

Federal GIS Conference

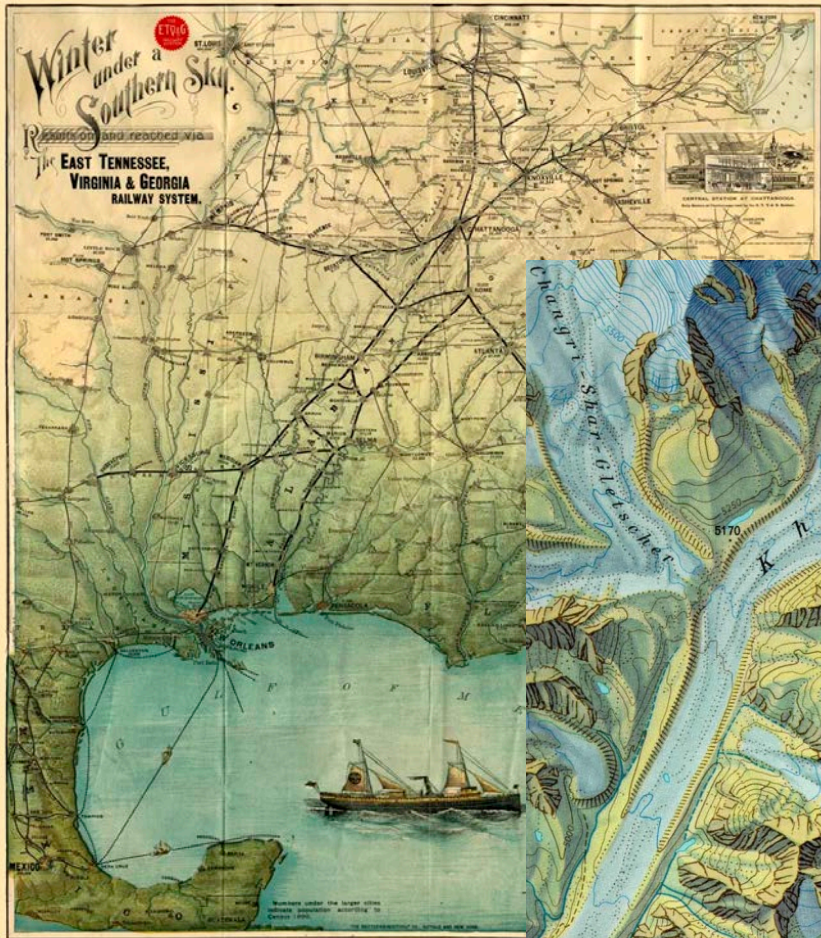
February 9–10, 2015 | Washington, DC

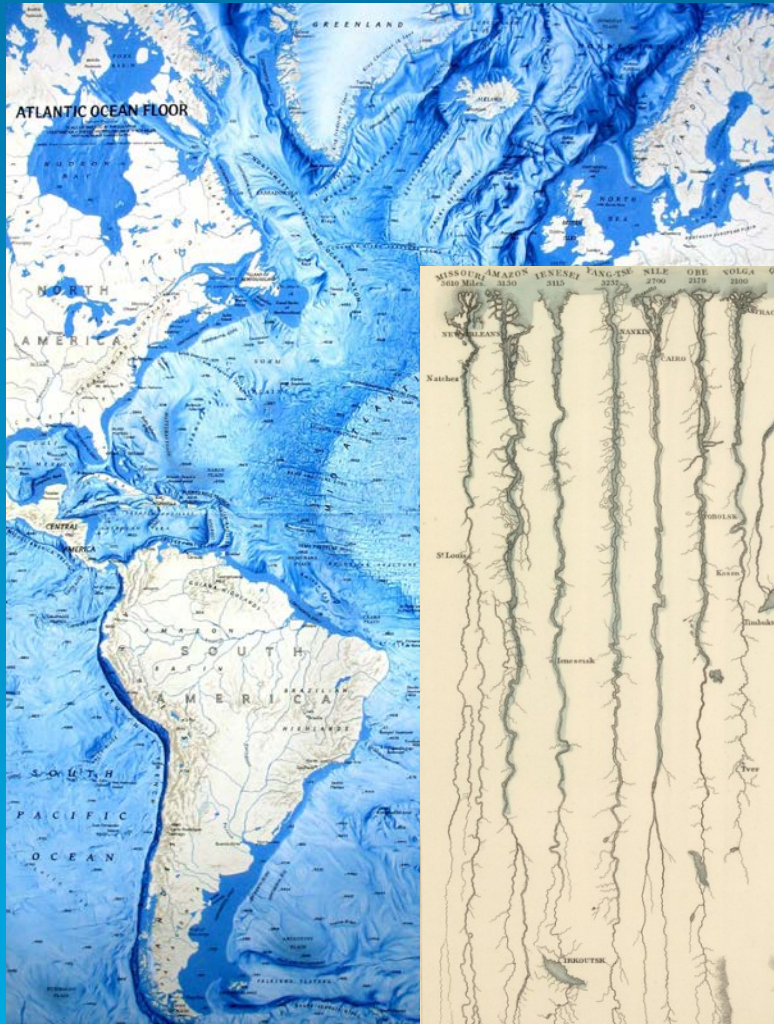


Making Beautiful Maps

John Wolf (Chesapeake Bay Program)

Billie Leff (Esri)







What do Beautiful Maps Have in Common?

Attractive

Simple

Informative

ACCURATE

Crafted

Memorable

EFFECTIVE

Clear

Balanced

Of higher standard

What is cartography?

The art,
science,
and practice
of making
and using maps.



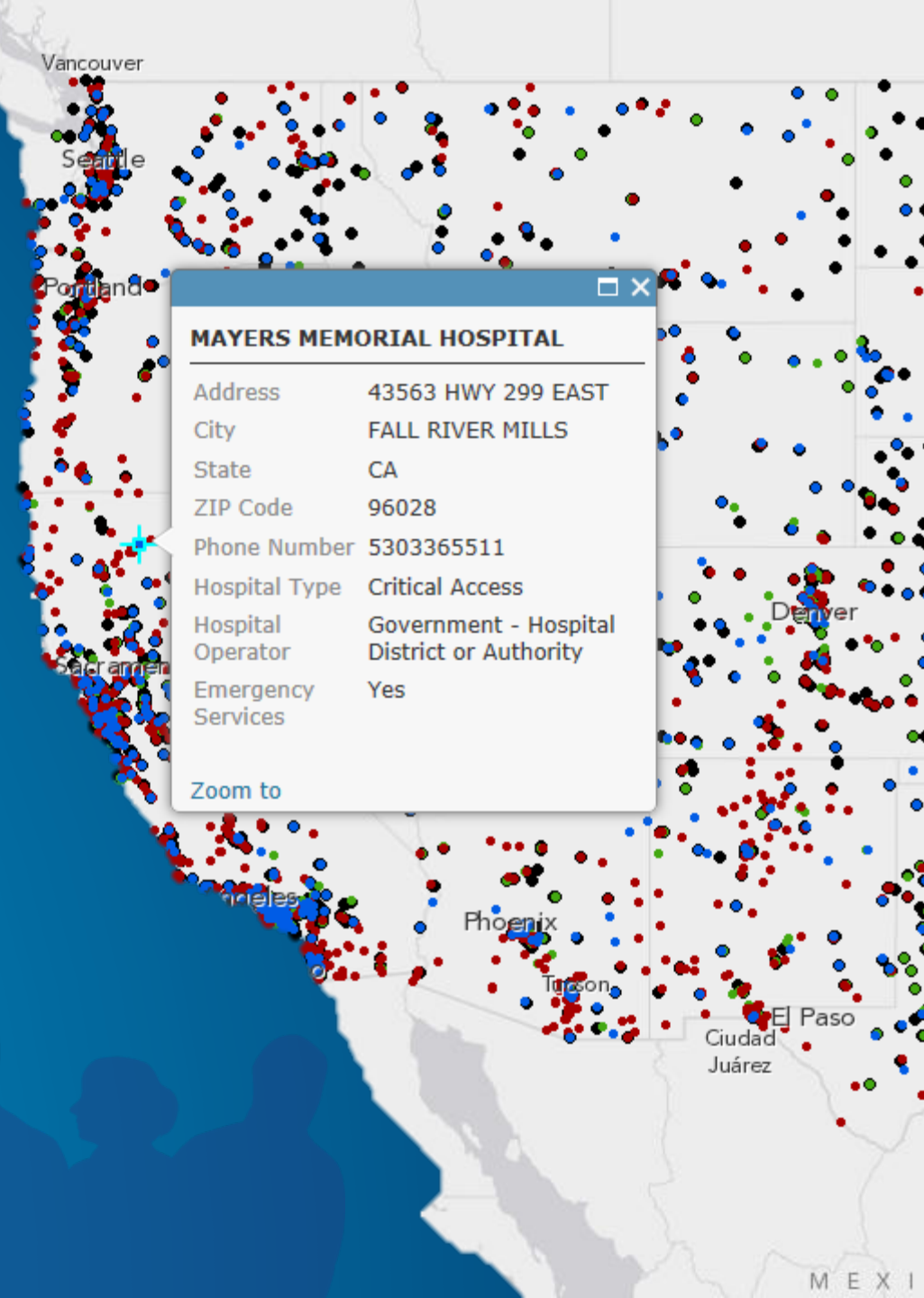
Myths about Beautiful Maps

1. **It is all about the data**
2. **Simple maps are fast and easy**
3. **I can use imagery for a basemap**
4. **All map elements need to be present**
5. **I have to manage all data, map services and basemaps**

1. It is all about the data!

What an audience wants/asks for

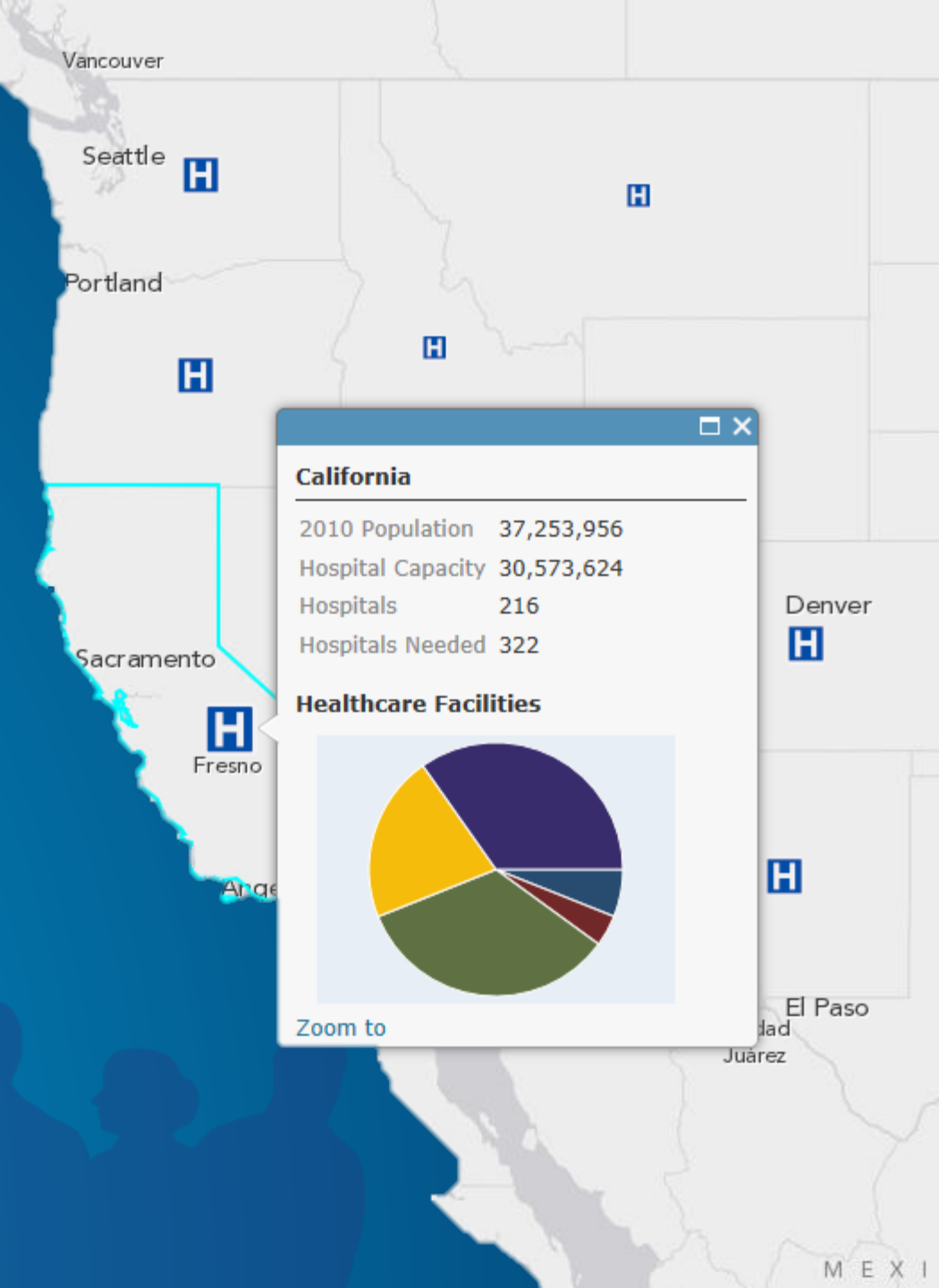
I want to see the
healthcare facilities in
the country.

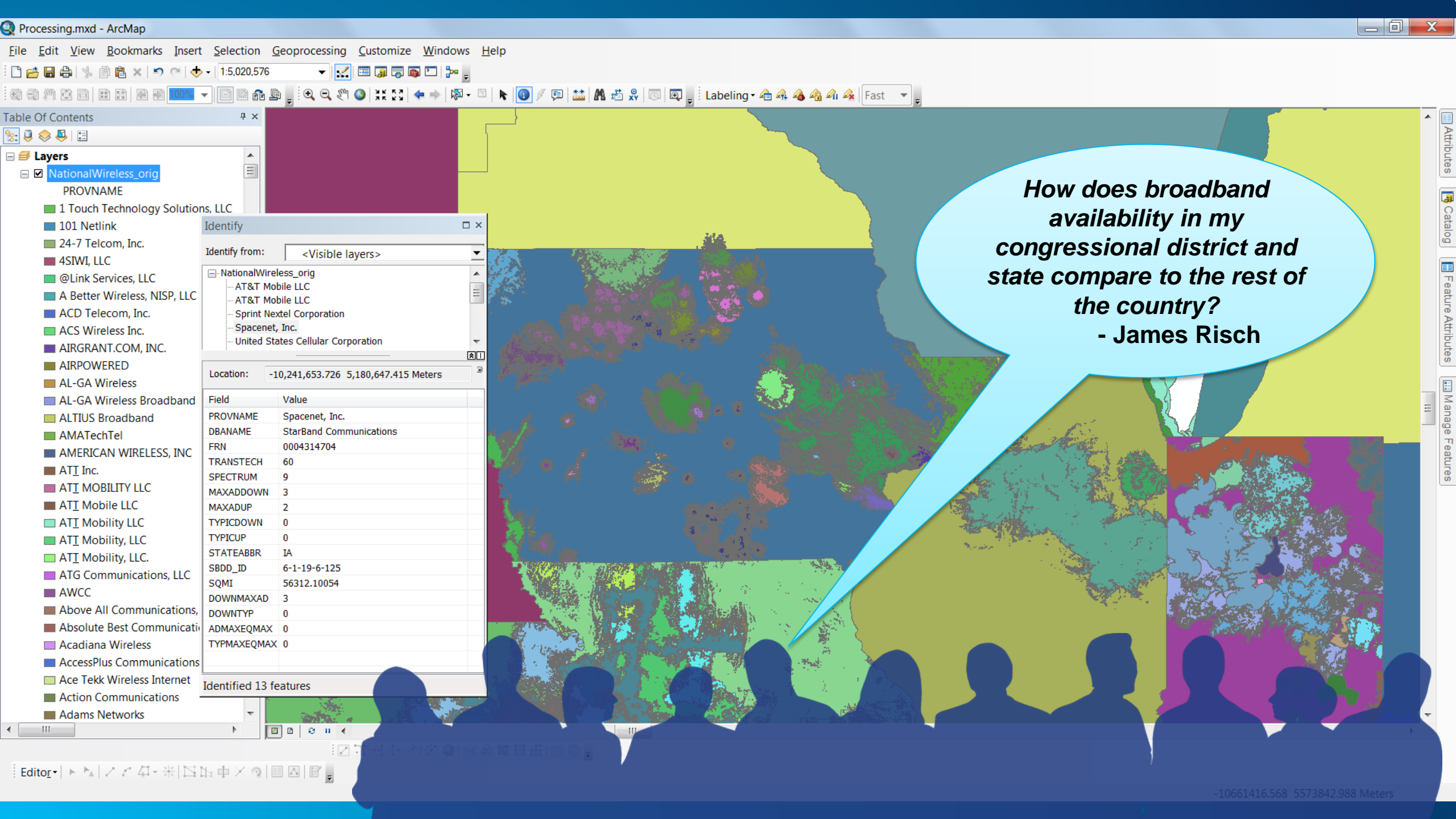


What an audience actually needs

How are healthcare facilities distributed at the state level?

~~I want to see the healthcare facilities in the country.~~





**How does broadband availability in my congressional district and state compare to the rest of the country?
- James Risch**

Identify

Identify from: <Visible layers>

- NationalWireless_orig
 - AT&T Mobile LLC
 - AT&T Mobile LLC
 - Sprint Nextel Corporation
 - Spacenet, Inc.
 - United States Cellular Corporation

Location: -10,241,653.726 5,180,647.415 Meters

Field	Value
PROVNAME	Spacenet, Inc.
DBANAME	StarBand Communications
FRN	0004314704
TRANSTECH	60
SPECTRUM	9
MAXADDOWN	3
MAXADUP	2
TYPICDOWN	0
TYPICUP	0
STATEABBR	IA
SBDD_ID	6-1-19-6-125
SQMI	56312.10054
DOWNMAXAD	3
DOWNTYP	0
ADMAXEQMAX	0
TYPMAXEQMAX	0

Identified 13 features

- Table Of Contents
- Layers
- NationalWireless_orig
 - PROVNAME
 - 1 Touch Technology Solutions, LLC
 - 101 Netlink
 - 24-7 Telcom, Inc.
 - 4SIWI, LLC
 - @Link Services, LLC
 - A Better Wireless, NISP, LLC
 - ACD Telecom, Inc.
 - ACS Wireless, Inc.
 - AIRGRANT.COM, INC.
 - AIRPOWERED
 - AL-GA Wireless
 - AL-GA Wireless Broadband
 - ALTIUS Broadband
 - AMATechTel
 - AMERICAN WIRELESS, INC
 - ATI Inc.
 - ATI MOBILITY LLC
 - ATI Mobile LLC
 - ATI Mobility LLC
 - ATI Mobility, LLC
 - ATI Mobility, LLC.
 - ATI Mobility, LLC.
 - ATG Communications, LLC
 - AWCC
 - Above All Communications,
 - Absolute Best Communicati
 - Acadiana Wireless
 - AccessPlus Communications
 - Ace Tekk Wireless Internet
 - Action Communications
 - Adams Networks

[Details](#)
[Add](#)
[Basemap](#)
[Save](#)
[Share](#)
[Print](#)
[Measure](#)
[Bookmarks](#)




Legend


NTIA In The Dark (Available Spectrums)


No available service



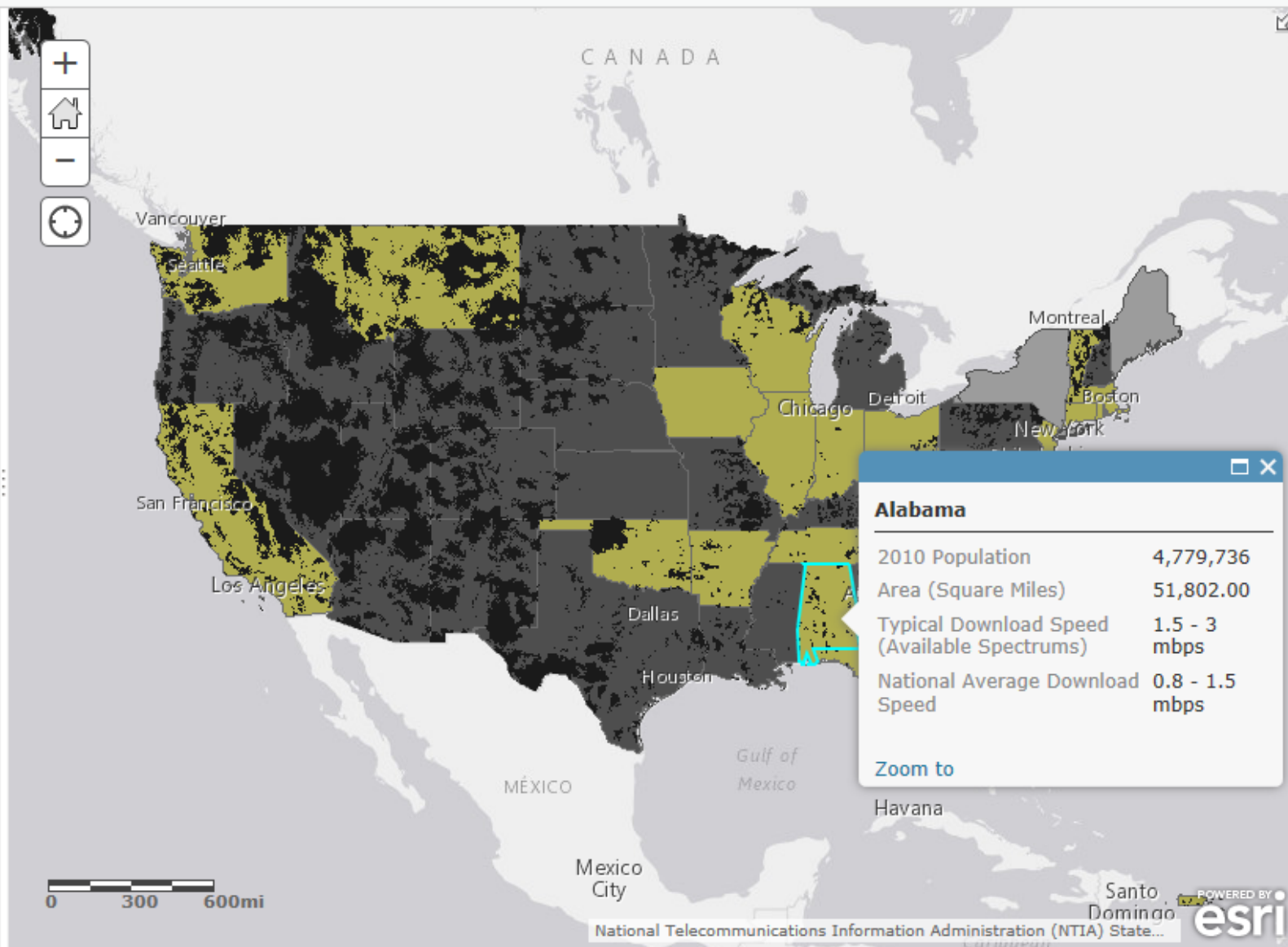
State Average Typical Download Speed

 0.2-1.5 mbps: E-Mail, Web Browsing (interactive pages), VOIP

 1.5-6 mbps: File Sharing (Small/Med Files), IPTV (Internet Protocol Television), Game console connecting to the Internet, Basic Video Conferencing

 6-10 mbps: Two-way online Gaming, Video on Demand

 No download speed data



Alabama

2010 Population	4,779,736
Area (Square Miles)	51,802.00
Typical Download Speed (Available Spectrums)	1.5 - 3 mbps
National Average Download Speed	0.8 - 1.5 mbps

[Zoom to](#)

Map Effectiveness

Who is the target **audience**?

What is the map **purpose and message**?

Is there **content** and **contextual** data to support the established map purpose?

What are the overarching **design** considerations?



1. It is all about the data!

Instead consider the...

- The audience, map purpose and message
- Content in context
- Overarching design considerations

BUSTED!

**2. It's just a simple map...
Shouldn't be hard, right?**

Chesapeake Bay Story Map Introduction

Chesapeake Bay Program



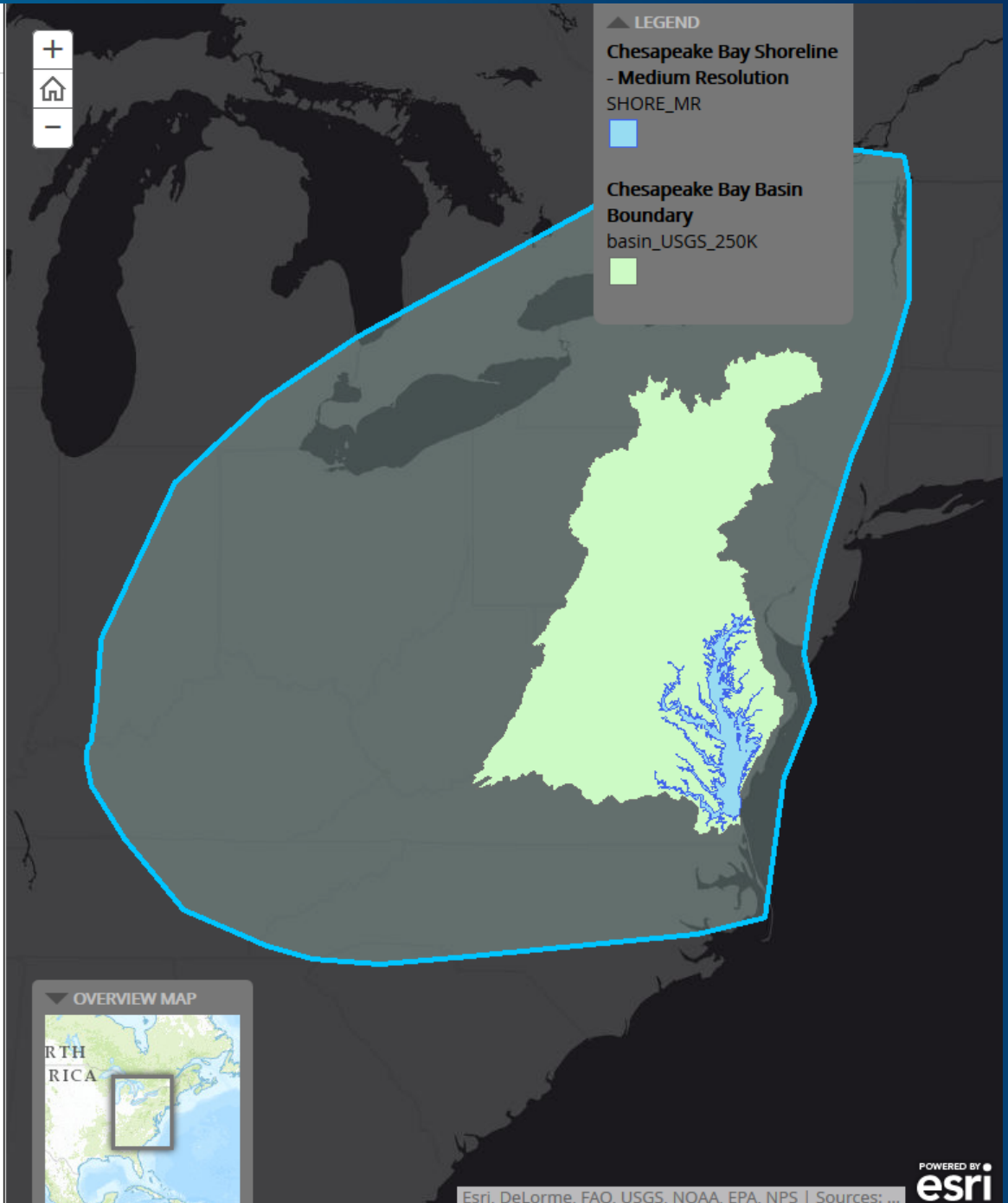
Cleaner Air - Cleaner Bay

Air sources contribute about one-third of the total nitrogen loads delivered to the Chesapeake Bay by depositing directly onto the tidal surface waters of Chesapeake Bay and onto the surrounding Bay watershed. Direct deposition to the Bay's tidal surface waters is estimated to be 6 to 8 percent of the total (air and non-air) nitrogen load delivered to the Bay. The nitrogen deposited onto the land surface of the Bay's watershed and subsequently transported to the Bay is estimated to account for 25 to 28 percent of the total nitrogen loadings delivered to the Bay.


Atmospheric loads of nitrogen are from chemical species of oxidized nitrogen, also called NO_x, and from reduced forms of nitrogen deposition, also called ammonia (NH₄⁺). Oxidized forms of nitrogen deposition originate from conditions of high heat and pressure and are formed from inert diatomic atmospheric nitrogen (N₂). The principle sources of NO_x are industrial-sized boilers such as electric power plants and the internal combustion engines in cars, trucks, locomotives, airplanes, and the like.


Reduced nitrogen, or ammonia, is responsible for approximately one-third of the total nitrogen atmospheric emissions that eventually end up as loads to the Bay. Ammonia sources are predominately agricultural, and ammonia is released into the air by volatilization of ammonia from manures and emissions from ammonia based fertilizers. Minor sources include mobile sources, slip ammonia released as a by-product of emission controls on NO_x at power plants, and industrial processes.

Two types of atmospheric deposition—wet and dry—are input to the Bay Watershed and Bay Water Quality Models



▲ LEGEND

Chesapeake Bay Shoreline
- Medium Resolution
SHORE_MR


Chesapeake Bay Basin
Boundary
basin_USGS_250K


▼ OVERVIEW MAP

Chesapeake Bay Story Map Introduction

The screenshot shows a web browser window displaying an ArcGIS web map. The browser's address bar shows the URL: <http://www.arcgis.com/home/webmap/viewer.html?webmap=...>. The page title is "Chesapeake Bay Background Info". The interface includes a search bar with the text "Find address or place", a legend on the left, and a map area. The map displays a large watershed area in light blue, covering the Great Lakes region and extending south to the Chesapeake Bay. Major rivers and lakes are labeled, including Lake Michigan, Lake Huron, Lake Ontario, Lake Erie, Lake St. Lawrence, and the Chesapeake Bay. The map also shows state boundaries and names such as Ohio, Kentucky, Tennessee, and Virginia. A scale bar at the bottom left indicates 0, 50, and 100 miles. The bottom right corner features the Esri logo and the text "POWERED BY esri" and "WWF, USGS, EPA, Esri | Sources: Esri, USGS, NOAA".

ArcGIS - Chesapeake Bay Background Info

NEW MAP CREATE PRESENTATION Billie

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

Legend

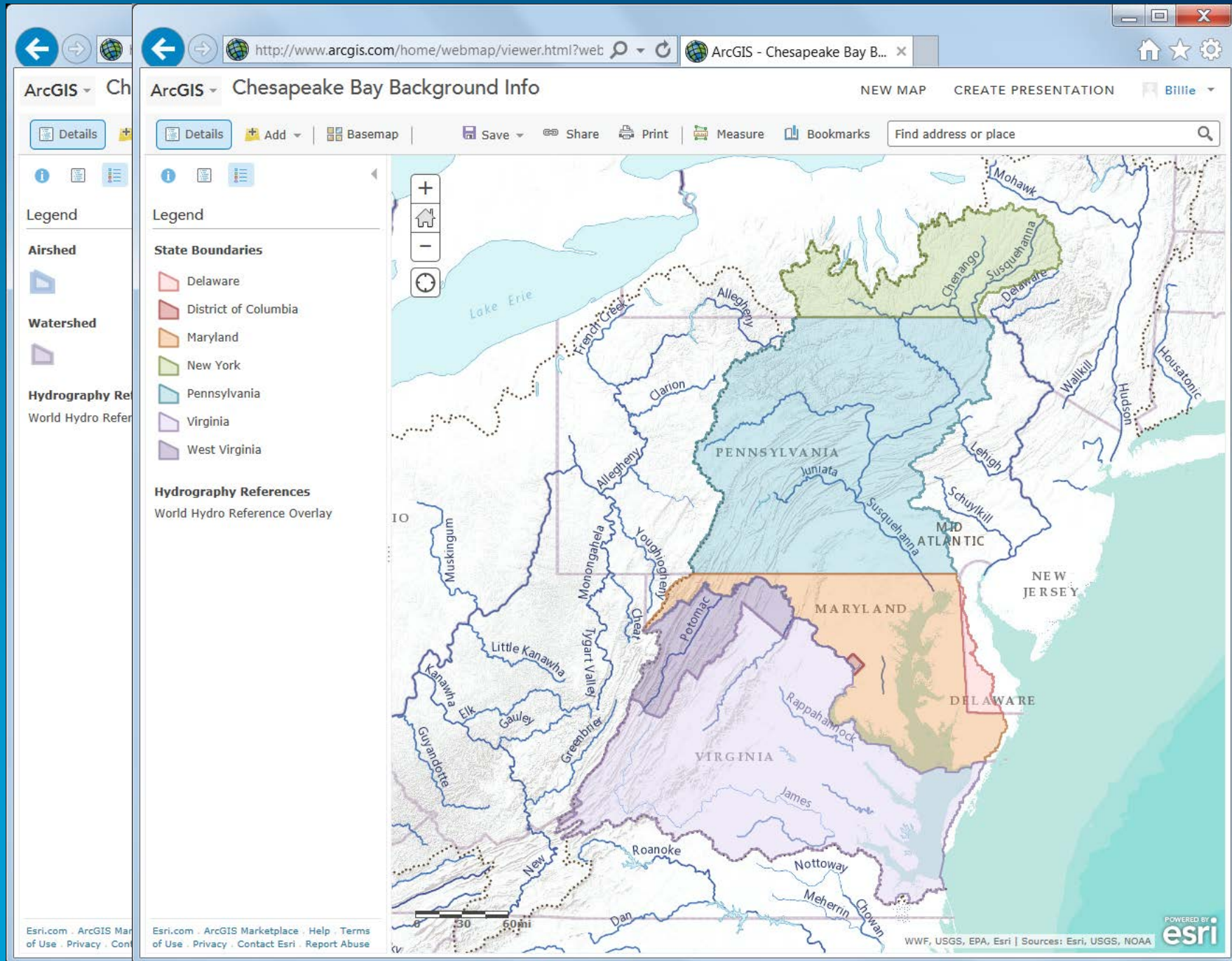
- Airshed
- Watershed
- Hydrography References
- World Hydro Reference Overlay

0 50 100mi

POWERED BY esri

WWF, USGS, EPA, Esri | Sources: Esri, USGS, NOAA

Chesapeake Bay Story Map Introduction



Chesapeake Bay Story Map Introduction

The image displays three sequential screenshots of an ArcGIS web map viewer, illustrating the layers and information available for the Chesapeake Bay region. The browser address bar shows the URL: <http://www.arcgis.com/home/webmap/viewer.html?web>.

Screenshot 1 (Left): Shows the initial map view with a legend on the left. The legend includes:

- Airshed** (represented by a blue trapezoid icon)
- Watershed** (represented by a purple trapezoid icon)
- Hydrography Reference** (World Hydro Reference)

Screenshot 2 (Middle): Shows the map with additional layers. The legend includes:

- State Boundaries**: Delaware, District of Columbia, Maryland, New York, Pennsylvania, Virginia, West Virginia.
- Hydrography Reference** (World Hydro Reference)

Screenshot 3 (Right): Shows the map with a detailed legend for land use and vegetation. The legend includes:

- Developed Open Space** (light gray)
- Low Intensity Urban** (light orange)
- Medium Intensity Urban** (orange)
- High Intensity Urban** (red)
- Barren** (dark gray)
- Unconsolidated Shore** (yellow)
- Deciduous Forest** (light green)
- Evergreen Forest** (dark green)
- Mixed Forest** (medium green)

The map displays the Chesapeake Bay watershed, including major rivers such as the Susquehanna, Potomac, James, and Rappahannock. State boundaries for Pennsylvania, Maryland, Virginia, Delaware, and New Jersey are visible. The map also shows Lake Erie to the northwest. A scale bar at the bottom indicates distances up to 60 miles. The Esri logo and text "POWERED BY esri" are visible in the bottom right corner.

DC Metro

M System Map

wmata.com
 Customer Information Service: 800 637-7000
 TTY Phone: 202 696-8790
 Metro Transit Police: 202 962-2121

Legend

- Red Line • Glenmont / Shady Grove
- Orange Line • New Carrollton / Vienna
- Blue Line • Franconia-Springfield / Largo Town Center
- Green Line • Branch Ave / Greenbelt
- Yellow Line • Huntington / Fort Totten
- Silver Line • Wiehle-Parkton East / Largo Town Center

Station Features

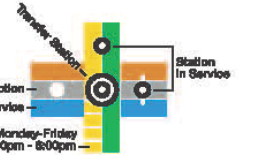
- Bus to Airport
- Parking
- Hospital
- Airport

Connecting Rail Systems



Under Construction - Full-Time Service

Rush-Only Service: Monday-Friday 6:30am - 9:00am & 9:00pm - 9:00pm



Metrolink Operating Times

Mon-Thu
5am-midnight

Fri
5am-3am

Sat
7am-3am

Sun
7am-midnight

Times are approximate.

Metro is accessible.



2. Its just a simple map, not hard...

Consider the...

- Necessary context: basemap and reference overlay
- Overarching design considerations
- Feature simplification, aggregation and abstraction

BUSTED!

3. Imagery makes a great basemap

ArcGIS - Social Vulnerability

NEW MAP Billie ▾

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

About Content Legend

Contents

- World Transportation
- Social Vulnerability 2010
 - Social Vulnerability
 - Highest
 - Very High
 - High
 - Normal
 - Low
 - Very Low
 - Lowest
- Imagery with Labels



Browser window showing ArcGIS Social Vulnerability map of Charleston, SC. The URL is <http://www.arcgis.com/home/webmap/viewer.html?webmap=cbe59156>. The page title is "ArcGIS - Social Vulnerability".

Map Title: ArcGIS - Social Vulnerability

Map Content: Social Vulnerability 2010

Legend:

- World Transportation
- Social Vulnerability 2010
 - Social Vulnerability
 - Highest
 - Very High
 - High
 - Normal
 - Low
 - Very Low
 - Lowest
 - Streets

Map Labels: Lincolnville, Ladson, Goose Creek, Belvedere Estates, Hanahan, North Charleston, Charleston, Mt Pleasant, Isle of Palms, Sullivan's Island, Folly Beach, James Island, Johns Island, Meggett, Hollywood, Ravenel, Wadmalaw Island, Rockville, Seabrook Island, Kiawah Island, Edisto Island, Charleston Harbor, Daniel Island Club, Bull Island.

Scale: 0 to 4 miles.

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Browser window showing an ArcGIS Social Vulnerability map. The URL is <http://www.arcgis.com/home/webmap/viewer.html?webmap=cbe59156>. The page title is "ArcGIS - Social Vulnerability".

The map displays social vulnerability levels for the Charleston, South Carolina area, categorized into seven levels: Highest, Very High, High, Normal, Low, Very Low, and Lowest. The map is color-coded according to these levels, with the highest vulnerability areas shown in dark red and the lowest in light yellow.

Key locations labeled on the map include Summerville, Goose Creek, Charleston Air Force Base, North Charleston, Charleston, Folly Beach, Seabrook Island, Kiawah Island, Wadmalaw Island, Johns Island, Ravenel, Hollywood, Meggett, Sullivan's Island, and Isle of Palms.

The interface includes a search bar at the top right with the text "Find address or place". The left sidebar contains a "Contents" panel with the following items:

- World Transportation
- Social Vulnerability 2010
 - Social Vulnerability
 - Highest
 - Very High
 - High
 - Normal
 - Low
 - Very Low
 - Lowest
- Light Gray Canvas

Navigation controls (Zoom In, Home, Zoom Out, Refresh) are visible on the left side of the map. A scale bar at the bottom left indicates 0, 2, and 4 miles. The bottom right corner features the Esri logo and the text "POWERED BY esri".

Browser window showing ArcGIS My Map interface. The URL is <http://www.arcgis.com/home/webmap/viewer.html?useExisting=1>. The page title is "ArcGIS - My Map".

Navigation and utility buttons include: Details, Add, Basemap, Save, Share, Print, Measure, Bookmarks, and a search bar labeled "Find address or place".

Legend: DC_Metro_Lines - DC Metro

- Red
- Yellow
- Orange
- Green
- Blue
- Silver

The map displays the DC Metro system lines overlaid on a satellite view of the Washington DC area. The lines are color-coded according to the legend: Red (Northern lines), Yellow (Yellow Line), Orange (Orange Line), Green (Green Line), Blue (Blue Line), and Silver (Silver Line). Major cities and landmarks like Washington DC, Arlington, Alexandria, and the Potomac River are visible.

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Browser window showing ArcGIS My Map interface. The URL is <http://www.arcgis.com/home/webmap/viewer.html?useExisting=1>. The page title is "ArcGIS - My Map".

Navigation and utility buttons include: Home, Star, Settings, Travel, Beta Testing, Okta, Esri Box, Adobe Connect, MAP SERVICES, WMX Viewer, AGOL, ArcGIS Help, AGOL Help, and CartoLab.

The main interface displays "ArcGIS - My Map" with a "NEW MAP" button and a user profile "Billie". A search bar contains the text "Find address or place".

The map shows the DC Metro Lines network, color-coded according to the legend:

- Red
- Yellow
- Orange
- Green
- Blue
- Silver

The map displays various locations including Gaithersburg, Rockville, Wheaton-Glenmont, Silver Spring, Chillum, Washington, Alexandria, and Springfield. The Potomac River and the Virginia border are also visible.

Footer text includes: Esri.com, ArcGIS Marketplace, Help, Terms of Use, Privacy, Contact Esri, Report Abuse, and POWERED BY esri. Technical details: VITA, Esri, HERE, DeLorme, NGA, USGS | Esri, HERE, DeLorme.

ArcGIS - My Map

Details Add Basemap

Save Share Print Measure Bookmarks

About Content Legend

DC_Metro_Lines - DC Metro

- Red
- Yellow
- Orange
- Green
- Blue
- Silver

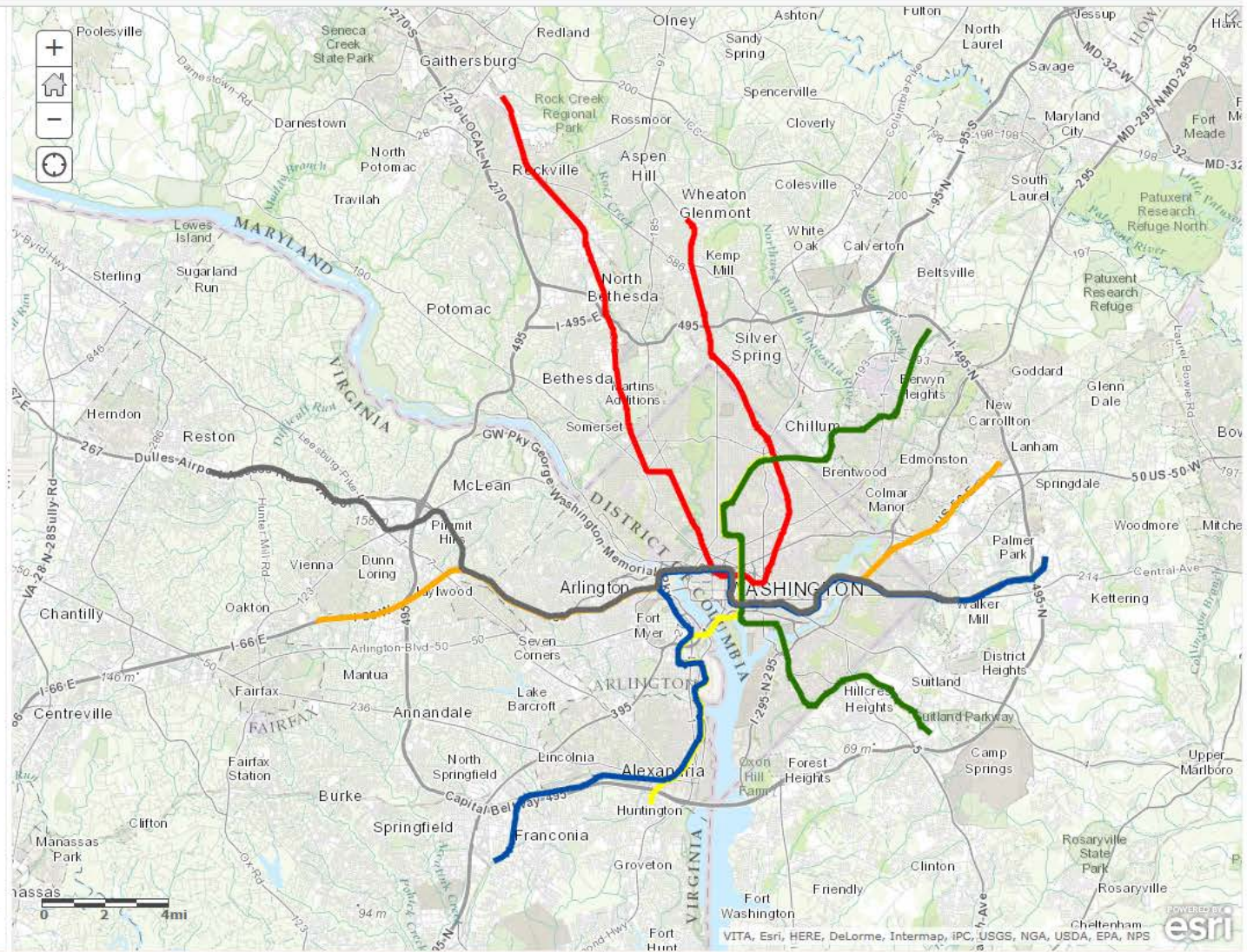


Table Of Contents

- Layers
 - Sports and entertainment
 - Eating and Drinking
 - Attractions
 - Accomodations
 - StreetMap
 - Imagery



- Attributes
- Catalog
- Feature Attributes
- Manage Features

Table Of Contents

Layers

- Sports and entertainment
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- Imagery
- World_Topo_Map

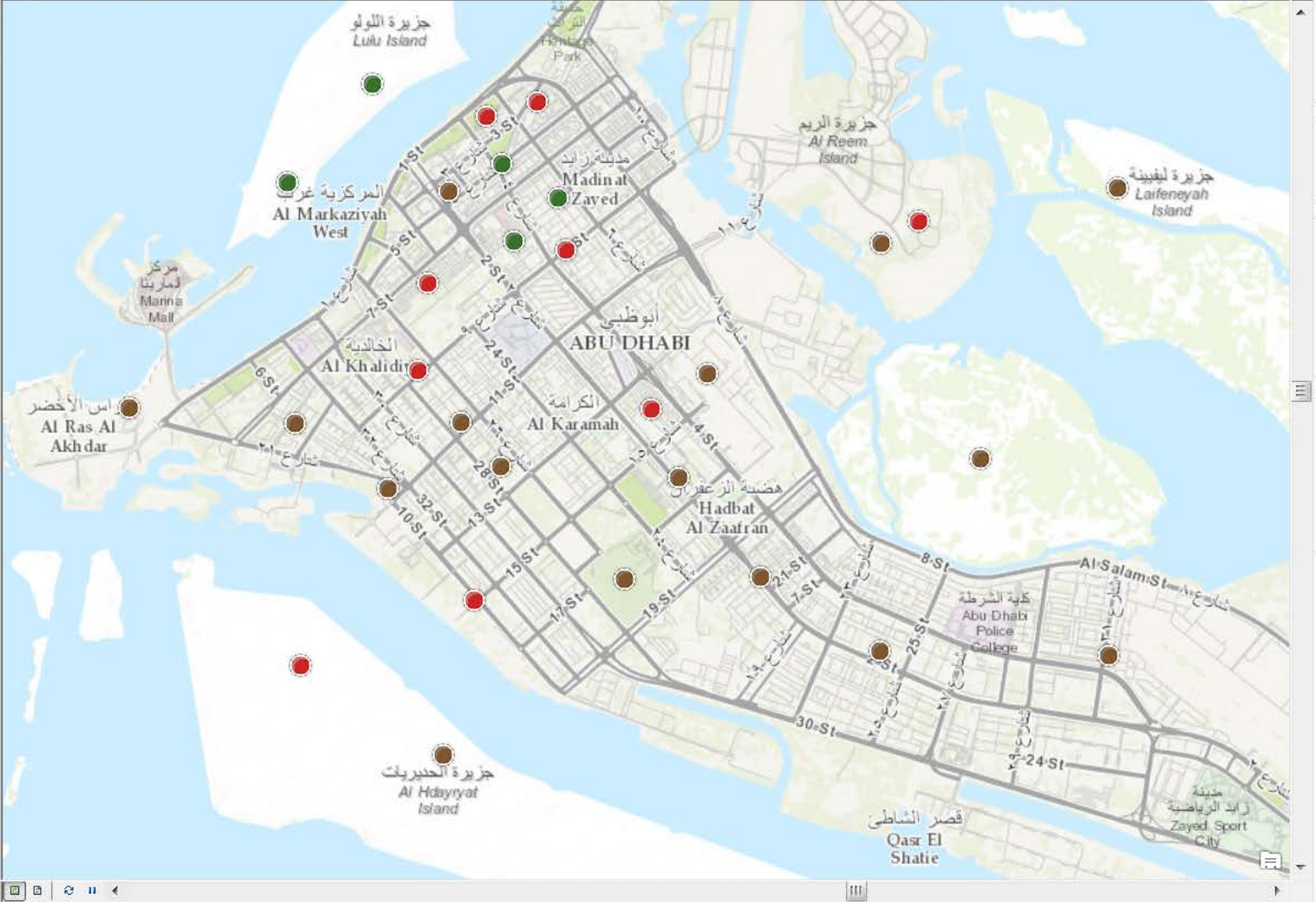


- Attributes
- Catalog
- Feature Attributes
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- Attributes
- Catalog
- Feature Attributes
- Manage Features

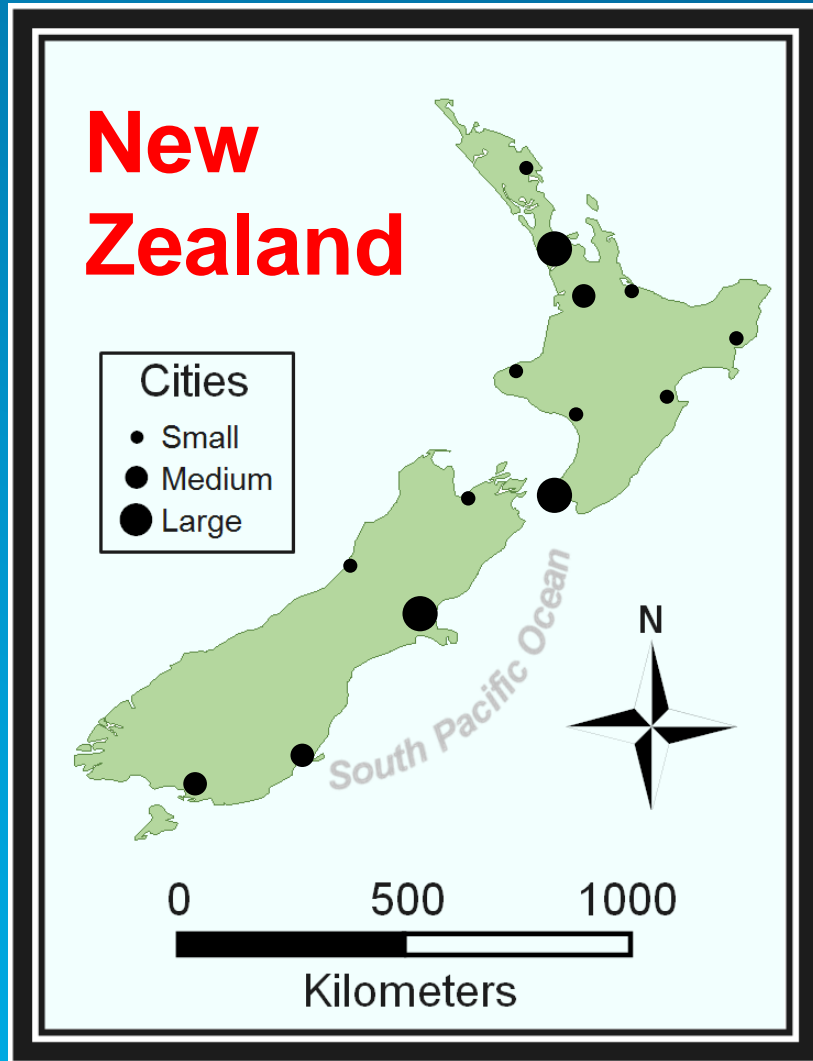
3. Imagery as a basemap

- Use for simple, point/marker symbology
- Use symbology and labels with halos and outlines
- Create separate overlays for labels (light text with dark halo)

BUSTED!

4. All map elements need to be there!

Map Elements



Interactive Elements

- Popups
- Widgets
- Application functionality



Twister Dashboard: Exploring Three Decades of Violent Storms

Although tornadoes can occur throughout the year, prime time for twisters in the U.S. is spring and early summer. Larger symbols show more violent tornadoes. Zoom into the map to see approximate tornado tracks.

- **Pan and zoom map** to explore; graphs show totals for current map view
- **Click on graph** to see annual totals
- **Click on a tornado** for stats about individual twisters

A story map [f](#) [t](#) [s](#)

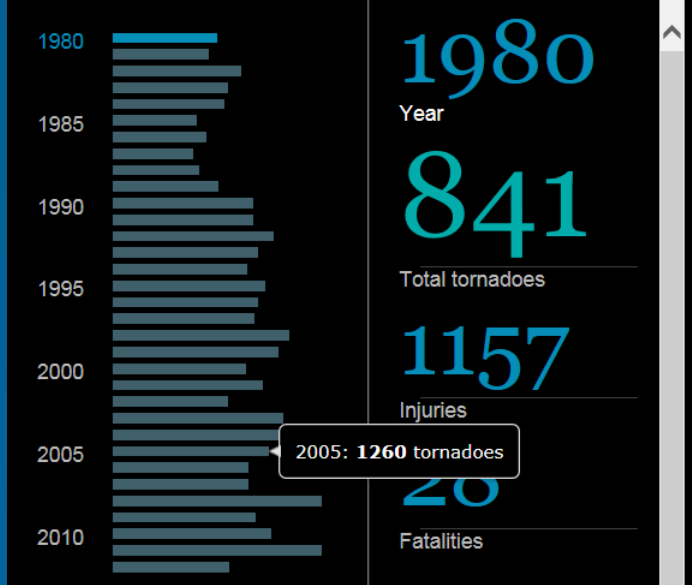
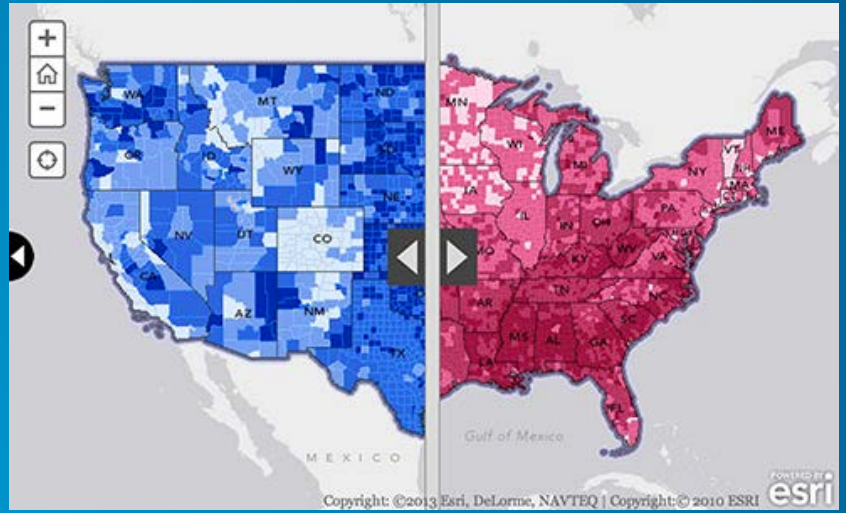
Wyoming

Number of Facilities 73
Facility Surplus +/-/Need - 30

Health Care Resources Comparison

Hospitals: 17

Zoom to



4. All map elements, always!

- Consider if the map element is needed or not
- If it is required, design the map without it
- Consider visual hierarchy and map element balance

BUSTED!

5. I have to manage everything!

For Data Managers and GIS Analysts

ArcGIS - Philly basemap

Select a basemap

- Imagery
- Imagery with Labels
- Topographic
- Dark Gray Canvas
- National Geographic
- Oceans
- OpenStreetMap
- USA Topo Maps

Map navigation controls: zoom in (+), zoom out (-), home, and refresh.

ArcGIS - My Map

Search for Layers

Find: terrain

In: ArcGIS Online

221 Results Found

- World Reference Overlay by esri
- World Hydro Reference Overlay by HydroTeamRC
- World Physical Map by esri
- USDHS FEMA 100 Year Flood Zones by Federal_User_Community
- World Terrain Base by esri**
- USA Labor Force by esri
- Crime Index by AtlasPu
- USA Population by esri
- USDOI USGS by Federal
- Utah Terrain E by UtahAG
- Landsat Shad by oevans
- AerialMostRecentHighestQualityComp by CIO_Research

World Terrain Base

Add to map
Item Details
Use as Basemap

Summary:
This map service features shaded relief imagery, bathymetry, and coastal water features designed to provide a neutral background for other data layers...

DONE ADDING LAYERS

City of Philadelphia
LIFE • LIBERTY • AND YOU™

Search Legend Regions Map Browser

Zoom in to see all features.

Map features: street names (e.g., S College Ave, N Broad St, John F Kennedy Blvd), landmarks (e.g., Benjamin Franklin Parkway, Penn Sq), and data points (represented by small circular icons).

For Cartographers

Search for Layers

Find:

In:

Within map area

71 Results Found

- Chesapeake Bay County Boundaries by JohnDawes_
- Chesapeake Land Cover by PASDA
- Health of Freshwater Streams in the Che by JohnDawes_
- HUC 12 Boundaries of the Chesapeake B by bmcintyre5
- CCWC_NHD by ccwc1
- Chester Tester Data 2010 by crawatershed
- Health of Freshwater Streams in the Bay by JohnDawes_
- HUC8 Subwatersheds of the Chesapeake by JohnDawes_
- Virginia Impaired Waters and Causes of I by JohnDawes_
- Chesapeake Bay State Boundaries by JohnDawes_**
- W Feature Layer Chesapeake by josnapowell_chesapeake
- Chester Tester Data 2008 by crawatershed
- Nitrogen and Phosphorus Effectiveness by JohnDawes

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ArcGIS - My Map

NEW MAP Billie

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

Contents

- Bay Outline - Bay Watershed
- Chesapeake Bay Airshed
- Chesapeake Bay State Boundaries
 - Delaware
 - District of Columbia
 - Maryland
 - New York
 - Pennsylvania
 - Virginia
 - West Virginia
- World Hydro Reference Overlay
- Imagery with Labels

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Earthstar Geographics | Esri, DeLorme **esri** POWERED BY

For Cartographers

The screenshot shows the ArcGIS web map viewer interface. The browser address bar displays the URL: <http://www.arcgis.com/home/webmap/viewer.html?web>. The page title is "ArcGIS - Chesapeake Bay Background Info". The map displays the Chesapeake Bay watershed, highlighting state boundaries for Delaware, District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. Major rivers and creeks are labeled, including the Susquehanna, Potomac, James, Rappahannock, and others. The map also shows Lake Erie and the Atlantic Ocean. The interface includes a legend on the left, a search bar at the top right, and various map controls like zoom and home buttons. The bottom of the page contains copyright information for Esri, USGS, EPA, and NOAA.

Legend

State Boundaries

- Delaware
- District of Columbia
- Maryland
- New York
- Pennsylvania
- Virginia
- West Virginia

Hydrography References

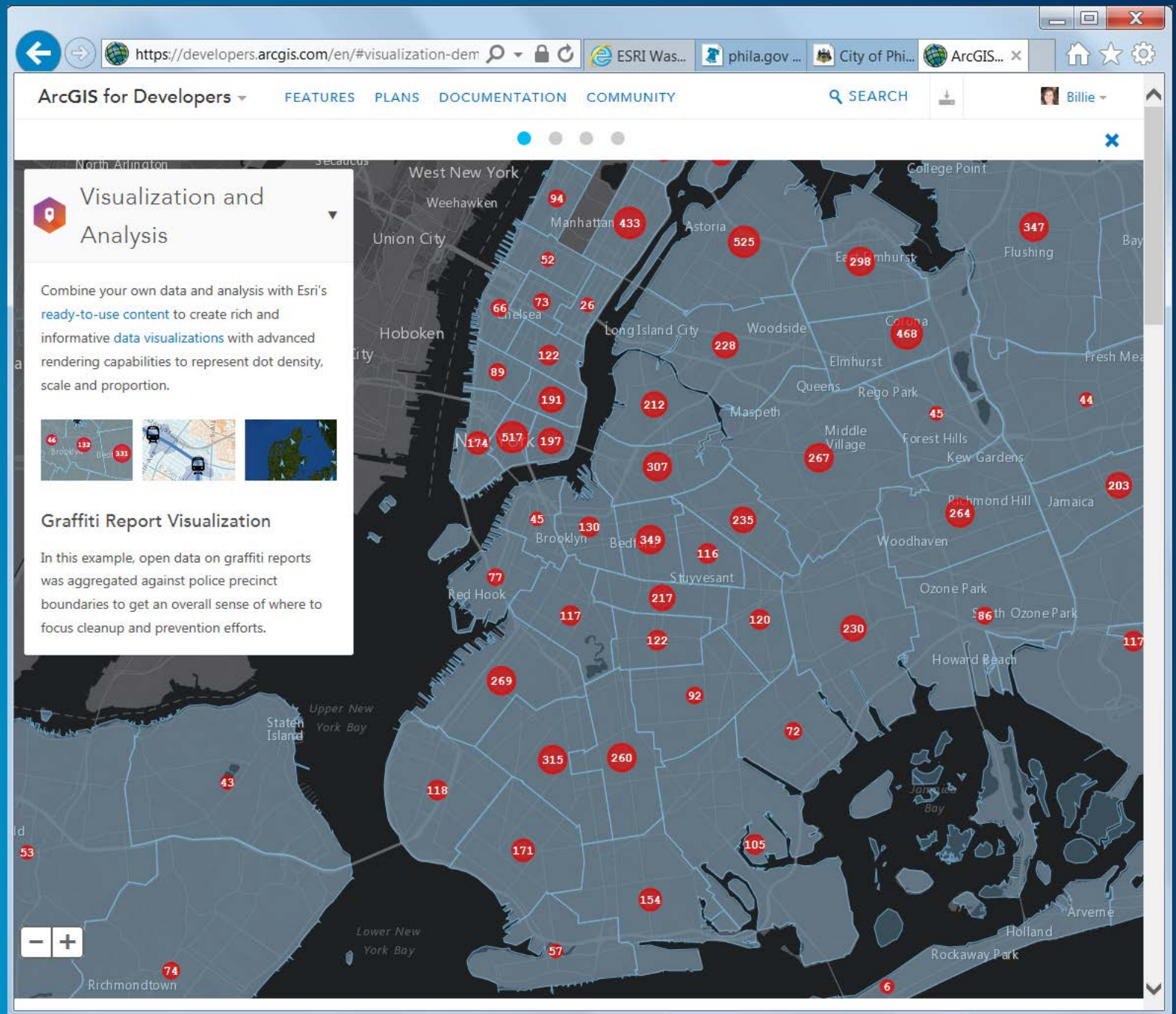
World Hydro Reference Overlay

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WWF, USGS, EPA, Esri | Sources: Esri, USGS, NOAA

POWERED BY **esri**

For Developers



5. I have to manage everything!

- Consider using existing basemap and layers
- Consider the layers created within your organization
- Consider samples and examples from others

BUSTED!

Chesapeake Bay Nitrogen Deposition Storymap

John Wolf (Chesapeake Bay Program)



Pending changes
Application is shared publicly

Chesapeake Bay Program



Bay Waters, Watershed, and Airshed

Cleaner Air - Cleaner Bay

Actions by the U.S. Environmental Protection Agency and its state partners have led to significant reductions in one of the major sources of pollution impacting the Chesapeake Bay watershed and tidal Bay: the atmospheric deposition of nitrogen oxides, or NOx.

The steady decline in nitrogen pollution that is carried by winds and falls to the Bay's waters and lands has been a key factor in the overall progress to date in meeting water quality goals of the historic Chesapeake Bay Total Maximum Daily Load (Bay TMDL).

EPA and partners reduced atmospheric nitrogen that fell directly on the Bay and its surrounding waters by an estimated 2.5 million pounds between 2009 and 2013, largely through actions under the Clean Air Act. During the same period, nitrogen that was washed to the Bay after falling to watershed lands and upstream waters dropped by more than 1 million pounds.

Through new and existing Clean Air Act regulations, as well



ADD SECTION



ORGANIZE

Myths about Beautiful Maps

~~1. It is all about the data~~

Consider the map purpose, message, context and design.

~~2. Simple maps are fast and easy~~

Consider feature simplification, aggregation and abstraction.

~~3. I can use imagery for a basemap~~

Use imagery only when appropriate and with simple point symbols.

~~4. All map elements need to be present~~

Consider what map elements are needed. Design maps without them.

~~5. I have to manage all data, map services and basemaps~~

Consider content created by others in your organization and Esri.



Understanding our world.

Billie – bleff@esri.com

John - jwolf@chesapeakebay.net