



**Maryland**  
Department of  
the Environment



# Improving the Chesapeake Bay Watershed Model Land-Use by Incorporating Local Data

MSGIC  
July 22, 2016

Jeff White  
Maryland Department of the Environment  
[Jeff.White@Maryland.gov](mailto:Jeff.White@Maryland.gov)

Stephanie Martins  
Maryland Department of Planning  
[Stephanie.Martins@Maryland.gov](mailto:Stephanie.Martins@Maryland.gov)

Matt Kaczynski  
Caroline County Planning and Codes  
[mkaczynski@carolinemd.org](mailto:mkaczynski@carolinemd.org)



MARYLAND DEPARTMENT OF  
PLANNING



# Background

---

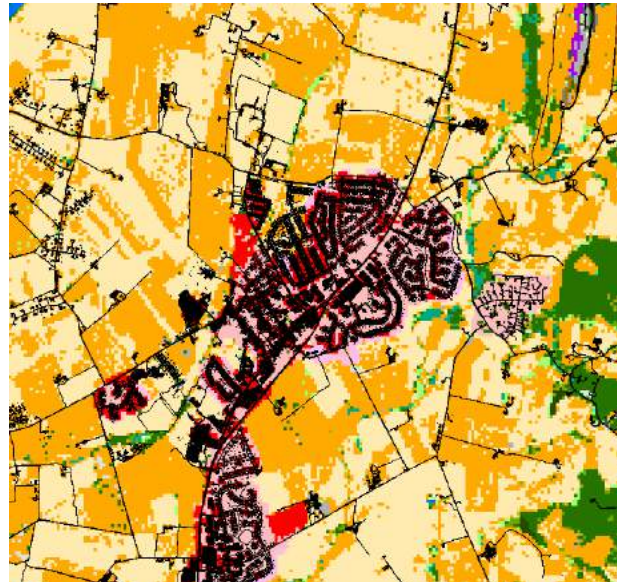
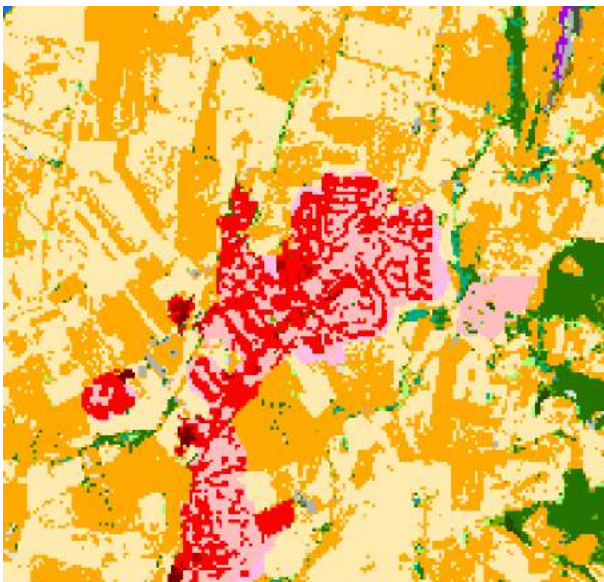
- Chesapeake Bay Total maximum Daily Load (TMDL)
  - Maximum amount of nitrogen, phosphorus, and sediment Bay can receive and still attain water quality standards
  - Specifies reductions from States
  - Developed using suite of EPA – Chesapeake Bay Program modeling tools
    - Watershed model – simulate pollutant loads from watershed
      - Phase 5 model
    - Estuarine model – simulates water quality response in bay from loads
      - Dissolved oxygen and water clarity
- Phase I and II watershed Implementation Plans
  - State plans outlining how reductions will be met
  - Assign reductions to local jurisdictions and source sectors



# Phase 5 Model Land-Use

- During Phase II WIP development, #1 comment received from local jurisdictions was that the model land-use acres were incorrect
  - Did not match local information

	Urban Imperv. (acres)	Suburb Imperv. (acres)	Rural Imperv. (acres)	Total Acres	Comparison with Local Totals
Frederick County, MD					
P532 Land Use	8,437	600	8,352	17,390	-18%
Local Data Impervious (2005)	9,784	743	10,641	21,167	



**Implications:**  
 Modeling - ???  
 Permitting - Significant



MARYLAND DEPARTMENT OF  
PLANNING



## Phase 6 Model

---

- State Phase II WIPs due in 2017
  - Will be developed using new watershed model (Phase 6)
- #1 priority for Phase 6 model is to improve the model land-use
  - How?
    - Use land-use and land-cover data from local jurisdictions to create the Phase 6 watershed model land-use
  - Why?
    - Get local jurisdictions to “buy in” to the model and its outputs
      - Load distribution, reductions, etc.



MARYLAND DEPARTMENT OF  
PLANNING



# Lessons Learned

---

- Data is not “one size fits all”
  - Different MD counties have different data accuracies, formats, and imagery dates
    - Model land-use estimates among counties can use different data, but must be consistent in what is being captured
    - Require slightly different methods per county to incorporate
      - **HUGE** time investment!!!





MARYLAND DEPARTMENT OF  
PLANNING



# Data Differences

County 1



Complete coverage

County 2



Missing features, i.e.,  
driveways, sidewalks, etc.





MARYLAND DEPARTMENT OF  
PLANNING



# Different Methods: Examples

County 1



Roads identified = no  
further work needed

County 2



Impervious features not uniquely  
identified





MARYLAND DEPARTMENT OF  
PLANNING



# Different Methods: Examples

## Solution:

Use ancillary data to identify which impervious is associated with roads







MARYLAND DEPARTMENT OF  
PLANNING



# Different Methods: Examples

- Image dates range from 2005-2014
  - Projection from image date
    - Different coefficients for each jurisdiction
    - Different projection time frame for each jurisdiction

## Non-residential projection coefficients

Non_Res_ID	Use Group	Non-Residential Development through 2010 (acres)	Non-Residential Development Impervious through 2010 (acres)	Coefficient
0	TRAVEL	248	138	56%
1	AUTO	933	480	51%
2	RESTAURANT	321	181	56%
3	STORE	2257	1525	68%
4	OFFICE	1955	920	47%
5	CARE	797	134	17%
6	BANK	4189	1148	27%
7	WAREHOUSE	4536	1885	42%
8	INDUSTRY	1061	422	40%
9	RECREATION	810	20	
10	BOAT	475	18	
11	BURIAL	15	8	
12	TRANSPORT	672	7	
13	COMMUNITY	6005	13	
14	SAFETY	878	9	

## Residential projection coefficients

LU	GENZONE	Residential Development through 2010 (acres)	Residential Development Impervious through 2010 (acres)	Coefficient
Residential	COMMERCIAL	160	27	17%
Residential	HIGH DENSITY RESIDENTIAL	593	237	40%
Residential	INDUSTRIAL	168	14	8%
Residential	LEAST PROTECTIVE	5683	500	9%
Residential	LOW DENSITY RESIDENTIAL	29214	4658	16%
Residential	MEDIUM DENSITY RESIDENTIAL	16668	4604	28%
Residential	MIXED USE	45	7	16%
Residential	MODERATELY PROTECTIVE	15720	1349	9%
Residential	MOST PROTECTIVE	1338	23	2%
Residential	MUNICIPALITY	2	0	1%
Residential	WATER	7	0	2%

*To make matters even more complicated....*



MARYLAND DEPARTMENT OF  
PLANNING



# Different Methods: Examples

*Variable image dates by parcel type within a local jurisdiction*

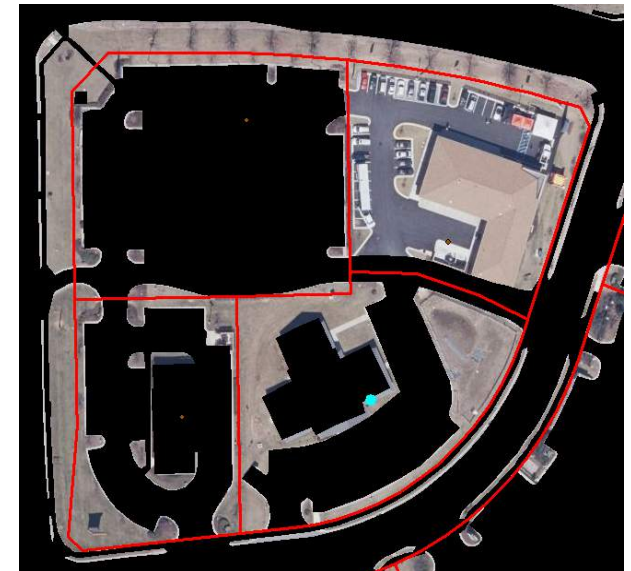
2008 Imagery



Commercial Parcel  
Parcel Built Year:  
2010  
2014 Imagery



Impervious surface  
captured in data





MARYLAND DEPARTMENT OF  
PLANNING



# Different Methods: Examples

2008 Imagery



Residential Parcel  
Parcel Built Year:  
2010  
2014 Imagery



Impervious surface not  
captured in data



***Solution:***

*Apply projection coefficients for commercial parcels from 2011  
Apply projection coefficients for residential parcels from 2008*





MARYLAND DEPARTMENT OF  
PLANNING



## Moving Forward....

---

- Because project is such a huge time and resource investment, State can not do for every progress scenario and/or model iteration
- If localities want their data to keep being used in the model, need commonality to easily incorporate
  - Other possibility: high-resolution data being collected by Chesapeake Conservancy for CBP
- State recommended specifications

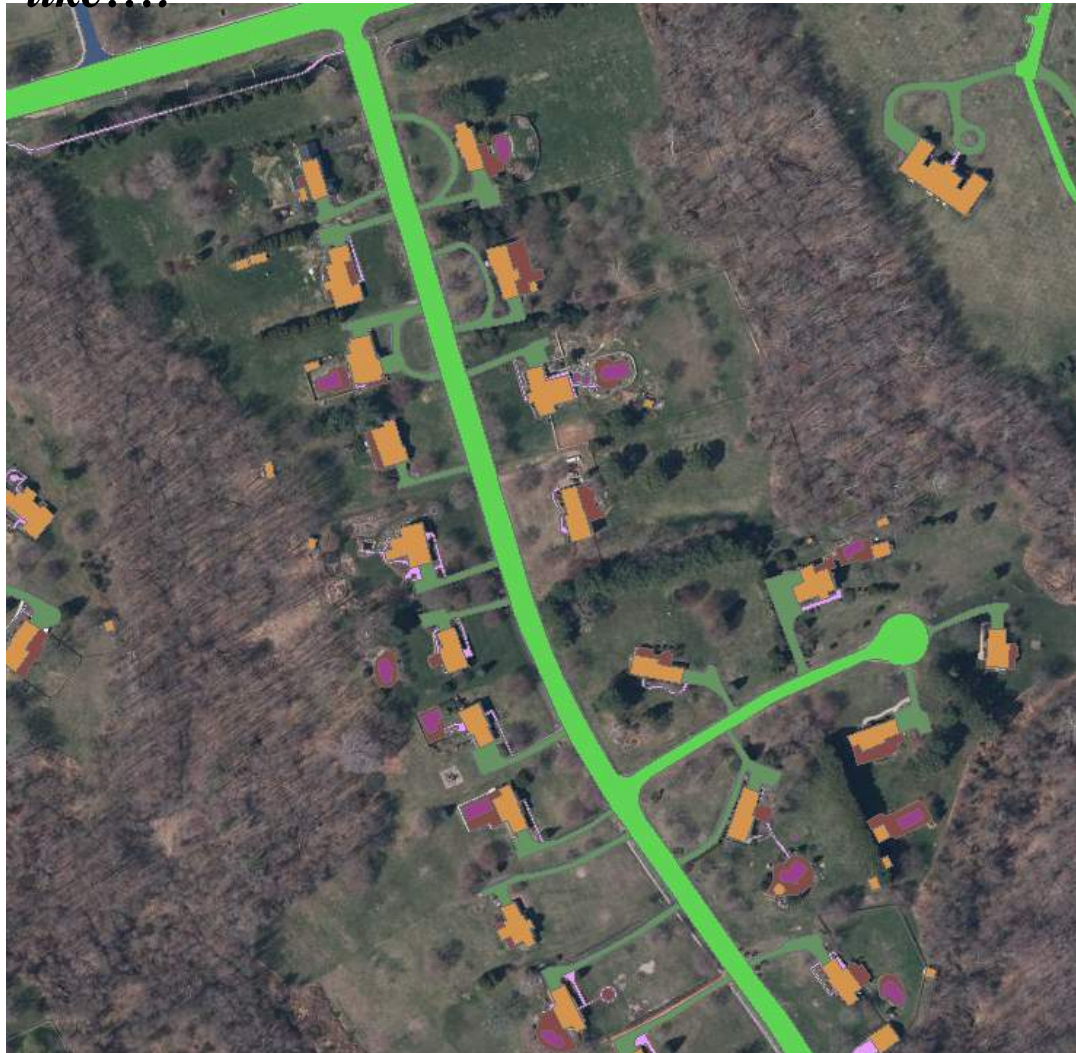


MARYLAND DEPARTMENT OF  
PLANNING



# Recommended Specification

*Example of what specification might look like....*





MARYLAND DEPARTMENT OF  
PLANNING



# Local Perspective (Caroline County)

---

- Prior data collection efforts
  - 2008 Imagery
  - Captured building footprints, roads, driveways, parking lots, and recreational features
    - Building footprints contracted out
    - Interns digitized parking lots, road centerlines, and driveway centerlines
      - Applied buffers to centerlines
    - Cost: very cheap
  - Impervious features not captured: patios, pools, and sidewalks
    - Minor features ~ 4% of total impervious surfaces





MARYLAND DEPARTMENT OF  
PLANNING



# Local Perspective (Caroline County)

---

- Implications
  - If locality can capture building footprints, parking lots, road centerlines, and driveway centerlines, can account for ~ 90% of total impervious surfaces
- Future efforts
  - Update data with more recent imagery
  - Potential for partnerships with universities and internships: Washington College, Salisbury University, etc.
- What state recommended specifications for data collection means from a local perspective
  - Clear guidance on what should be collected = ease of project
  - What level of data do we need to collect to make a



MARYLAND DEPARTMENT OF  
PLANNING



## Next Steps

---

- Broader buy-in for this approach. Is a specification for planimetrics/impervious surface data useful for other purposes/programs?
  - MS4 permit required impervious area baselines
- Explore funding opportunities
- Work with MSGIC to write and publish specifications
- Work with local jurisdictions to incorporate specifications/timing of updates, etc.