

# **New Land Cover and Land Use Data for Counties in the Chesapeake Bay Watershed**

**Peter Claggett, U.S. Geological Survey**

**September 20, 2016**

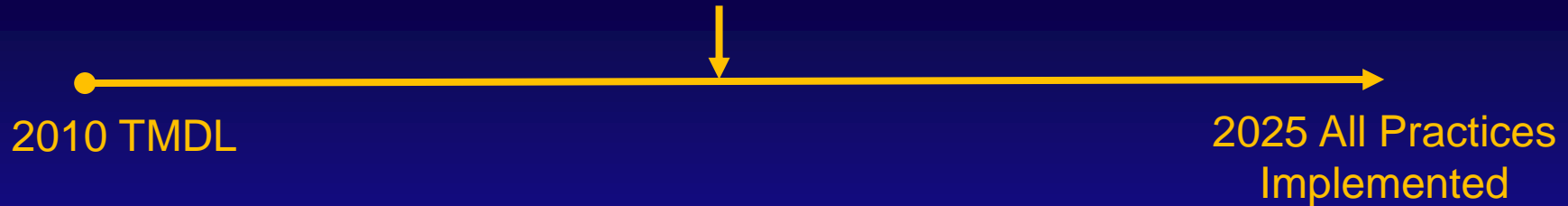
**Webinar: <http://www.chesapeakebay.net/calendar/event/24320/>**

# Presentation Outline

1. Purpose and Background
2. Production of 2013 Land Use Data
3. Production of historic land use data, 1984 – 2013
4. Local Review Expectations and Process
5. Q & A.



# Chesapeake Bay 2017 Mid-Point Assessment



Goal: Determine whether the implementation the CBP Partnership's restoration strategies by 2025 will achieve water quality standards in the Bay.

Objective: Make this determination based on the best available science data, tools, BMPs, and lessons-learned.

**#1 Priority: improve accuracy of land use/cover data.**

Best available data = county & municipal level land use, land cover, parcels, sewer service areas, zoning, and other relevant information.

## Local land use and parcel data



- Low-density Residential
- Recreation
- Agriculture
- Roads

## High-resolution land cover data



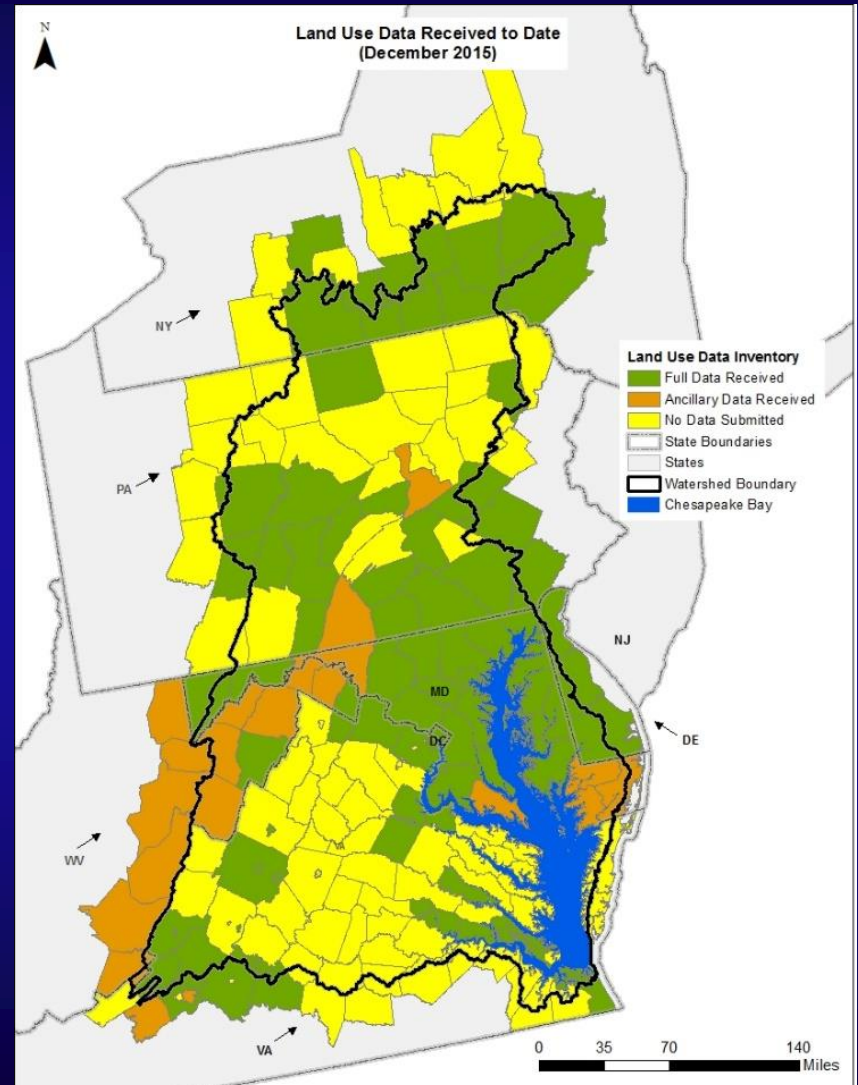
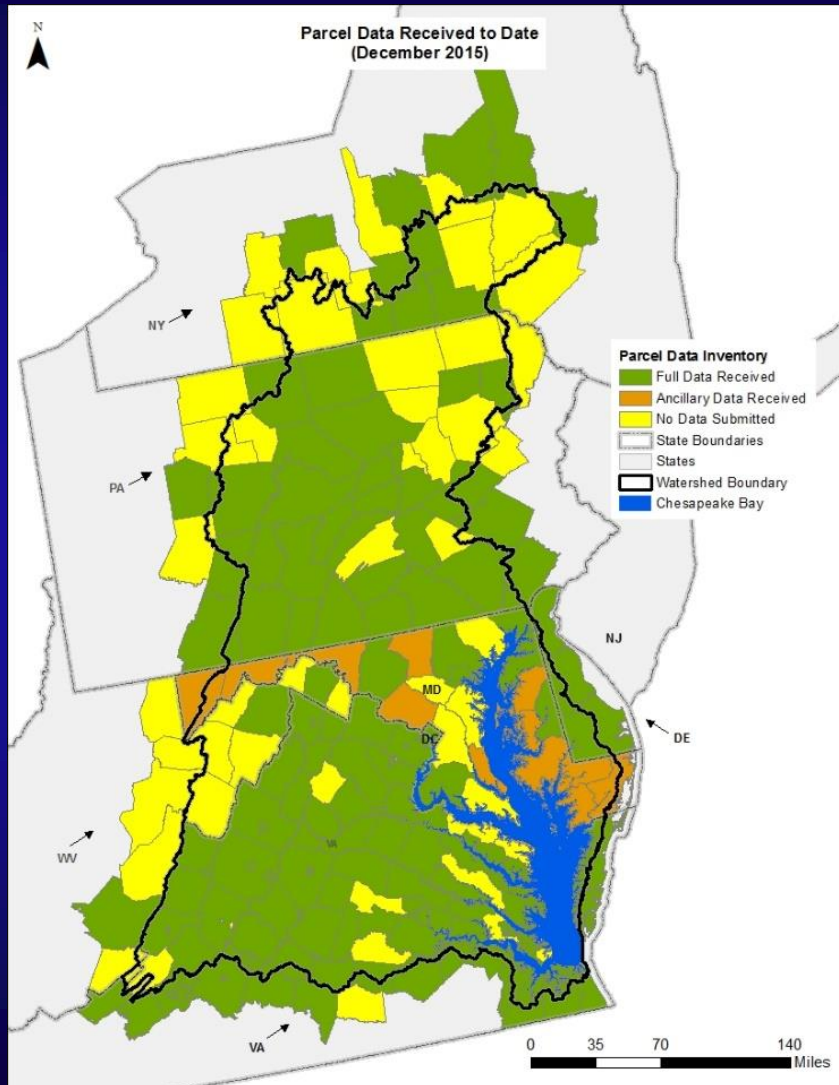
- Impervious surfaces
- Tree canopy
- Low vegetation
- Water



### Phase 6 Land Uses

- Impervious-Roads
- Forests
- Turf Grass
- Open Space

# Local Parcel and Land Use Data Collected by CBP

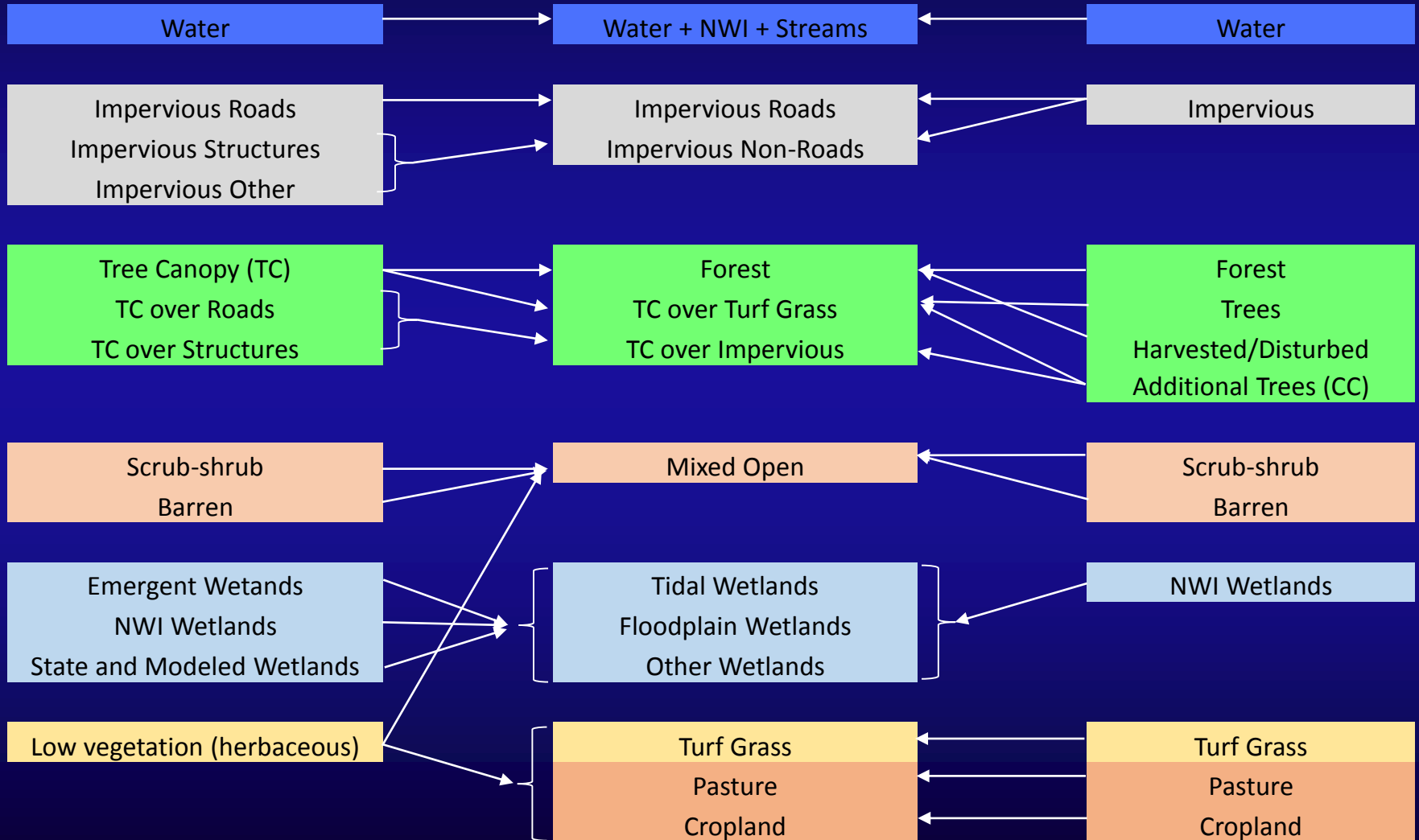


# Land Cover to Land Use Crosswalk

## Chesapeake Conservancy/ UVM

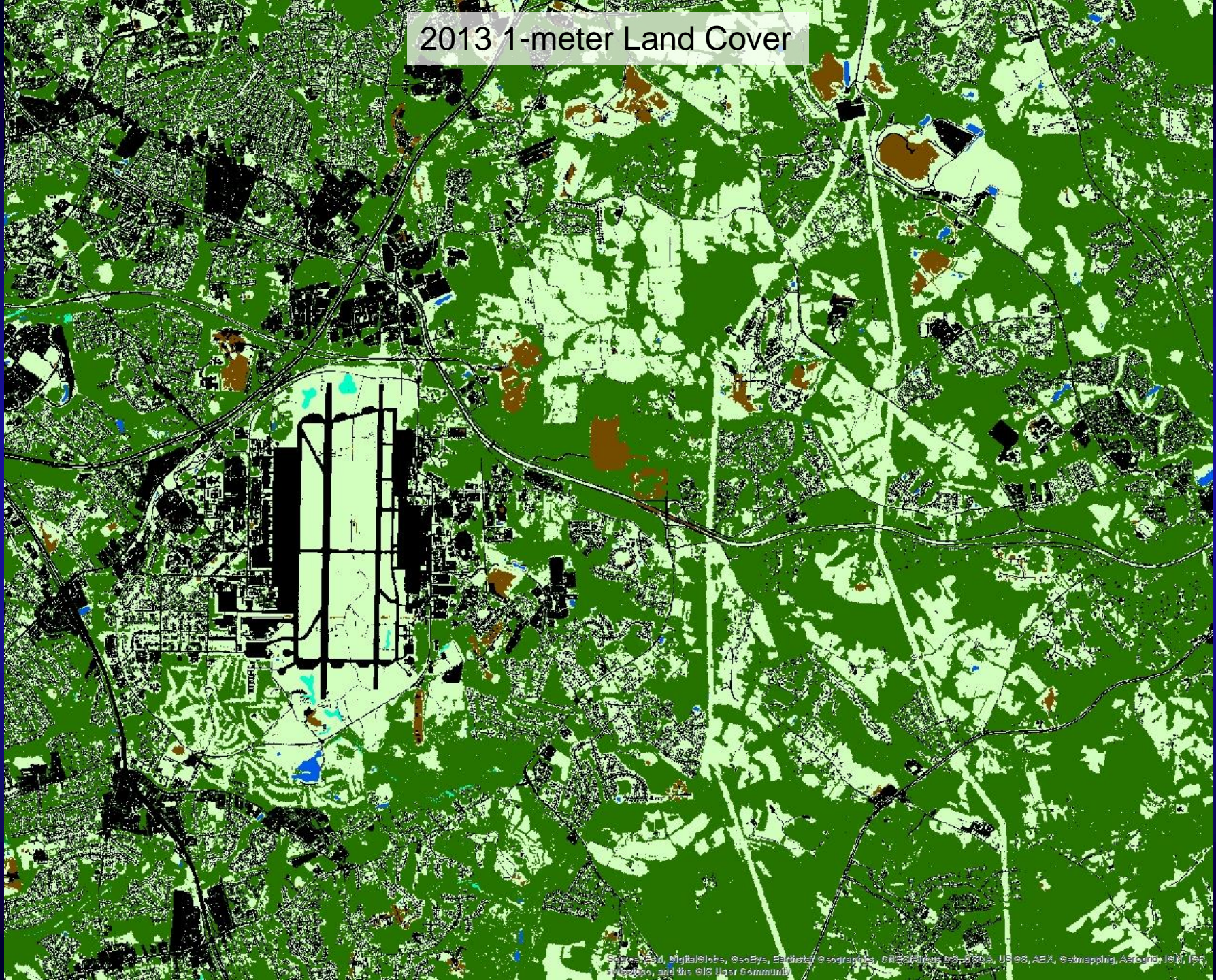
## Phase 6 CBP

## Worldview Solutions Inc.





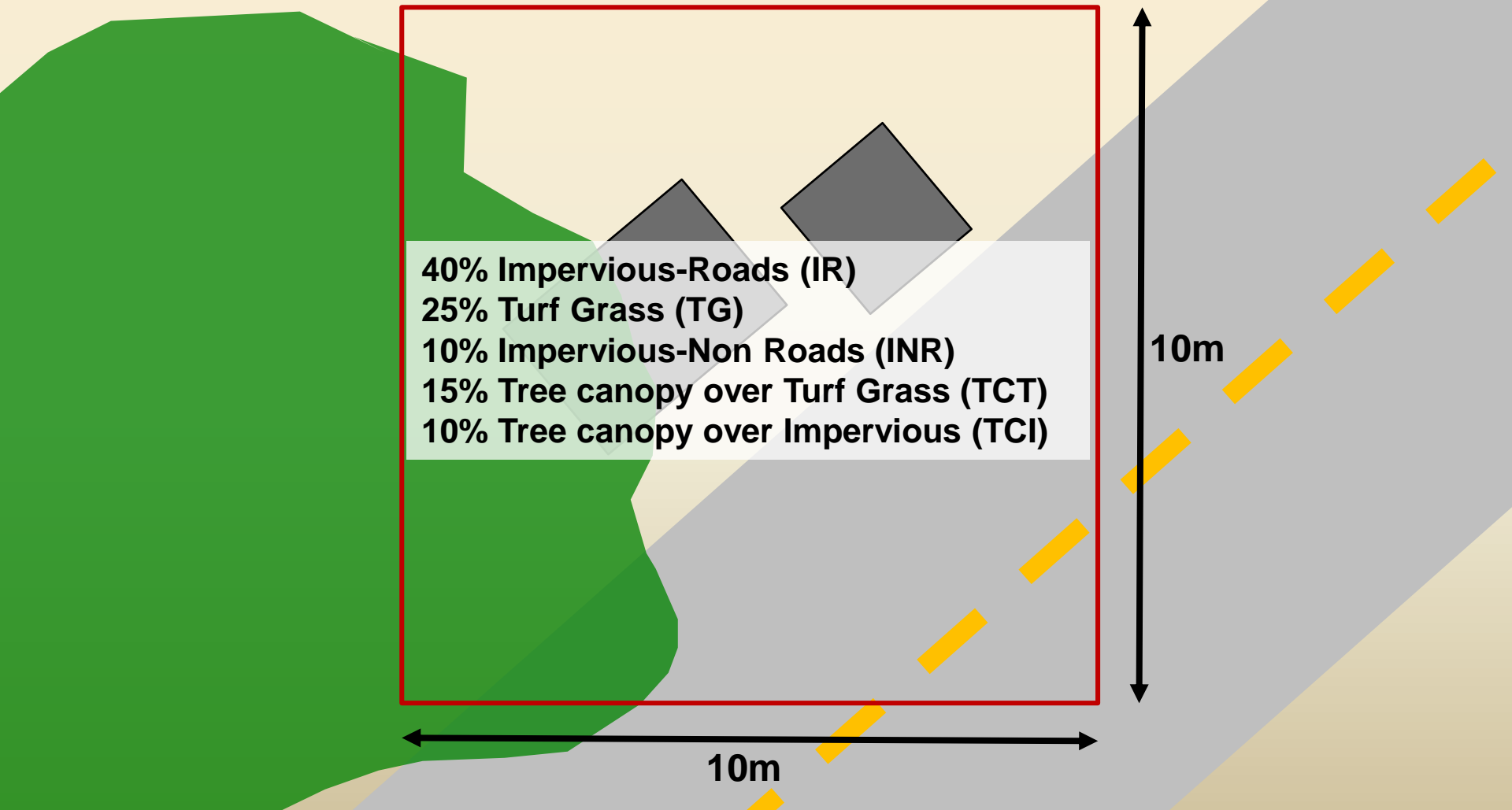
# 2013 1-meter Land Cover



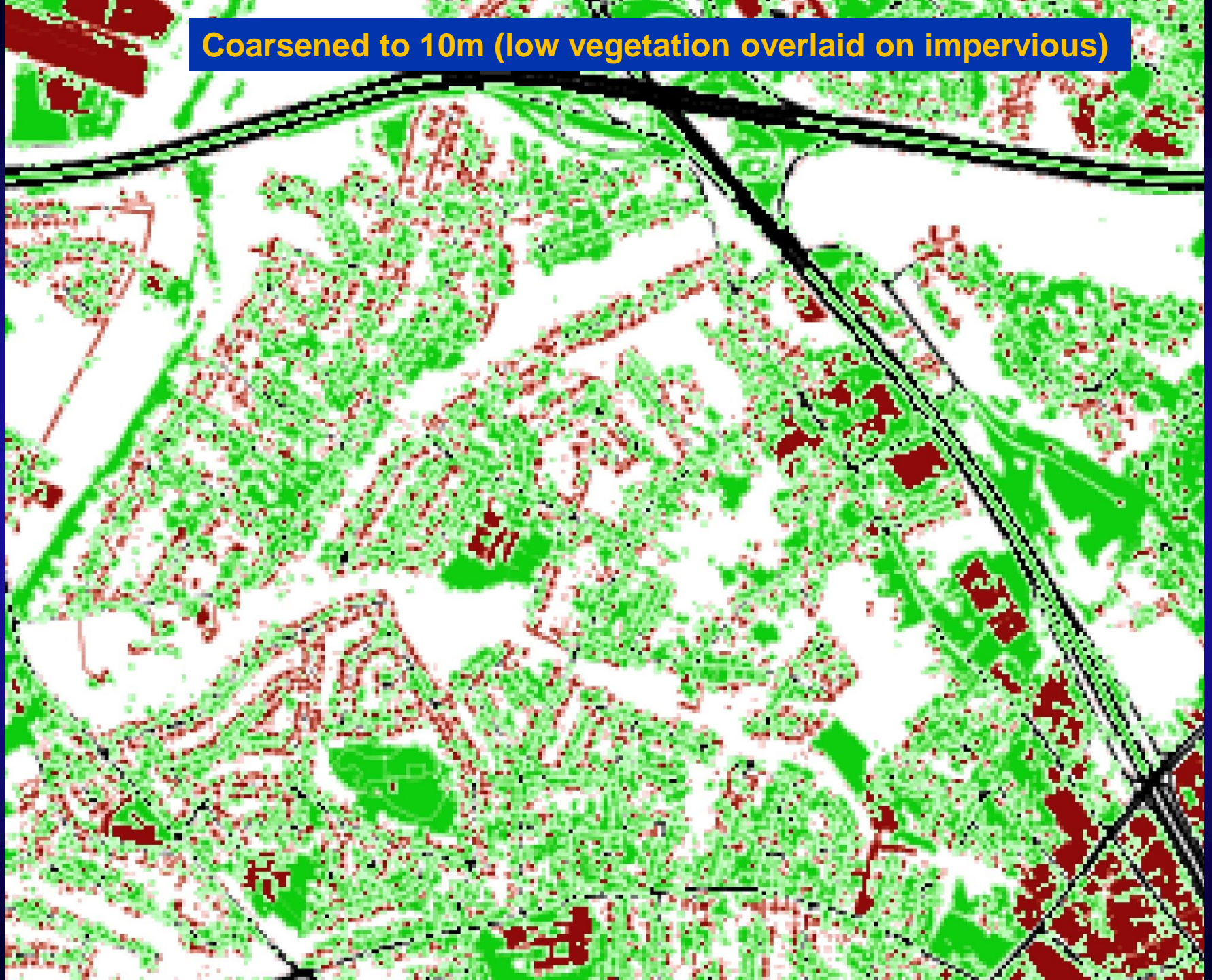


# Phase 6 Land Use Database – from local & high-res data

- Thirteen different 10m resolution raster datasets
- Each cell includes the fractional composition of all land uses.



Coarsened to 10m (low vegetation overlaid on impervious)



# P6 Developed Land Uses

**Impervious Roads:** paved and unpaved roads and bridges.

**Impervious Non-Roads:** buildings, driveways, sidewalks, parking lots, runways, and some private roads.

**Tree Canopy over Impervious:** trees overhanging impervious surfaces.

**Tree Canopy over Turf Grass:** trees overhanging low vegetation within 30' to 80' of impervious non-roads.

**Turf Grass:** low vegetation within developed\* areas that are potentially fertilized and/or mowed and assumed to have partially compacted soils with a shallow organic layer.



# P6 Developed Areas- defined

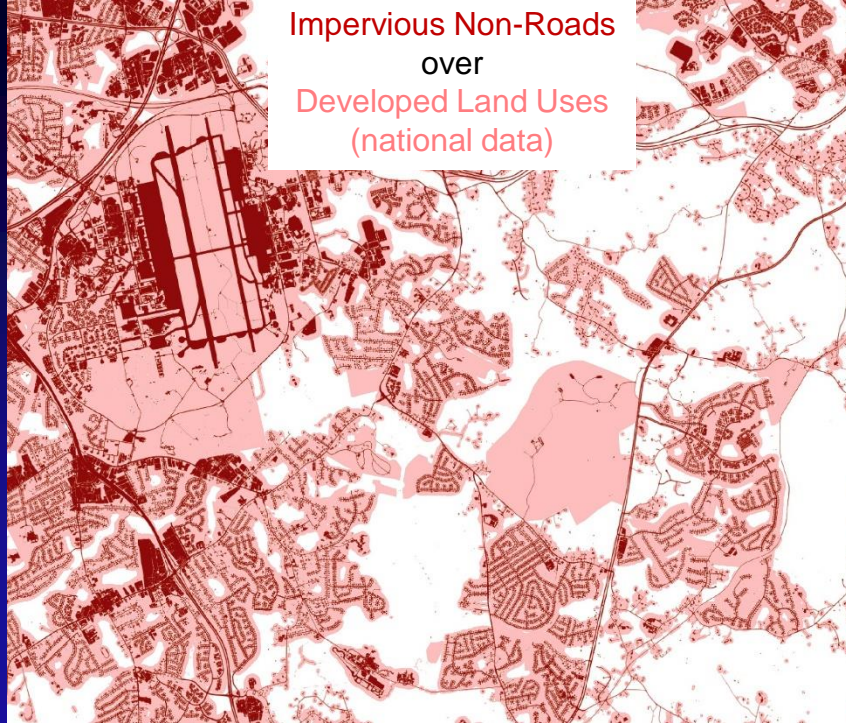
## With local data:

- Land Use:
  - residential, commercial, industrial, recreational, institutional and other urban uses.
- Parcels:
  - $\leq 10$  acres with at least 1000ft<sup>2</sup> (93m<sup>2</sup>) of non-road impervious surfaces.

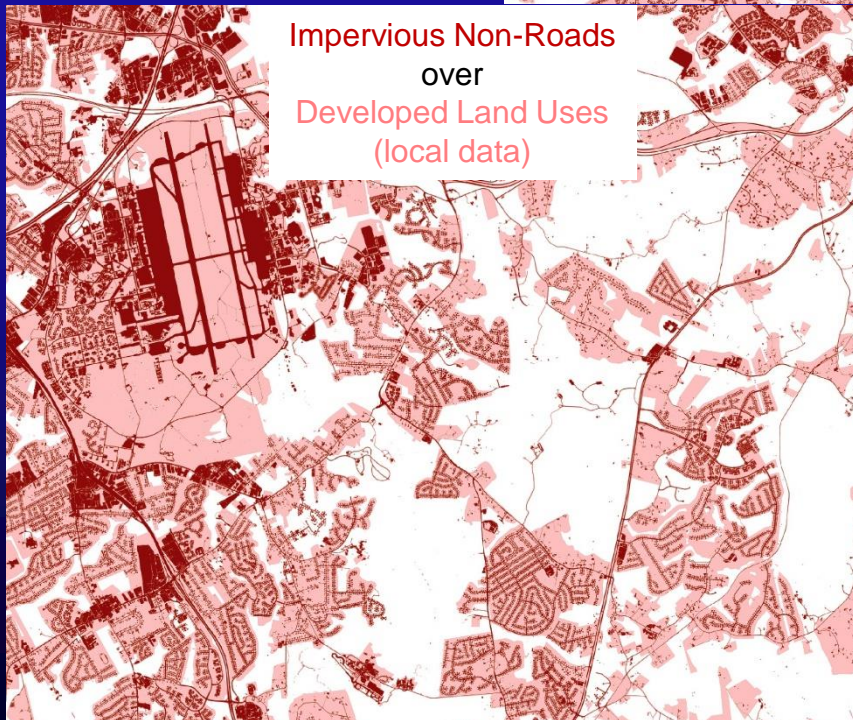
## With just land cover data:

- Zone within 30'-80' of dense non-road impervious surface areas.

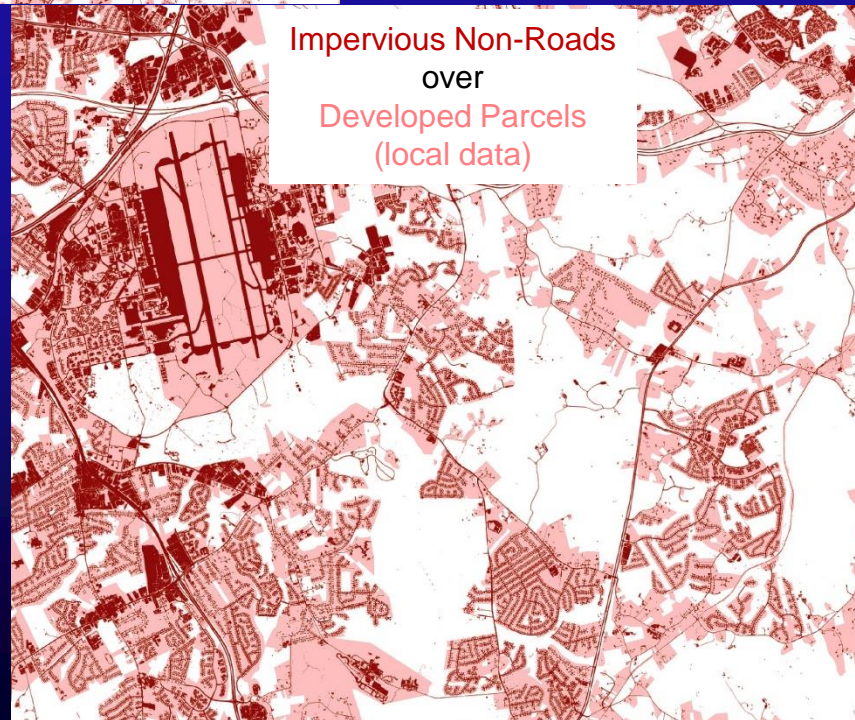
**Impervious Non-Roads  
over  
Developed Land Uses  
(national data)**



**Impervious Non-Roads  
over  
Developed Land Uses  
(local data)**



**Impervious Non-Roads  
over  
Developed Parcels  
(local data)**



## P6 Natural Land Uses

**Forest:** trees farther than 30' to 80' from impervious non-roads with patch sizes  $\geq 1$  acre.

**Wetlands:** Areas mapped as wetlands in the National Wetlands Inventory (NWI), state wetland datasets, or areas modeled as wetlands based on soils, vegetation, and topography.

**Water:** All waterbodies mapped in the high-resolution land cover data, NWI water features, and stream surface areas modeled from a 10m-resolution Digital Elevation Model.

## P6 Mixed Land Uses

**Mixed Open:** all scrub-shrub and low vegetation and barren lands associated with landfills, surface mines, beaches, transmission line right-of-ways, vacant lots, etc.

**Mixed Open (30%)/Impervious (70%):** low vegetation and barren lands within industrial, transitional, and other areas assumed to be heavily compacted.

**Mixed Open (30%)/Turf Grass (70%):** low vegetation and barren lands within large parcels and institutional and government properties assumed be variably managed.



# Federal Facilities Editor Tool

gis.chesapeakebay.net/fedfacs/

**Federal Facilities Editor**

Use this map to edit the land use data for Federal Facilities.

Find a facility by typing an address in the search box, or by zooming/panning the map.

Click a facility to view and/or edit its data.

☐ Federal Facilities

0% Transparency 50% 100%

Find an address: Annapolis, MD

**Sign In**

Please sign in to access the item on <https://gis.chesapeakebay.net/ags/FederalFacilitiesEditor/FederalFacilitiesEditorSimplified4m>

Username:

Password:

VITA, Esri, HERE, DeLorme | Earthstar Geographics, CNES/Airbu...

esri

# Federal Facilities Editor Tool

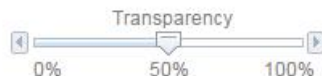
## Federal Facilities Editor

Use this map to edit the land use data for Federal Facilities.

Find a facility by typing an address in the search box, or by zooming/panning the map.

Click a facility to view and/or edit its data.

☒ Federal Facilities



**Pasture/Hay:** Herbaceous and barren lands that are not classed as turf grass or mixed open. The portion of such lands that are pasture/hay is determined by the frequency at which the lands are classified as pasture/hay in the NASS Cropland Data Layers (2008 through 2015).

The screenshot displays the Federal Facilities Editor tool interface. On the left, a sidebar contains instructions and a legend. The main area shows a satellite map of Norfolk, VA, with a search bar at the top. A facility is highlighted in yellow on the map. On the right, a 'Federal Facilities' panel shows the following data:

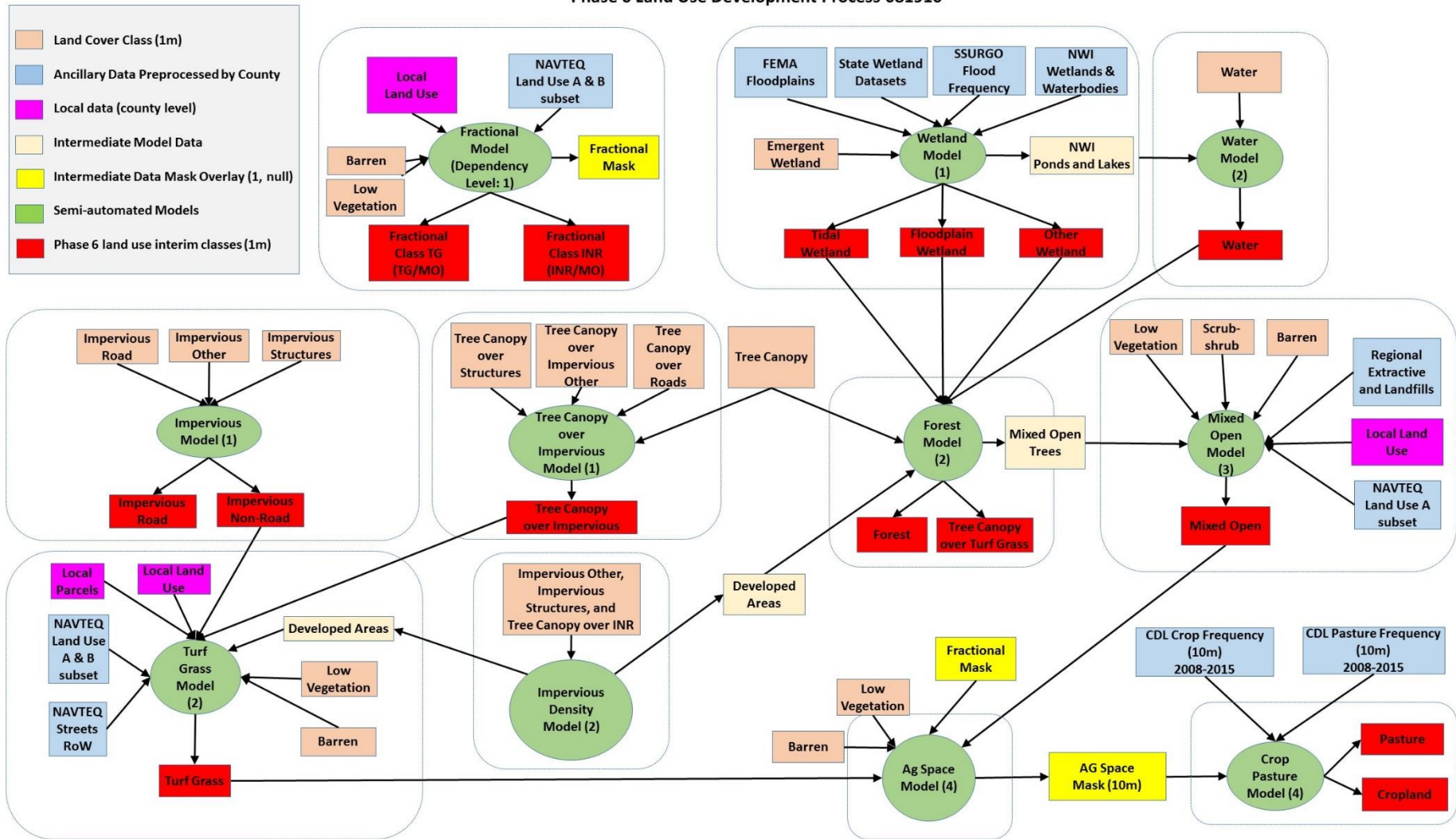
Federal Facilities	
UID	681
Unit Name	NAVSTA NORFOLK
Alternate Name	NAVAL STATION NORFOLK
Local Owner	United States Department of
Manager Name	NAVFAC ML
Local Manager	
Facility Contact	
Facility Info	
Regional Coordinator	
Regional Info	
Acres	3509.11930625
Notes or Corrections	
Mixed Open Land Use %	35%
Turf Grass Land Use %	65%
Crop Land Use %	0%
Pasture Land Use %	0%
Last Edited by ARCGIS on 8/29/16 at 10:04 AM	
<button>Save</button>	

At the bottom of the map, there is a footer with the text: 'Earthstar Geographics, CNES/Airbus DS | VITA, Esri, HERE, DeL...'. The Esri logo is also present in the bottom right corner.



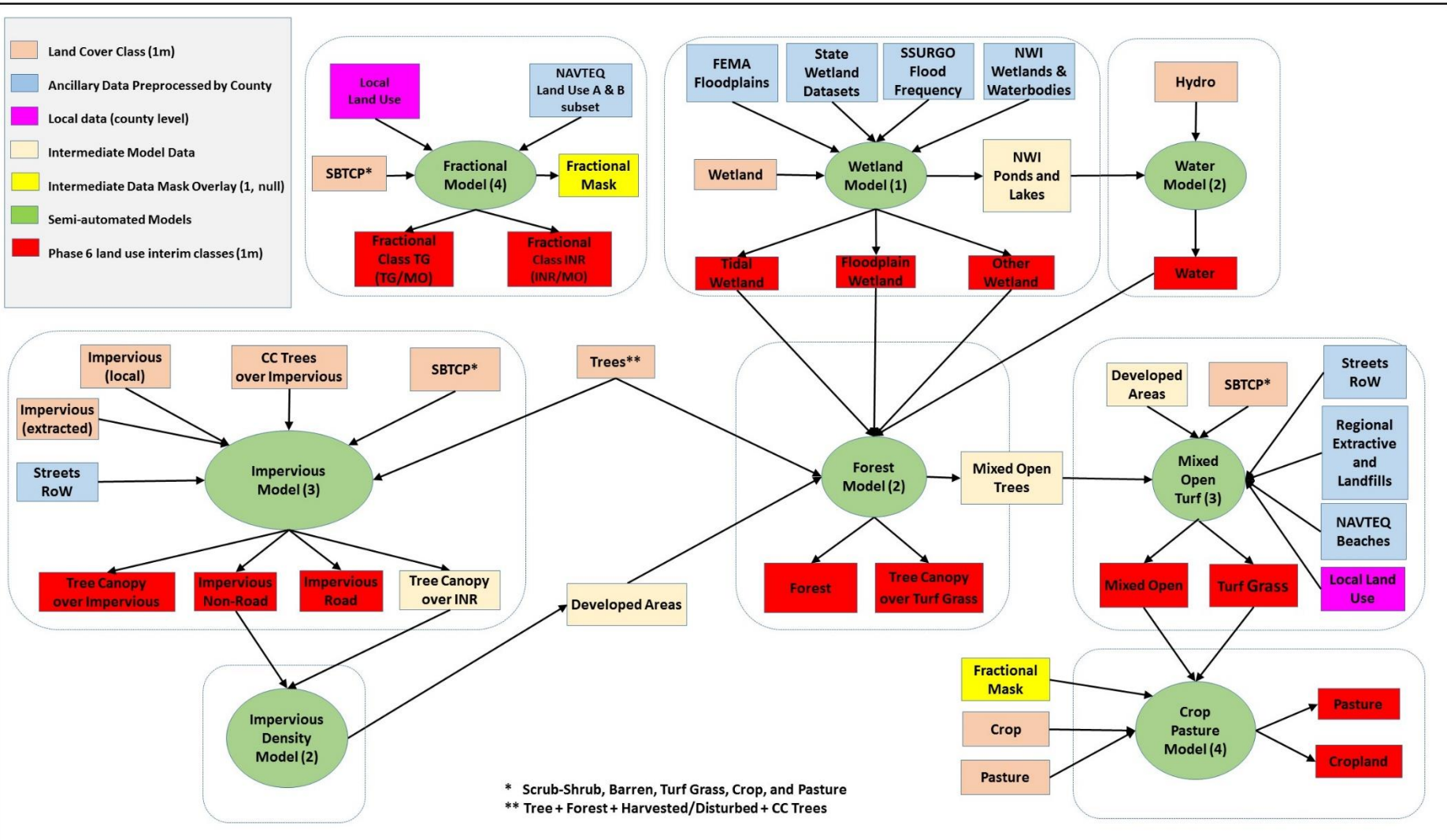
# Phase 6 Land Use Development Process (all but Virginia)

Phase 6 Land Use Development Process 081916



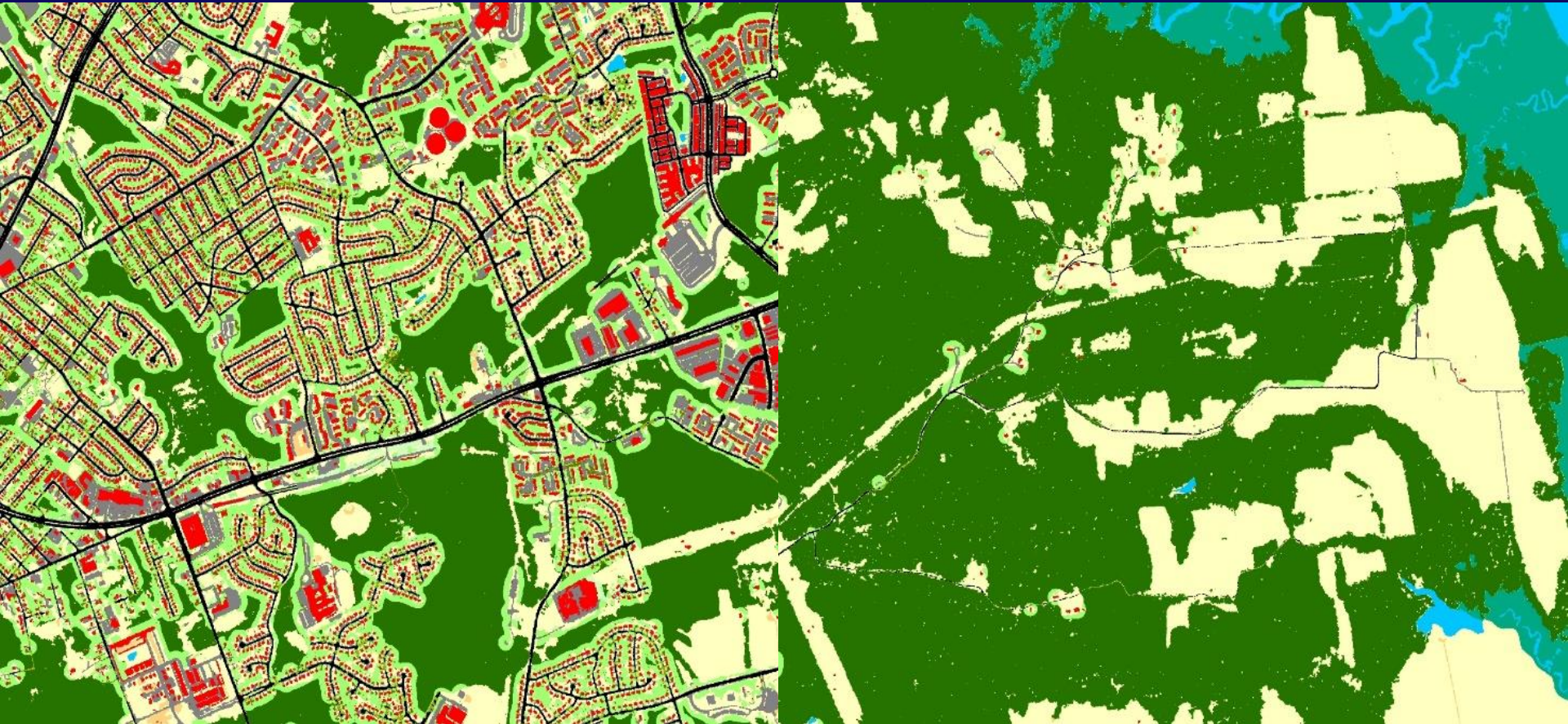
# Virginia Phase 6 Land Use Development Process

Phase 6 VA Land Use Development Process 072816





# Forest vs Tree Canopy over Turf



Urban Area

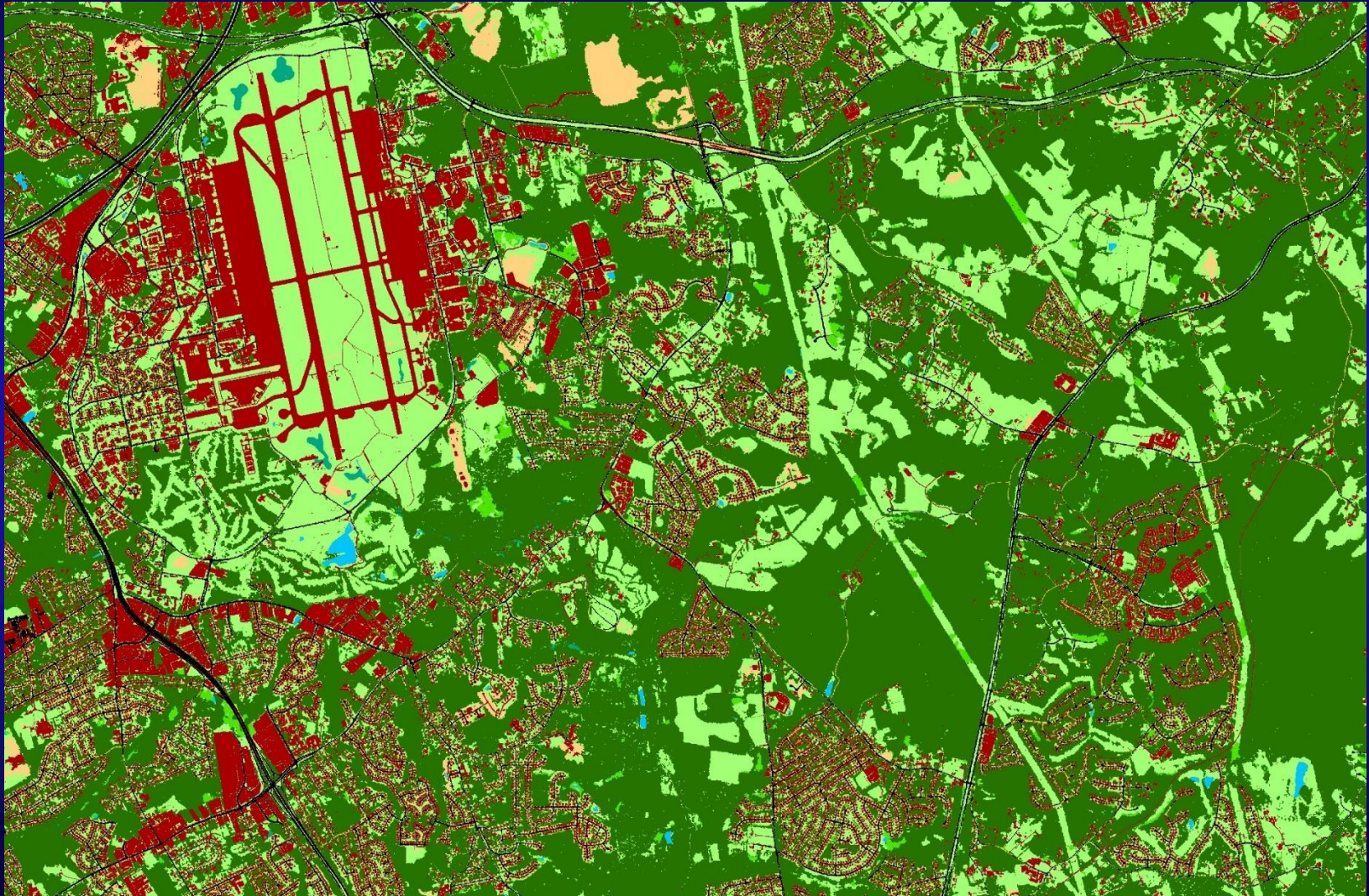
Forest

Rural Area

Tree Canopy over Turf

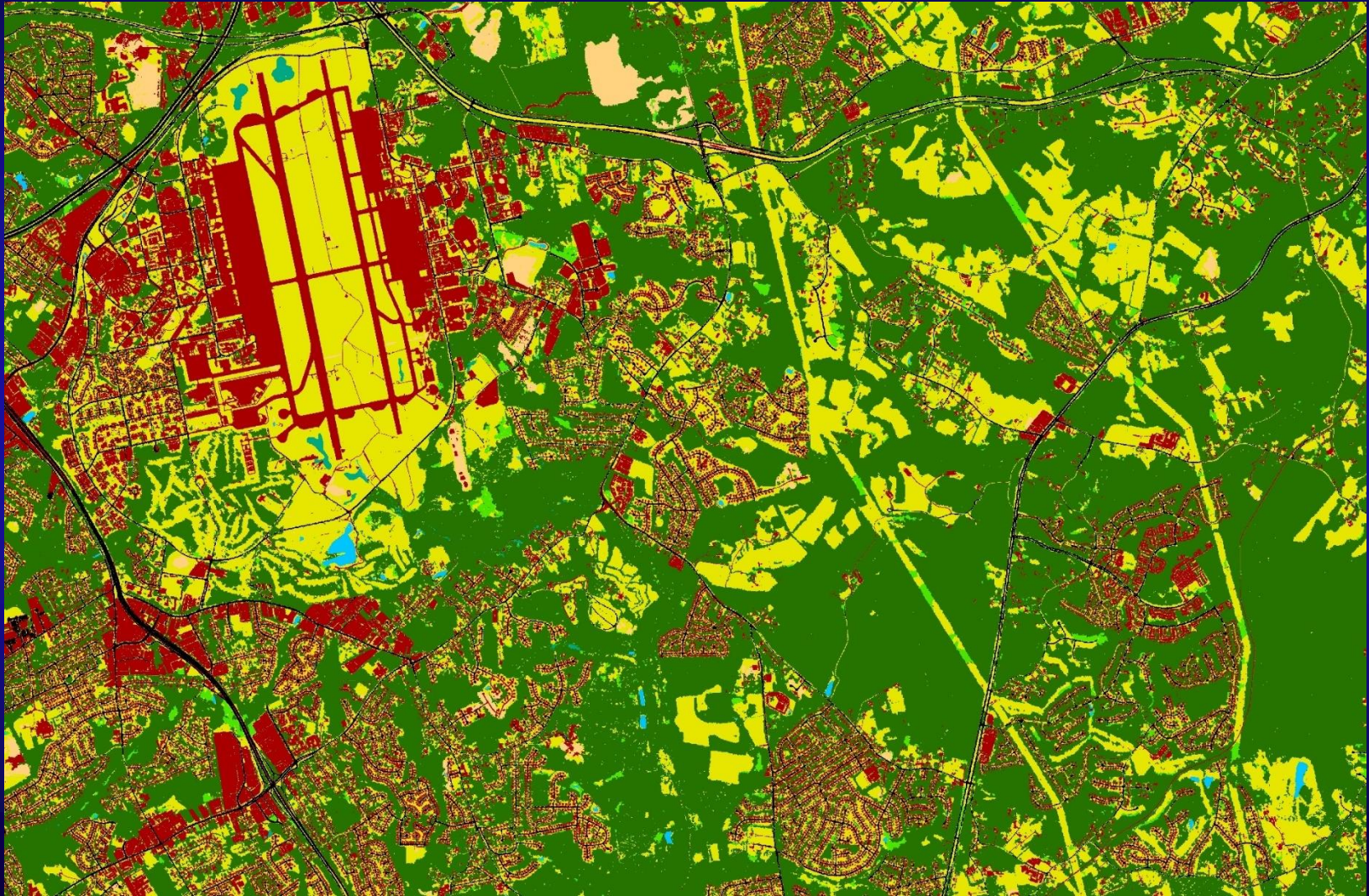


# Turf Grass vs Agriculture (land cover)



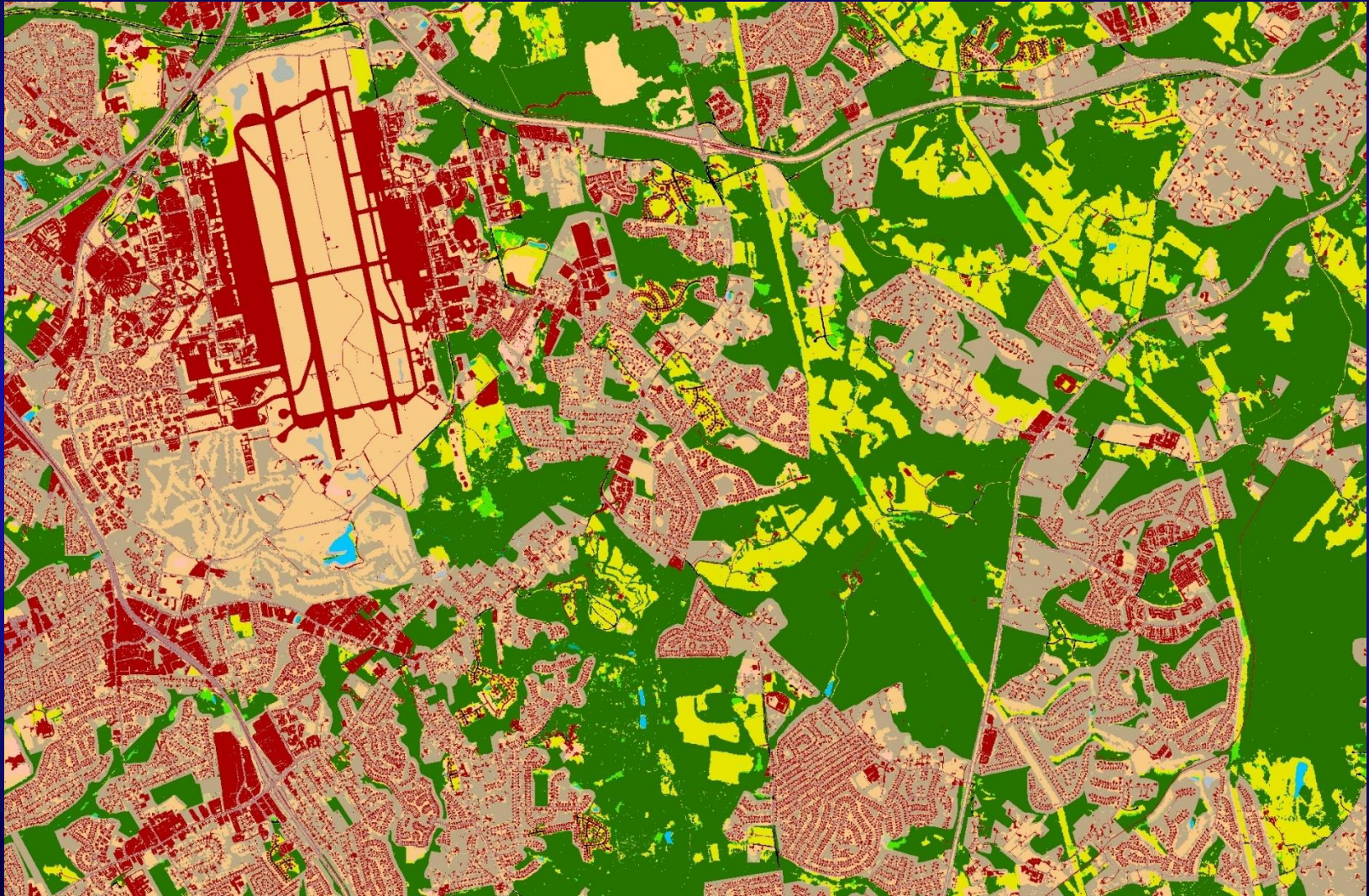


# Turf Grass vs Agriculture (low vegetation)



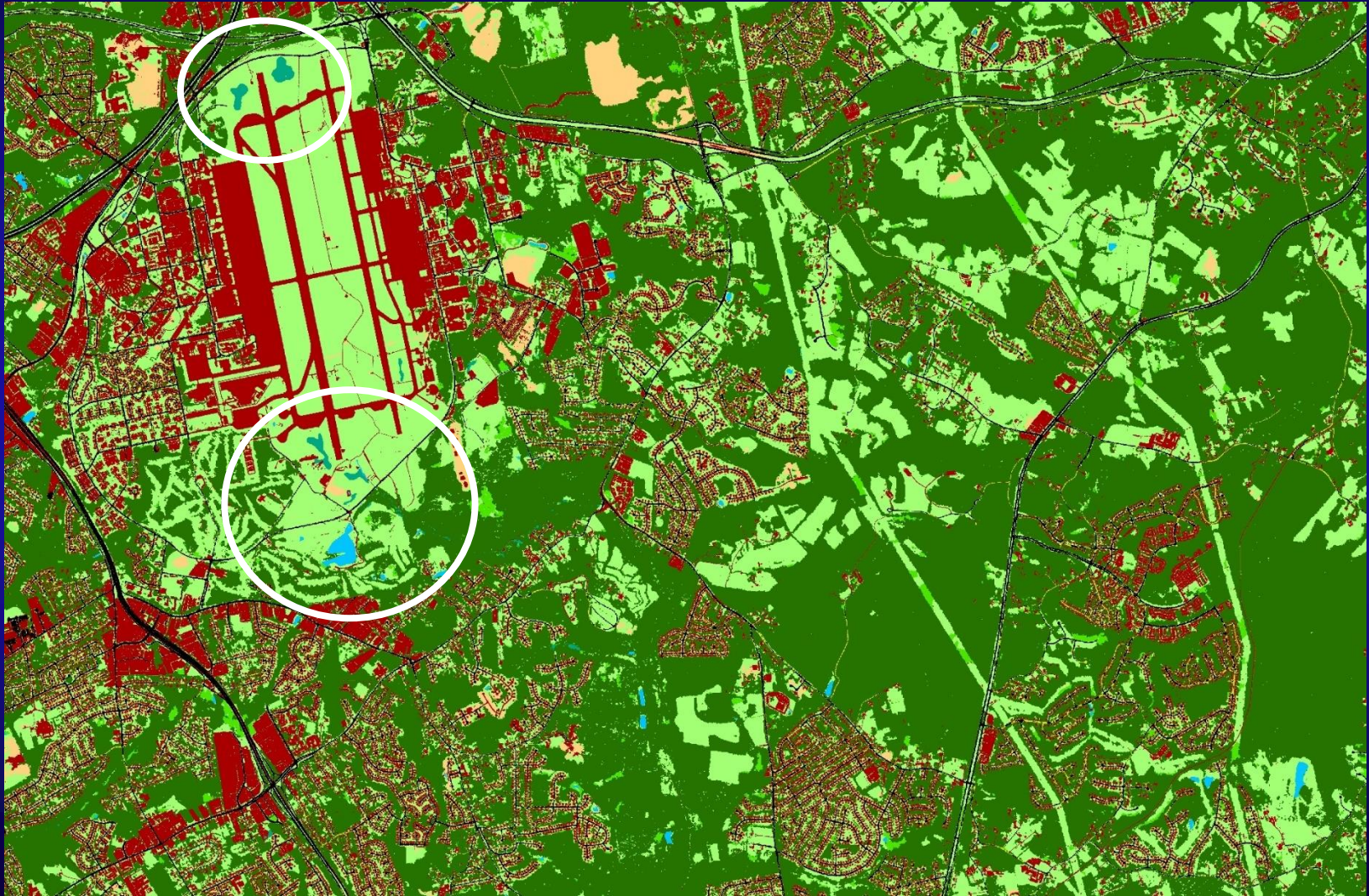


# Turf Grass vs Agriculture (developed land use overlay)



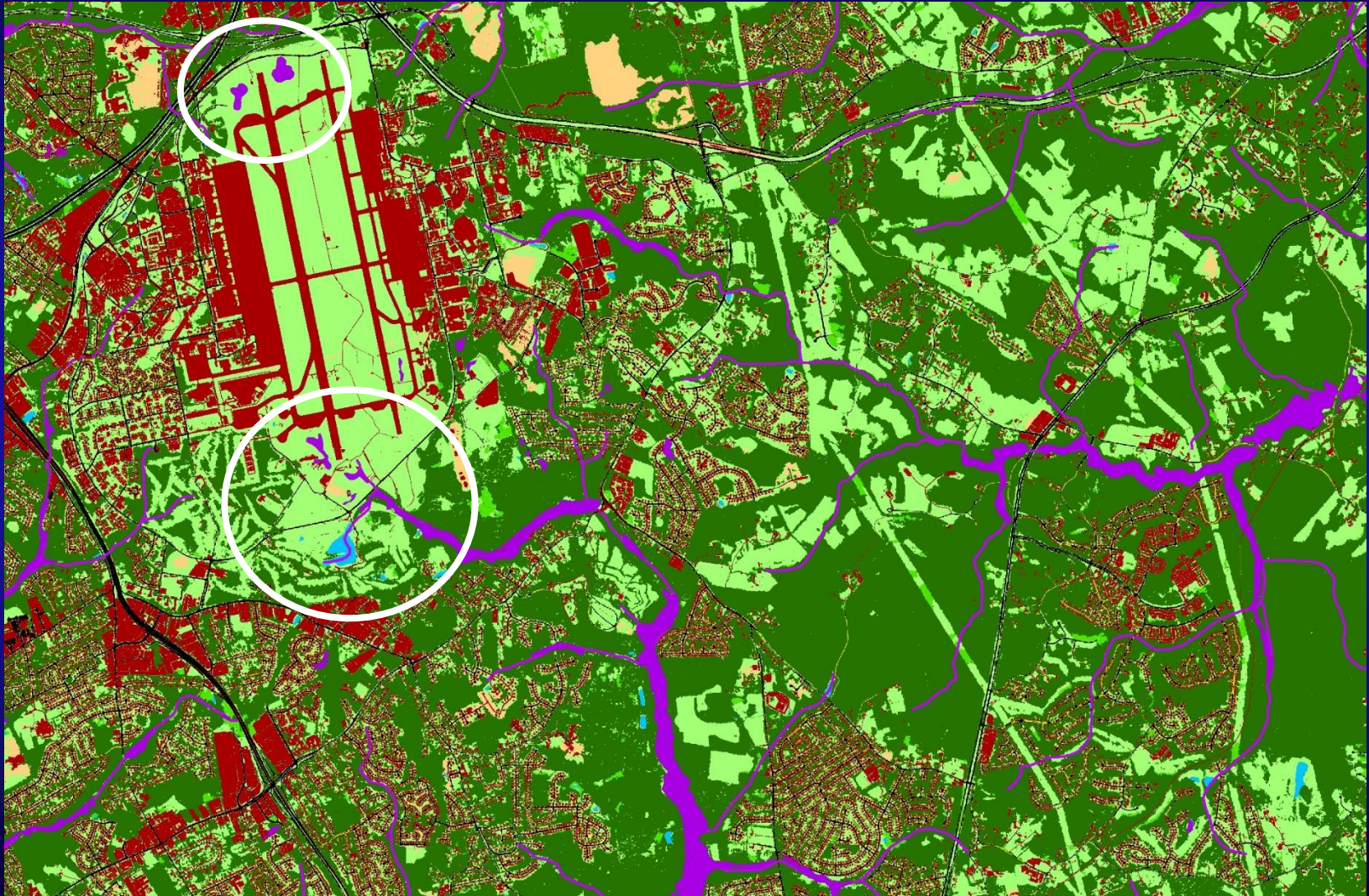


# Water and Wetlands (mapped from land cover)





# Water and Wetlands (added from NHD and NWI)



# Data used Previously to Backcast Land Use for Calibrating the Chesapeake Watershed Model

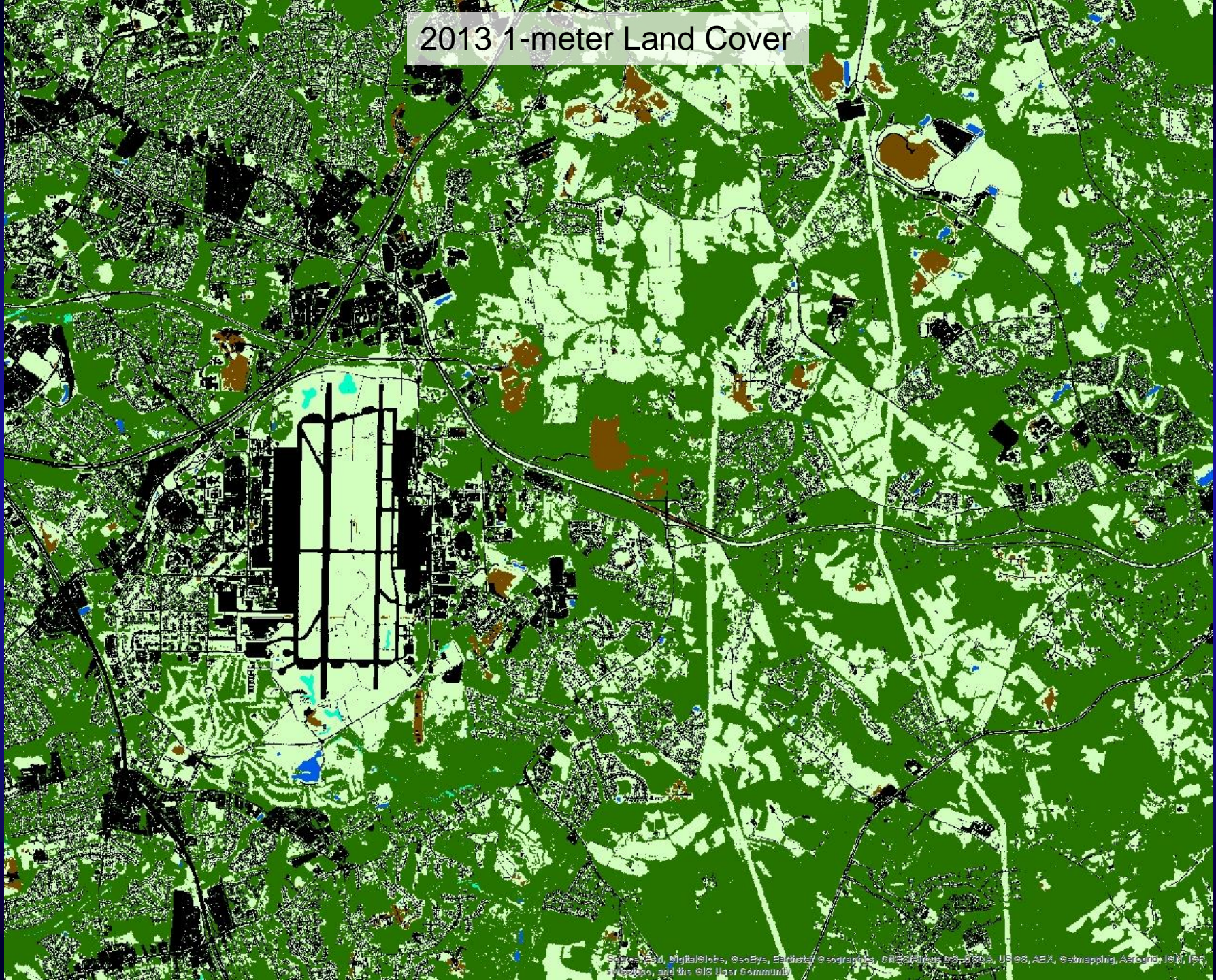


◆ Census of Population and Housing (block level)

▲ Census of Agriculture (county level)

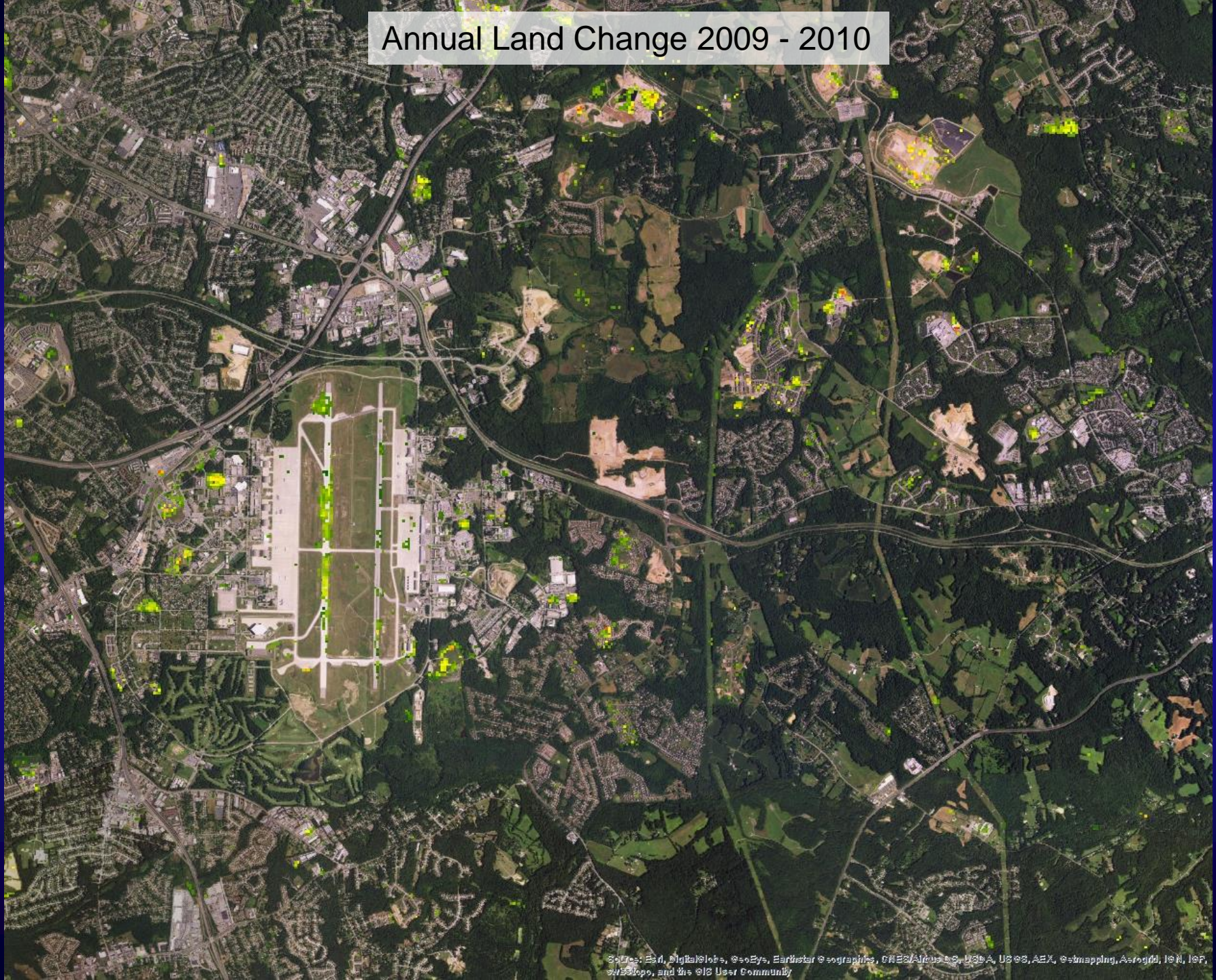


# 2013 1-meter Land Cover



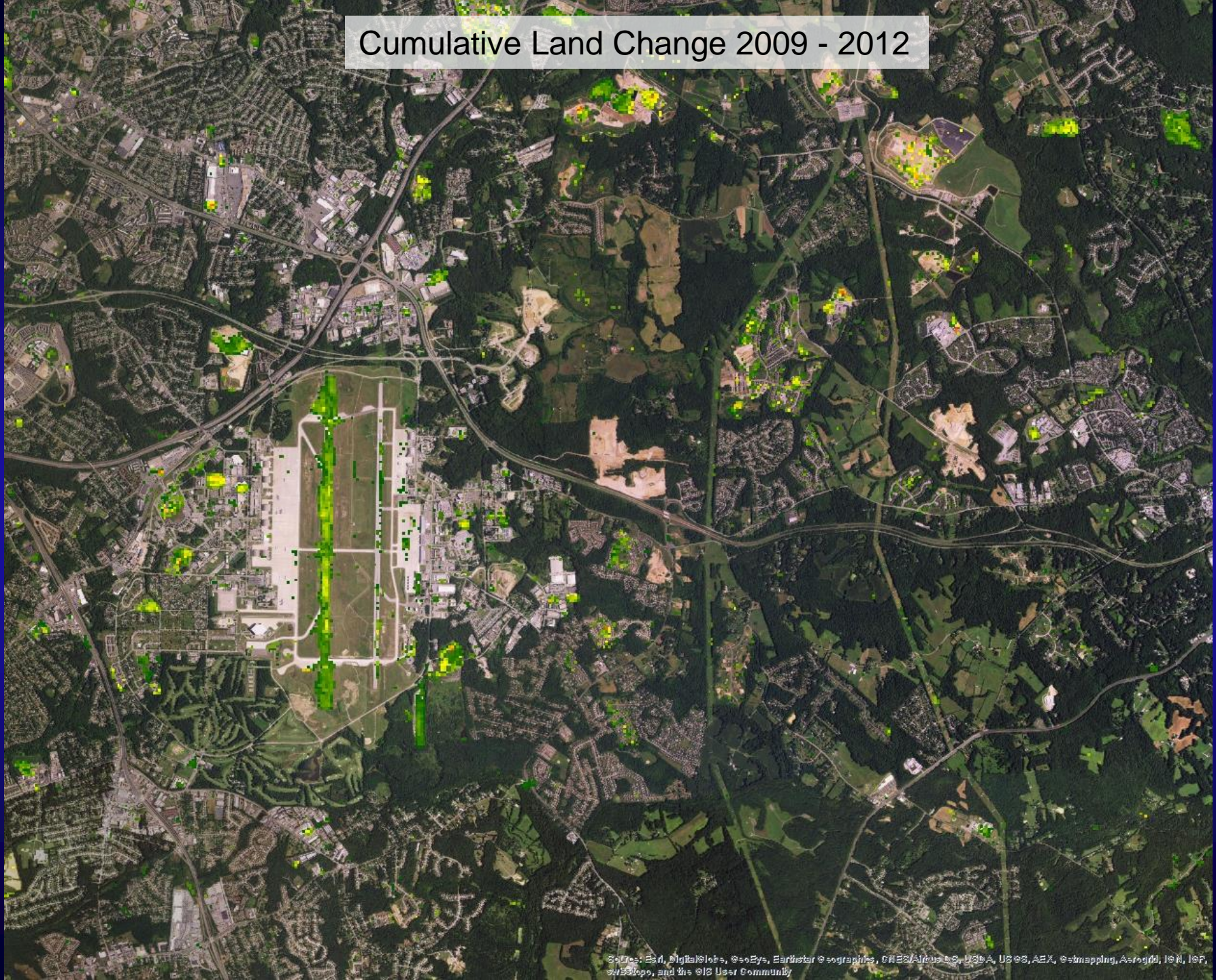


# Annual Land Change 2009 - 2010



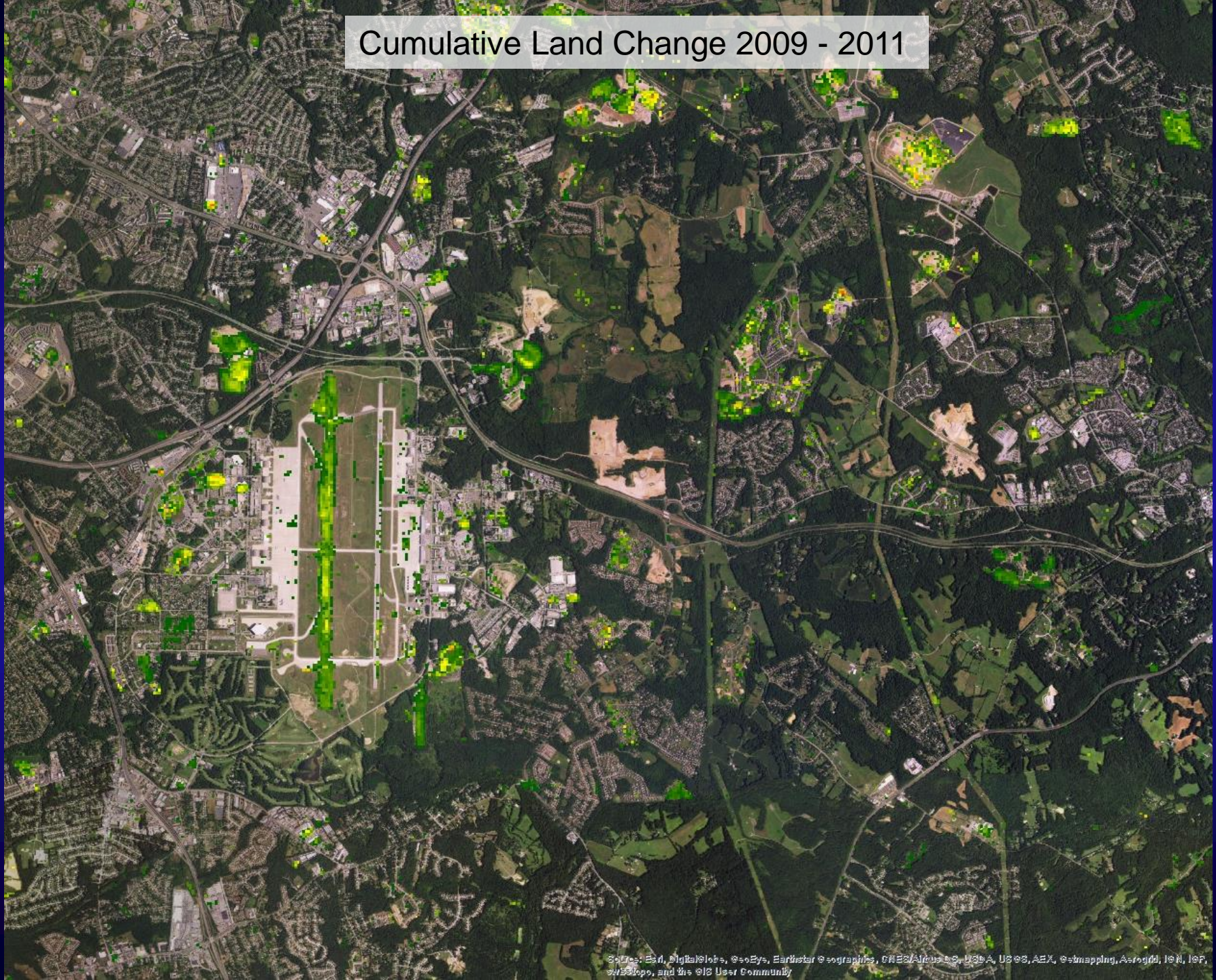


# Cumulative Land Change 2009 - 2012



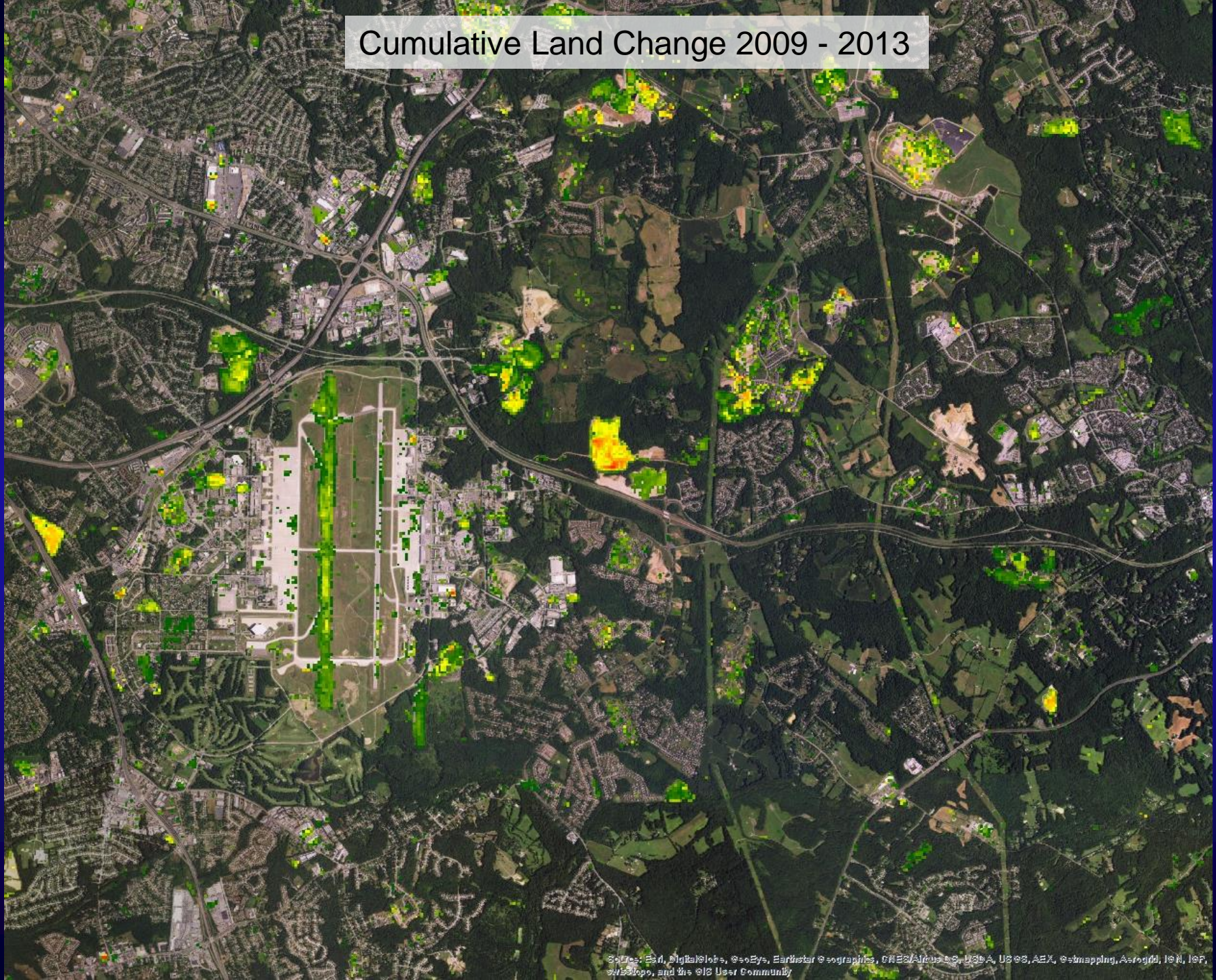


# Cumulative Land Change 2009 - 2011





# Cumulative Land Change 2009 - 2013

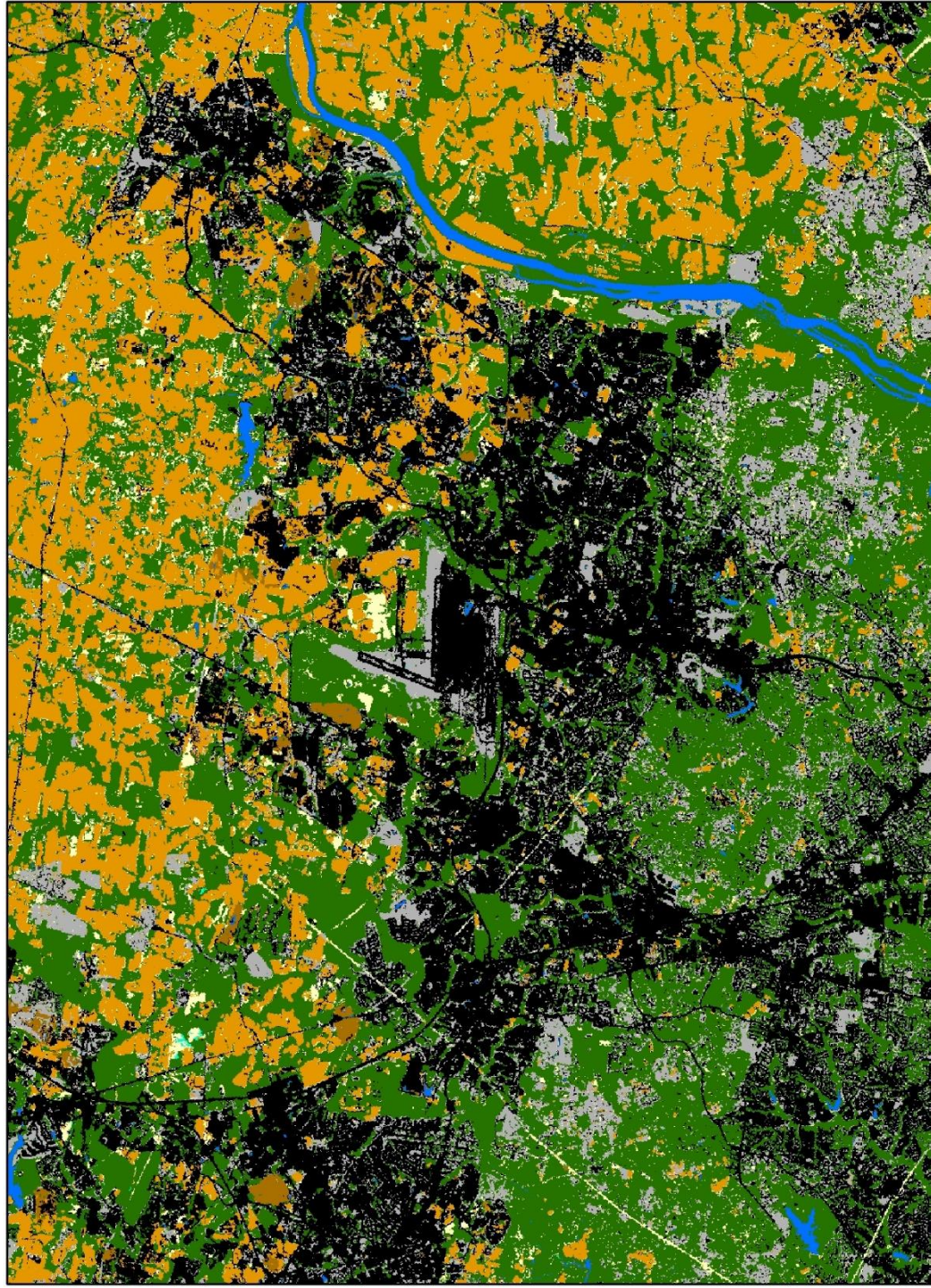




1984



2011



# **Phase 6 Land Use Database: Production Schedule**

## **January 2016 – August 2016:**

- 1m-resolution Land Cover Data
- Local Review and QA/QC of Land Cover Data
- 10m-resolution Land Use Methods and Models

## **September – mid-October 2016:**

- 10m-resolution Land Use Data
- Pennsylvania Potential Wetlands Data

## **October – mid-November 2016 (4 week review):**

- Local Review of Land Use Data

## **November 2016:**

- Finalization of Land Use Data

# Local Review of Land Use Data: Process and Expectations

1. Review CBP interpretation of local land use and parcel data.

Action: Tell us if we've misinterpreted your data.

2. Review accuracy of MS4, CSS, Sewer Service Areas, and Septic estimates.

Action: Provide us with new/updated GIS data or septic estimates if needed.

3. Become familiar with the CBP Land Use classification.

## Options:

- a. Review data on the web (no GIS software or expertise required)
- b. Review data in house. Download the data from FTP site and review independently in a GIS environment.



# Local Review of Land Use Data: Process and Expectations

## 1. Review CBP interpretation of local land use and parcel data.

Action: Tell us if we've misinterpreted your data.

1	LandUseCod	SubLandUse	TG	MO	MO_TG	MO_INR	
2	C	91	0	1	0	0	
3	C	91	0	1	0	0	
4	R	91	0	1	0	0	
5	C	39	0	1	0	0	
6	R	91	0	1	0	0	
7	R	91	0	1	0	0	
8	C	54	1	0	0	0	
9	C	55	1	0	0	0	
10	C	57	1	0	0	0	
11	C	67	1	0	0	0	
12	C	63	1	0	0	0	
13	C	54	1	0	0	0	
14	C	55	1	0	0	0	
15	C	91	1	0	0	0	
16	C	64	1	0	0	0	
17	C	64	1	0	0	0	
18	C	61	1	0	0	0	
19	C	52	1	0	0	0	
20	C	91	1	0	0	0	
21	A	1	1	0	0	0	

SnyderParcels\_prj

READY



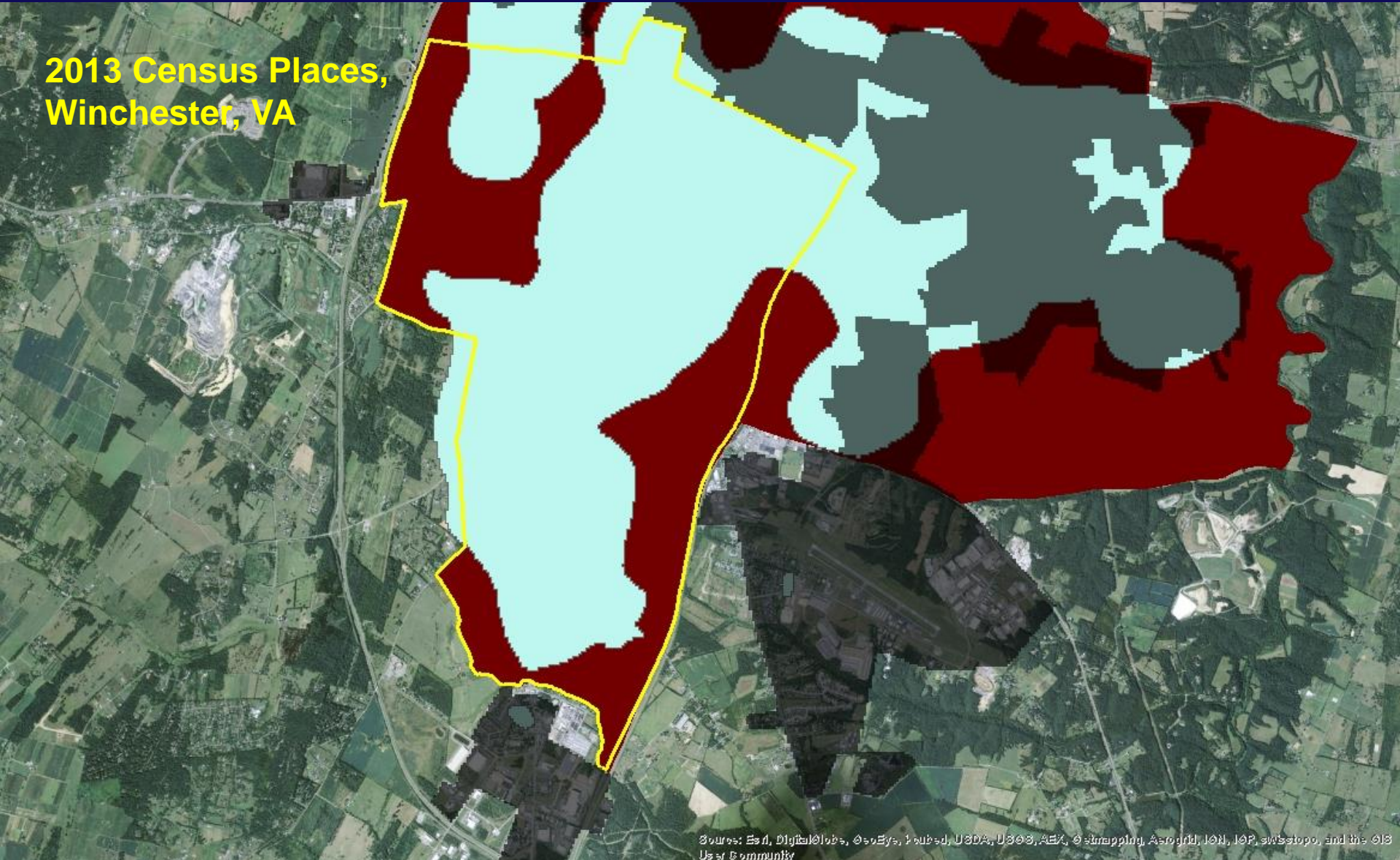
# **Local Review of Land Use Data: Process and Expectations**

## **2. Review accuracy of MS4, CSS, Sewer Service Areas, and Septic estimates.**

**Action: Provide us with new/updated GIS data if needed. Tabular data will be accepted for county septic numbers.**

# Mapping Sewer Service Areas using Weight-of-Evidence Approach

2013 Census Places,  
Winchester, VA



Sources: Esri, DigitalGlobe, GeoEye, IGN, USDA, USGS, AEX, © mapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



# **Local Review of Land Use Data: Process and Expectations**



## **3. Become familiar with the CBP Land Use classification.**

### **Options:**

- a. Review data on the web (no GIS software or expertise required)**
- b. Review data in house. Download the data from FTP site and review independently in a GIS environment.**

# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>




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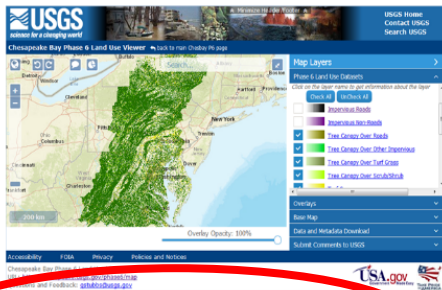
Chesapeake Bay: A Landsat 8 Surface Reflectance Mosaic. USGS provides scientific information to help manage this vital ecosystem. USGS EROS created this true color composite image using Provisional Surface Reflectance data from five Landsat 8 scenes, acquired in October and November 2014.



A snapshot from space. [Satellite Map](#) of the Chesapeake Bay aids management efforts.

### Phase 6 Land Use Review Application

The Chesapeake Bay Program (CBP) partnership wants to ensure that new land use and land cover data being developed to inform Chesapeake Bay restoration activities, including the Phase 6 suite of modeling tools, are as accurate and useful as possible. For this purpose, the CBP's Land Use Data Team is seeking outside review of this new land use and land cover data. This review process is open to all interested parties, but it is especially intended for local governments to participate in it. Formal review of this data can be completed by using the map application.



[Access the Map Application](#)

The Phase 6 Land Use Review Application has the following functionality:

- View Phase 6 Land Use data
- Download Phase 6 Land Use data for available counties
- Submit comments with selected coordinates

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U.S. Department of the Interior | U.S. Geological Survey



# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>

The screenshot displays the Chesapeake Bay Phase 6 Land Use Viewer web application. The browser address bar shows the URL <http://chesapeake.usgs.gov/phase6/map/#map=7/-8582732.74/4851421.17/0.0/0.4>. The USGS logo and navigation links are at the top. The map shows the Chesapeake Bay region with land use data. A red circle highlights the Lancaster, PA area. The map layers panel on the right lists various land use categories, including County Status, Impervious Roads, Impervious Non-Roads, Tree Canopy Over Roads, Tree Canopy Over Other Impervious, Tree Canopy Over Turf Grass, Tree Canopy Over Scrub/Shrub, Open Space, Turf Grass, Forest, Tidal Wetland, Non-tidal Floodplain Wetland, Non-tidal Other Wetland, Open Water, Cropland, and Pasture. The footer contains accessibility, FOIA, Privacy, and Policies and Notices links, along with contact information and the USA.gov logo.

Chesapeake Bay Phase 6 Land Use Viewer

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Chesapeake Bay Phase 6 Land Use Viewer back to main Chesbay P6 page

Map Layers

Phase 6 Land Use Datasets

County Status

Completed Pending Not Started

Click on the layer name to get information about the layer

Check All Uncheck All

Impervious Roads

Impervious Non-Roads

Tree Canopy Over Roads

Tree Canopy Over Other Impervious

Tree Canopy Over Turf Grass

Tree Canopy Over Scrub/Shrub

Open Space

Turf Grass

Forest

Tidal Wetland

Non-tidal Floodplain Wetland

Non-tidal Other Wetland

Open Water

Cropland

Pasture

Overlays

Base Map

Data and Metadata Download

Submit Comments to USGS

Accessibility FOIA Privacy Policies and Notices

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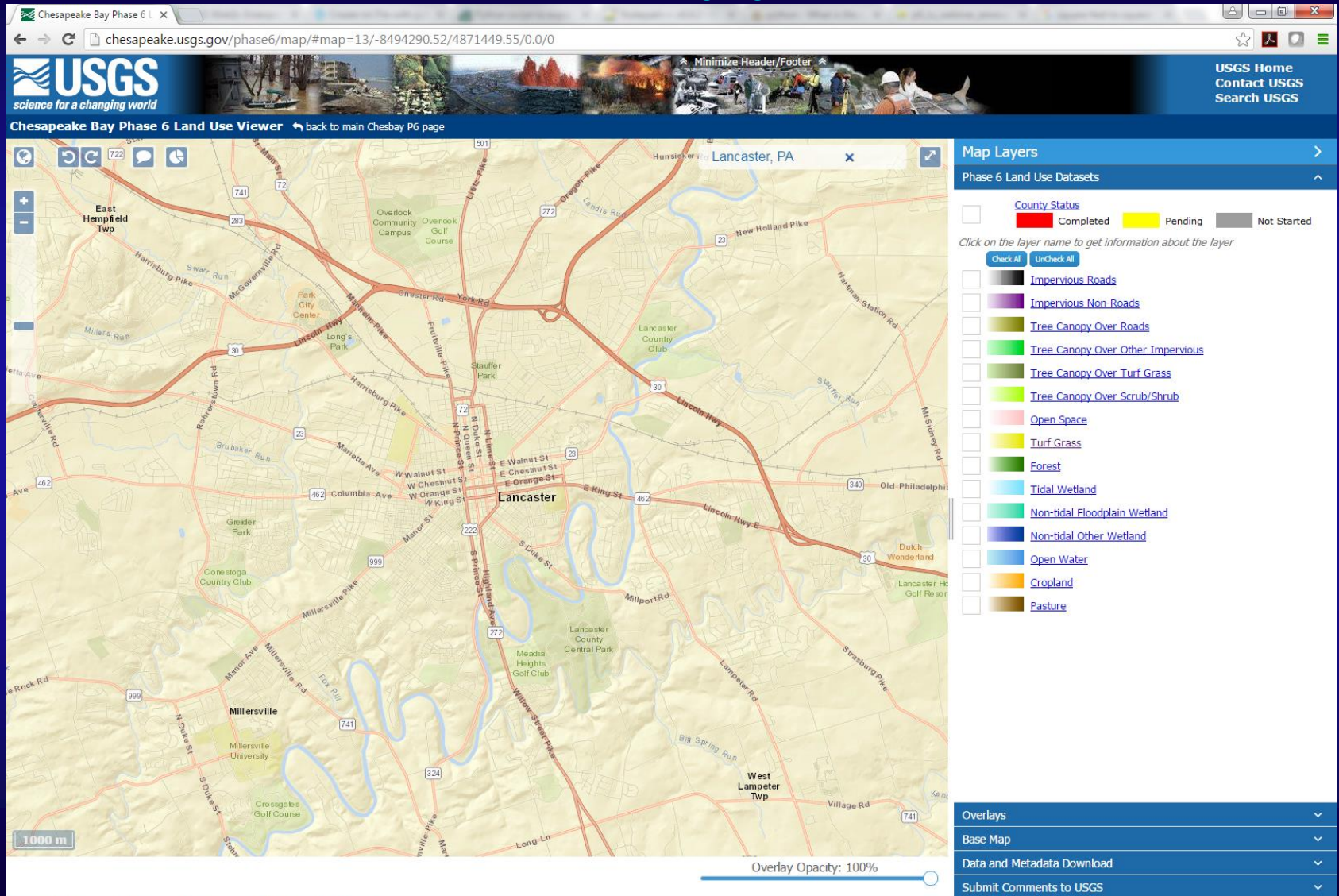
URL: <http://chesapeake.usgs.gov/phase6/map>

Questions and Feedback: [gstubbs@usgs.gov](mailto:gstubbs@usgs.gov)

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<http://chesapeake.usgs.gov/phase6/>



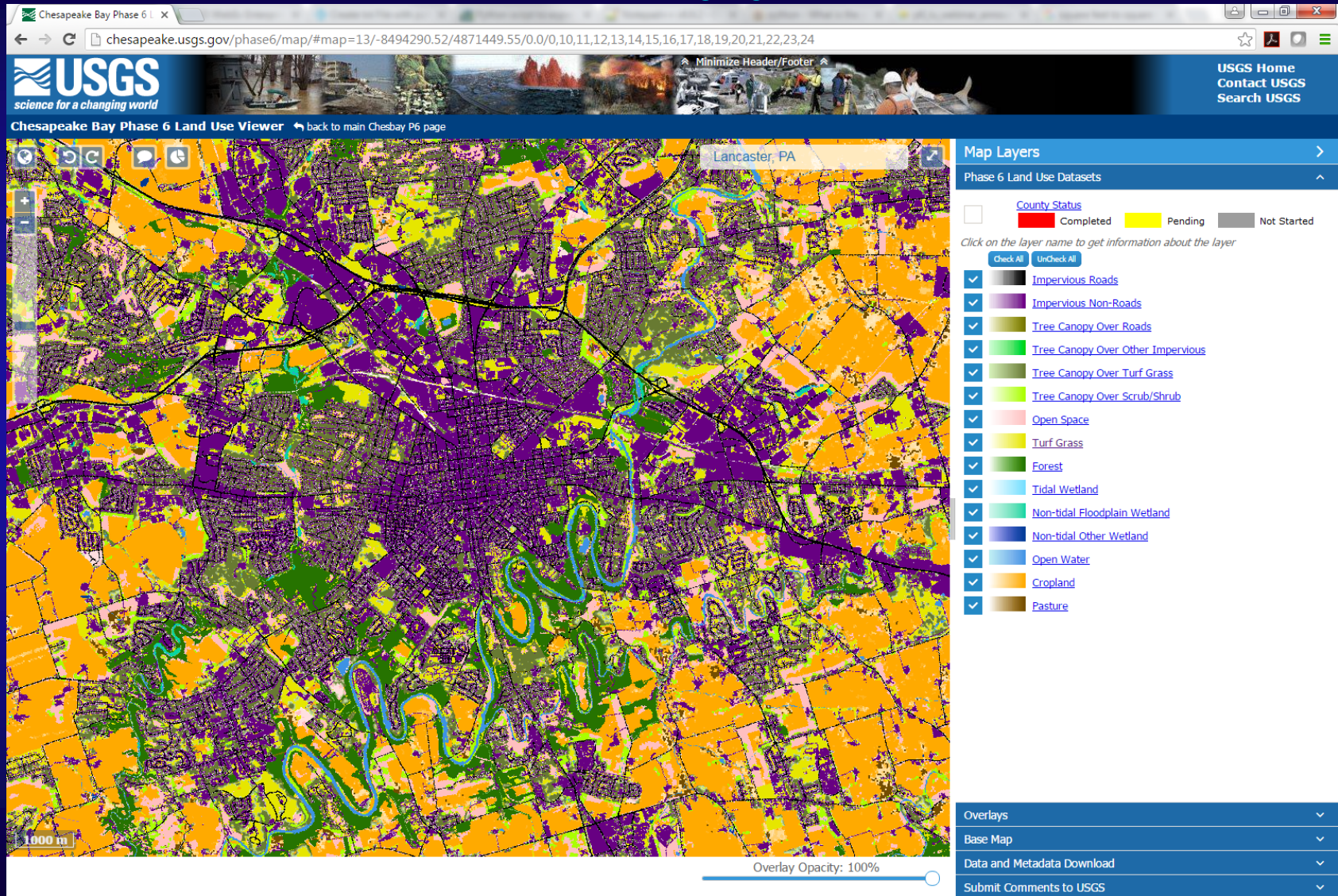
Accessibility FOIA Privacy Policies and Notices

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<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6 | X

chesapeake.usgs.gov/phase6/map/#map=16/-8494290.52/4871449.55/0.0/1

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Chesapeake Bay Phase 6 Land Use Viewer ↶ back to main Chesbay P6 page

Lancaster, PA

**Map Layers**

Phase 6 Land Use Datasets

☐ County Status

☐ Completed ☐ Pending ☐ Not Started

Click on the layer name to get information about the layer

☐ Check All ☐ Uncheck All

- ☐ Impervious Roads
- ☐ Impervious Non-Roads
- ☐ Tree Canopy Over Roads
- ☐ Tree Canopy Over Other Impervious
- ☐ Tree Canopy Over Turf Grass
- ☐ Tree Canopy Over Scrub/Shrub
- ☐ Open Space
- ☐ Turf Grass
- ☐ Forest
- ☐ Tidal Wetland
- ☐ Non-tidal Floodplain Wetland
- ☐ Non-tidal Other Wetland
- ☐ Open Water
- ☐ Cropland
- ☐ Pasture

200 m

Overlay Opacity: 100%

Overlays  
Base Map  
Data and Metadata Download  
Submit Comments to USGS

Accessibility FOIA Privacy Policies and Notices

Chesapeake Bay Phase 6 Land Use Viewer  
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Questions and Feedback: [gstubbs@usgs.gov](mailto:gstubbs@usgs.gov)

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<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6 Land Use Viewer

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Lancaster, PA

200 m

Overlay Opacity: 100%

Map Layers

Phase 6 Land Use Datasets

County Status

Completed Pending Not Started

Click on the layer name to get information about the layer

Check All Uncheck All

Impervious Roads

Impervious Non-Roads

Tree Canopy Over Roads

Tree Canopy Over Other Impervious

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Lancaster, PA

Map Layers

Phase 6 Land Use Datasets

County Status

Completed Pending Not Started

Click on the layer name to get information about the layer

Check All Uncheck All

☒ Turf Grass

☒ Impervious Roads

☒ Impervious Non-Roads

☐ Tree Canopy Over Roads

☐ Tree Canopy Over Other Impervious

☒ Tree Canopy Over Turf Grass

☐ Tree Canopy Over Scrub/Shrub

☐ Open Space

☐ Forest

☐ Tidal Wetland

☐ Non-tidal Floodplain Wetland

☐ Non-tidal Other Wetland

☐ Open Water

☐ Cropland

☐ Pasture

Overlays

Base Map

Data and Metadata Download

Submit Comments to USGS

Overlay Opacity: 100%

Accessibility FOIA Privacy Policies and Notices

Chesapeake Bay Phase 6 Land Use Viewer

URL: <http://chesapeake.usgs.gov/phase6/map>

gis.chesapeakebay.net/ags/rest/services/LandUseDataViewer/P6LandUse/MapServer/3

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# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6 Land Use Viewer

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Chesapeake Bay Phase 6 Land Use Viewer back to main Chesbay P6 page

Map Layers

Phase 6 Land Use Datasets

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Tree Canopy Over Roads

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Tree Canopy Over Turf Grass

Tree Canopy Over Scrub/Shrub

Open Space

Turf Grass

Forest

Tidal Wetland

Non-tidal Floodplain Wetland

Non-tidal Other Wetland

Open Water

Cropland

Pasture

Land Cover Class Percentages

Turf Grass: 56.0 %

Impervious Non-Roads: 39.0 %

Tree Canopy Over Turf Grass: 5.0 %

200 m

Overlay Opacity: 100%

Overlays

Base Map

Data and Metadata Download

Submit Comments to USGS

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URL: <http://chesapeake.usgs.gov/phase6/map>

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<http://chesapeake.usgs.gov/phase6/>

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Search...

Map Layers

- Phase 6 Land Use Datasets
- Overlays

Click on the layer name to get information about the layer

- ☒ Sewer Service Areas
- ☐ Federal Facilities
- ☐ Phase 6 Land-River Segments
- ☒ Municipal Separate Storm Server Systems
- ☒ CSOs

Base Map

Data and Metadata Download

Submit Comments to USGS

2 km

Overlay Opacity: 100%

Accessibility FOIA Privacy Policies and Notices

Chesapeake Bay Phase 6 Land Use Viewer  
URL: <http://chesapeake.usgs.gov/phase6/map>  
Questions and Feedback: [gstubbs@usgs.gov](mailto:gstubbs@usgs.gov)



# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6 Land Use Viewer

USGS science for a changing world

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Lancaster, PA

Map Layers

- Phase 6 Land Use Datasets
- Overlays

Click on the layer name to get information about the layer

- ☒ Sewer Service Areas
- ☐ Federal Facilities
- ☐ Phase 6 Land-River Segments
- ☒ Municipal Separate Storm Sewer Systems
- ☒ CSOs

500 m

Overlay Opacity: 75%

Accessibility FOIA Privacy Policies and Notices

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URL: <http://chesapeake.usgs.gov/phase6/map>  
Questions and Feedback: [gstubbs@usgs.gov](mailto:gstubbs@usgs.gov)

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# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6 | X

chesapeake.usgs.gov/phase6/map/#map=15/-8480898.49/4869607.2/0.0/1,5,8,9

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Search USGS

Map Layers

- Phase 6 Land Use Datasets
- Overlays
- Base Map
- Data and Metadata Download
- Submit Comments to USGS

Instructions:

- Enable comments...**  
...by clicking the button in the upper-left corner of the map.
- Enter comments...**  
Comments for specific locations can be entered by clicking on the map at those locations when the button is enabled. Comments for a larger area can be submitted by manually copying the URL in your browser address bar when the view port of the map is showing the area of interest. Additional annotations may also be included in your comments.
- Submit comments...**  
When finished adding comments, submit to USGS by clicking the button below:  
Submit Comments to USGS

Submit comment on 40.02484, -76.18398: \*

This sewer service area is over generalized. I'll send you a better one.

Submit

500 m

Overlay Opacity: 75%



# Chesapeake Bay Phase 6 Land Use Viewer

<http://chesapeake.usgs.gov/phase6/>

Chesapeake Bay Phase 6

Chesapeake Bay Phase 6

chesapeake.usgs.gov/phase6/map/email.html

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Questions/Comments

Your e-mail address\*

pclaggett@usgs.gov

Name

Peter Claggett

County

Lancaster

Organization

County Planner

Subject

Phase 6 Land Use Comments

40.02484,-76.18398:  
This sewer service area is over generalized. I'll send you a better one.

Message\*

Please only click once! You will get a page in response.

Send message

\* Required field. We need your e-mail address to reply to you! See our [Privacy Statement](#).

AccessibilityFOIAPrivacyPolicies and Notices

Chesapeake Bay Phase 6 Land Use Viewer  
URL: <http://chesapeake.usgs.gov/phase6/map>  
Questions and Feedback: [gstubbbs@usgs.gov](mailto:gstubbbs@usgs.gov)

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# For more information:

Webinar Recording, Project Description (whitepaper), Frequently Asked Questions (TBD),  
Production/Review Schedule (TBD):

<http://www.chesapeakebay.net/calendar/event/24320/>

Phase 6 Land Use Database:

<http://chesapeake.usgs.gov/phase6/>

Mid-Point Assessment Data Visualization Tool:

<https://mpa.chesapeakebay.net/Phase6DataVisualization.html>

Phase 6 Land Use Database:

- U.S. Geological Survey: Fred Irani, [firani@usgs.gov](mailto:firani@usgs.gov), Peter Claggett, [pclaggett@usgs.gov](mailto:pclaggett@usgs.gov)

High-resolution Land Cover Datasets:

MD, WV, NY, and DC:

- Chesapeake Conservancy: Cassandra Pallai, [cpallai@chesapeakeconservancy.org](mailto:cpallai@chesapeakeconservancy.org)

PA and DE:

- University of Vermont: Jarlath O'Neil-Dunne, [Jarlath.ONeil-Dunne@uvm.edu](mailto:Jarlath.ONeil-Dunne@uvm.edu)

VA:

- Virginia Department of Environmental Quality: James Davis-Martin, [James.Davis-Martin@deq.virginia.gov](mailto:James.Davis-Martin@deq.virginia.gov)
- <http://vgin.maps.arcgis.com/home/item.html?id=6ae731623ff847df91df767877db0eae>