

Esri News

for State & Local Government

Winter 2015/2016

Maps Lead the Way to a Smart Community in Minneapolis

Esri Technology

- ArcGIS Online
- ArcGIS Open Data
- Esri Story Map

The City of Minneapolis was hard-hit by the recession in 2010. A tightened budget made the city slash its geographic information systems (GIS) team from eight employees to three. But while most organizations would be hobbled by such a reduction, the recession acted as a catalyst that helped transform Minneapolis into a smart community.

While the city had used Esri GIS software since the late 1990s, its use was specialized and few people in the organization knew what GIS could do. The staff reduction caused the GIS team to shift its approach, ultimately changing how Minneapolis operates. Rather than serving as GIS gatekeepers throughout the city, the team focused on empowering employees and departments to be successful on their own. The team met with middle managers throughout the city and provided guidance on tools and data that could help each department.

The city replaced its focus on metadata and standards with an emphasis on educating staff on the benefits and capabilities of GIS. Starting with MapIt Minneapolis, the city's ArcGIS Online website, each department now uses online GIS tools and mobile apps to work smarter and communicate better with the public.

The public works department embraced GIS as a tool for snow removal. When heavy snowfall occurs, the city plows designated streets. But if cars are parked in plow areas, the plows cannot effectively clear the streets, wasting time

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↑ The city has created a comprehensive GIS portal with ArcGIS Online that provides links to interactive maps and apps.

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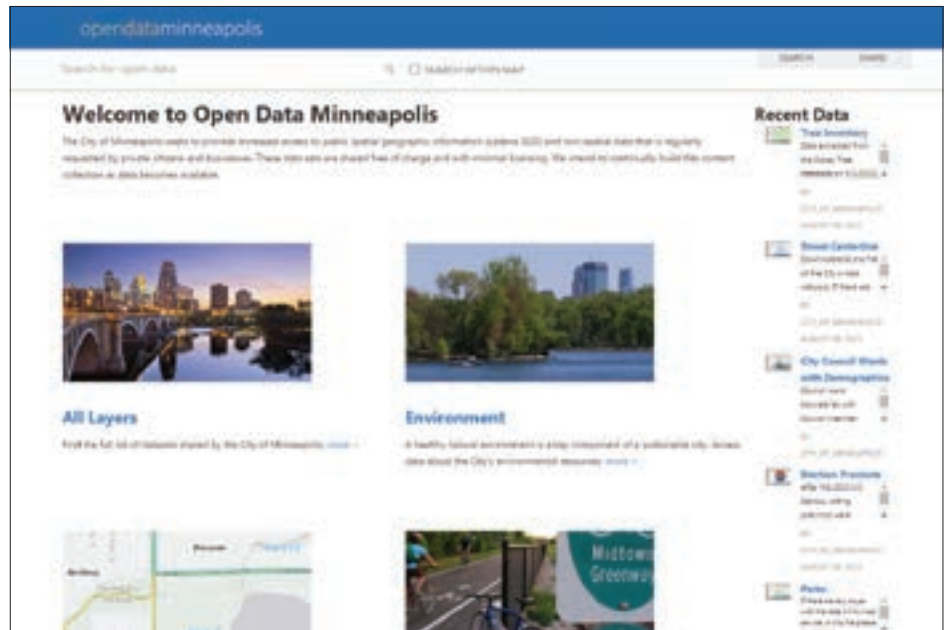


Maps Lead the Way to a Smart Community in Minneapolis continued from cover

and money and frustrating citizens. The department created an app with ArcGIS Online that illustrates plow routes and parking rules. The app, which has been well received by residents, allows anyone to easily find a location on a map and clearly see the parking rules for that area. Residents have a better understanding about parking rules, and the city can plow its streets more efficiently.

Another popular app is the city's Dangerous Dogs map, which plots data from the Animal Care and Control division on a story map. Residents can click through a scrolling photo tour of animals to see where dangerous dogs live. The map replaced tabular lists that had existed on the division's site for years and offers an easy way for people to be aware of dogs with documented incidents within the community. The division maintains the map and updates it as needed, without ever interacting with the GIS team.

GIS has also positioned Minneapolis government as a leader in transparency and openness. When the Minneapolis CIO made open data a priority, the GIS team used ArcGIS Open Data, included with the city's ArcGIS Online subscription,



↑ In addition to MapIT Minneapolis, the city has also created an open data site to boost transparency.

to meet the city's directive. With a few clicks, the city created a branded open data site. Residents now have access to collections of open data in a variety of formats, including APIs.

Since the recession, GIS use at the city has exploded. Having to rely on a team of three employees has given way to

letting hundreds of users throughout the city interact with data through ArcGIS Online on a regular basis. GIS has helped the city operate more effectively while increasing transparency and collaboration.



↑ Mapping snow emergency routes help residents understand which streets snow plows will clear first.

Story Map Rallies Local Community to Get Out the Vote

By Matt Felton, Datastory Consulting

Esri Technology

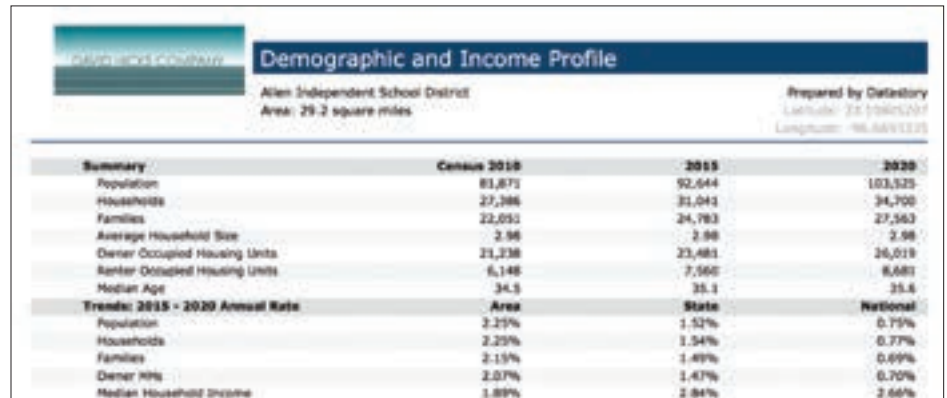
- ArcGIS Online
- Esri Story Map Journal
- Esri Data

Providing information to voters in a way that is easy to understand is one of the keys to successful election outcomes. David Hicks, a commercial real estate broker in Allen, Texas (just north of Dallas), knows this. He collaborated with Esri partner Datastory Consulting to create a story map, using ArcGIS Online, that helped explain a \$272 million public school bond to voters. As a result, Hicks helped pass the largest bond to date in the district.

The bond money will be used by Allen Independent School District (AISD) to expand facilities and improve programs in the growing area. Student enrollment, which has doubled since 1989, is currently 20,780 and is expected to grow 2.25 percent over the next five years. That is three times the national average. The bond will help AISD grow to meet that demand as well as help children prepare for college and twenty-first-century careers by building a science, technology, engineering, and mathematics (STEM) center that will serve up to 2,000 students each day.

The Project Kids Committee—an 80-member community group consisting of students, parents, and teachers—met to review the facility needs of the district and understand their financial and instructional impact. The committee had helped form bond proposals on five previous ballots, but this was by far the biggest measure ever proposed.

In 2015, the focus of the committee was on five key facility needs: Lowery Freshman Center; expansion of Allen High School; elementary school renovations; possible construction



↑ Datastory Consulting used Esri data to create a demographics and income profile of the Allen Independent School District.

of an eighteenth elementary school; and improvements to safety, security, transportation, and technology across the district. Members also evaluated the readiness of facilities to support a Science, Technology, Engineering, Arts, and Mathematics (STEAM) curriculum as construction and renovations occur within school facilities.

As a longtime resident and active businessman in the community, Hicks is a member of the Kids First Allen Political Action Committee (PAC), which supported the 2015 school bond. The PAC is composed of parents, friends, and neighbors who are united in building strong schools in Allen, and the PAC's mission has been to inform the public about the bond and its importance to AISD.

As a means to communicate the complex bond, Hicks commissioned Datastory Consulting to create the Kids First Allen story map. Story maps help organize complex ideas in a way that is meaningful and engaging, because story maps provide interactive access to data through the lens of a map. Viewers of the Kids First Allen story map can scroll through information and see on a map exactly what is being proposed for the school district, and where.

Hicks chose the story map format because it is easy for anyone to navigate and provides a way for viewers to step through information in a logical fashion. As viewers are reading information, they can click hyperlinked text for more detail while maintaining context of the larger story. For example, users can understand why a new elementary school is necessary when they see that area along with locations of highest population growth in the district and the location of current schools.

Rallying Voters

The story map, displayed on the Kids First Allen web page, was used for nearly 40 live presentations during various meetings around the district and was part of a direct marketing campaign to get out the vote.

Hicks and his community were successful in getting the \$272 million school bond passed on November 3, 2015, and the results were impressive: 75.7 percent voted for the bond.

Turnout for this election was 13 percent of registered voters, a great number for a bond election, which, on average, draws from 5 to 15 percent of eligible voters. Votes for the election totaled 6,967, smashing the previous voter turnout record of 4,758, made in May 2004. The

previous record was for voting on a ballot that had both a school bond and a local option for alcohol sales, two popular topics that typically rally communities.

Creating a Smart Community, One Vote at a Time

Hicks is on the front line of creating a smart community, using technology to improve the quality of life in his neighborhood. When citizens don't have access to information, they tend to be more critical of government decisions. Providing information helps all parties operate from a common base of understanding grounded on fact, and it creates the transparency citizens are requesting.

Longtime residents sometimes don't realize how much their community has changed over time, and they base their policy opinions on outdated information. Leaders can communicate a lot of information quickly and effectively by using maps to display data, trends, and analyses, much like the Kids First Allen story map project did for this community. Informing citizens is important, especially as communities generate plans for the future and seek participation from

citizens in shaping and approving those plans.

Hicks has found that using ArcGIS Online has made his firm very successful at competing for business in the Dallas area commercial real estate market and has also freed his time for building relationships and giving back to the community. In addition to creating a story map that influenced a historic local election, he has successfully brokered a client's 16-acre land donation to AISD. The donation will be used for the Allen High School STEM Center, which will serve more than 2,000 students per day beginning in 2018. And, not surprisingly, Hicks is actively involved in coordinating a GIS program for the new center.

More about David Hicks

After working with successful national and international firms for the first 22 years of his career, David Hicks opened his own small commercial real estate brokerage and development consulting firm. His four-person company generates an annual sales volume of approximately \$50 million.

Eighteen months ago, Hicks adopted the Esri ArcGIS platform to enhance

his company's research and marketing, and with the expertise of Datastory Consulting, the technology is applied across most aspects of the business. Location analytics drives better decisions for clients who lease or buy real estate, and interactive maps on the company's website simplify access to the information needed to evaluate specific sites for clients. Leveraging geographic knowledge has helped Hicks maximize his group's time to compete with larger organizations and better serve customers. Now Hicks uses story maps daily.

"Freeing myself from spending time in research and presentation preparation gives me the time to focus on customer and client relationship building and actual transaction negotiation," said Hicks. "This way, our small firm can provide a level of service previously only available from much larger companies."

This means taking time to help his community through the Kids First Allen project.

Explore the Kids First Allen story map at esriurl.com/kidsfirstallen.



↑ The Kids First Allen story map helped voters easily understand how bond funds will be used throughout the district.

GIS Unearths the Root of Arsenic in Drinking Water

Maps Help Cerro Gordo County Department of Public Health Protect Health of Well Owners

By Samantha Mac Donald, Esri

Esri Technology

- ArcGIS for Desktop
- ArcGIS 3D Analyst

Eight glasses of water a day keeps the doctor away. Or so Sandy Davis thought. Davis—a resident of Cerro Gordo County in Iowa—learned in 2004 that her shaking hands and neurological issues were a result of having unknowingly consumed high levels of arsenic in the water from her private well. Even more disconcerting: she could have prevented long-term exposure to the known carcinogen by doing a simple test of her well water.

And she wasn't the only person whose health was at risk from drinking well water that was laced with arsenic above the public maximum contaminant level (MCL) of 10 parts per billion (ppb). In fact, 15 percent of the county's residents (nearly 7,000 people) rely on unregulated private well water every day.

Protection without Regulation

The Cerro Gordo County Department of Public Health aims to guard residents like Davis from contaminants in private wells—a goal that is often difficult for public health agencies to achieve.

After private wells are drilled, property owners are responsible for maintaining the safety of their own water supplies. Public agencies, such as the Cerro Gordo County Department of Public Health, don't have the authority or resources to regularly check well water quality before it is sent to household taps.

Unfortunately, news of Davis's condition wasn't the first time the department was alerted to arsenic in private wells. In 2003, the agency set out to raise awareness of arsenic in water after the Iowa Geological Survey and US Geological Survey discovered its presence in every major aquifer in the state.



↑ GIS coordinator and environmental health specialist Sophia Walsh records field parameters for a well that is being tested for arsenic as water flows in the collection chamber.

Environmental health scientists with the department responded by developing a mapping tool to educate the public about arsenic in private wells. The team used Esri's GIS technology to merge private well water records and arsenic test results and then map every known well that tested above the MCL in the county. By doing so, a clear "arsenic zone" emerged on the map, indicating which properties were likely to have arsenic in private well water. Using data and insights derived from ArcGIS for Desktop, officials created a new ordinance in 2007 that dictated stricter well drilling and testing requirements.

Three years later, with Davis's story at the forefront and public health still at risk, department officials knew they had to take preventive action one step further. They turned once again to GIS

for solutions—this time, to locate the underground source of the arsenic and develop a targeted plan to protect residents' health.

Mapping a Better Path Forward

The department collaborated with Dr. Doug Schnoebelen of the University of Iowa, Paul Van Dorpe and Chad Fields from the Iowa Department of Natural Resources, the Iowa State Hygienic Laboratory, and private well drilling operator Shawver Well Company. The team pursued and received a grant from the Centers for Disease Control and Prevention (CDC) to determine whether arsenic-contaminated wells were concentrated in a specific area of the county.

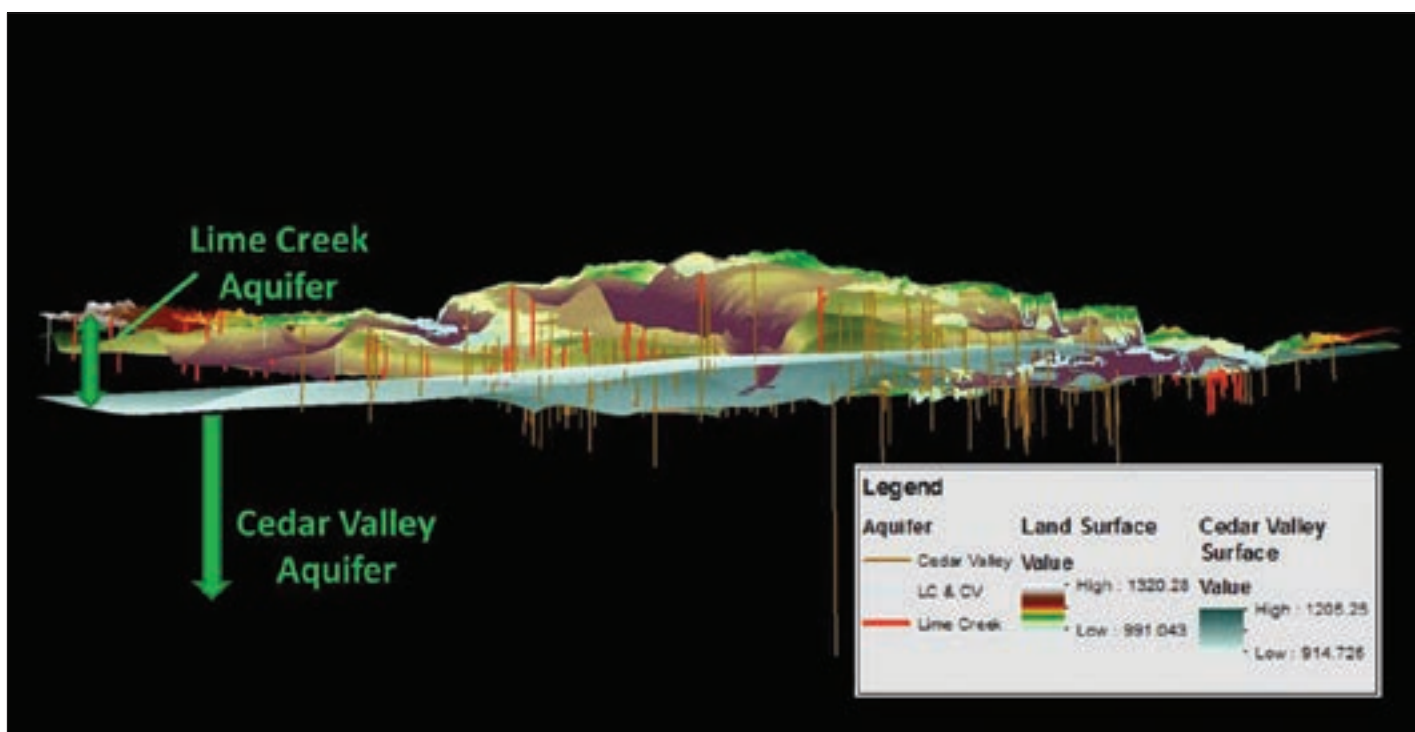
With grant funds secured, officials from the Department of Public Health and partners embarked on a three-year



↑ Water samples are collected from the tap and tested in a lab for arsenic.



↑ An example of a private well is pictured. Unlike public water supplies, private wells are unregulated after drilling, and the owners are responsible for maintaining the safety of their own water supply.



↑ A well casing is like a large straw stuck in the ground and only allows water in at the casing's end. Cerro Gordo County Department of Public Health used the ArcScene app in ArcGIS 3D Analyst to visualize each well casing's depth in comparison to the elevation of groundwater sources. This method helped the team identify each casing's water source—the Lime Creek Aquifer or the Cedar Valley Aquifer.

study. The team initially pulled geologic information about select wells including well depth, casing depth, location, and terminating aquifer.

Then, twice a year, the team collected data from approximately 70 wells. Each well was tested for pH, dissolved oxygen, redox potential, sulfide, total arsenic, arsenic speciation, and several other components that could affect arsenic levels. The team also analyzed rock chip

samples from all newly drilled wells. Half of all the private wells that were tested had detectable levels of arsenic in the water, and a third contained unsafe levels of arsenic (above 10 ppb).

The department mapped the data with ArcGIS for Desktop to show the geographic distribution of sample sites and arsenic levels at each of those sites. Surprisingly, there was no clear indication that the arsenic-contaminated wells were

concentrated in a specific location. When a third dimension was added into the mix, using the ArcGIS 3D Analyst extension to explore beneath the earth's surface, the map revealed a completely different story.

Going below the Surface

The ArcScene application within ArcGIS 3D Analyst empowered the team—for the first time—to see and interact with

continued on page 8

geospatial data in 3D. By overlaying arsenic levels with well depth, casing information, and aquifer elevations, the researchers created an interactive 3D map that revealed a common thread. The source of the problem wasn't based on well property location—it tied back to the aquifer through which the well was cased.

With 3D Analyst, the team was able to explore the paths of each aquifer relative to the wells that had been drilled. Upon viewing the data in 3D, the team realized that the wells with consistently higher arsenic contamination levels had all been drilled into the same source: the Lime Creek Aquifer.

The 3D map revealed that wells pumping groundwater from the Cedar Valley Aquifer had significantly lower detectable levels of arsenic than did the wells cased through the Lime Creek Aquifer. Though arsenic contamination was prevalent in about half of all wells countywide, Lime Creek Aquifer wells were much more likely to have water with unsafe levels of arsenic.

The highest measured contamination for wells cased through the Cedar Valley Aquifer was less than 10 ppb, the MCL for municipal water supplies. In stark contrast, rock chip samples showed an average of 11.4 ppb of arsenic in the Lime

Creek Aquifer—nearly 10 times the average amount found in rock chip samples from the Cedar Valley Aquifer (1.2 ppb).

"Visualizing our data in 3D gave us insights that just weren't possible in 2D," said Sophia Walsh, GIS coordinator and environmental health specialist with the Cerro Gordo County Department of Public Health.

Geospatial Data Drives Change

The Department of Public Health was now equipped with the critical data needed to determine which populations were at high risk for water contamination. Using parcel data, the team used ArcGIS to geocode at-risk wells.

The department then launched a targeted outreach plan to notify residents of the potential danger in their well water. The team sent postcards and flyers to well owners, recommending that they test their water for arsenic. Department staff followed up with these residents to confirm that they received and understood the information. Based on feedback from the well owners with whom the team connected, 99 percent stated they would make a change to reduce their arsenic consumption, such as treating their well water or using a different water supply.

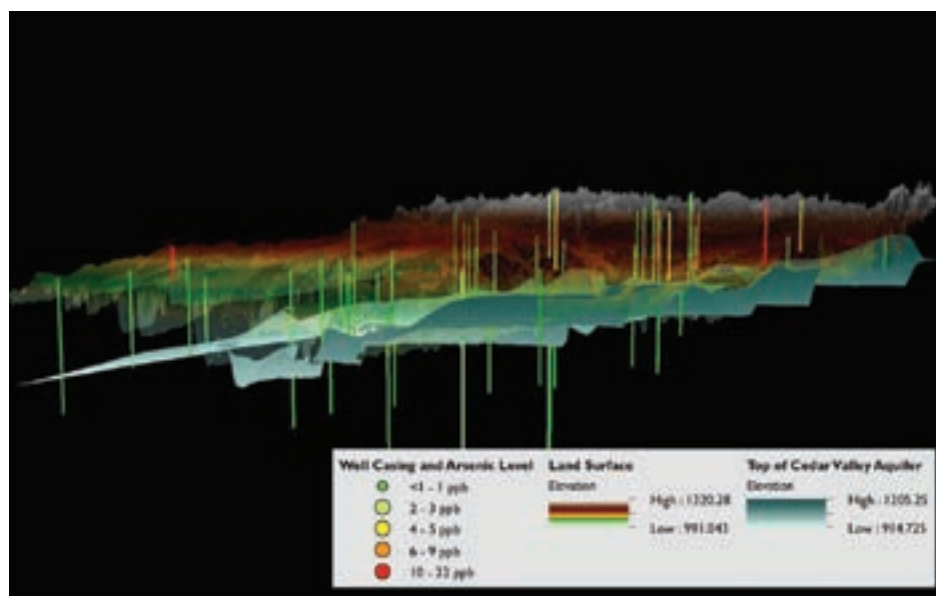
"The vital role GIS played in this project was twofold," Walsh said. "On the research side, GIS allowed us to figure out which aquifer the arsenic was coming from and begin to construct a model. On the public health side, GIS allowed us to find and target at-risk well owners in our community, who were sent pertinent information about the risk of arsenic in their water and offered well water testing."

"Without the GIS used to research arsenic in groundwater and target specific well owners, there would be hundreds of well users in our community still drinking arsenic-contaminated water," Walsh said.

Digging Deeper with GIS

Change didn't stop there. Because of the knowledge gained through GIS, Cerro Gordo County is taking measures to change how wells are drilled in the county. As of July 1, 2015, all new wells must be drilled to use water from only the Cedar Valley Aquifer.

The county is also seeking funding from the National Institutes of Health to develop a web GIS model and predictive database using the ArcGIS platform. The GIS team envisions that the online mapping tool will inform the public about how deep wells should be drilled to reduce the risk of arsenic contamination.



For more information, contact Sophia Walsh, GIS coordinator and environmental health specialist with the Cerro Gordo County Department of Public Health, at 641-421-9318 or swalsh@cghealth.com.

← Well casings that extended through the top of the Cedar Valley Aquifer did not allow water from the Lime Creek Aquifer to be utilized, significantly reducing the risk of arsenic contamination.

Become a Better You with the ArcGIS for Home Use Program

Although many economies have rebounded since the global recession of 2008, several government organizations still face reduced budgets and resources. As an employee in one of these organizations, you may have trouble finding the budget and time necessary to advance your geospatial skills and professional development. But did you know that Esri has a low-cost program that can help you do just that?

The Esri ArcGIS for Home Use Program gives you access to the full ArcGIS platform for just \$100 a year. Designed for personal, noncommercial use, the ArcGIS for Home Use Program gives you everything you need to map like a pro. Here's what you get:

- ArcGIS for Desktop Advanced (ArcMap and ArcGIS Pro)
- The most popular ArcGIS for Desktop extensions
- ArcGIS for Desktop software updates
- An ArcGIS Online Named User Account
- 100 service credits for data storage, premium data access, and geocoding and analysis
- A suite of ready-to-use apps for use anywhere, on any device

- The Living Atlas of the World with maps and data, including access to foundation content from Esri, on thousands of topics
- Installation support

Personal Development

The Esri ArcGIS for Home Use Program provides a cost-effective way to get hands-on experience with the latest technology from Esri.

If you're brand-new to ArcGIS, the program comes with the tools to make your first print or web map. For experienced desktop users, you can try your hand with online maps and story maps by taking advantage of the ArcGIS Online Named User Account. And for folks who are interested in ArcGIS Pro but aren't sure how it will impact their existing work, the ArcGIS for Home Use Program provides an excellent mechanism to test-drive the next generation of desktop GIS technology.

No matter what your level of expertise with ArcGIS is, the ArcGIS for Home Use Program lets you explore tools, extensions, and apps that you may not otherwise have a chance to use in your work.

And the best part? You'll likely uncover workflows or a new approach to common challenges that you can use to transform your work. The ArcGIS for Home Use Program can help you both develop new skills and impress your superiors with new solutions to organizational problems.

Map for Good

ArcGIS for Home Use is designed for noncommercial programs. While you can't use software licensed through the Home Use Program for your job, you can absolutely use it for volunteer purposes. Whether you're mapping trips for the Boys & Girls Club or you're serving as a GeoMentor in a local school program, the ArcGIS for Home Use Program empowers you to unleash your GIS expertise to make a difference in your community.

Get Started

No matter what your passion is, the ArcGIS for Home Use Program will let you map it for just \$100 a year. Get started today—learn more at esri.com/homeuse.



Prepare for Winter Weather with AccuWeather Data



↑ Kim Avery

Weather is a fact of life. And in the winter, the weather can bring challenges that are very different from other times of the year. Chief among these

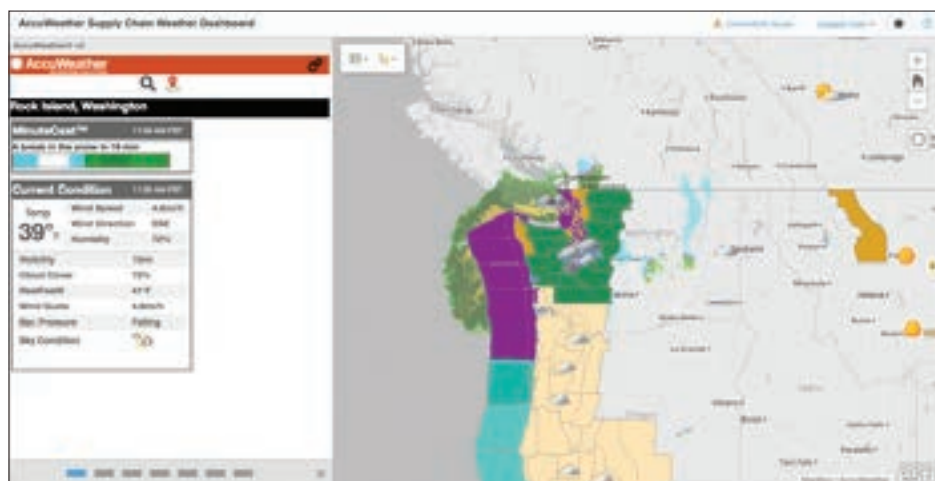
is snow—maybe lots of it, depending on where you live. The good news is that most cities/public works departments have some kind of winter weather plan. Plans can range from what to do in the case of a major weather event to season-long scheduling and optimization of snowplow routes.

Keeping the roads open for emergency responders and residents alike can be a scheduling nightmare. But you can get ahead of the game by knowing what's coming and being prepared. The more you know about the weather forecast, including the predicted intensity and duration of a storm, the better prepared you can be to protect your assets and manage your resources.

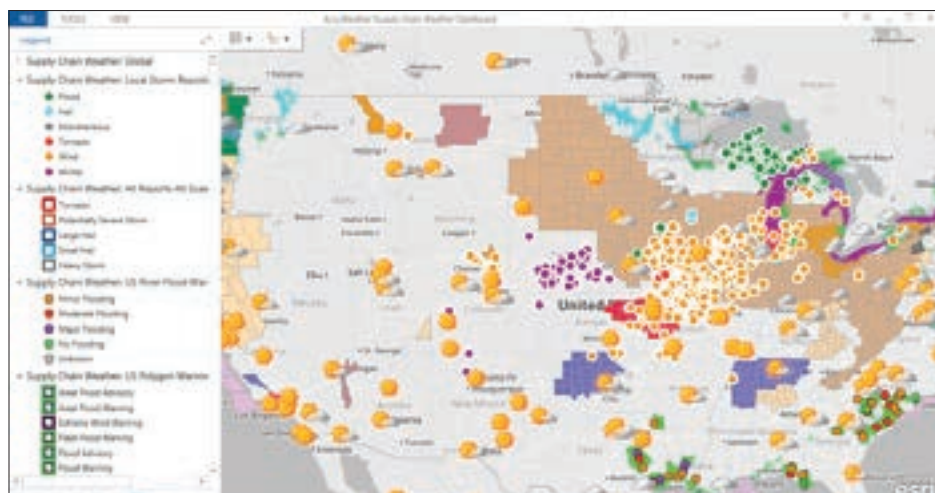
AccuWeather services, available at Esri ArcGIS Marketplace, provide valuable weather information such as accurate snowfall and ice amounts for local areas. AccuWeather meteorologists issue their storm potential forecasts more than a day ahead of the National Weather Service. These services can be directly used in ArcGIS and consumed by all your planning maps and apps. With AccuWeather services, you can look into the future and begin planning before an event occurs, mitigating problems and improving your response times.

It is important to know what's coming and plan now. Don't get caught in the snow unprepared.

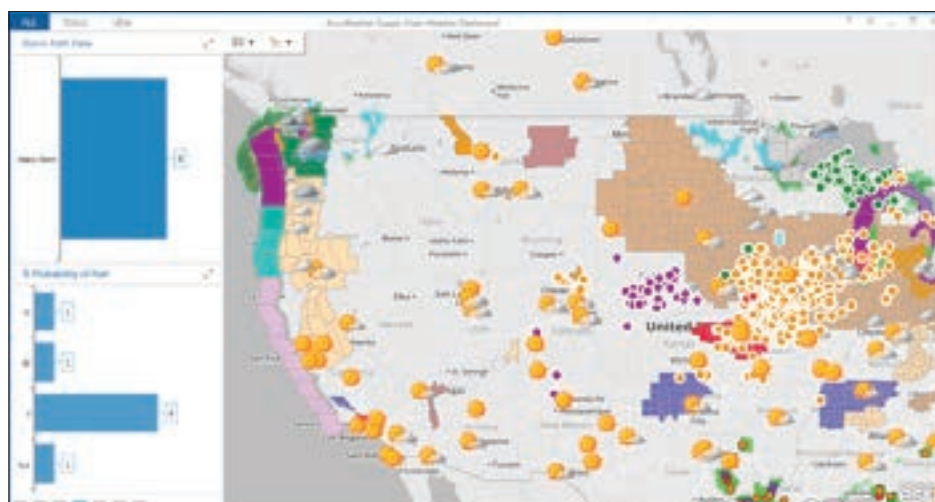
Check out the AccuWeather services at ArcGIS Marketplace to see how a subscription to these services can help with your weather management needs. Learn more at esriurl.com/accuweather.



↑ With AccuWeather data, you can get detailed information about the forecast for a given area.



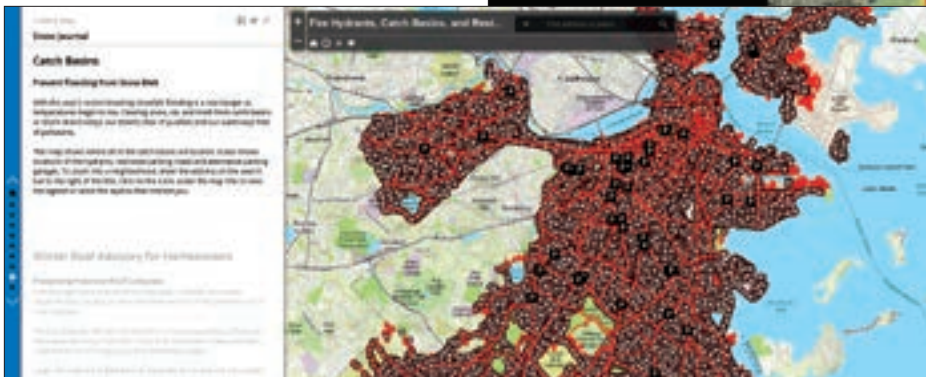
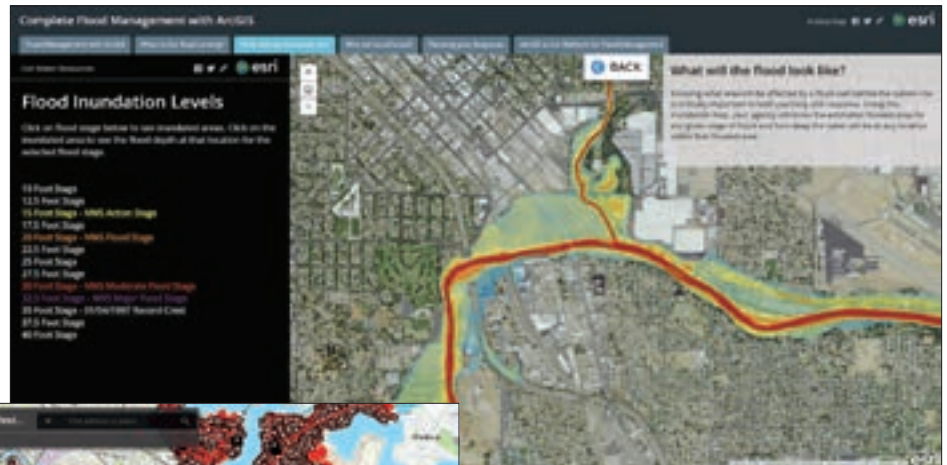
↑ AccuWeather data shows real-time weather information and identifies areas at risk of severe weather conditions.



Weather the Storm with Two New Offerings for Weather Management

Snow Fighting Solutions and ArcGIS for Flood Now Available

Of the risks that governments routinely face, weather conditions can be one of the most unpredictable. But for many communities across the United States, city, county, and state governments know they will likely contend with snow or flooding year after year. And with the uncertainty of a looming El Niño, planning and managing weather-related events in 2016 will take on even greater importance for many communities.



↑ The City of Boston used the ArcGIS platform to manage record snowfall in 2015.

Esri has created two new offerings, Snow Fighting Solutions and ArcGIS for Flood, to empower communities with the tools and workflows they need to stand up to extreme weather.

Smart Snow Fighting

The best way to mitigate and respond to snowstorms is to know when and where they'll have the greatest impact. Esri Snow Fighting Solutions includes premium severe weather subscriptions from AccuWeather to help organizations determine the best places to allocate resources ahead of the snow. With packages that scale from basic weather monitoring to a complete platform for emergency operations and real-time tracking of snow removal vehicles, you'll find the right mix of data and software to survive the winter.

Esri Snow Fighting Solutions is based on the same practices and approaches that the City of Boston followed to survive historic severe weather conditions in 2014. See how Boston conquered the winter hardships—explore the story map at esriurl.com/snowjournal or watch the video at esriurl.com/snowcopvideo.

Learn more about Esri Snow Fighting Solutions at esriurl.com/snowfighter.

Defend against Flooding

Flooding is one of the most costly and complex natural disasters that governments face. Everything from a community's development footprint to landscape

↑ With ArcGIS for Flood, organizations get everything they need to understand when and how floods will impact their community.

changes caused by other disasters can impact where and how flooding occurs. ArcGIS for Flood provides a suite of configurable apps, software, and professional services that help organizations keep their communities safe. By empowering planning, response, and recovery activities with the power of geography, ArcGIS for Flood can help communities minimize the effects of flooding and enable a speedy recovery.

ArcGIS for Flood encompasses the full spectrum of flood management, from the creation of authoritative flood extents to tools that help you identify at-risk assets and populations and communicate with your community. ArcGIS for Flood can be tailored to meet your organization's specific needs, expertise, and workflows.

Experience ArcGIS for Flood in action by checking out the story map at esriurl.com/floodmap.

Learn more about ArcGIS for Flood at esriurl.com/arcgisforflood.

E380 Snapshot

Did you know that Esri has a media channel devoted to highlighting inspirational uses of GIS around the world? It's called E380, and it's a living catalog of the best user stories, conversations, and technology presentations you need to know about. We're launching a new feature at *Esri News for State and Local Government*—each issue will feature three videos that we think you'll love. You can browse E380's full library at esri.com/E380.

DeKalb County Talks Homelessness, Foreclosures, and More

Stacey Greer, director of GIS for DeKalb County, Georgia, discusses the county's innovative new Homeless Census app. Learn how the county used the GeoForm template to transform its annual point-in-time homeless people census and gain a broader understanding of the county's homeless populations. Greer also explains how GIS has helped the county manage foreclosed properties to speed economic recovery.

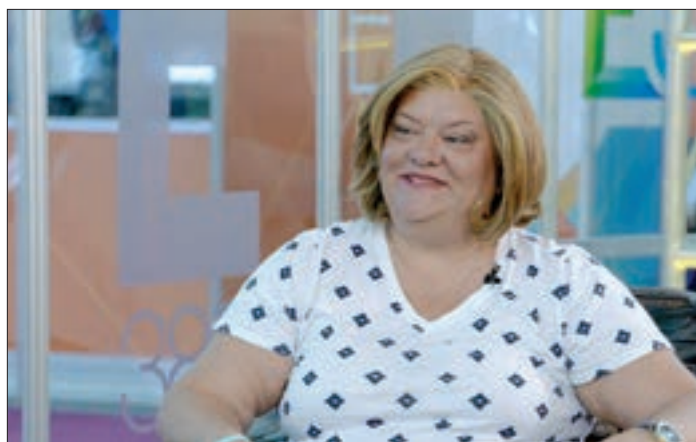
Watch the video at
esriurl.com/e380dekalb.



A New Approach to Capital Improvement Planning at the City of Palm Bay, Florida

Crystal Phillips-Mustain, enterprise GIS division manager for the City of Palm Bay, Florida, explains how the city has embraced the ArcGIS platform throughout the organization. Hear how the city transitioned from traditional spreadsheets to engaging maps for utilities and road management capital improvement planning. She also talks about extending GIS access to all staff throughout the city, as well as the role of GIS for tracking and maintaining assets related to a new water treatment plant.

Watch the video at
esriurl.com/e380palmbay.



Agile App Configuration at the South Carolina Department of Health and Environmental Control

Take a behind-the-scenes tour of the South Carolina Department of Health and Environmental Control (SCDHEC), and learn how the department uses focused templates to empower non-GIS professionals. Hear how SCDHEC uses the templates in ArcGIS for State Government to easily create and customize task-specific apps for everything from monitoring beach erosion to promoting recycling statewide. Staff throughout the department also explain how these apps have transformed community outreach and have even tapped the public to crowdsource valuable data.

Watch the video at
esriurl.com/e380scdhec.



The Democratization of Accuracy

By Brent Jones, PE, PLS, Esri Global Manager, Land Records/Cadastre

While writing this, I contemplated titling it, “The Deregulation of Positioning.” As you can see, I changed my mind. I don’t want it to sound like a literal judicial repealing of laws. It’s still, however, something that clearly has occurred and will transform our work and enhance the capabilities of GIS. No longer is high accuracy a luxury that only cash-rich business sectors can afford (utilities, for example). Now everyone has access to highly accurate GPS tools and workflows without any middlemen or middleware.

Thanks, Standardization

Let’s discuss what’s happened. First, a long list of technological standards have been adopted and institutionalized in a relatively short time—Bluetooth, REST, NTRIP (don’t worry if you haven’t heard of this one), NEMA, 3G, LTE, Wi-Fi, USB, and many more. It’s a long list, and we use them every day without thinking about them. That’s what makes a good standard. It just works. Second, in 2000, President Bill Clinton intentionally turned off selective availability, making GPS signals accessible to the public. Designed to make GPS more responsive to civil and commercial users, Clinton’s executive decision immediately improved GPS accuracy for the entire world and opened up a market for lower-cost GPS devices and solutions. As a result, GPS manufacturers expanded by building and selling GPS components (e.g., modules and chipsets) not just end-user devices. This created competition for components that could be embedded into all kinds of solutions in a multitude of areas, such as precision agriculture, logistics, and machine control. It also allowed entrepreneurs to apply GPS in innovative ways, such as installing it in appliances in foreclosed homes to track theft, embedding it in gadgets to find lost keys, and enabling it on the now-ubiquitous smartphones and tablets for location services.



↑ Esri/Leica's ZenoCollector

Fast-forward to today. We now have highly accurate stand-alone GPS devices, such as the one-meter Bad-Elf GNSS Surveyor, the submeter Trimble Navigation R1, the Spectra Precision Mobile Mapper 300, the Geneq iSXBblue, the single-centimeter Eos Arrow 200, and the super-accurate geodetic Septentrio Altus NR2—and more are coming. These devices don’t come with heavy desktop software to process data; they just produce a highly accurate position that you can use in your own technology or solution. This modularization represents the virtual deregulation of accuracy.

Rock and Roll

Now choose your mobile device: iPhone, iPad, Android phone and tablet, or ruggedized laptop. It really doesn’t matter anymore as long as it has Wi-Fi or Bluetooth capability. Choose your GPS for what accuracy you need (or want—remember that someone once said, “accuracy is addictive”). Then choose your GIS (I’m partial to ArcGIS Online, but you can also use Portal for ArcGIS) and download a field app—in this case,

Collector for ArcGIS or Survey123 for ArcGIS. Configure your system from your desktop and use one of Esri’s excellent basemaps. That’s it. You’re off and running, collecting highly accurate data that goes directly into your system—no middleman, no middleware.

There are all kinds of workflows you can configure, such as using a versioned database to quality check the data before sharing it with everyone. It’s that simple. If you want, you can use a device that bundles the GIS with the hardware for you, like Esri/Leica’s ZenoCollector, enabling you in the field to access and edit the same data that you have in the office.

As a surveyor, I’ve always coveted accuracy, as most surveyors do. It’s in our DNA. It’s cool. As a GIS guy, I’ve always preferred to do all my work in a single system: create and manage data, perform unique analysis, identify patterns, make maps, and publish and share outcomes. Thanks to high-accuracy positioning and its direct relationship to GIS, now we have the best of both worlds.

Putting Utah's Transportation Data Online

UPLAN Provides Model for US Departments of Transportation

Esri Technology

- ArcGIS Online
- Esri Maps for Office

The Utah Department of Transportation (UDOT) uses ArcGIS Online to power UPLAN, an interactive mapping platform that includes information about the state's unified transportation plan, pavement management, safety and crash analysis, bridge locations, bike lanes, mileposts, and more.

UDOT needed a mapping solution for a long time. The department manages 5,800 miles of roads and highways with goals to reduce crashes, injuries, and fatalities (to zero if possible); preserve transportation infrastructure through proactive investments; and optimize mobility across the state via innovative designs.

This work requires access to extensive amounts of data: traffic volumes, accident statistics, pavement conditions, and much more. But for years, data was isolated so that only some UDOT employees could see it.

"We didn't know how to get at it," UDOT planning director John Thomas said.

Spatial data for projects wasn't always on maps either. At meetings, engineers devoted a lot of time to describing spatial information.

"We would spend half the conversation trying to describe a location and issue when a simple map would allow the discussion to address the issues at hand much more effectively," Thomas said.

After several attempts to devise mapping solutions of its own, UDOT turned to Esri and ArcGIS Online to provide exactly what the department needed: a browser-based GIS application that fostered organization-wide access to data-driven map viewers published as web services.

"It was a perfect match," Thomas said. "UDOT had the business need, and Esri had the software."

Transformed by Maps

UDOT had used Esri software before, but ArcGIS Online was transformational. The service enabled UDOT to publish

maps, tools, and apps on its internal website. Non-GIS staff across the agency could view and analyze data intuitively on user-friendly maps. Collaboration spread throughout UDOT as employees began embedding maps in websites and putting them on mobile devices. Anyone who needed data could access, query, analyze, and edit it via ArcGIS.

UDOT was also an early adopter of Esri Maps for Office, which let users quickly build maps in Microsoft Excel. Employees published these maps as live web maps, which could also be integrated with other web services. Staff used these in presentations, emails, and Microsoft SharePoint. The web maps were updated every night, so staff knew the information was current.

In a perpetuating cycle, employees began to want more information. With ArcGIS Online, they could access groups of content related to road planning, asset management, and more critical road and highway information. UDOT also started



↑ A web map in UPLAN displays phase-based, long-term plans for Utah's roads and highways.

sharing its visual data with partners, which could use the maps themselves.

Staff became more productive at meetings, and projects took less time and money. UDOT used ArcGIS Online to identify potential rail-line corridors in a 200-mile-by-200-mile study area in parts of three states. Using ArcGIS Online, the agency developed 26 corridors, totaling more than 4,000 miles. Screening the 26 alternatives for engineering and environmental feasibility took just two months, at a cost of only \$400,000.

"If UDOT had done that before ArcGIS Online, it would have taken at least three years and several million dollars to do the same work," said Thomas.

By helping UDOT understand where and what assets—such as signs, pavement markings, and rumble strips—are in its system, UPLAN supports decision making at all levels. UDOT managers bookmark UPLAN to access their most-referenced maps. There is seldom a meeting without a live web map, which can be pulled up on any employee's device. Gone are the spreadsheets and poster boards the GIS department used to supply for meetings. Now everyone expects a web map. UPLAN also uses a single web map to provide access to its phase-based, long-term planning for Utah's roads and highways.

Regulatory agencies and UDOT have started to share more information earlier in the process as well. UDOT can produce environmental impact reports in minutes instead of several weeks or months. UDOT's relationships with federal and state permitting agencies became stronger as information sharing among the agencies created greater transparency during reviews.

Additionally, residents of the state can view some UPLAN maps on the UDOT website. They can find live, mapped access to weather conditions, safety information, and planned road construction projects. The maps foster a greater level of engagement, trust, and involvement between UDOT and the public, as well as regulators.



↑ Maps are organized in UPLAN using groups, such as UDOT Asset Management and UDOT Enterprise Content.

One DOT at a Time

Thomas quickly realized that UPLAN was unique, though it shouldn't be.

"Transportation doesn't stop at the border," he said.

The United States has never had a federally supported, collaborative framework to view and interpret its entire national road system, and most state departments of transportation have not been equipped with systems like UPLAN, which shocked some officials. Yet transportation is critical infrastructure. Roads and highways are the pulse of the national economy, and optimizing the transportation system improves quality of life. Departments of transportation often get asked for information related to the federal highway system at congressional hearings—but the data isn't readily available.

So Thomas contacted the American Association of State Highway and Transportation Officials (AASHTO), which circulates technological best practices among departments of transportation through its AASHTO Innovation Initiative. Before long, he started forming a passionate team with goals to share Utah's experiences with other states and learn best practices from those states.

Thomas's main questions were critical: How do we share information within our state? How do states collaborate with each

other? Does a tool like UPLAN help with a national view that supports US Department of Transportation (DOT) goals?

With AASHTO's help promoting cutting-edge technology, best practices, and implementation tools, Thomas, Esri's Terry Bills, AASHTO Innovation Initiative consultant Monica Worth, and others, set out to get each state to develop its own ArcGIS Online system. Esri supported the AASHTO Innovation Initiative by providing a one-year free license of ArcGIS Online to participating states.

The team deployed ArcGIS Online at each state's department of transportation, often working long and late hours to get to every state quickly. By the end of 2014, 30 departments of transportation across the United States had begun to launch their own versions of UPLAN.

"There has been a lot of interest by states to implement a tool that helps use their information to learn more about their transportation systems," Thomas said.

The initiative is rolling out state-by-state and, so far, includes Minnesota, North Carolina, and Pennsylvania.

"It's just kind of everybody talking to each other and understanding each other better," Worth said. "That's a demonstration of a really good use of the taxpayers' dollar to bring information to the public."



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