Federal GIS Conference

February 9–10, 2015 | Washington, DC

Best Practices for Map Design

Billie Leff, Esri Cartography Technical Lead

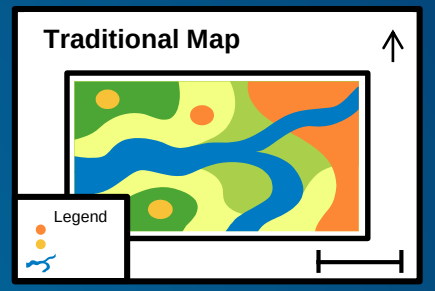
Owen Evans, Esri Solution Engineer

What is a map?

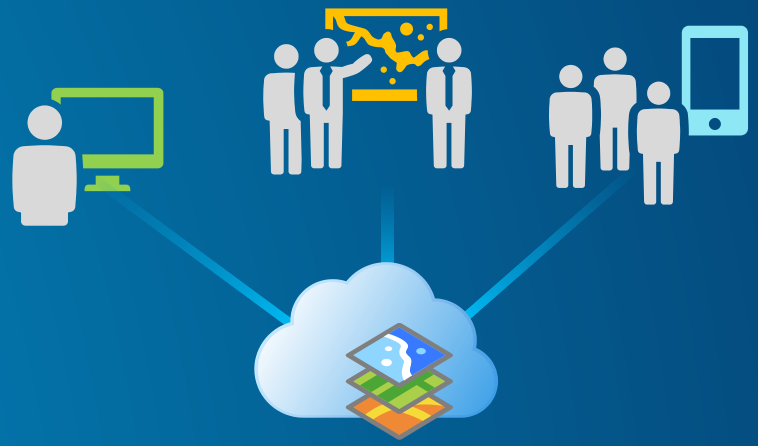
A map to Grandma's house
Zander Leff, age 4

Traditional vs. Web Maps

- **Traditional**
  - Printed/pdf, map/poster/atlas
  - Static perspective
  - Limited audience

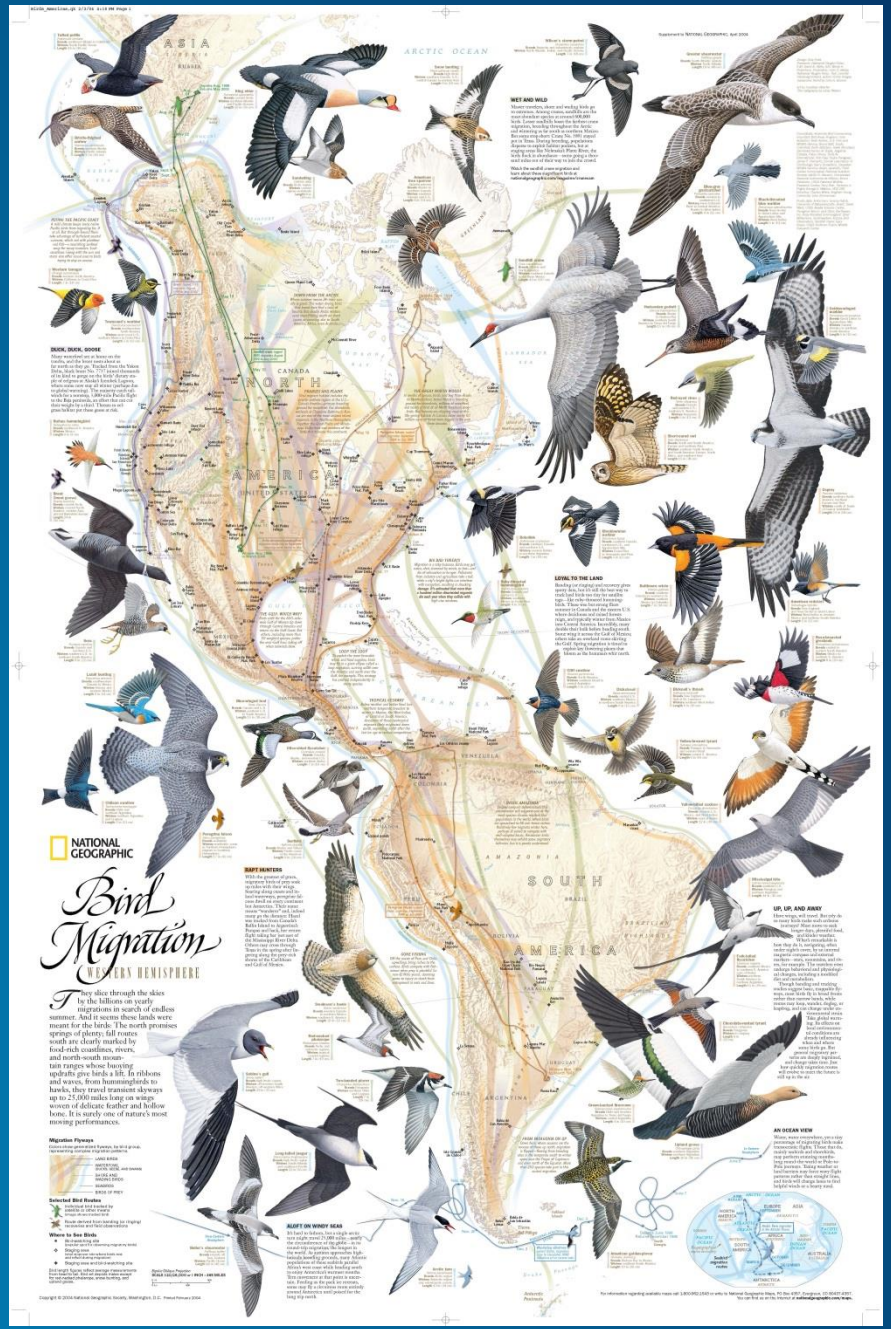


- **Web**
  - Digital and interactive!
  - Dynamic perspective
  - Multiple published forms e.g. apps
  - Limited, wide or unknown audience



What's the big deal?

- Maps generate reactions
- Esthetics or something else?
- The importance of expertise
  - Cartographic
  - Subject matter
  - Institutional and audience
  - Other?



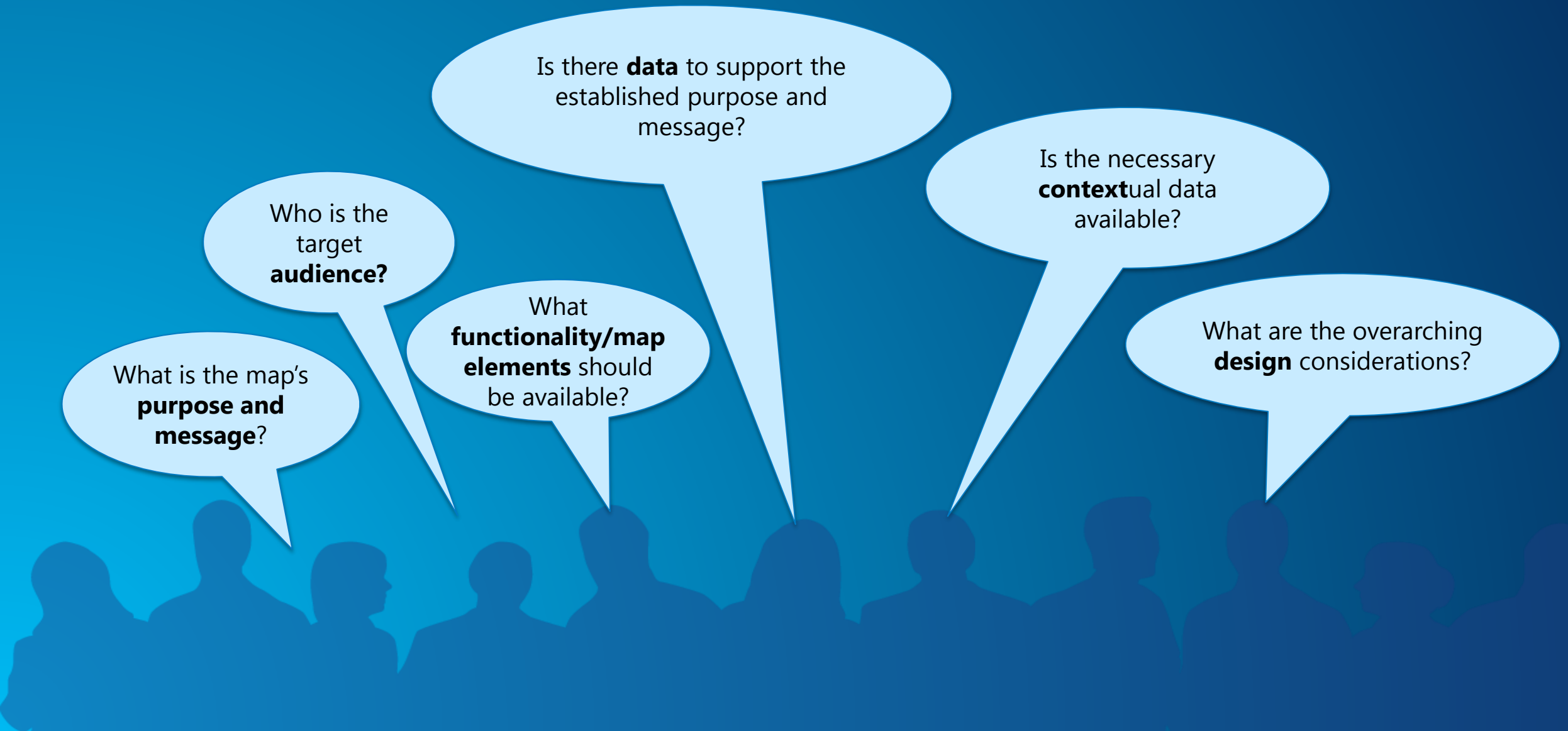
Best Practices for Map Design: Topics

1. Making an effective map
2. Working with complex data
3. Balancing performance and esthetics
4. Improving your maps

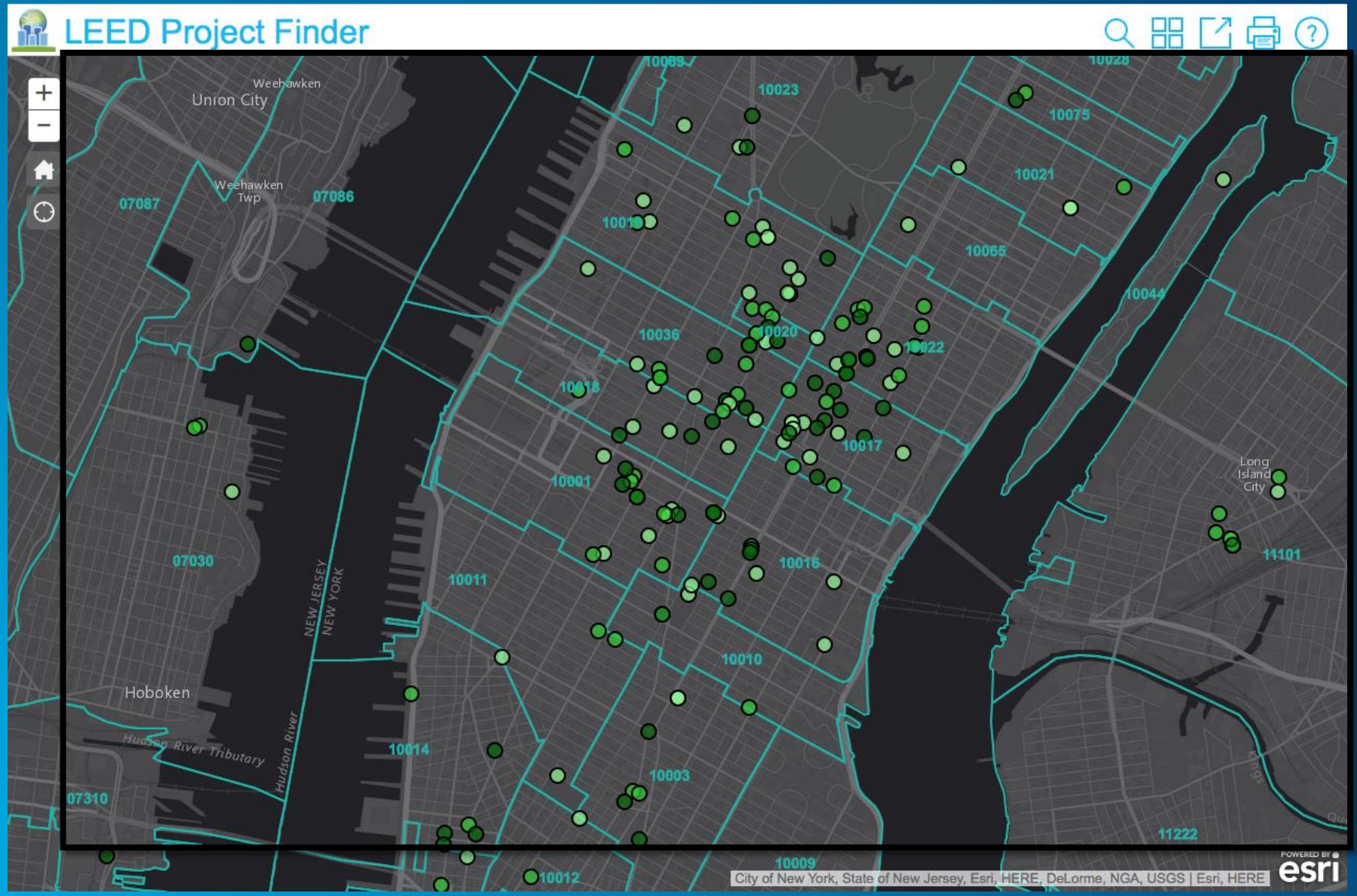
Making an Effective Map

Owen Evans

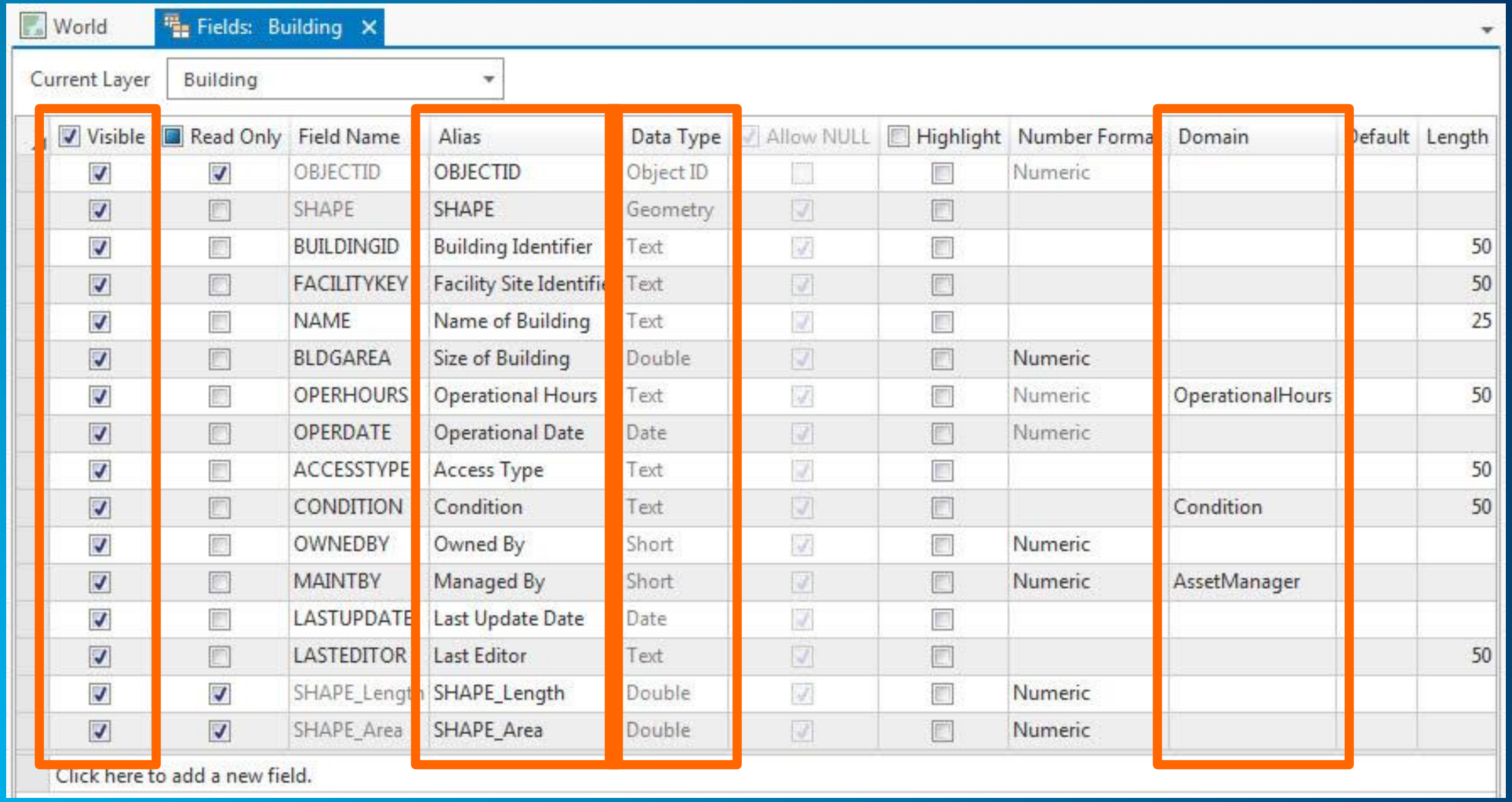
Map effectiveness depends on knowing…

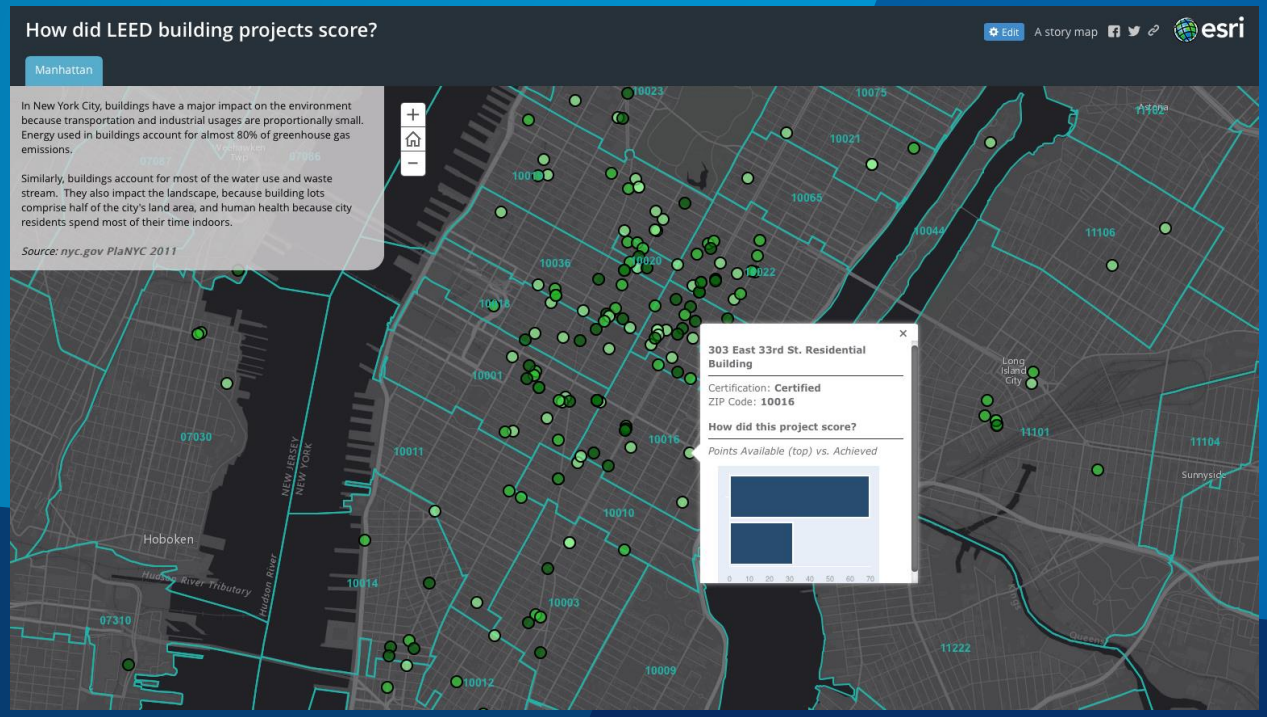


Web maps are INTERACTIVE



Before you start making a map, get your data in order!





Demonstration: From one layer… many maps!

Owen

Making an Effective Map

- Ask yourself some basic questions
- Take time to work on the data first.
- You may not use every aspect of your data, and that’s ok!

Working with complex data

Billie Leff

Mapping Complexity

- The world is complex, dynamic and multi-dimensional
- Cartography = (art + science) * (making + using)
- Strategies:
  - Separation
  - Layering

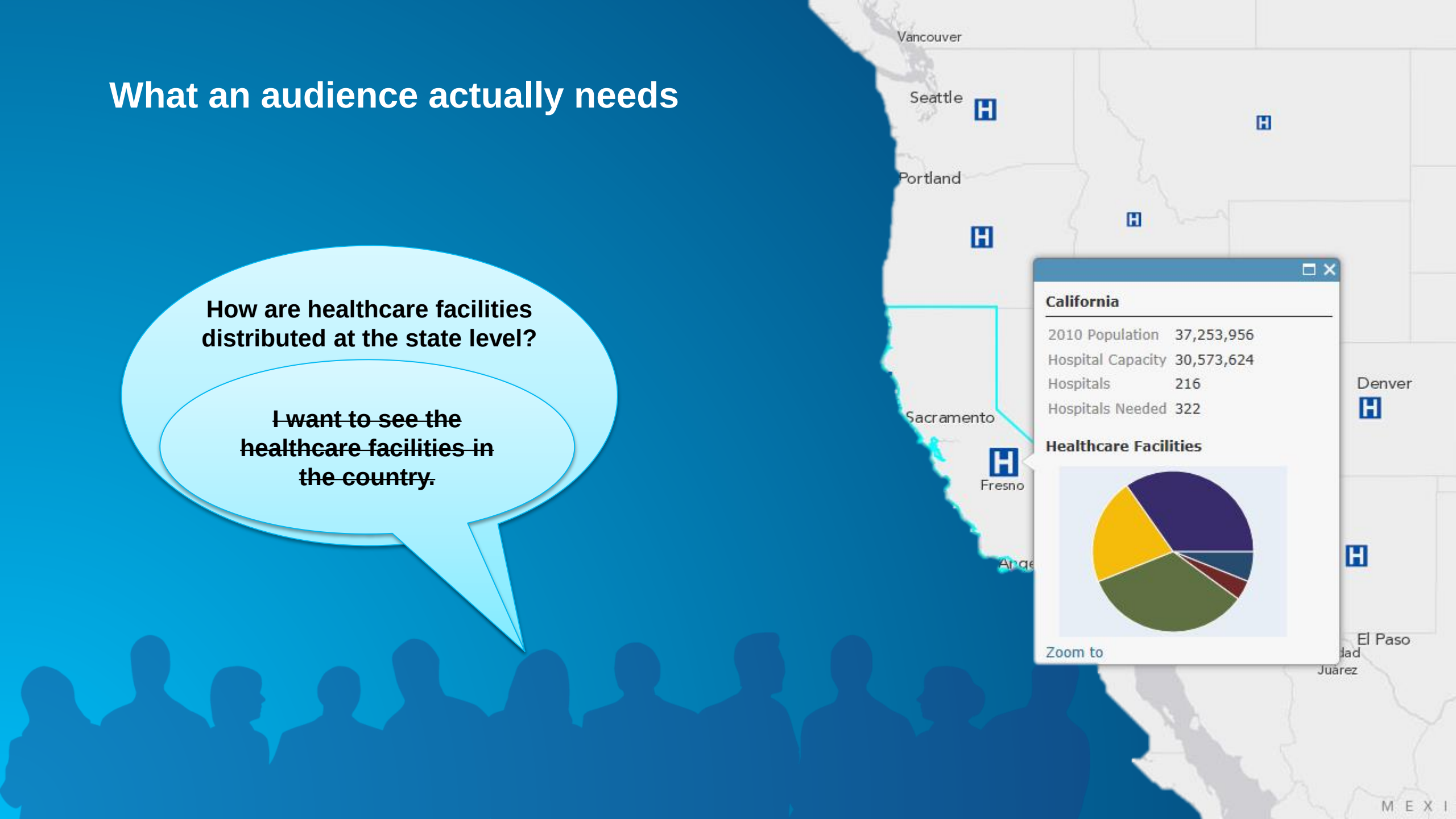
What an audience wants/asks for

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.~~



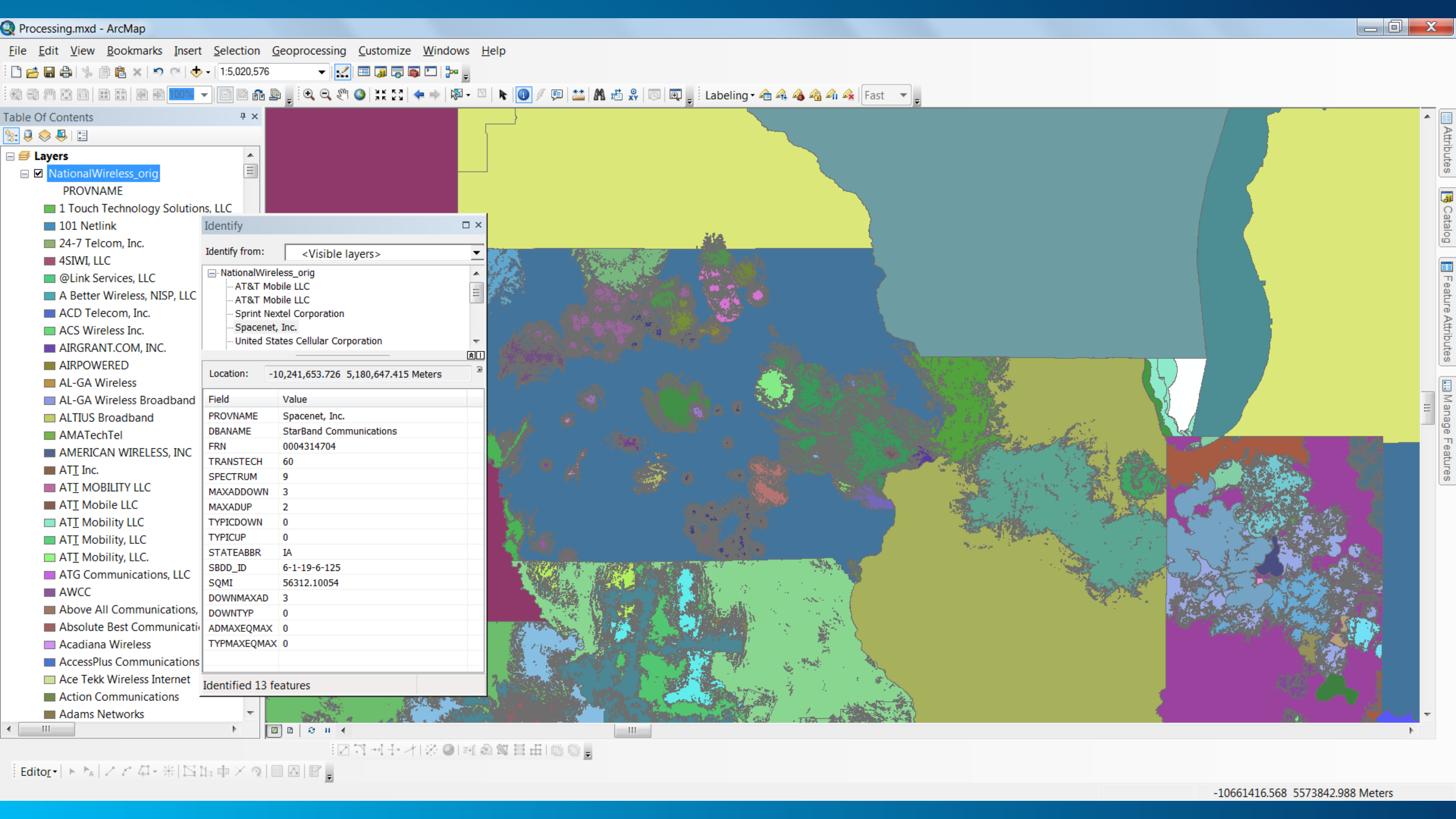

Processing.mxd - ArcMap
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Table Of Contents
Layers
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1 Touch Technology Solutions, LLC
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24-7 Telcom, Inc.
4SIWI, LLC
@Link Services, LLC
A Better Wireless, 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
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ATI Mobility, LLC.
ATG Communications, LLC
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AccessPlus Communications
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Action Communications
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United States Cellular Corporation
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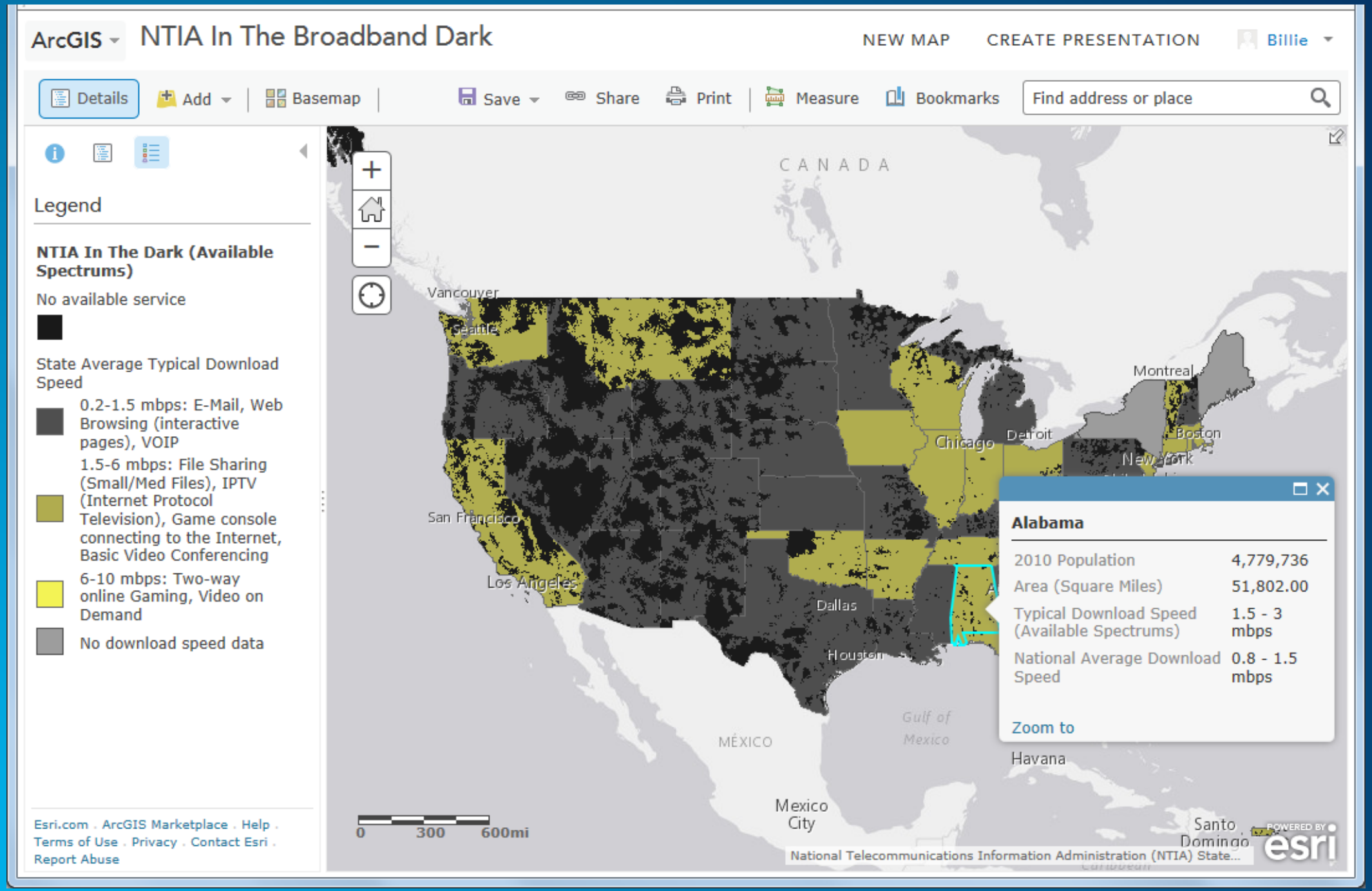
ArcGIS
NTIA In The Broadband Dark
NEW MAP
CREATE PRESENTATION
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Basemap
Save
Share
Print
Measure
Bookmarks
Find address or place
Legend
NTIA In The Dark (Available Spectrums)
No available service
State Average Typical Download Speed
0.2-1.5 mbps: E-Mail, 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
Esri.com . ArcGIS Marketplace . Help .
Terms of Use . Privacy . Contact Esri .
Report Abuse
CANADA
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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
National Telecommunications Information Administration (NTIA) State...
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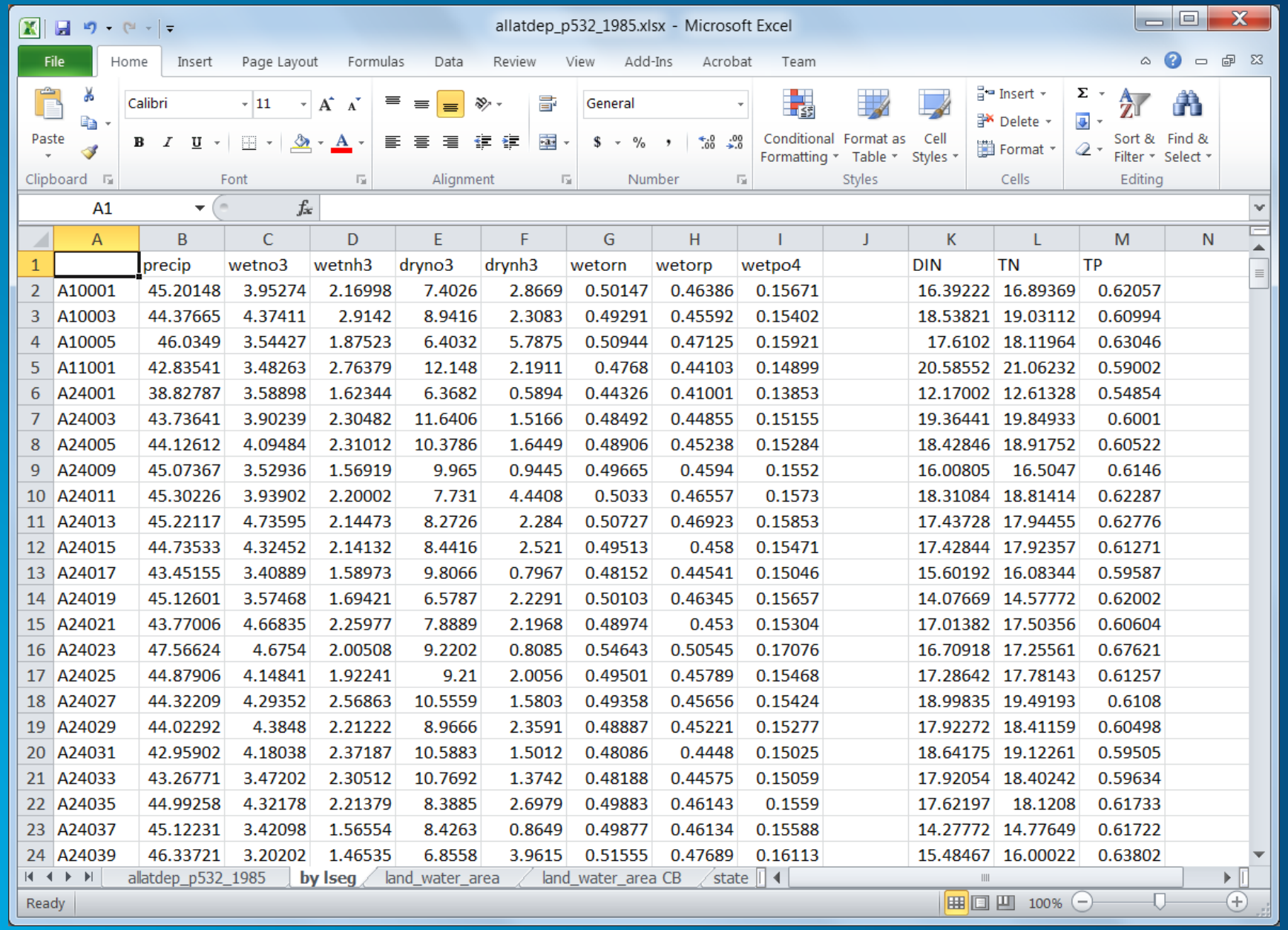
Raw Scientific Data



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8	A24005	44.12612	4.09484	2.31012	10.3786	1.6449	0.48906	0.45238	0.15284		18.42846	18.91752	0.60522	
9	A24009	45.07367	3.52936	1.56919	9.965	0.9445	0.49665	0.4594	0.1552		16.00805	16.5047	0.6146	
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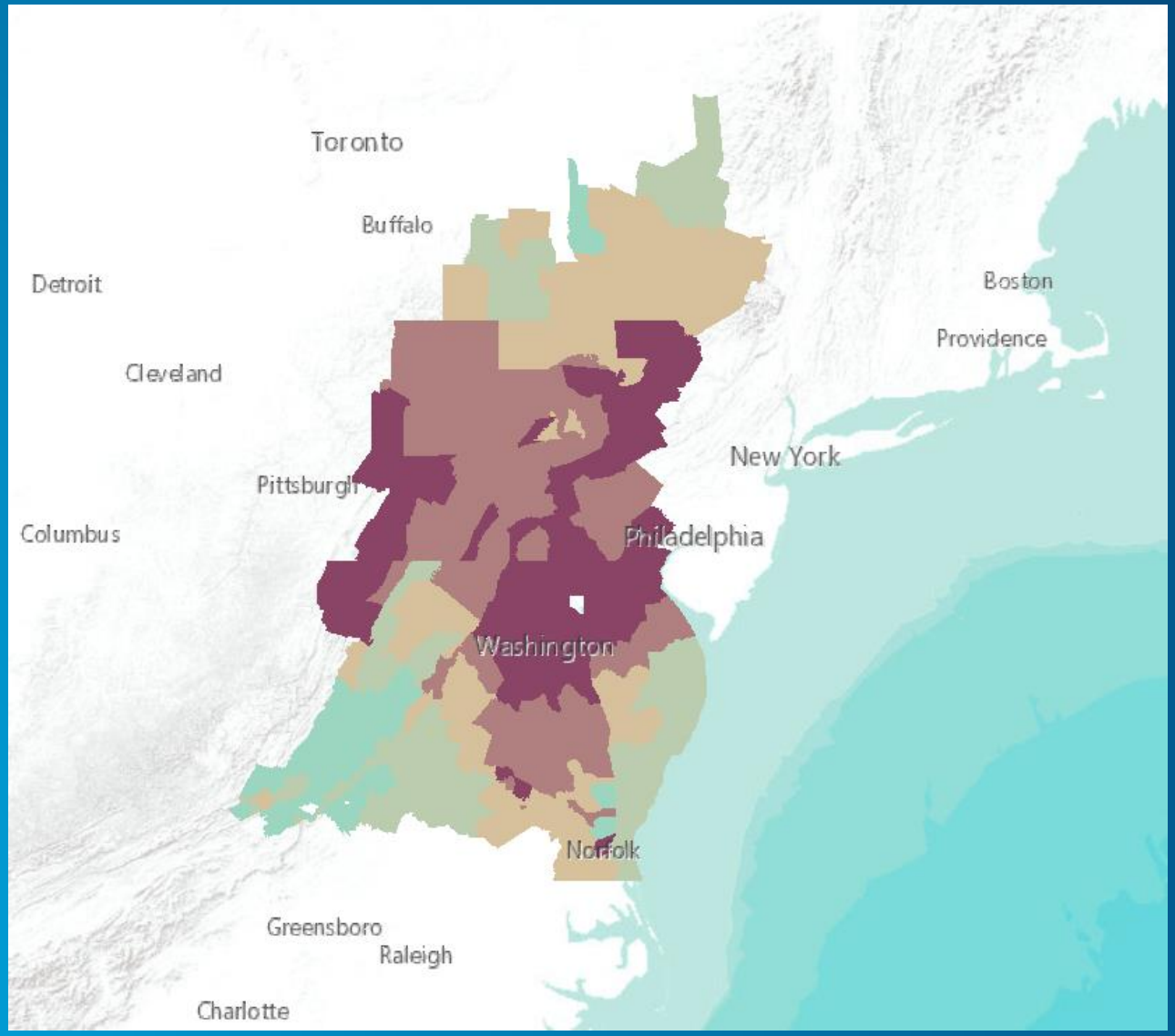
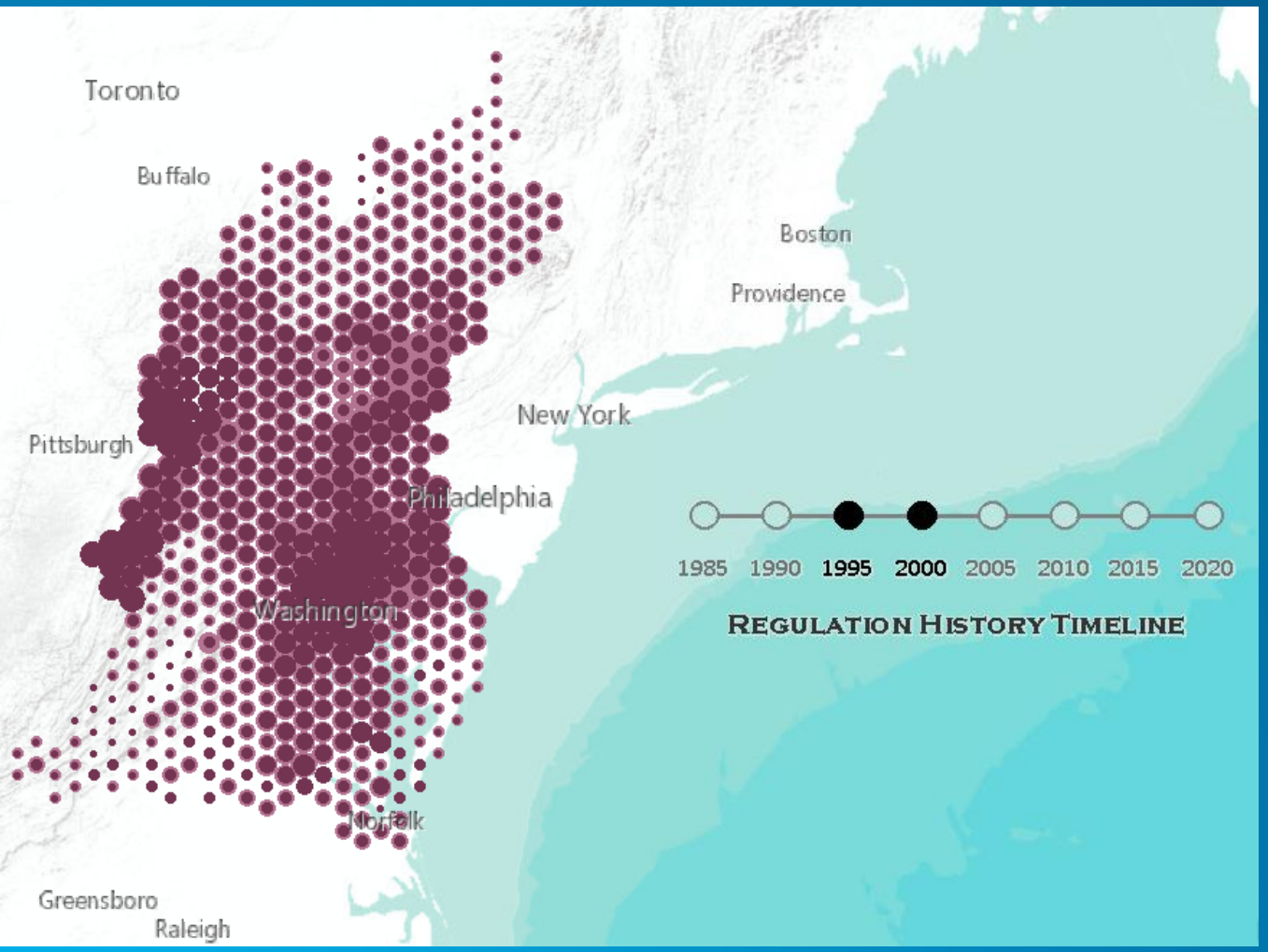
11	A24013	45.22117	4.73595	2.14473	8.2726	2.284	0.50727	0.46923	0.15853		17.43728	17.94455	0.62776	
12	A24015	44.73533	4.32452	2.14132	8.4416	2.521	0.49513	0.458	0.15471		17.42844	17.92357	0.61271	
13	A24017	43.45155	3.40889	1.58973	9.8066	0.7967	0.48152	0.44541	0.15046		15.60192	16.08344	0.59587	
14	A24019	45.12601	3.57468	1.69421	6.5787	2.2291	0.50103	0.46345	0.15657		14.07669	14.57772	0.62002	
15	A24021	43.77006	4.66835	2.25977	7.8889	2.1968	0.48974	0.453	0.15304		17.01382	17.50356	0.60604	
16	A24023	47.56624	4.6754	2.00508	9.2202	0.8085	0.54643	0.50545	0.17076		16.70918	17.25561	0.67621	
17	A24025	44.87906	4.14841	1.92241	9.21	2.0056	0.49501	0.45789	0.15468		17.28642	17.78143	0.61257	
18	A24027	44.32209	4.29352	2.56863	10.5559	1.5803	0.49358	0.45656	0.15424		18.99835	19.49193	0.6108	
19	A24029	44.02292	4.3848	2.21222	8.9666	2.3591	0.48887	0.45221	0.15277		17.92272	18.41159	0.60498	
20	A24031	42.95902	4.18038	2.37187	10.5883	1.5012	0.48086	0.4448	0.15025		18.64175	19.12261	0.59505	
21	A24033	43.26771	3.47202	2.30512	10.7692	1.3742	0.48188	0.44575	0.15059		17.92054	18.40242	0.59634	
22	A24035	44.99258	4.32178	2.21379	8.3885	2.6979	0.49883	0.46143	0.1559		17.62197	18.1208	0.61733	
23	A24037	45.12231	3.42098	1.56554	8.4263	0.8649	0.49877	0.46134	0.15588		14.27772	14.77649	0.61722	
24	A24039	46.33721	3.20202	1.46535	6.8558	3.9615	0.51555	0.47689	0.16113		15.48467	16.00022	0.63802	

Traditional Choropleth Map



Analyze Business Needs

How does nitrogen deposition change in time and in relationship to air quality regulations?


Toronto
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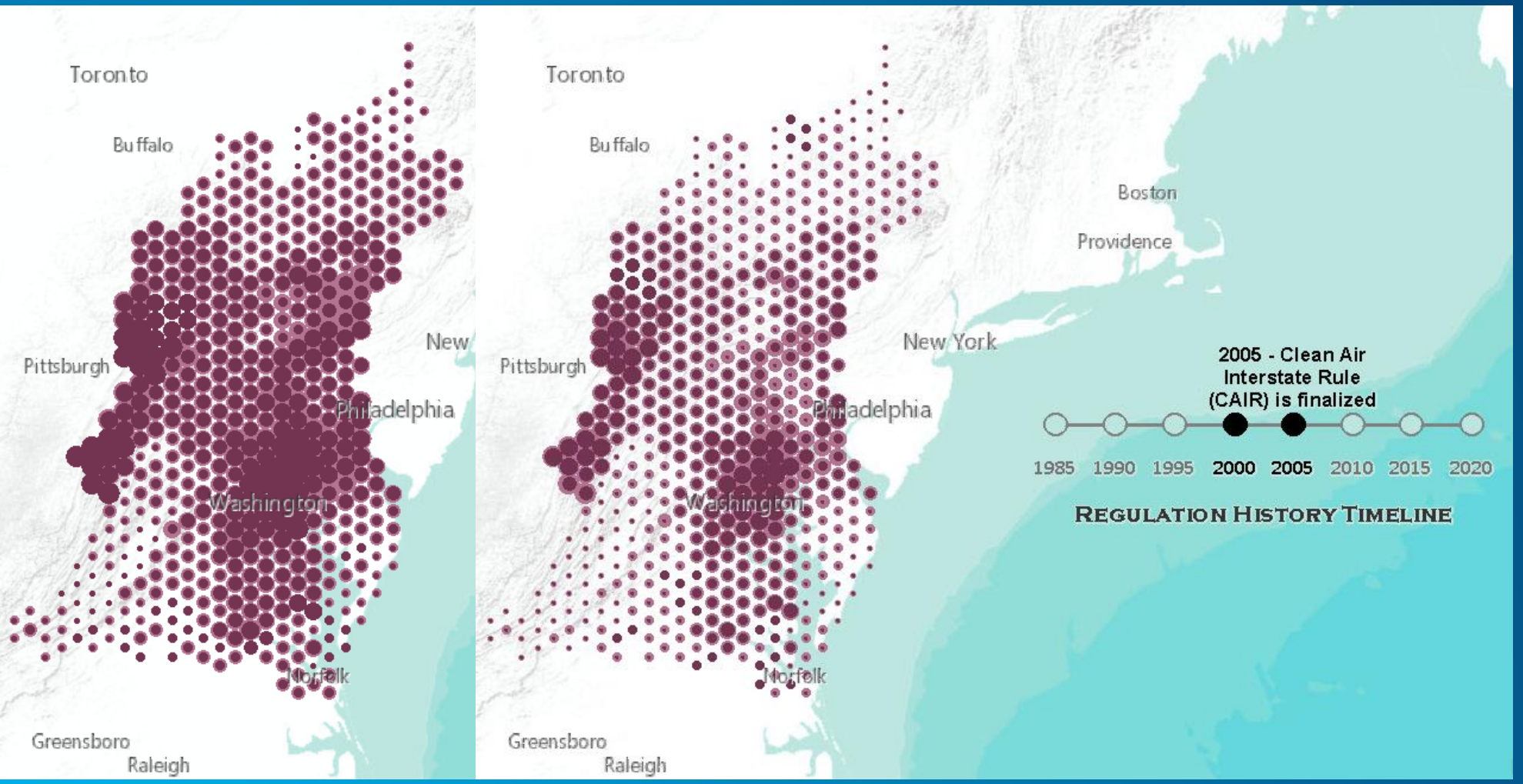
Philadelphia
Washington
Norfolk
Greensboro
Raleigh
1985 1990 1995 2000 2005 2010 2015 2020
REGULATION HISTORY TIMELINE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Toronto
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Boston
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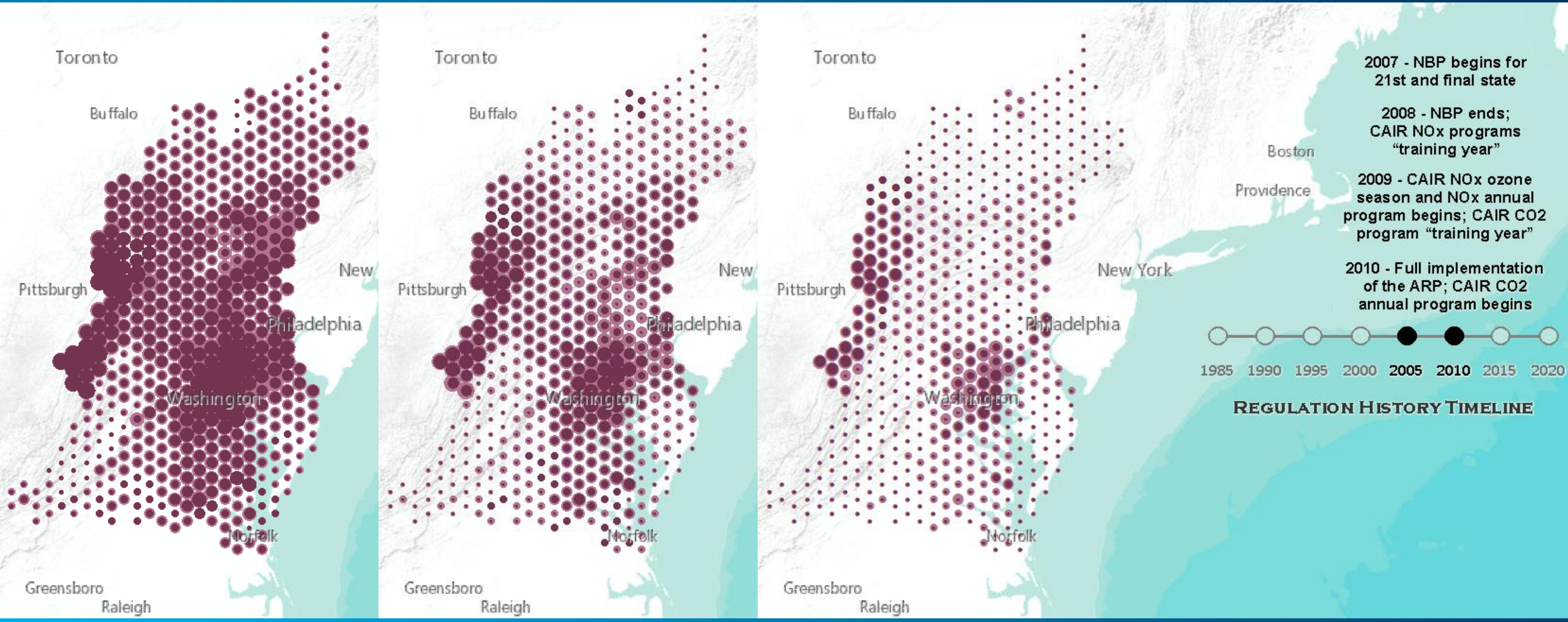
New York
Philadelphia
Washington
Norfolk
Greensboro
Raleigh
2005 - Clean Air Interstate Rule (CAIR) is finalized
1985 1990 1995 2000 2005 2010 2015 2020
REGULATION HISTORY TIMELINE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Norfolk
Greensboro
Raleigh
Toronto
Buffalo
Pittsburgh
New York
Philadelphia
Washington
Norfolk
Greensboro
Raleigh
Boston
Providence
2007 - NBP begins for 21st and final state
2008 - NBP ends; CAIR NOx programs "training year"
2009 - CAIR NOx ozone season and NOx annual program begins; CAIR CO2 program "training year"
2010 - Full implementation of the ARP; CAIR CO2 annual program begins
1985 1990 1995 2000 2005 2010 2015 2020
REGULATION HISTORY TIMELINE

Working with complex data

- Consider the map message, purpose, audience
- Separate ideas, variables, simplify symbology
- Layer information and symbology, compare and contrast

Balancing Performance and Aesthetics

Owen Evans

Factors that affect map performance

- Number of features in the view
- Projection on-the-fly
- Complex query definitions
- Complex label expressions
- Complex symbology
- Halos
- Maplex vs. standard label engine

Factors that affect map performance - Ranked

1. Number of features in the view
2. Projection on-the-fly
3. Complex query definitions
4. Complex label expressions
5. Complex symbology
6. Halos
7. Maplex vs. standard label engine

Problem: Too many features in the map…

Solutions…

- Use scale dependency to turn off non-critical layers
- Generalize one or more line/polygon layers
- Use simple definition queries (Desktop) and/or filters (Online)

- Aggregate to regions at smaller scales
- Use a heat map
  - Coming to ArcGIS Online in Feb 2015!

Problem: Complex definition query or label expression…

Solutions…

- Create a new feature class and/or service of from the subset of features needed
- Add an attribute to make the query/expression simpler
- Omit most/all labels and rely on pop-ups when designing for the web

Designing for the Web: Cached and Dynamic Layers

Use the best delivery mechanism for each layer in the map

- There is no one right answer all the time
  - May publish layers more than once for different purposes
  - Common to publish BOTH hosted tiles (fast display) and hosted features (pop-ups, symbol changes) for a single layer

- Layers with detailed data and/or complex symbols → cache
- Consider several cached services
- Separate labels or avoid their use (especially in cached service)
- Balance flexibility and reuse with specific map requirements

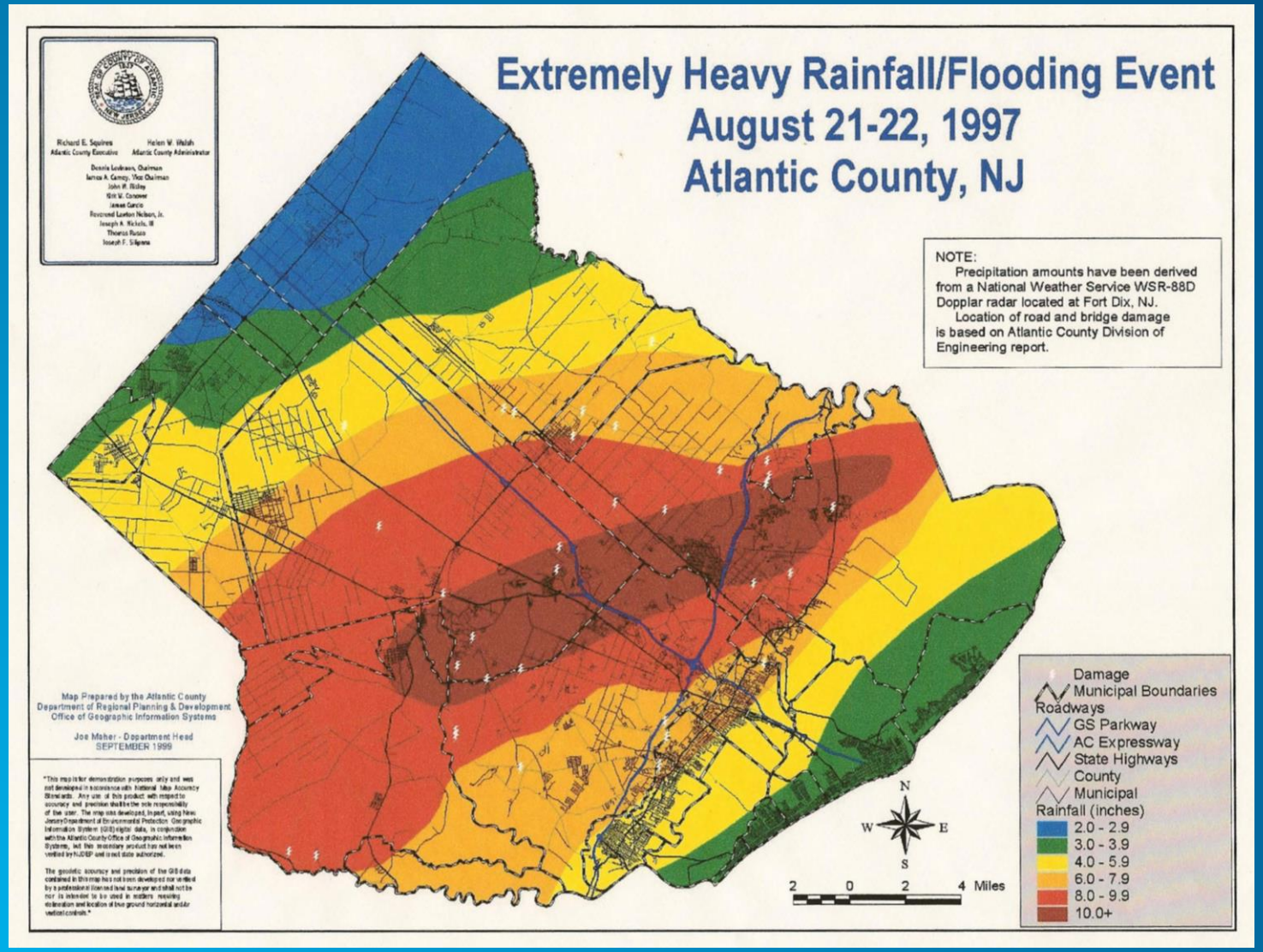
What is the best way to create the finished product?

Balancing Performance and Aesthetics

- Many techniques for improving performance
- Treat aspects individually, but consider effects on final product
- Design for the web

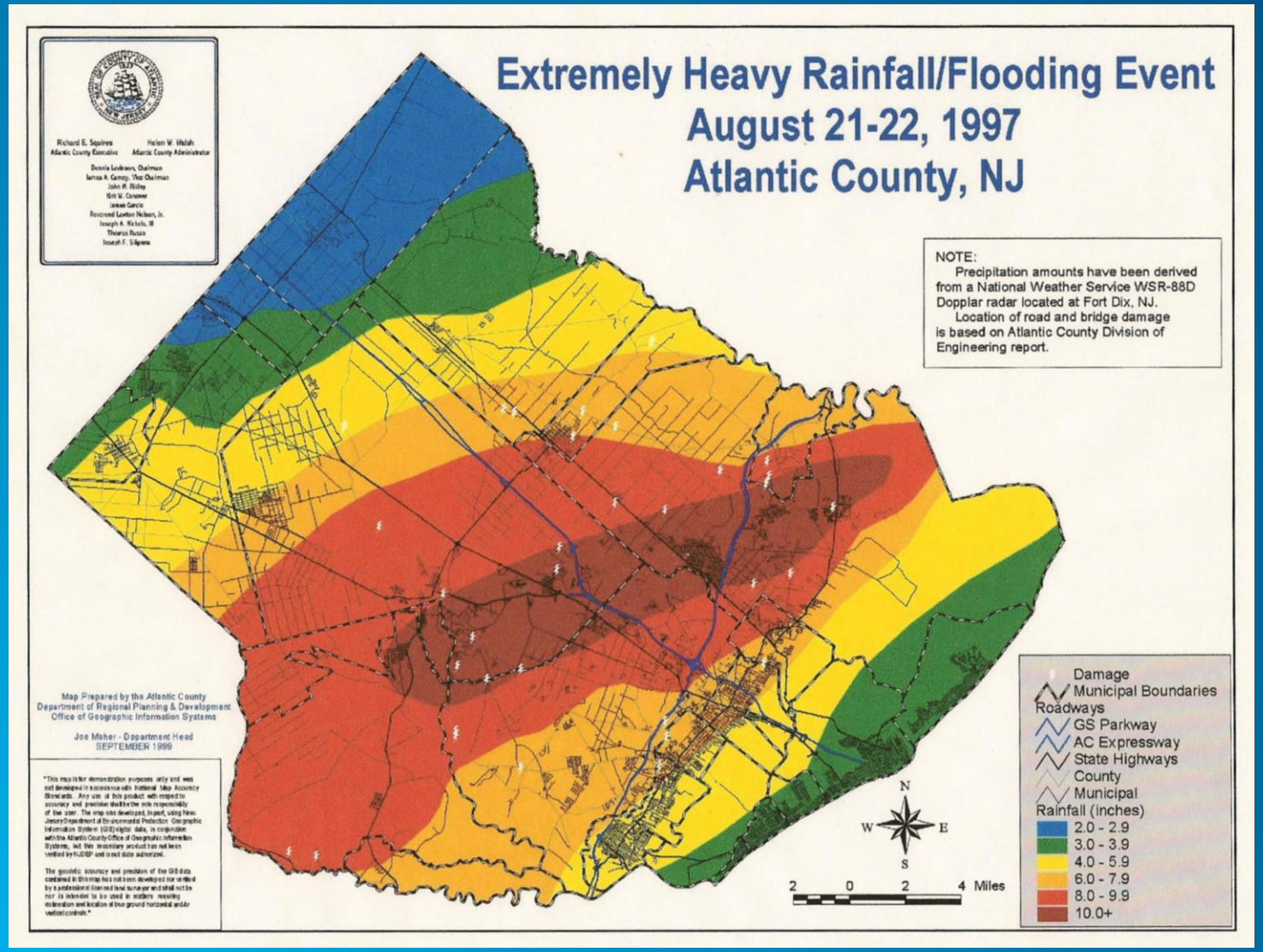
Improving Your Maps

Billie Leff



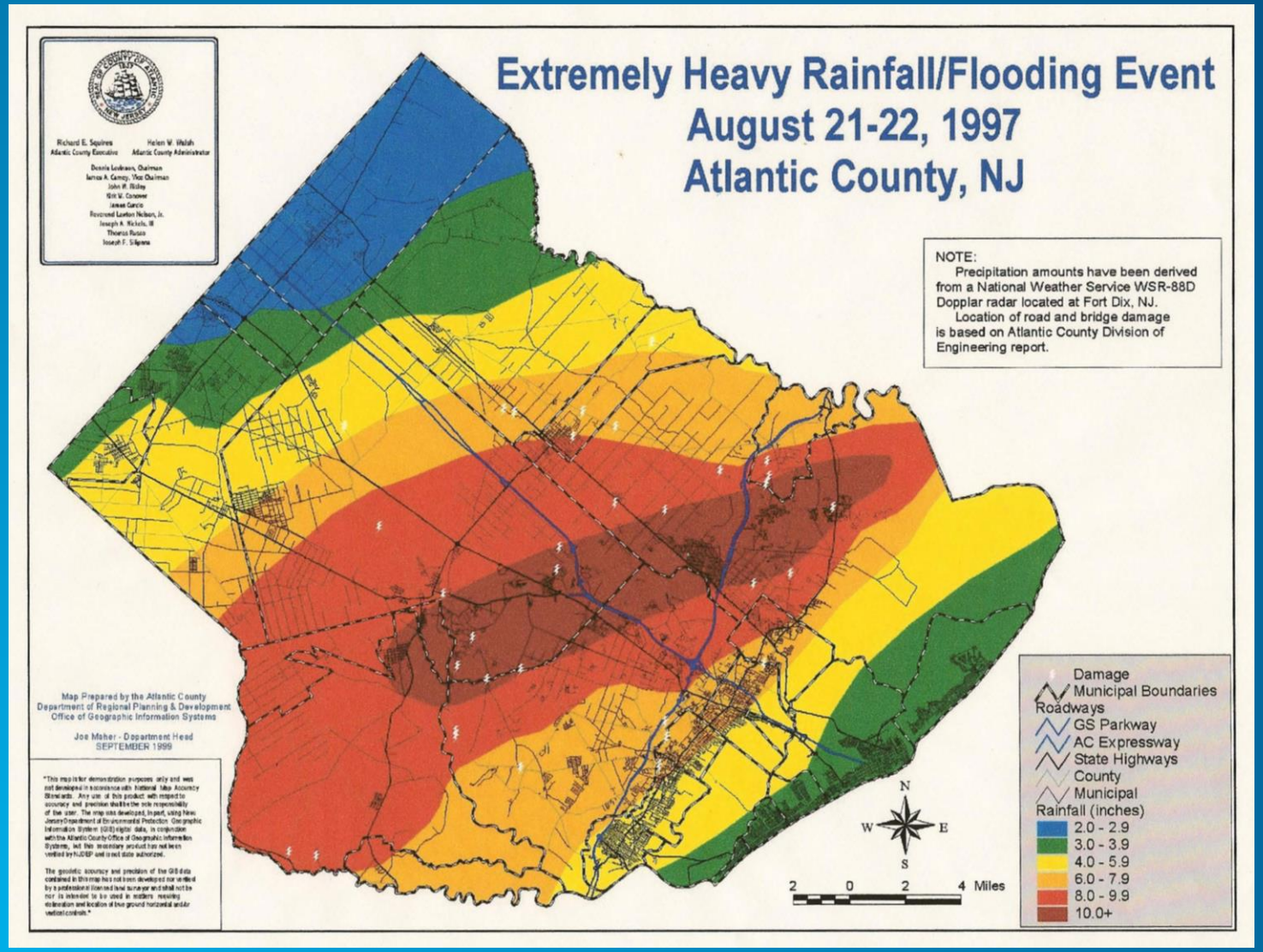
1. Map Concept

- Is the map purpose clear?
- Is the audience defined?
- Does the information make sense and is it easily understood?



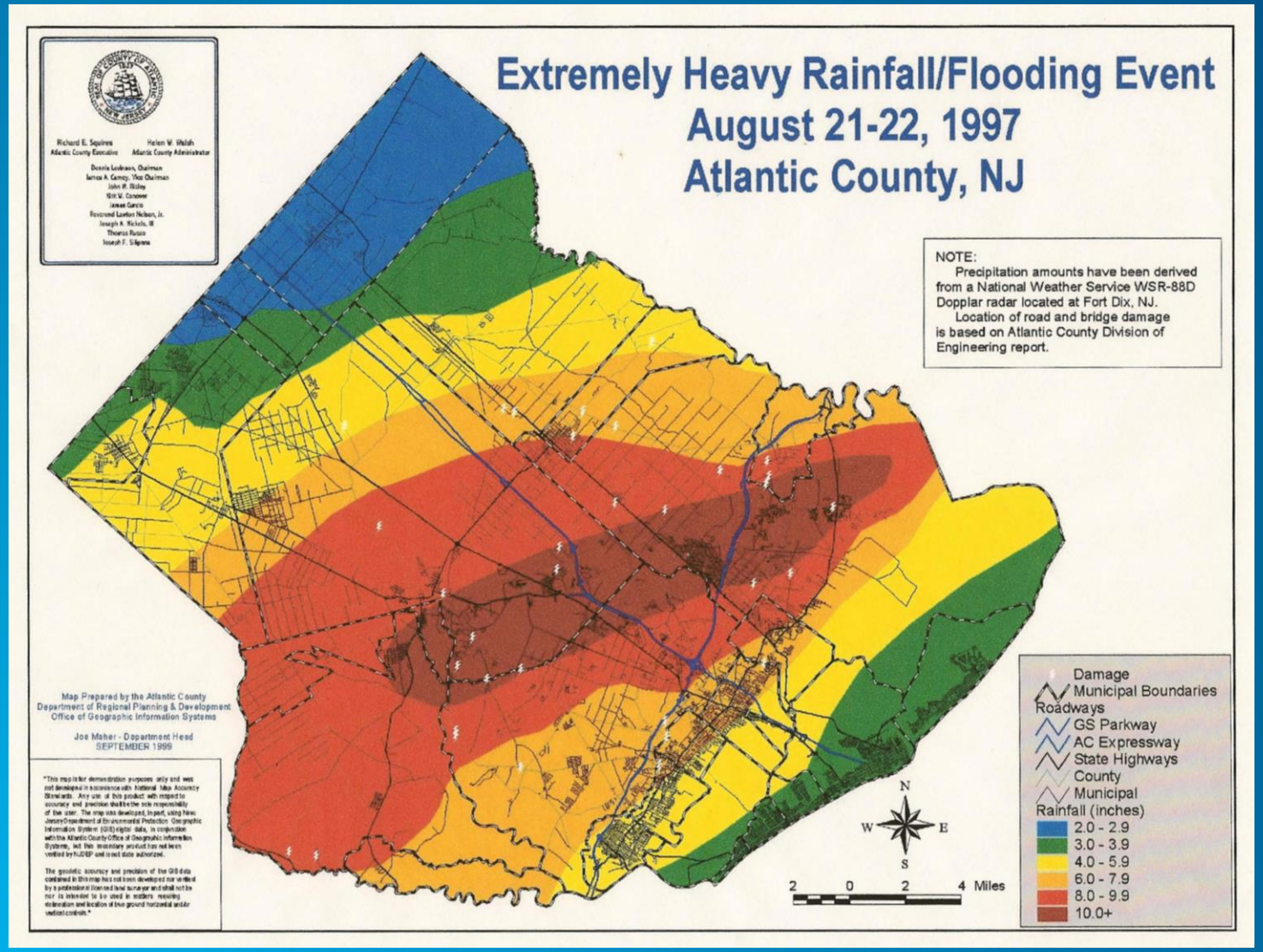
2. Map Content

- **Is the subject matter relevant, current and enriched?**
- **Is the appropriate context provided?**



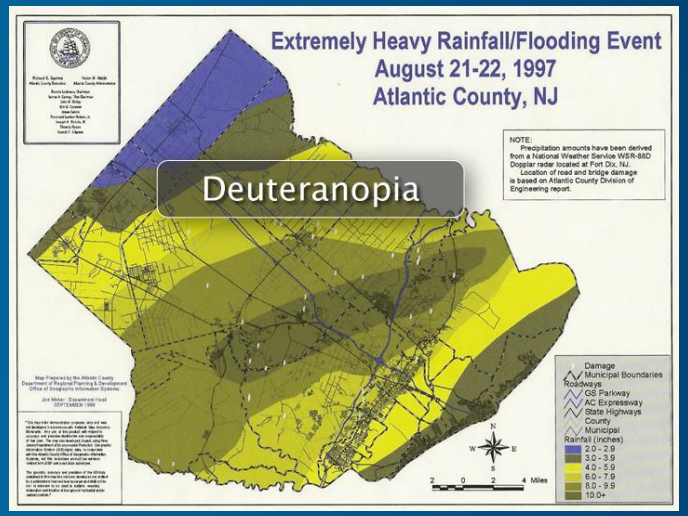
3. Cartography

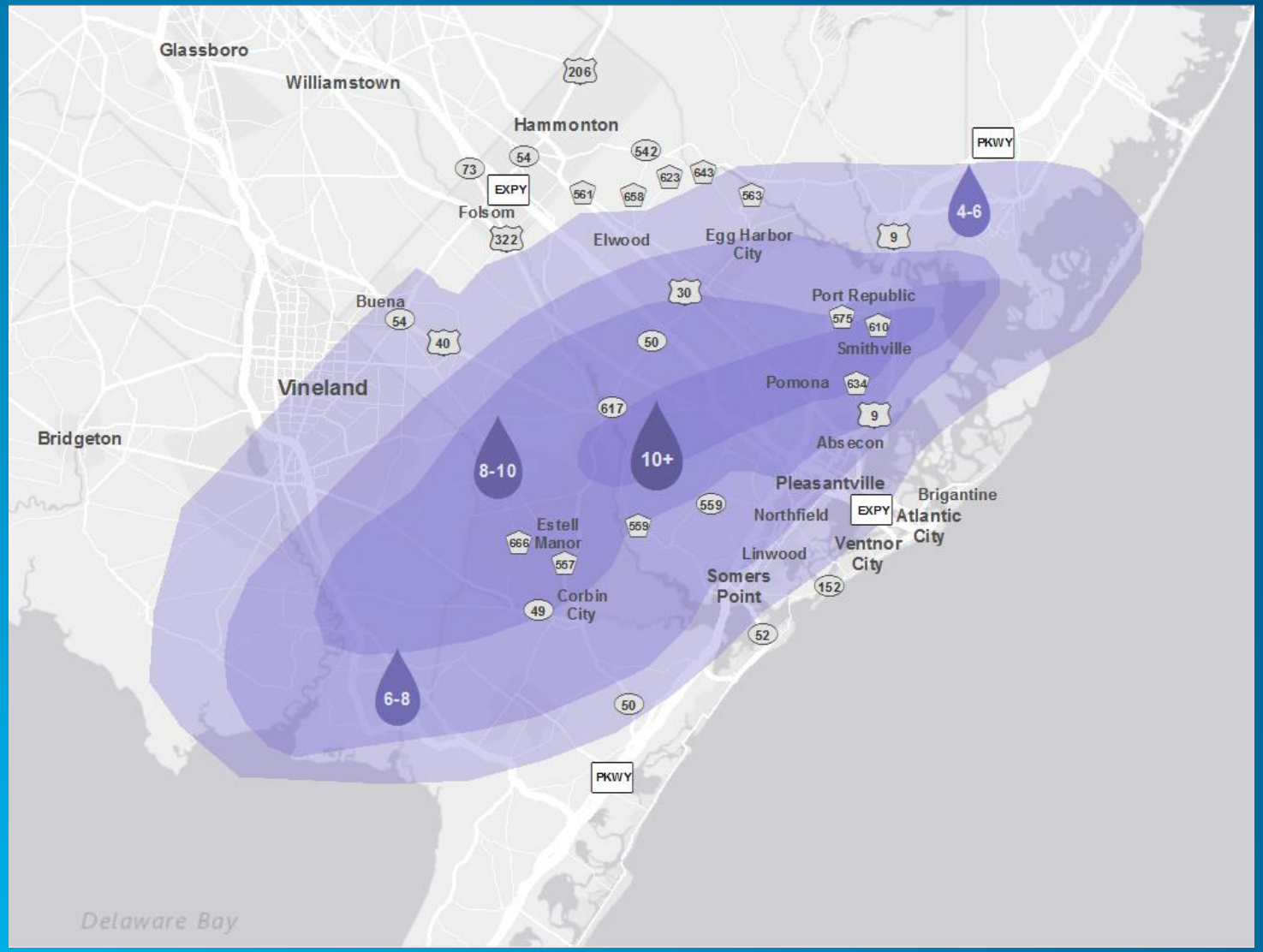
- **Is the cartography simple, appealing and appropriate?**
- **Is a visual hierarchy present?**



3. Cartography

- Limit rich, solid colors
- Gray/neutral instead of white
- Use 6 or fewer colors
- Avoid using red and green
- Use standards where those apply and consider the implied meaning of colors





3. Cartography

- Limit rich, solid colors
- Gray/neutral instead of white
- Use 6 or fewer colors
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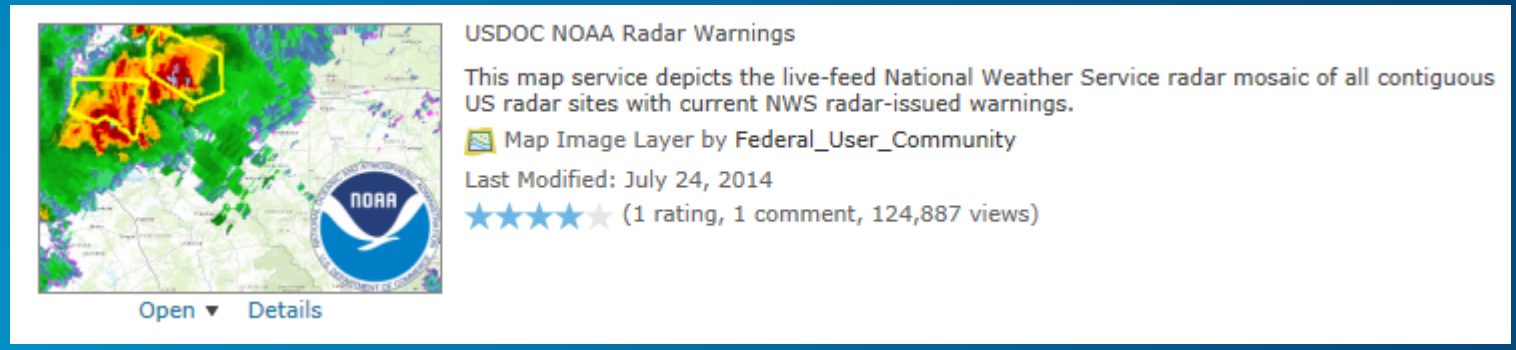
- Use standards where those apply and consider the implied meaning of colors

4. Map Service

- Title, description, tags, credits present and helpful
- Attributes are limited and aliased
- Web map performs as expected (scale dependencies and popups)



Improving Your Maps

- Consider map effectiveness (concept and content)
- Cartography should be simple, appealing and appropriate
- Configure maps documents and service properties

Summary

- Separate ideas, one dataset many maps
- There’s no cookie-cutter approach
- Balancing requirements with data, esthetics and performance, and the ability to reuse maps vs. one-offs

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Don’t forget to complete a session evaluation form!

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Printing stations located on L St. Bridge, next to registration

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GIS Solutions EXPO, Hall D

Tuesday, 10:45 AM–4:00 PM

- Exhibitors
- Hands-On Learning Lab
- Technical & Extended Support
- Demo Theater
- Esri Showcase

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Networking Reception:

National Museum of American History

Tuesday, 6:30 PM–9:30 PM

Bus Pickup located on L Street

- **Owen –** oevans@esri.com
- **Billie –** bleff@esri.com