1. Sediment processes are simulated on the land surface resulting in an Edge-Of-Field sediment load. More land use types are simulated in Phase 5.3.

2. A time series of Best Management Practices (BMPs) is applied based on available data.

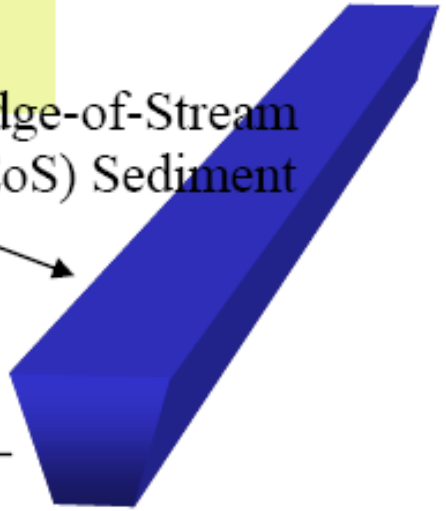
Land Acre Factor

3. A time series of land use acreage factors is applied.

4. A delivery factor based on the land use distance from the stream is applied (see below), resulting in the Edge-Of-Stream load.

Sediment Delivery Factor

Edge-of-Stream (EoS) Sediment



5. Processes of deposition and scour are simulated in the stream, resulting in concentrations that can be compared to observations.

Stream Sediment Concentrations

CBWM Sediment Simulation

- The model is calibrated to calculate sediment loads using expected annual average edge of field erosion targets.

- The overall estimated erosion rate target for construction land is 24 tones per acre per year (Trickett, 2006).

CBWM Calibration Delivered Sediment Loads (Millions of pounds)