Department of the Environment

Chesapeake Bay Phase 6 Watershed Model Land-Use

Incorporating Data from Maryland's Local Jurisdictions

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MDP, MDE – SSA, and Tetra Tech, Inc.
Stephanie Martins – Stephanie.Martins@Maryland.gov
Jeff White – Jeff.White@Maryland.gov
Alex DeWire – alex.dewire@tetratech.com

MD Phase 6 Land-Use Development

- By September, 2015 MD will have estimates for:
  - Impervious surfaces
    - Road and non-road
  - Tree Canopy
  - Forest
  - Wetlands
    - Tidal, floodplain, and headwater
  - Turf Grass

- Final data product
  - Tabular estimates
  - Spatial data layer (approximate locations)

MD Phase 6 Land-Use Development

- Phase II WIP development

  – Local jurisdictions said model land-use is not accurate

- Phase 6 land-use development

  – Began in February 2013

  – Collect data from local jurisdictions to improve accuracy

- Guiding principle for MD

  – Leave accuracy of data from local jurisdictions intact

  – Compliment, if need be, for model requirements

Impervious Surfaces

- Data similarities among jurisdictions

  - Complete planimetric data

  - Incomplete planimetric data + high res land-cover

  - Incomplete planimetric data only

  - Building footprints and/or roads only

- Imagery years vary among counties:

  - Generally, 2005-2011

- Phase 6 baseline = 2012

- Scenario 1

- **Complete planimetric dataset**
- **If imagery year = 2010**
- **Model simulation year 2010 = polygons acres**
- **Issue: model baseline = 2012**

Project to Baseline Conditions

- Impervious data
  - Imagery = Winter/Spring 2011
    - Reflects 2010 conditions

- How project to 2012?
  - Best available data
    - MDP - MD Propertyview database
    - MDP - Generalized Zoning
    - Parcels developed in 2011 and 2012

- Method
  - Calculate impervious coefficients for parcels in 2010
  - Project to 2012 based on increase in developed parcels
  - Projection for both residential and non-residential parcels
    - Res: impervious % varies per parcel type/zoning
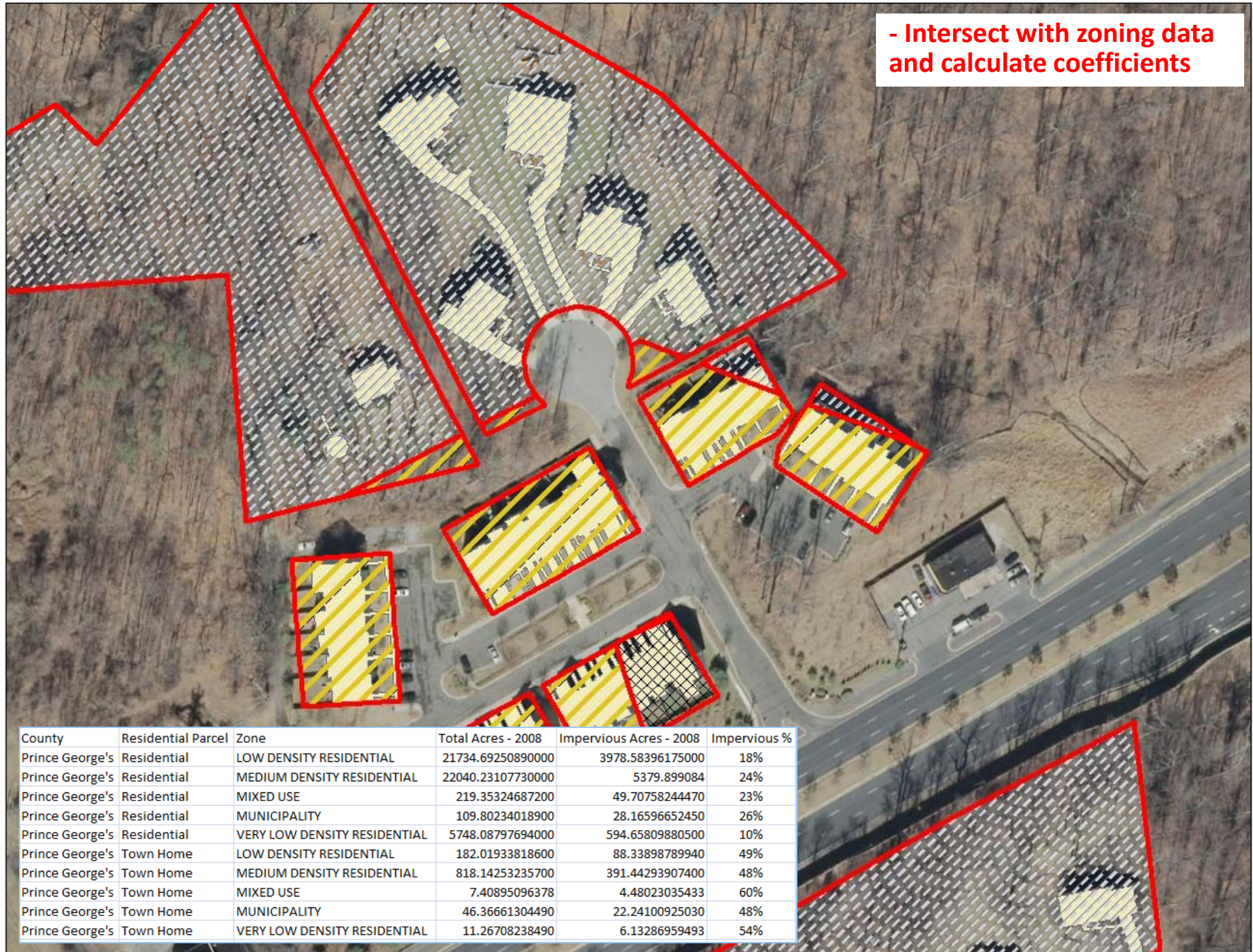   - Non-res: impervious % varies by type (CIUSE)

- Extract single family residential parcels: residential + townhomes + condos + Ag

- Extract impervious associated with single family residential parcels
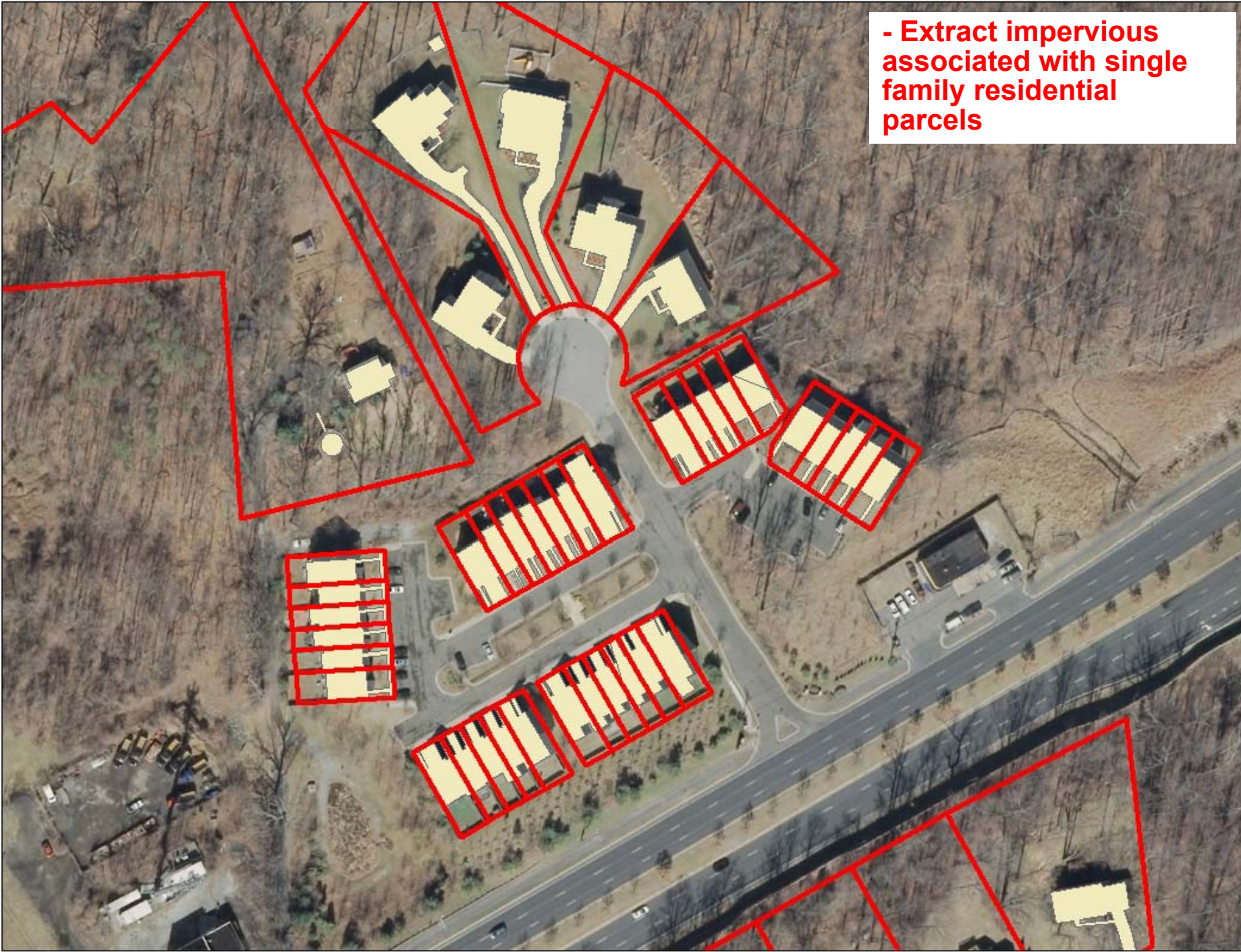
- Intersect with zoning data and calculate coefficients

| County	Residential Parcel	Zone	Total Acres - 2008	Impervious Acres - 2008	Impervious %
Prince George's	Residential	LOW DENSITY RESIDENTIAL	21734.69250890000	3978.58396175000	18%
Prince George's	Residential	MEDIUM DENSITY RESIDENTIAL	22040.23107730000	5379.899084	24%
Prince George's	Residential	MIXED USE	219.35324687200	49.70758244470	23%
Prince George's	Residential	MUNICIPALITY	109.80234018900	28.16596652450	26%
Prince George's	Residential	VERY LOW DENSITY RESIDENTIAL	5748.08797694000	594.65809880500	10%
Prince George's	Town Home	LOW DENSITY RESIDENTIAL	182.01933818600	88.33898789940	49%
Prince George's	Town Home	MEDIUM DENSITY RESIDENTIAL	818.14253235700	391.44293907400	48%
Prince George's	Town Home	MIXED USE	7.40895096378	4.48023035433	60%
Prince George's	Town Home	MUNICIPALITY	46.36661304490	22.24100925030	48%
Prince George's	Town Home	VERY LOW DENSITY RESIDENTIAL	11.26708238490	6.13286959493	54%

Impervious 2012

- 2012 IC = 2010 IC + [(ΔDPA, 2010-2012) x (IC %)]
  - Where,
    - IC = Impervious cover
    - ΔDPA = increase in developed parcel acres
    - IC % = impervious coefficient

- For residential and non-residential parcels
  - Residential = coefficients by parcel type and zone
  - Non-residential = coefficients by CIUSE

- QA/QC
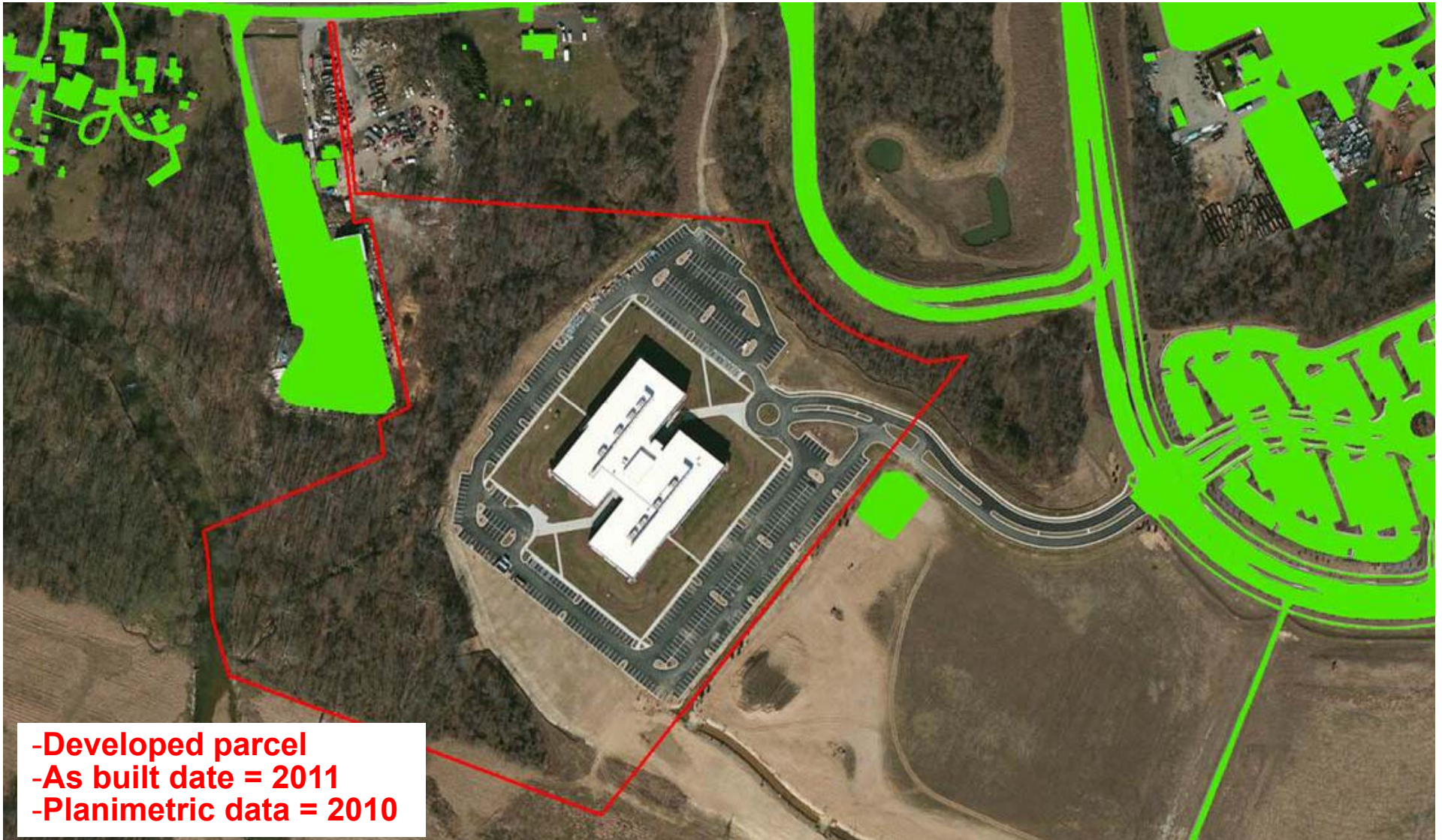
-Developed parcel
-As built date = 2011
-Planimetric data = 2010

What about roads?

- NAVTEQ
  - Best available data
    - 2012 conditions

- Method:
  - Intersect road centerlines with impervious polygons
  - Roads that do not intersect polygons = new development
  - Buffer based on attributes, i.e., # lanes
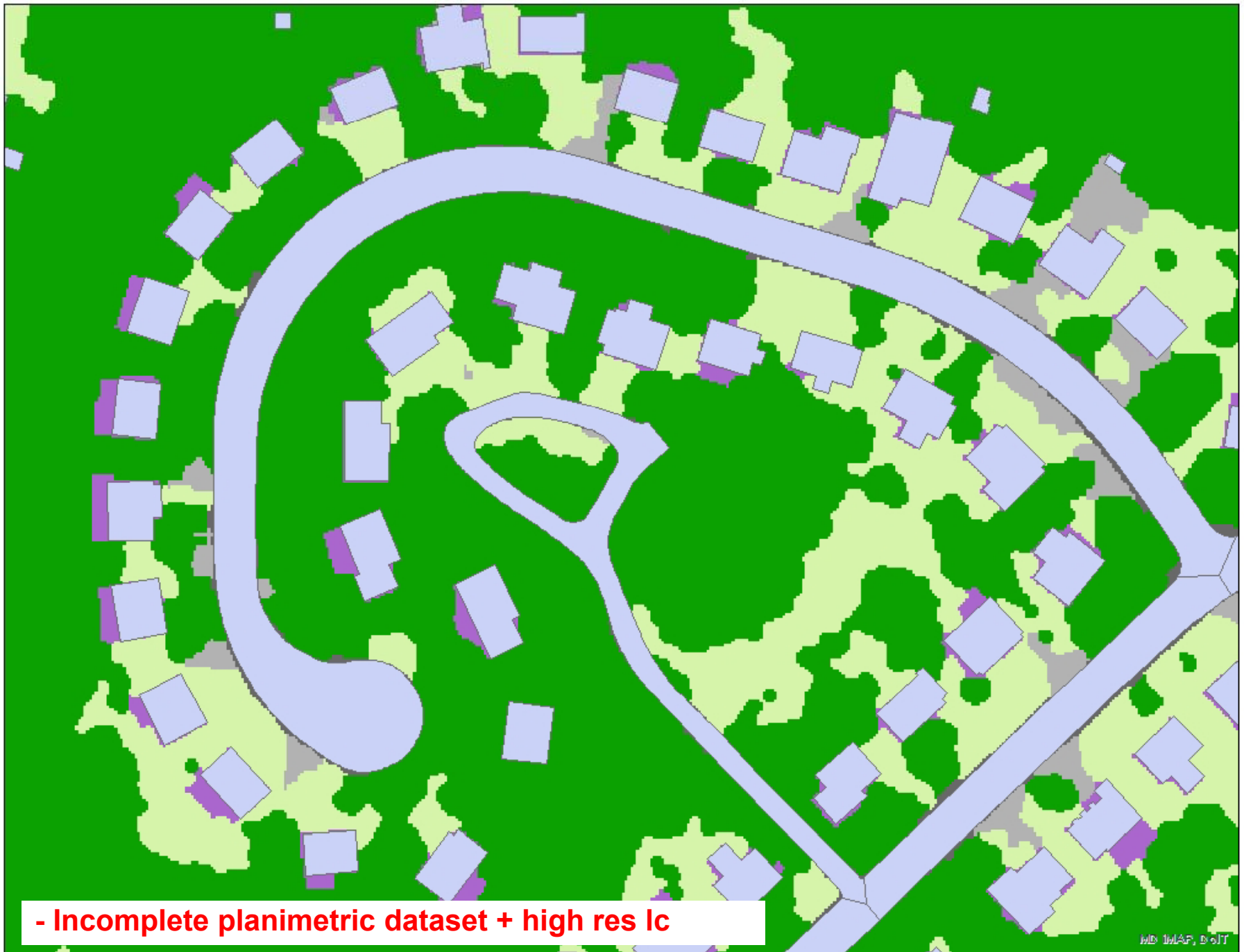
-NAVTEQ road data to estimate increase in road impervious
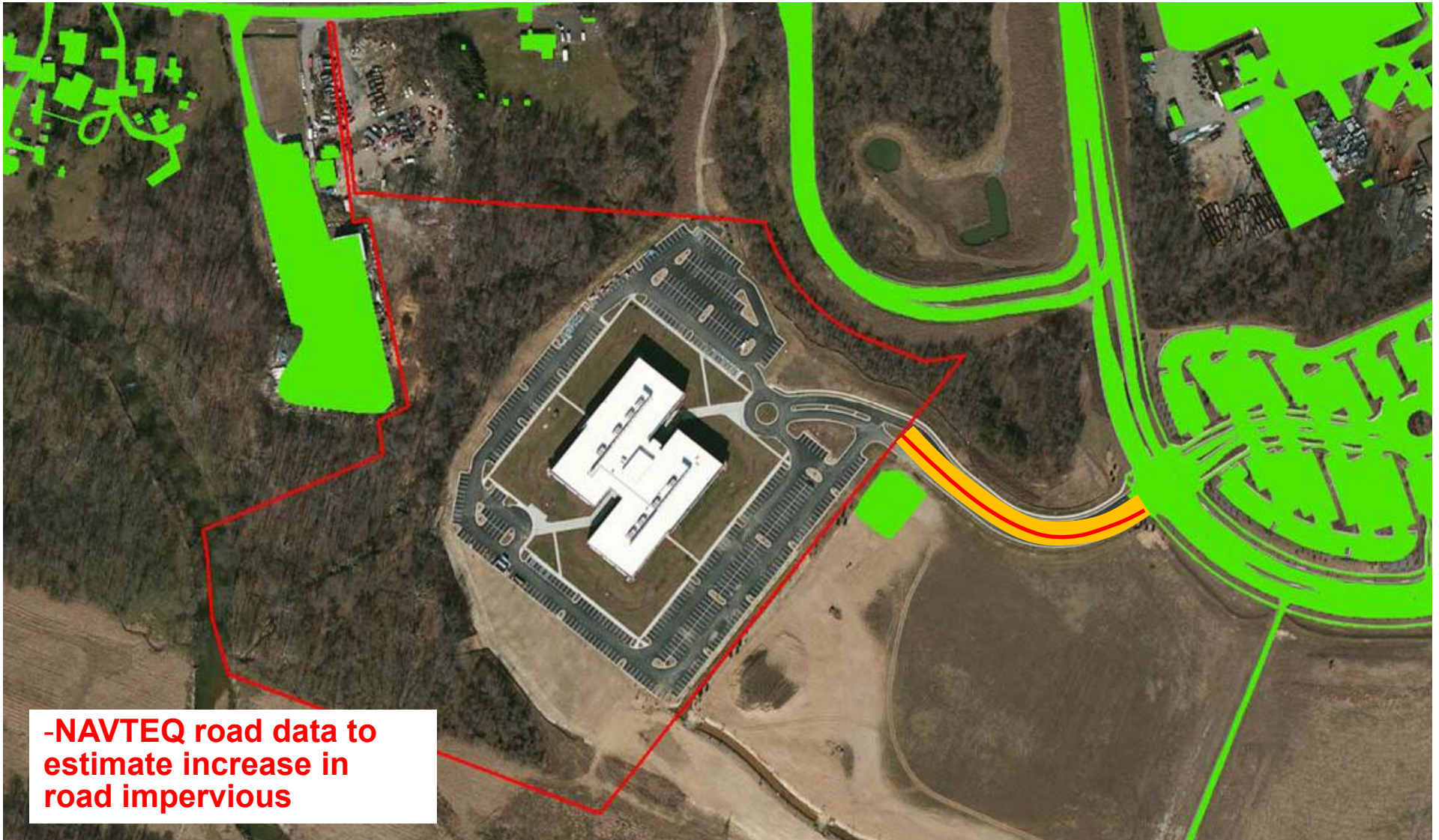
- Scenario 2

- Incomplete planimetric dataset

- Incomplete planimetric dataset + high res lc

MD iMAP, DoIT

-Burn planimetric data into high res Ic

MD iMAP, DoIT

Error Adjustment

- Error assessment on reclassified LC

		Imagery Actual Classification		
		Impervious	Pervious	
Data Classification	Impervious	**42**	**8**	50
	Pervious	**1**	**49**	50
		43	57	

- Method:

  – Adjust impervious acres per model segment up or down based on error assessment
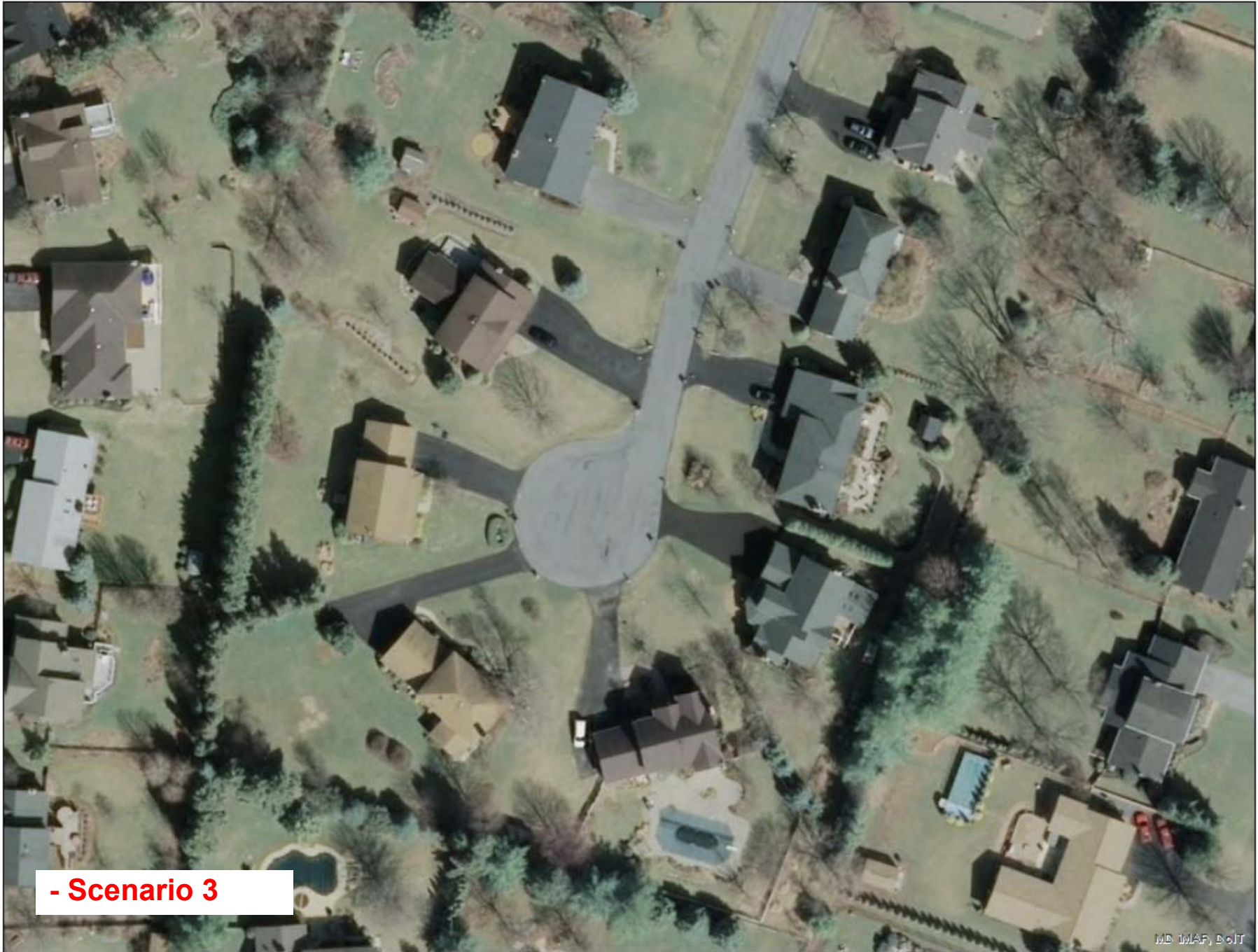
- Scenario 3

-Incomplete planimetric dataset
-No high res lc
-Missing small features

Estimate Minor IC Feature Area

- Account for minor impervious features missing from data using coefficients

- Method:
  - Use counties with complete planimetric data
  - Identify parcel types majority of features are located in
  - Calculate coefficients for these parcel types
  - Apply coefficients to county with missing data

Estimate Small IC Feature Area

Patios		
Tax Assessment	**Acres**	**Percentage (%)**
N/A	9	1%
Agriculture (A)	15	1%
Commercial (C)	36	3%
County Club (CA)	1	0%
Commercial Condo (CC)	0	0%
Commercial Residential (CR)	4	0%
Exempt (E)	12	1%
Exempt Commercial (EC)	15	1%
Industrial (I)	2	0%
Apartments (A)	9	1%
Marsh Land (MA)	0	0%
Residential (R)	1,039	89%
Residential Commercial (RC)	0	0%
Residential Condo (U)	27	2%
Total	**1,170**	**100%**
Total GIS Acres	**1,229**	
Total County Impervious Acres	**39,071**	
% Patio	**3%**	

| Feature	Tax Assessment (TA)	Feature TA Impervious (Acres)	Total TA Impervious (Acres)	Feature TA Coefficient (%)
Sidewalk	Residential (R)	471	12,562	4%
Sidewalk	Commercial (C)	207	6,035	3%
Sidewalk	Exempt Commercial (EC)	573	13,995	4%
Patio	Residential (R)	1,039	12,562	8%
Pool	Residential (R)	230	12,562	2%

Turf Grass

- Random Sampling + Statistical Modeling

- Method

  - Randomly sample developed parcels and digitize turf from imagery

  - Use statistical methods to make decision rules regarding amount of turf on parcels

  - Develop statistical models to predict turf on developed parcels

  - Done by parcel type

Turf Grass
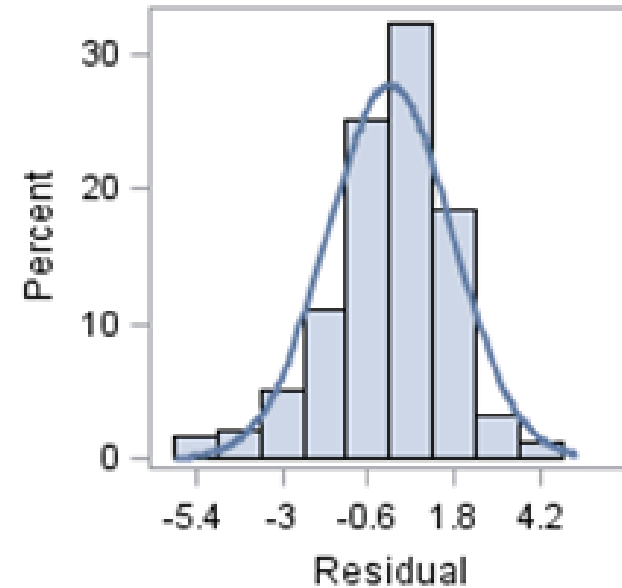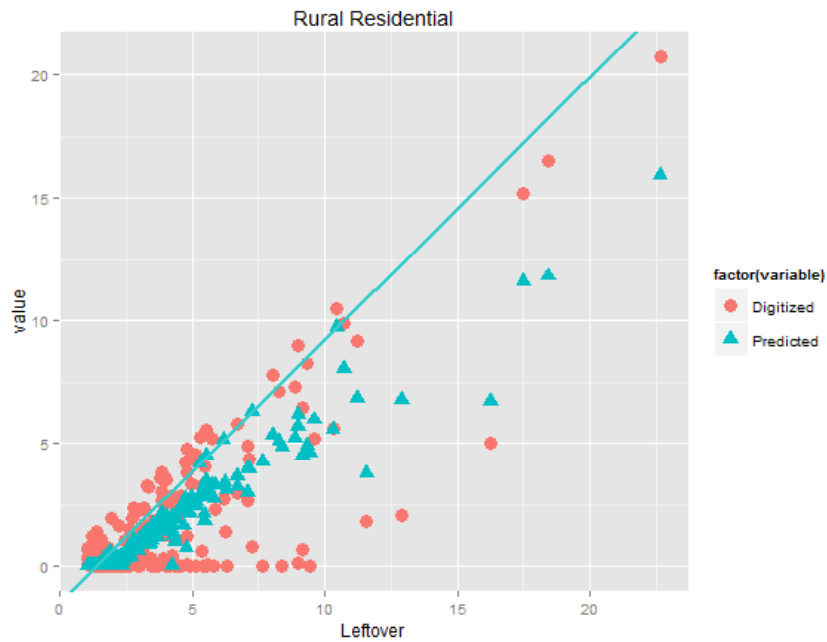
$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

Y = Turf acres

X_1 = Leftover acres

X_2 = Interaction term Leftover * Residential Building acres

Forest and Urban Tree Canopy

- Best available data
  - UMD 2013 statewide 1 m canopy cover and local jurisdiction data
  - Same methods used for local canopy data (Univ. Vermont)
  - Updated imagery year vs. local canopy data

- Forest vs. urban tree canopy
  - MD DNR modeling
    - Uses statewide 1 m canopy data
    - Applies US Forest Service definitions for forest
      - Total size = 1 acre
      - Width = 120 ft.
    - Leftover canopy = urban tree canopy

Wetlands

- Data
  - NWI data
  - MD DNR data
  - DFIRMs

- Method
  - Union NWI + DNR polygons
  - Extract wetlands with emergent vegetation
  - Erase open water areas (NHD waterbodies)
  - Divide into sub-classifications
    - Tidal = NWI + DNR attribute information
    - Floodplain = intersection with 100 year floodplains (DFIRMs)
    - Headwater = Leftover

Agriculture

- Agriculture acres set by agricultural census data

  – Cropland

  – Pasture/Hay

  – Specialty Crops

Updates

- Updates to local jurisdiction planimetric data
  - End of 2015
  - If received, possible incorporation by Summer 2016 (LULC V3)

- Data needs from some jurisdictions
  - Methods for counties with no data

- BMPs
  - Importance of SW BMP cleanup to accompany improvements in land-use

County	Planimetric Data	High Res. Land-Cover Data
Anne Arundel	Complete	Yes
Prince George's	Complete	Yes
Harford	Complete	No
Charles	Complete	No
Calvert	Complete	No
Dorchester	Complete	No
Montgomery	Missing Features	Yes
Baltimore City	Missing Features	Yes
Baltimore	Missing Features	Yes
Frederick	Missing Features	No
Howard	Missing Features	No
Allegany	Missing Features	No
Caroline	Missing Features	No
Cecil	Missing Features	No
Kent	Missing Features	No
Queen Anne's	Missing Features	No
Talbot	Missing Features	No
Wicomico	Missing Features	No
Carroll	No	No
Garrett	No	No
Somerset	No	No
St. Mary's	No	No
Washington	No	No
Worcester	No	No

Questions?

**Stephanie Martins – Stephanie.Martins@Maryland.gov
Jeff White — Jeff.White@Maryland.gov
Alex DeWire – alex.dewire@tetratech.com**