

Maryland DOT's Innovative Visualization of Living Right-of-Way Boundaries in GIS

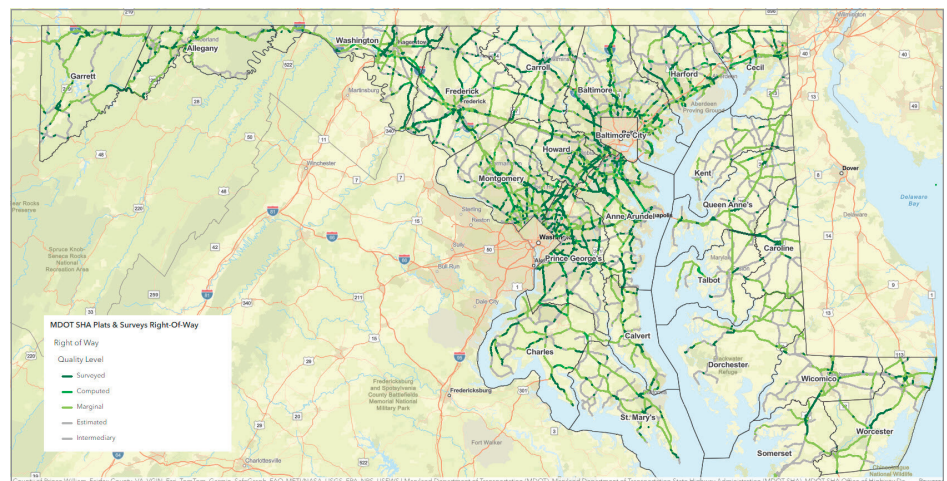
Digitization and geographic information system (GIS) are significantly improving speed of access to the Maryland Department of Transportation (MDOT) land parcel information, and positively influencing overall accuracies.

The US has embarked on a once-in-a-generation investment in infrastructure, covering everything from roads and bridges to construction of the infrastructure to support the electrification of the vehicle fleet. Most of these funds go to the state departments of transportation (DOTs) that are responsible for building and maintaining the multimodal transportation networks within their states.

The vast majority of a DOT's assets are in their right-of-way (ROW), the land owned by the state surrounding the highway. In fact, in many states, the DOT is the single largest public landholder, and the right-of-way can total hundreds of thousands of acres.

Despite the overall value of that land and associated assets, many DOTs still manage their ROW with traditional paper document management techniques, which can pose unnecessary risks of document deterioration and/or destruction. On top of that, the time spent trying to locate specific ROW documents for customers can be considerable, time which could be more productively spent.

This was the challenge the MDOT faced as staff sought to digitize their ROW. To



↑ Statewide coverage of the public MDOT SHA Plats and Surveys Right-Of-Way feature layer is displayed in the image above.

meet this challenge, the Plats and Surveys Division (PSD) within the MDOT State Highway Administration (SHA) Office of Highway Development (OHD) is digitizing existing right-of-way plats, which are maps showing official land transactions. These documents are vital historical records used in the planning and designing of SHA projects. This data is being presented uniformly within the ArcGIS Online environment as authoritative feature layers: MDOT SHA Right of Way and MDOT SHA Right of Way Polygon.

Now, both internal MDOT users and members of the public can access ROW and associated plat information from a single location via the web.

Creating Quality Data

Initial discussions about digitizing images in the plat archives extend as far back as

2015, originating from PSD's desire to modernize and enhance its own internal research capabilities. The process of georeferencing over 60,000 plat images began around this time. Initially, the end goal was simply to have the scanned images (TIFFs) georeferenced and organized by location. However, as the effort began to yield tangible benefits for project-related research, extracting more spatial data from the plat images became a greater priority. By 2018, the georeferencing effort had expanded to include the creation of a digital right-of-way boundary line in ArcGIS.

Early in the process, the PSD staff needed to formulate ways to manage internal project deliverables. This was critical because, without a system in place to capture newly obtained survey

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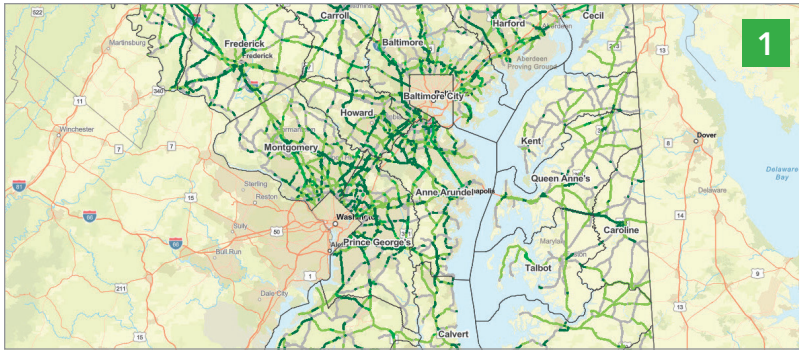
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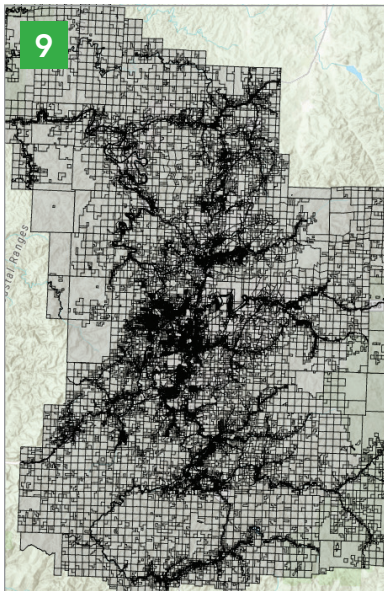
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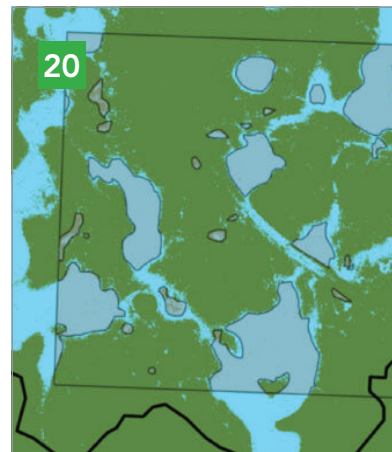


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GIS-ENABLED ELECTION SOLUTIONS

ELECTION MANAGEMENT

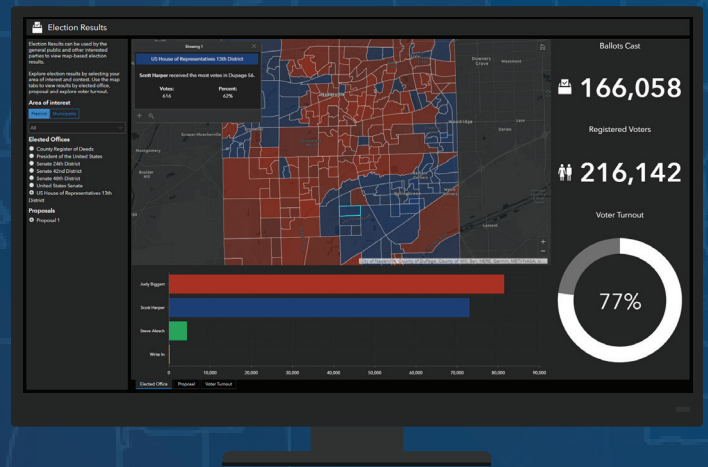
- Monitor election performance.
- Maintain authoritative district boundaries and voter location.
- Support poll workers' requests for assistance.
- Monitor wait times of polling places.
- Collect voter sentiment.
- Ensure chain of custody for equipment and ballot collection.

ELECTION OUTREACH

- Notify voters on polling place wait times.
- Keep the public informed on who its elected officials are.
- Connect and route voters to polling places.
- Inform voters of early voting options.

ELECTION RESULTS

- Enhance transparency for citizens and the media.
- Streamline the sharing of election night results.
- Move tabular data into an interactive web map.



Planning for today's elections requires that government adapts to changing technological advancements, voting preferences, and new requirements. Geographic information system (GIS) technology helps government stay ahead of these factors. Shifting the focus to a location before, during, and after an election enhances business workflows and the voter's experience with web-based maps and mobile apps that work seamlessly together. Talk to a GIS expert who can help your organization be Election Day ready.



Go to go.esri.com/ElectionsSLG
for more information.



Emergency Operations

When an emergency happens, it's all hands on deck. Timely and accurate information helps ensure a speedy response, and for an affected community, a speedy response literally saves lives. To meet this need, emergency management agencies must increase their response capabilities during critical events.

The Emergency Management Operations solution helps agencies implement a data-driven approach that ensures that emergency managers are aware of rapidly changing conditions and can communicate disruptions to critical services and any evacuation notices to stakeholders in a community. The newest version of the solution, available now, includes several key enhancements that make emergency coordination and response even more effective.

Manage Emergency Information

Update community lifelines—The solution includes a new form that allows operations staff to document community lifeline status and communicate disruptions to critical services.

Brief key stakeholders—The Incident Status Dashboard app can be used to provide all this information, ensuring clear communication at all command levels and facilitating effective decision-making at the executive level.

Share emergency information—The Emergency Management Information site serves as a platform to communicate necessary emergency information to the public.

Find out how to implement the enhanced Emergency Management Operations solution at [go.esri.com/EMUpdate](https://www.esri.com/EMUpdate).



Signs are among the most common assets found along a roadway. They are critical assets that communicate rules, warnings, guidance, and other road and highway agency information needed to navigate roads safely and efficiently. Properly maintained road signs save lives, prevent injuries and property damage, and improve traffic flow.

While most of the nation's roads are managed by state and local governments, the Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control Devices (MUTCD)* sets minimum standards and ensures uniformity of traffic control devices across the nation. Public agencies rely on the *MUTCD* for uniformity, and noncompliance or missing signage can result in the loss of federal funds as well as a significant increase in liability.

Over time, signs degrade due to sunlight, weather, and environmental damage. Signs and poles that are placed too close to the roadway can also become a hazard when struck by a vehicle. As a result, road maintenance organizations routinely inspect and replace signs and poles and use inspection programs to reduce

maintenance costs and identify safety issues before an incident occurs.

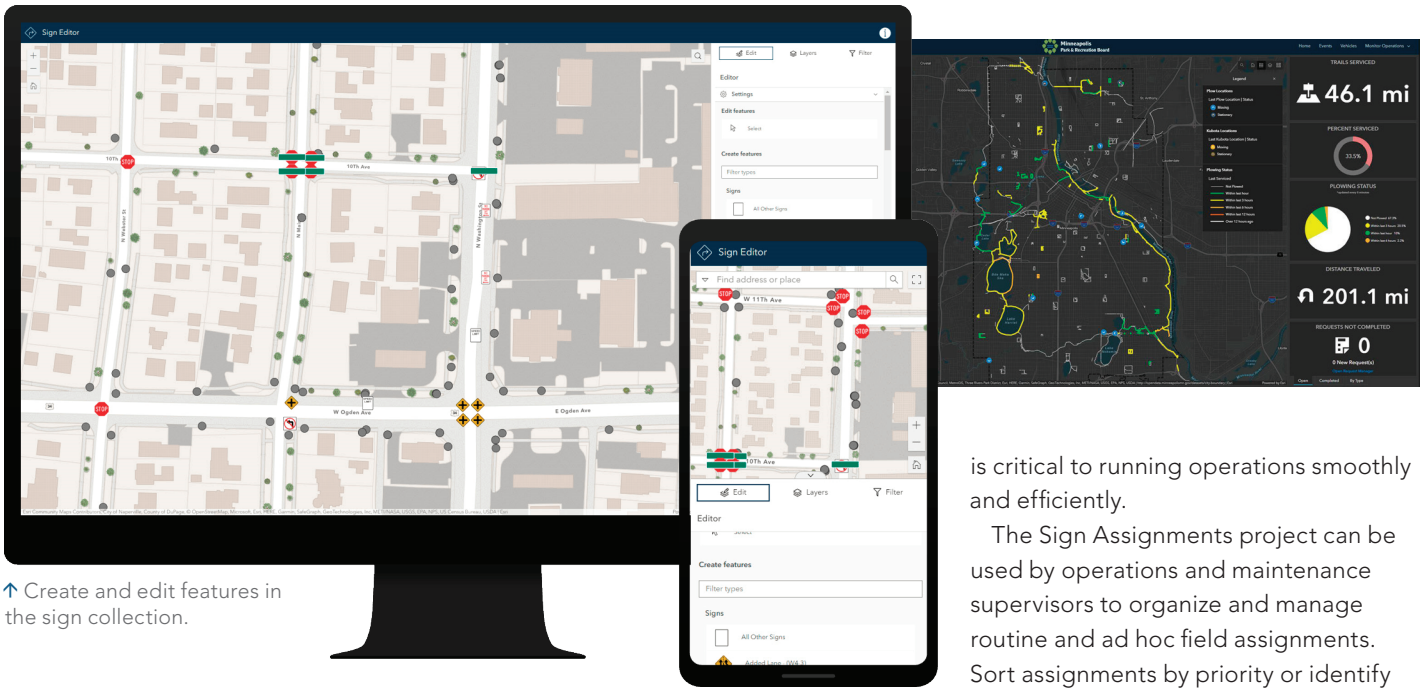
The Sign Management solution delivers a set of capabilities that help state and local governments collect roadway signs and poles, conduct routine inspection and maintenance activities, and understand asset conditions.

Create a Sign Collection

The first step is to create an authoritative collection of signs and poles. In this collection, signs and poles are treated as separate but related assets. Each can be visualized and filtered in the information products deployed with the solution.

To simplify the creation of a sign collection, the Sign Management solution includes nearly 150 preconfigured editing templates, symbols, and default values for signs and their respective *MUTCD* codes. This set of common signs and poles can be configured to support additional pole types, *MUTCD* codes, or local sign codes your organization needs.

Using predefined tasks in the Sign Data Management ArcGIS Pro project, existing sign data can be loaded into the layers provided with the solution and



↑ Create and edit features in the sign collection.

modified appropriately. New signs can also be captured from record drawings your organization maintains.

Mapping technicians also have access to the Sign Editor app, which provides a lightweight browser experience to create new features or edit existing ones in the sign collection.

In many cases, performing mobile data collection of signs and poles may be the most efficient way to develop an authoritative collection for your community. The Sign Editor app can be used in ArcGIS Field Maps to collect asset information and record inspection and maintenance activities in the field.

While you are in the field, you can enhance existing sign information and capture new signs and poles missing from your collection. You can also access inspection and maintenance assignments and update office staff as you complete each assignment.

Manage Sign Operations

The Sign Management Center app can be used to monitor sign and pole conditions, manage requests for service, and create work assignments. When you initially use the Sign Management Center app, key metrics help you understand

your organization’s sign collection. They also highlight requests for service that need to be addressed and work that must be assigned to maintenance staff.

Access your entire sign collection, understand sign conditions, and view inspection or maintenance history. To target field activities, filter the collection by characteristics such as sign type, MUTCD code, condition, or date installed. When necessary, create a work assignment for a given sign or pole and share it with maintenance staff.

Many times, residents will see missing or damaged signs as they travel throughout a community. Residents can use the Sign Request form to submit requests for service.

Staff can use the Sign Request Manager app to monitor, triage, and address service requests before small issues become too big, costly, or unsafe for your community. Staff can also review requests for service over time, identify any trends or patterns, and ensure that requests are being addressed promptly.

Finally, operations and maintenance staff manage routine sign inspection and maintenance programs that identify safety issues and reduce long-term maintenance costs. Real-time information

is critical to running operations smoothly and efficiently.

The Sign Assignments project can be used by operations and maintenance supervisors to organize and manage routine and ad hoc field assignments. Sort assignments by priority or identify assignments in each maintenance district on the map. Assign the assignments to the appropriate maintenance staff. When each assignment is completed in the field, maintenance staff can close the assignment and note the work completed.

View a Sign Collection

The Sign Viewer app can be used by engineers and planners to evaluate a sign collection during routine operations or when planning a broader transportation capital improvement project.

Select a particular sign and review its characteristics or condition. Then review inspection and maintenance information collected by your organization. Finally, view the signs and poles in a 3D representation along a roadway or at a given intersection.



Learn More

For more information about how to deploy the Sign Management solution, check out go.esri.com/SignSolution.

Enhancing Equity across Public Works: A Cross-Industry Q&A



↑ Sophia Garcia,
Equity and Civic
Nonprofits Industry
Lead at Esri



↑ Adam Carnow,
Public Works
Industry Specialist
at Esri



← Christopher
Thomas, Director
of Government
Marketing at Esri

So how do our departments prioritize projects within a jurisdiction's budget, in communities with the most need? Let's learn more about the public works industry professionals and how they are incorporating equity throughout their work.

Garcia: Can you please define what public works professionals do? Many readers might not be aware of the industry's functionalities that they all probably benefit from day to day.

Carnow: The American Public Works Association [APWA]—which supports those who operate, improve, and maintain public works and infrastructure through advocacy, education, and member engagement—defines public works as “the combination of physical assets, management practices, policies, and personnel necessary for government to provide and sustain structures and services essential to the welfare and acceptable quality of life for its citizens.” For example, water, utilities, and trash collection are all functions of public works.

Garcia: Now that we have a bit more background on the functions of a public works department, how would you

enhance equity within the public works industry?

Carnow: Equity is a large issue that covers many facets of the public works industry, but the most impactful way that the public works industry can enhance equity in our communities is through the fair, just, and equitable distribution of public services and infrastructure. Residents benefit when services and infrastructure investments are provided in an equitable manner.

Thomas: As Adam cites, equity spans across many facets of the public works disciplines. The increased attention on equity offers the opportunity for state and local governments to place a new lens on their work. While basic demographic information has long been a part of long-range planning and maintenance, governments are being asked to take it up a notch and look more closely at the neighborhoods they serve and look more closely at race, income, gender, age, and people with disabilities. In the past, data was not easily accessible to help make these decisions. Today GIS offers the opportunity to rethink, reengineer, and reimagine the way we extend public works services. There's an opportunity to adapt facilities and open space to shifting demographics, allocate capital project dollars to communities in need, enhance economic mobility, and keep the public safe.

Garcia: What organizations are successfully pioneering the equity effort in this industry?

Carnow: There are lots of examples of local government organizations innovating and developing best practices while bringing equity into their workflows with GIS technology:

- Torrance, California, is using demographic and spatial analysis to meet its goal of ensuring that every electric vehicle driver is never more than one

mile from a charging station within the city.

- Austin, Texas, used equity in its plan to improve the tree canopy across the city to help battle the urban heat island effect and the bias created by the lack of shade trees in communities of color and lower-income neighborhoods.
- Tacoma, Washington, has altered its capital investment planning process to require a review of all proposed projects, using an equity index.
- Oakland, California, is using equity as part of its data-driven prioritization of traffic safety improvements.
- Fairfax County, Virginia, is using a vulnerability index staff developed in-house to review projects across multiple departments including tree planting and LED streetlight conversions.

Thomas: Every day, we come across amazing examples of governments using GIS to address inequities in their communities. Each jurisdiction tends to focus on areas that are unique to its geography. We have connected with jurisdictions that are using GIS to extend broadband, identify and replace lead in water systems, and improve ridership on public transit. With climate change being another major theme, public works professionals can plan for a more sustainable future dealing with sea level rise and drought, develop approaches to lessen the impacts of extreme heat and cold, and help reduce our carbon footprint by rethinking mobility.

Garcia: What datasets do public works professionals need to consider to enhance equity in this space?

Carnow: There is a wide variety of data available to assist in analyzing a community through an equity lens. This can start with demographic data that includes age, race, ethnicity, education level, employment, income, housing, access to broadband,



and predominant languages other than English. There is also the Justice40 Atlas data, which the federal government is using to identify disadvantaged communities to help focus 40 percent of the overall benefits of certain federal investments. The Climate Mapping for Resilience & Adaptation tool helps show which areas of our communities are at risk and vulnerable to climate-related impacts. This can be combined with local data of facilities, infrastructure, transportation, employment, education, health and childcare access, and service areas and their related levels of service to see how well or not the community is being served equitably.

Thomas: While there are hundreds of sets of data available to public works professionals through Esri offerings, federal datasets, and open data hubs, the most important data lies within your own organizations. We have witnessed a rise in cross collaboration with your peers in other departments. Whether we are dealing with humans in crises like homelessness, substance misuse, the pandemic response, and disaster mitigation, many times the data you need to make a difference in equity is contained in your business systems and systems of records, like accounting and finance data, GIS data, and event data from spreadsheets. Setting up a data hub for your organization can open new views and approaches to addressing inequities in your communities.

Garcia: What federal requirements should be considered when addressing equity in this space?

Carnow: Much of the federal funding sources earmarked for infrastructure investment at the state and local levels

has stipulations that require the grantee to document how the funding is being used in an equitable manner. This includes the following:

- Infrastructure Investment and Jobs Act (IIJA)—In addition to road, bridge, and port repairs and public transit investments, the IIJA provides funds for clean water, expanded access to high-speed internet, cybersecurity, and infrastructure protection from weather disasters.
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE)—The RAISE discretionary grant program helps communities build transportation projects that have significant local or regional impact and improve safety and equity.
- Safe Streets for All—This program is part of the IIJA and provides funding for community projects that help reduce the number of deaths and serious injuries on highways, streets, and roads.

Thomas: GIS has been acknowledged by numerous federal agencies as a mission-critical tool for decision support, infrastructure design, and much more. Governments have used ArcGIS Dashboards to fulfill the transparency and accountability requirements associated with federal funding of infrastructure. You can keep abreast of Esri's efforts to meet the requirements of federal funding by visiting our web page, dedicated to sharing best practices.

Garcia: Which GIS tools can organizations leverage to advance equity in this industry?

Carnow: There is a huge collection of ready-to-use GIS data and maps in ArcGIS Living Atlas of the World and the Esri Maps for Public Policy collection. ArcGIS Solutions includes the Social Equity Analysis, Racial Equity Community,

and Broadband Outreach solutions. There is also the Climate Mapping for Resilience & Adaptation tool and the Justice40 Atlas, as mentioned above.

Thomas: The tools Adam has mentioned are a great start. Products such as ArcGIS Business Analyst have allowed organizations to jump-start discussions in their organizations. It's full of demographic analysis tools that can be combined with your local data. ArcGIS StoryMaps helps effectively communicate your organization's objectives to stakeholders and constituents. Public works professionals will find real power in combining our equity tools with apps designed to support your workflows through ArcGIS Solutions.

The Road Ahead

Similar to other industries, public works is a field expanding to emergency management, transportation, water, and more. Carnow and Thomas outlined the breadth of equity and GIS examples. Through this conversation, we learned that the public works industry is expanding its use of data and community engagement tools and that existing projects range from tree canopy and EV charging stations to capital improvement projects. We also learned that there are several federally available equity datasets, such as Justice 40 Atlas, as well as the Climate Mapping for Resilience & Adaptation tool.



If you would like to get started on applying an equity lens in your industry, please go to go.esri.com/4StepEquityPlan.

Parcel Fabric and Beyond: From Legacy System to Long-Term Success at Douglas County

When Vyla Grindberg joined Douglas County, Oregon, as its GIS coordinator in 2020, the county had taken tentative steps to transition to Esri's ArcGIS Enterprise software. Grindberg targeted the critical process of managing tax parcel data, which was in demand by numerous departments for important functions across the organization.

"Tax parcel data is an incredibly valuable asset that is used for emergency management, planning, public works, as well as local municipalities and individual citizens. With so many needs and requests to fulfill, it was clear that we needed a system that would allow us to manage, update, and share it efficiently with those who needed it," said Grindberg.

Data was being manually updated

to work with other systems in place at the county, such as iWorQ. A great need existed for parcel data that would meet the county's needs for emergency response. Grindberg saw that these needs could be met more efficiently using Esri's ArcGIS Parcel Fabric to manage data.

With approval of a grant application from the Municipal Wildfire Assistance Program (MWAP), Douglas County was able to move forward with research and planning for deployment of the new software.

Preparation and Transition

Grindberg identified a small, six-week window of time—when tax rolls were being finalized—for moving the county's

data to the Parcel Fabric environment. Douglas County engaged a partner—Pro-West & Associates—whose expertise in data migration could aid in the Parcel Fabric implementation process. Along with Pro-West, Grindberg performed testing to prepare for transitioning data from the county's legacy system. This ensured that the county would be able to access Parcel Fabric in ArcGIS Pro, as well as use an Esri map series to generate 3,108 plat maps.

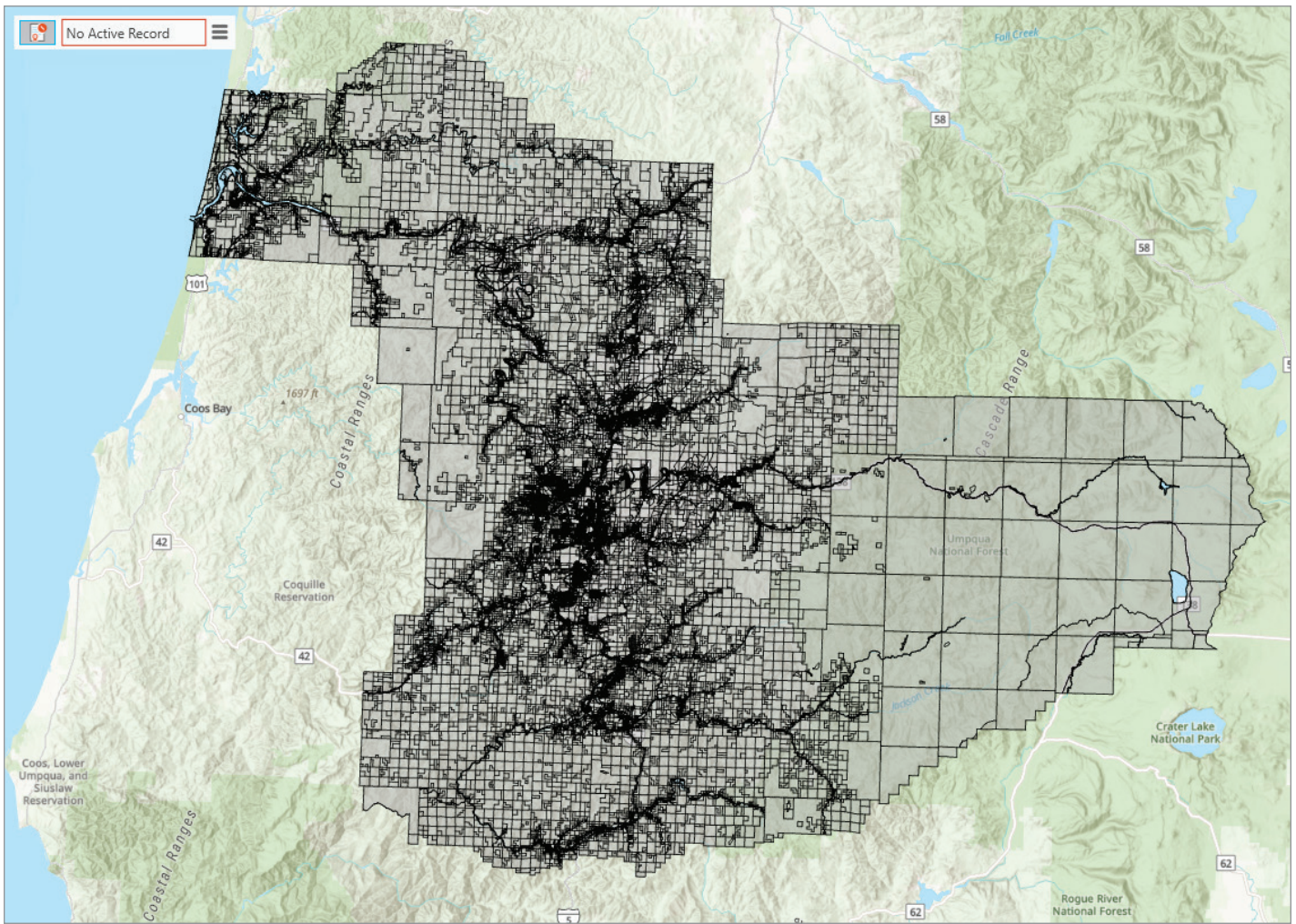
The entire project—including the migration to Parcel Fabric in ArcGIS Pro and the deployment of Python scripts to publish data on a daily basis—was completed within a four-month period.

Training for Success

Critical to the success of the project and ongoing maintenance of parcel data was training. Grindberg, who also teaches college GIS courses, trained the county's cartography department, whose team was new to ArcGIS Pro. In addition, she set up ArcGIS Pro projects in which the cartographers could work on an ongoing basis.

Then, Pro-West joined the county on-site for a week to provide customized training to Grindberg and the cartography department, focusing on editing in Parcel





Fabric using the county’s unique data, handling specific scenarios and a range of topics that would equip county staff to maintain up-to-date, accurate parcel data.

Delivering Value for All

By implementing ArcGIS Parcel Fabric, Douglas County can now deliver accurate data, updated automatically on a daily basis to meet the needs of departments including planning, assessors, and emergency services. Grindberg no longer has to manually work with data to prepare it for various uses. Thanks to automated processes in Parcel Fabric and integrations connecting it to other business systems within the county and partner agencies, data is no longer out-of-date by a week or a month, but accurate on a daily basis.

Grindberg can now use the time she used to spend processing data on other

tasks that help advance the policy needs of the county. Also, departments and agencies are able to receive updated data even if she is unavailable.

“Previously, if I was out of the office or working on an urgent task, I couldn’t truncate and append the data that was needed,” said Grindberg “At times, a three- to four-week wait existed for data requests to be fulfilled. Thankfully, that’s no longer the case. Others are not relying on me to personally work on and deliver the data they need—they automatically receive it. That represents great value for the county and our end users.”

The Future

As GIS coordinator, Grindberg’s mission is to use GIS to provide high-quality services to the public. She sees many opportunities across the county to integrate GIS to enhance services.

“Implementing Parcel Fabric has been an important step forward for Douglas County, but it’s just one piece of the puzzle,” said Grindberg. “There are so many opportunities to provide value to residents through GIS. We’re looking at [using] ArcGIS Hub [to develop a hub] site for emergency management, leveraging Esri software to replace other aging applications, and integrating processes for zoning inquiries into GIS, for example. I’m looking forward to bringing even more of the benefits of GIS to Douglas County’s citizens.”



To discover holistic farming approaches, please go to go.esri.com/PFforSLG.

Five Tips to Jump-Start Your Parcel Migration to ArcGIS Pro

By Linda Foster, Global Manager of Land Records and Cadastre at Esri

Attention, land records managers—approach migration with confidence and complete the process before ArcMap deprecation.

March 2026 may seem far away, but it is coming fast—it's when Esri will be retiring (no longer supporting) ArcMap. Proper preparation is the key to a successful migration to ArcGIS Pro. Those who haven't already completed their transition should get organized as soon as practical to avoid operating an unsupported vital system.

If you're unfamiliar, ArcGIS Parcel Fabric, the new parcel editing solution in ArcGIS Pro, is highly configurable

and efficient and replaces customized workflows in ArcMap. Many organizations report a 50 percent increase in parcel editing productivity.

For some, however, this seems like a daunting task. Concerns about staff retraining, migration workload management, whether the organization's current functionalities will be replicated, and how it works with third-party tools can make the process seem like an uphill challenge.

But what does parcel migration to ArcGIS Pro really look like? Keep reading to learn about what it takes to overcome some of the concerns that may be stalling progress:

- **Learn about licensing needs.** Identifying the organization's licensing needs will help tremendously in the planning process, from budgeting to learning which licenses individuals will need in relation to their job roles.
- **Get help.** For many organizations, working with a vendor that is an expert in parcel (and Parcel Fabric) migration to ArcGIS Pro makes sense. Since it's a one-time task, having staff learn about and perform the migration may be inefficient and reduce their capacity to undertake regular responsibilities. However, many vendors' pipelines are filling up to perform ArcMap to ArcGIS Pro parcel migrations as deprecation approaches, so reach out soon. Research vendors by reaching out to peers in neighboring counties, or ask your Esri account manager for recommended vendors.

- **Discover what's possible.** Parcel Fabric has functionalities that do not exist in ArcMap. These could be powerful in increasing speed and improving performance! If you have customized workflows, you'll probably need a lot fewer functionalities. Work with your Esri account manager to understand what's new and how it could work for your needs.
- **Evaluate how third-party tools will be managed.** If your organization's parcel data connects with other systems to offer additional capabilities to users, investigate how these will be handled in ArcGIS Pro. Some third-party capabilities are included in ArcGIS Pro tools while others may need to be reconnected to the data once migrated.
- **Learn about training options.** Esri offers a learning plan specifically for essential parcel and land records management skills, including a variety of instructor-led or self-paced courses, webinars, videos, and documents to jump-start your training. Additionally, partners may also offer training options that make sense. Work with your Esri account manager to learn what's available.



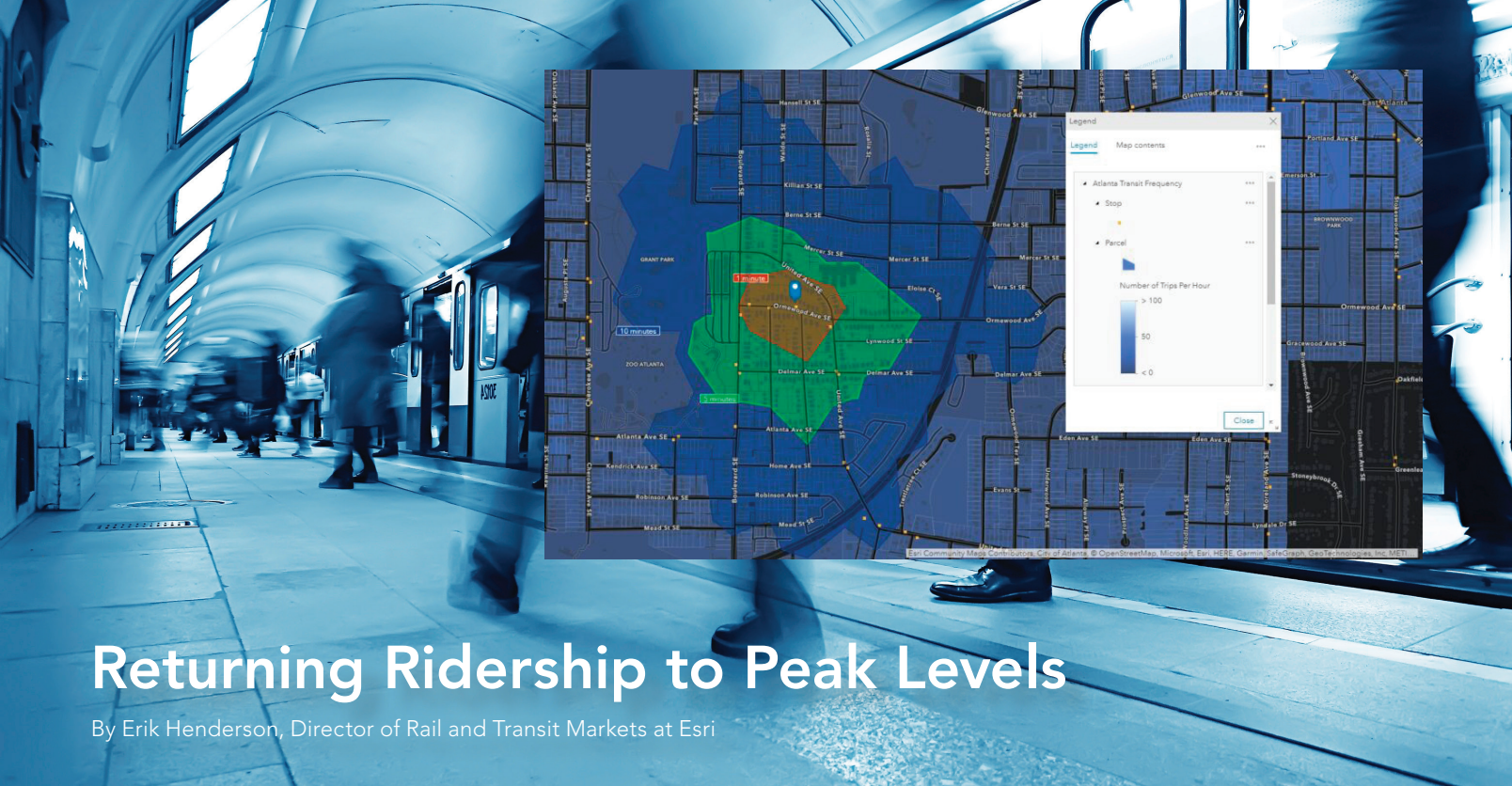
We hope these tips help you move forward in your journey to ArcGIS Pro. What advice do you have for others planning their migration? Share your suggestions at go.esri.com/SLGParcel.

We Want Your Stories

Partners, startups, nonprofits, and customers are encouraged to submit an article for inclusion in Esri's state and local government publications. Tell readers across the country how your organization or customers have saved money and time or acquired new capabilities through using GIS.

go.esri.com/sharestory

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Returning Ridership to Peak Levels

By Erik Henderson, Director of Rail and Transit Markets at Esri

We have experienced a lot of change in the way we work, live, and travel. These changes have allowed us to reevaluate the way we used to do things and create a new way of living.

However, new ways of living make this a critical time to really understand who your riders are and how you can better serve their needs. By implementing a geographic approach with Esri's GIS technology, users can dive into datasets for any city—you can visualize your community makeup across your geography to better understand exactly who travels on your transit lines.

Understanding Your Riders

Where exactly do your customers live? Where do they work? How far do they typically travel to get to work? Who is most in need of access to health-care facilities?

These and many other questions can be answered with ArcGIS Business Analyst. ArcGIS Business Analyst houses a wide variety of infographics that allow you to choose your city and an area of interest to study. You can easily upload and overlay your existing network on a map to create buffers around drive times or even walking times to your stops.

Having access to this level of information allows you to make fact-based decisions about adjusting your buses' availability in certain areas.

Navigating Title VI Geographically

Compliance with Title VI is always at the forefront of how transit agencies provide access to public transportation. The detailed information provided by ArcGIS Business Analyst infographics can speak directly to some of the Title VI requirements. In this example, in Atlanta, we show the walk times to a city bus stop, overlaid on how frequently the buses serve this area. This level of analysis can be done for any place in your district with any type of geography you'd like to analyze. Publicly available data, like census data and the Justice40 Initiative data housed in ArcGIS Living Atlas of the World, can also be applied to your network and queried to help you understand the diversity of your population and geographic access to your services.

Applying a Holistic Lens to Your Community

Many agencies provide multimodal transit coverage of their cities with light-rail, buses, dedicated on-demand vehicles, and even ferryboats. Esri GIS technology allows you to overlay data on all your modes of transportation and provide advanced analytics across the total coverage of transit. You can upload and maintain data or connect directly to an existing transit time web service of your routes. This provides constant monitoring and analysis of incidents or route modification plans.

GIS provides a wide variety of products for the transit markets. We can help you get started with simple-to-use online tools or integrate with your established systems to help spatially enable your data.



To achieve a better understanding of your population; create fact-based, actionable information about the spatial layout of your system; or take advantage of constantly updated demographic data for your agency, go to go.esri.com/business-analyst-for-transit.

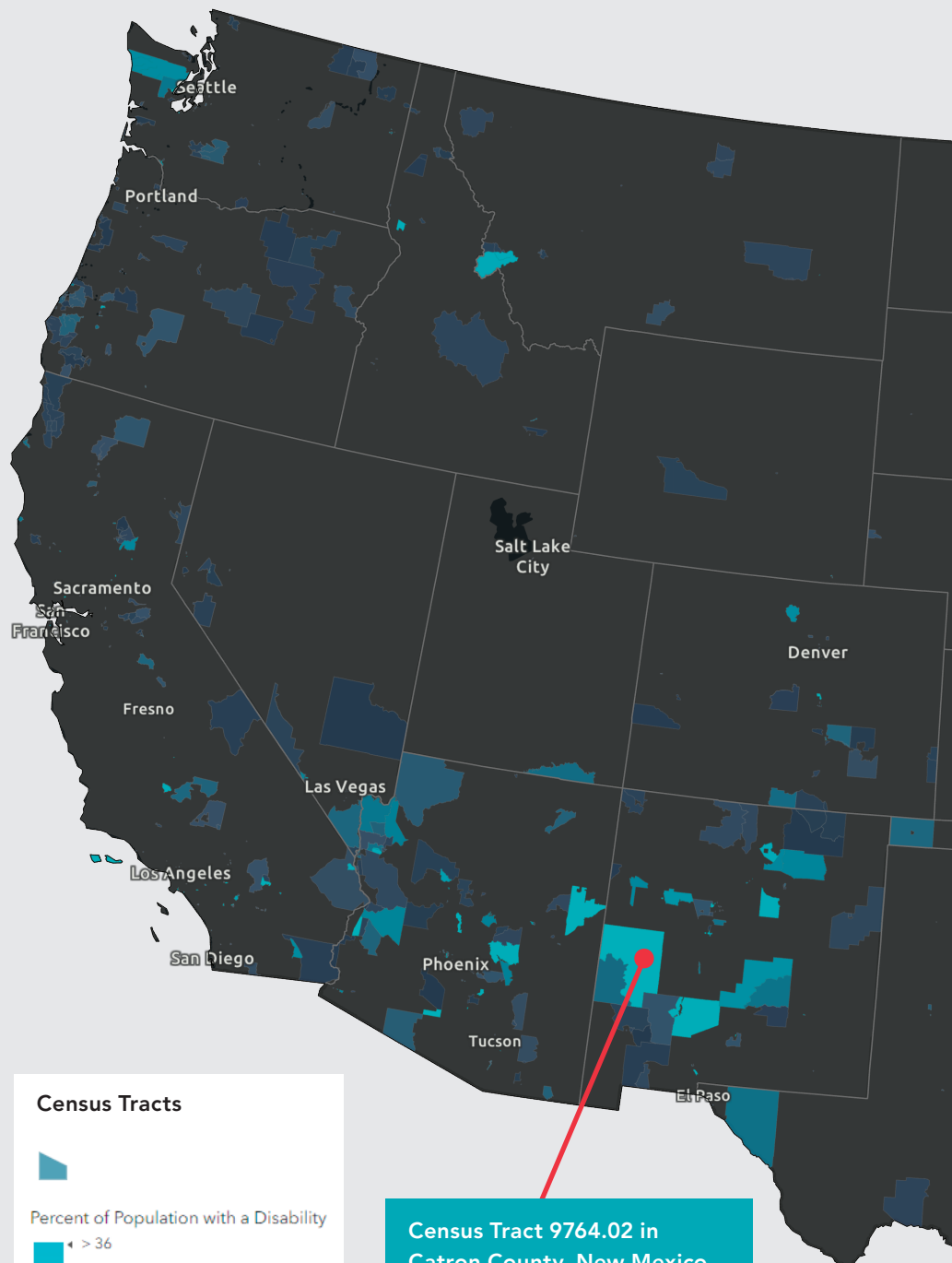
EASILY ACCESS AND USE AMERICAN COMMUNITY SURVEY DATA

The 2018–2022 American Community Survey (ACS) five-year estimates are now available within ArcGIS Living Atlas of the World. The Census ACS layers in ArcGIS Living Atlas cover a wide range of topics: population, income, education, health insurance, language, race and ethnicity, and more. More than 100 layers are available, each focusing on a specific topic.

These ready-to-use layers empower people to instantly begin to explore, map, analyze, and download the data at state, county, and tract levels. Having these layers in ArcGIS Living Atlas for free saves GIS users many hours or even days of download and data processing time. You can also easily use the layers to create your own customized web maps and applications to tell an endless number of stories about the population, housing, and other issues in your area.

This map shows the census tracts in the country where 25 percent of the population or more have a disability. Local officials, community leaders, and businesses within these communities can use this map to understand the changes taking place in their neighborhoods to know how to improve services and infrastructure. By proving or disproving your assumptions about your community, you can see where to prioritize investments, know which services to provide in your local community center, find out who's most at risk during an emergency, discover where to install Americans with Disabilities (ADA)-compliant curb ramps, and more.

To find out how to start using ACS layers for your mapping and analysis, go to go.esri.com/ACSslg.



Census Tracts



Percent of Population with a Disability

> 36

30.6

< 25

Census Tract 9764.02 in Catron County, New Mexico

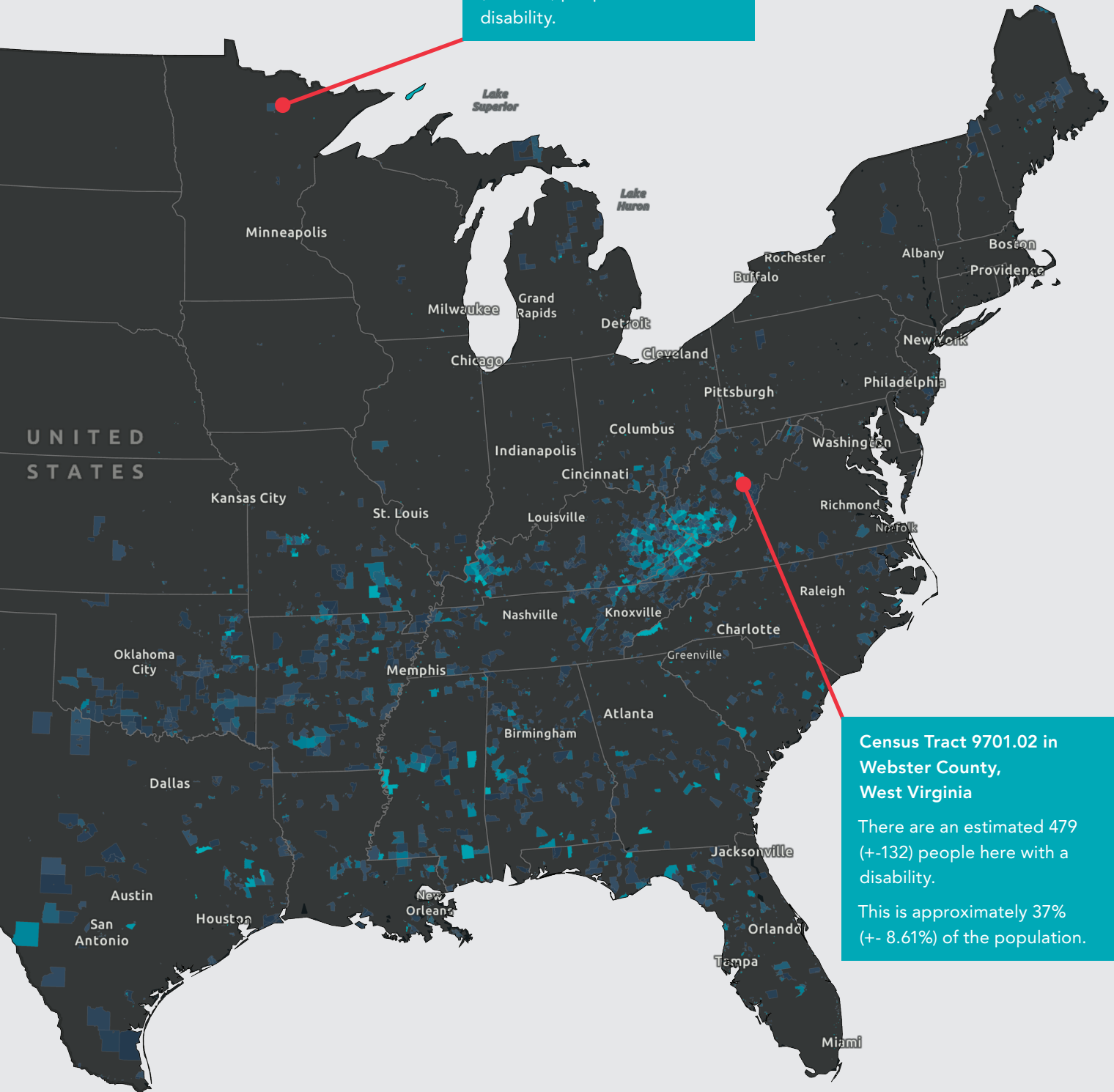
There are an estimated 964 (+221) people here with a disability.

This is approximately 49% (+9.51%) of the population.

**Census Tract 4801.01 in
Itasca County, Minnesota**

There are an estimated 235
(+/-49) people here with a
disability.

This is approximately 29%
(+/-5.32%) people here with a
disability.



**Census Tract 9701.02 in
Webster County,
West Virginia**

There are an estimated 479
(+/-132) people here with a
disability.

This is approximately 37%
(+/- 8.61%) of the population.

Maryland DOT's Innovative Visualization of Living Right-of-Way Boundaries in GIS continued from cover

data and plat CADD files, the product of a large-scale digitization effort would quickly become obsolete. To ensure that project deliverables remained organized, the GIS team established workflows and reporting systems within PSD.

The digitization of plat ROW was a significant undertaking for the GIS team. It began in 2018, after the team had successfully georeferenced approximately 80 percent of all scanned plat images. To ensure an efficient and organized process, the team organized the digitization efforts by county and route. PSD GIS specialists were assigned to sort through all plats associated with a particular county and route, identifying the plats that provided the most accurate source of ROW information.

Throughout the process, PSD staff always sought out the highest quality information to guide their efforts. Whenever a CADD file representing the field-surveyed boundaries of the ROW was available, staff would extract the features from the file and incorporate them into the GIS layer.

This meant that the latest and greatest information available in any given area was used to create the ROW layer. However, in areas where CADD or georeferenced plats were not available,

the GIS team incorporated ROW lines from the Maryland Department of Planning's Parcel Boundary GIS layer. The result of this digitization was a patchwork of ROW lines from a variety of sources.

As the ROW database feature count grew from the consistent digitization and CADD extraction efforts, the differences in precision between the various resources used to create the ROW line data became more apparent. PSD felt that it was necessary to illustrate these differences to convey a level of confidence that users could have in the ROW line's source assets. After much consideration, the GIS team decided to classify the data on five levels of ROW line quality: surveyed, computed, marginal, estimated, and intermediary. This unique approach to representing ROW data by quality level has proved to be valuable for planning purposes and site research within MDOT SHA.

1. Surveyed: The boundaries have been established directly through actual ground surveys and are associated with an original CADD design file (DGN). The design file for a surveyed ROW must be created or overseen by a professional land surveyor licensed in Maryland.

Additionally, it must meet the Maryland minimum standards as found in the Code of Maryland Regulations (COMAR). This level of quality is ideal for project planning and preliminary engineering design.

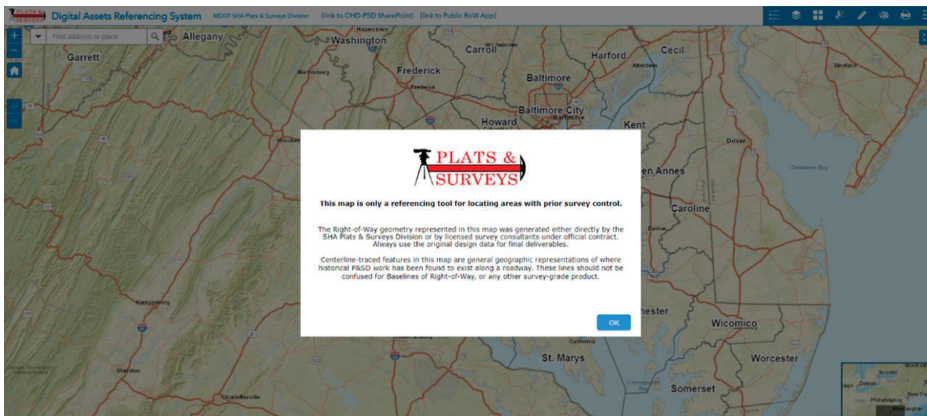
2. Computed: ROW lines of computed quality are also associated with an original CADD design file; however, the geometry in the file is a mosaic of calculations based on existing plats, deed descriptions, and construction plans, as opposed to recent ground surveys. This quality level is ideal for situations where the ROW is well established and documented.

3. Marginal: These are ROW lines derived from tracing scanned historical ROW plats that have been georeferenced to a ± 10 -foot accuracy. ROW lines are digitized from the most recently issued plats. Marginal quality lines are not associated with an original CADD design file, as the file may no longer exist or the plat predates CADD. This level of quality imparts an approximate location of the ROW, which is supported by recorded plat documents.

4. Estimated: Originally derived from historical Maryland Department of



↑ The MDOT SHA Right-of-Way polyline and MDOT SHA Right-of-Way Polygon layers in the Digital Asset Referencing System are shown above.



↑ PSD Digital Asset Referencing System is an ArcGIS Online web mapping application built specifically for PSD internal research and planning purposes.

Planning parcel boundaries on raster tax maps, this level of quality is ideal for situations where there are no existing ROW plats or other documentation and a best estimate is needed.

5. Intermediary: Extrapolated line segments are generated by a geoprocessing model developed by the PSD GIS team. Intermediary lines are used to connect the end points of adjacent ROW features to generate ROW polygons.

This quality level classification system is publicly available from MDOT, but it does not include any specific attributes that are reserved for state government and contractor access. While a line feature layer is available, it serves primarily as a reference for the information. The GIS team has also created a polygon layer using the enclosed ROW boundary lines, which can be used with geoprocessing tools. However, it should be noted that the polygon layer does not include the various quality levels associated with the ROW line layer. Both the line and polygon layers are available through the MD iMap Open Data Catalog.

Continuous Process Improvement

MDOT's ROW digitization project has been in a continuous state of evolution, progressing from its initial concept to its current state over the course of five years. The team worked county by county and plat by plat. If a file was of field survey grade, extraction and attribution were

relatively simple in the sense that the information contained could be held to be reliable. However, at other times, the information being extracted had to be checked more thoroughly to ensure that it was correct. Where subsequent work takes place, the marginal data is superseded by the new data. In this way, an already geographically complete map will see improvement in discrete areas over time.

Another factor in the time taken for the build was people: Efrain Tacoronte, the GIS leader at the Office of Highway Development, noted that it took time to train individuals on the totality of the process, from georeferencing plats to digitizing ROW lines and accurately attributing those linear features. He adds that the task of updating will effectively never be completed, as once all locations have been brought up to a given standard, there will still be new projects and therefore new information.

It is the qualitative element that makes the work done in Maryland stand out. "We are seen as providing an accurate representation of the right-of-way data, with the different qualities reflected in the levels," said Tacoronte.

Data maintenance is critical to the ongoing success of the ROW digitization effort. PSD has developed rigorous processes to review and update the ROW layer when new MDOT SHA projects that alter ROW boundaries are completed or when newer information is found. To start,

the team developed a right-of-way error reporting tool in ArcGIS Survey123 that allows MDOT employees to report errors or outdated features.

In addition, PSD staff have regular QA/QC checks they perform on the data, as well as a daily reconciliation of database versions to ensure data currency. The regular improvement and maintenance of this dataset have made it an essential tool for Maryland's transportation industry.

On-Screen Asset

The MDOT SHA's Plats and Surveys Division's georeferencing and right-of-way digitization initiatives demonstrate how technology and innovation can be used to preserve and make critical information accessible for public use. As of 2023, over 10,800 miles of ROW of different quality levels have been produced by the PSD GIS team across the state of Maryland. The dataset has been published as a feature service to MDOT SHA's ArcGIS Online data catalog and incorporated into web mapping applications accessible to MDOT users.

The MDOT SHA ROW dataset is a valuable resource for infrastructure planning and development, as well as for researchers and historians. Through the implementation of a quality-level system, MDOT SHA has been able to enhance the level of detail within the ROW boundary dataset, which has ultimately resulted in a more comprehensive and reliable source of information. MDOT SHA's commitment to maintaining and improving this dataset ensures that it will remain an invaluable asset for Maryland's land development and planning, while serving as a model for other transportation agencies seeking to improve on their own GIS data.



To see four ways GIS can aid right-of-way management, go to go.esri.com/ROWSteps.



Empowering Rural Communities: Mid-Shore Council on Family Violence's GIS Program Revolutionizes Domestic Violence Support

For more than four decades, the Mid-Shore Council on Family Violence (MSCFV) has been at the forefront of providing comprehensive services to domestic violence victims in Maryland's rural midshore counties. With its commitment to empowering survivors and addressing the unique challenges faced by rural communities, MSCFV leverages GIS technology to revolutionize the way domestic violence victims access vital resources. Applying a geographic approach to their programs and initiatives has earned them recognition, notably the prestigious Domestic Shelters Purple Ribbon Award.

A Need for Location-Based Solutions

Since its establishment in 1980, MSCFV has been a crucial lifeline for domestic violence survivors in Maryland's rural midshore counties. The region's rural nature is characterized by key industries such as farming, fishing, tourism, and health care. To meet their unique rural challenges, MSCFV staff knew they needed to apply location-based solutions to provide comprehensive services and efficient case management.

During their time with the agency, survivors receive a variety of services: case management, legal representation,

housing support, economic empowerment, and other supports for their journey. These services impact survivors and their families in many tangible and intangible ways.

Rural victims of domestic violence encounter unique challenges that compound the difficulties of escaping abusive situations. Economic constraints, limited employment opportunities, transportation limitations, lack of affordable housing, the need to leave with pets, community misconceptions, social and geographic isolation, childcare constraints, and food insecurity contribute to the complexity of their circumstances. In addition, the social cohesion of rural communities can make it hard to access help.

GIS Applications: A Beacon of Hope for Victims

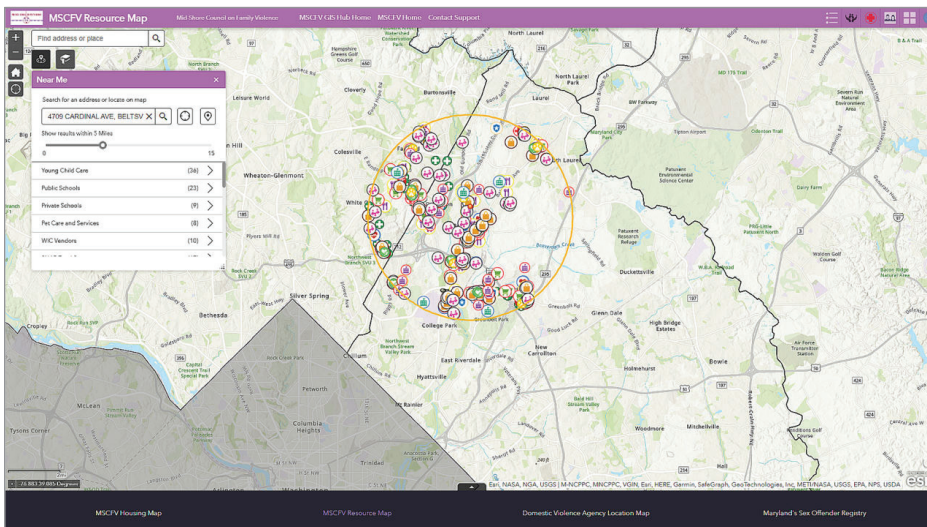
Recognizing the pressing need to address these barriers, MSCFV embarked on an innovative journey to leverage GIS technology. The MSCFV GIS Hub was built to empower victims by facilitating access to safe and affordable housing, transportation options, and local community resources. The organization needed a one-stop shop for clients to identify where they can find basic necessities such as food and medical care,

as well as connectivity information like Wi-Fi hot spots and cell service coverage crucial for clients living in relative isolation. The program transitioned from an initial partnership with a local college to an in-house deployment hosted with Amazon Web Services to ensure greater control over scheduling and data management.

Created using ArcGIS Online, MSCFV GIS Hub integrates data from various sources, including popular rental property platforms like Zillow.com, Apartments.com, Realtor.com, and affordable housing options from MDHousingSearch.org. This comprehensive database also provides critical information on services and resources surrounding a chosen housing location, including schools, medical facilities, grocery stores, law enforcement agencies, courthouses, and local social service organizations. This allows MSCFV to help clients make the best possible decisions when seeking housing.

The Impact: Winning the Domestic Shelters Purple Ribbon Award

The MSCFV GIS program has gained significant recognition for its transformative impact on domestic violence support throughout the state. The program's dedication to providing crucial resources has been indispensable in ensuring the safety and well-being of



↑ Once a housing location is identified, clients can understand what resources and services are near the desired location.



↑ MSCFV team Accepting the Domestic Shelters Purple Ribbon Award

victims and their families.

As one MSCFV client stated:
 “Surprisingly, here [this rural area] would be the last place I would think I would get any help; I think in the city there would be more resources or somewhere where there’s more people and organizations involved. I mean, I just can’t believe how smoothly everything has gone! I mean, it isn’t smooth ‘cause it’s scary and you don’t know what’s gonna happen next, but looking back on it in a timeline, everything just fell into place and seriously, it was all Mid-Shore.... they’ve hooked me up with attorneys, the care packages, with transportation, with—energy assistance, food stamps, medical assistance—just resources in the community, support groups, things like that.”

These achievements, coupled with the program’s commitment to leveraging innovative technology to support survivors, led to MSCFV being honored with a prestigious Domestic Shelters Purple Ribbon Award as the Rural Initiative of the Year 2023.

Sally’s story shows the important role GIS technology plays in client services. Sally reached out to MSCFV in early 2021 for assistance for herself and her two young children, to escape an abusive relationship. In addition to providing legal assistance, advocacy, and emotional support, MSCFV enrolled Sally in the transitional housing program. Sally used that time to obtain a divorce, start a business, and heal emotionally. Recently the MSCFV GIS Hub assisted her in

searching for a house to purchase. Today Sally and her children are enjoying the safety and security of their own home, thanks to the streamlined services easily found in the MSCFV GIS Hub.

A Glimpse into the Future: Expanding Services and Empowering Clients

Looking ahead, MSCFV aims to further expand its GIS applications to better serve domestic violence survivors and the wider community. The organization plans to develop client-facing applications focused on employment and housing, empowering survivors to rebuild their lives and achieve self-sufficiency. In addition, MSCFV would like to create portals that extend support to other victim services, including law enforcement, legal services, and youth services, fostering collaboration, and strengthening the network of resources available to those in need.

The Mid-Shore Council on Family Violence’s GIS program has emerged as a beacon of hope for domestic violence survivors in rural communities and throughout Maryland. By addressing the unique challenges faced by victims, the program has revolutionized access to vital resources, empowering survivors on their path from victimhood to self-sufficiency. With an illustrious history, impactful achievements, and ambitious plans for the future, MSCFV is poised to continue leading the charge in leveraging technology and collaboration to support and uplift those affected by domestic violence in Maryland’s rural mid-shore counties. continue leading the charge in leveraging technology and collaboration to support and uplift those affected by domestic violence in Maryland’s rural midshore counties.



To ensure your clients have easy access to services, please go to go.esri.com/NPOforSLG.

Five Public Health Areas Where Location Cannot Be Forgotten

Geographic information system (GIS) technology is leveraged by leading health organizations to address homelessness, substance misuse, global pandemics, health inequity, and the growing mental health crisis. To prioritize efforts, GIS technology and tools collect data; perform analysis; help allocate resources; communicate with decision-makers; and, ultimately, help improve health outcomes.



HUMANS IN CRISIS

Issues such as homelessness, the opioid epidemic, racial inequities, and food insecurity require organizations to respond in crisis mode. GIS analyzes which communities are impacted the most, then work collaboratively between departments and with community organizations to direct resources to areas in need.



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ACCESS TO CARE

Understanding access to health care and health-promoting services includes calculations of travel time and distance as well as social, racial, economic, and physical barriers to getting care. Location-based solutions help you understand gaps in accessibility and show where opportunities to intervene exist.



HEALTH EQUITY

The need to advance health equity is central to all health workflows. GIS technology allows you to understand the connection between where things are happening, where service gaps exist, and where you need to plan interventions.



PUBLIC HEALTH PREPAREDNESS

Location data is essential to every phase of planning, response, and recovery in the face of a crisis. GIS tools such as dashboards and real-time monitoring optimize response efforts to events ranging from extreme weather conditions to pandemics.



ENVIRONMENTAL HEALTH

Communities are at risk from deadly chemicals; disease; and contaminated air, water, and soil. GIS technology enhances environmental health monitoring, helps comply with regulatory requirements, explores possible solutions, forecasts potential hazards, and promotes environmental justice, helping keep all communities safe.

Learn more here
go.esri.com/HHSforSLG



Delineating the Future of Wetlands: How States and Local Governments Use GIS to Support Wetland-Related Workflows

By Sunny Fleming, Environment and Natural Resources Industry Specialist at Esri



Since the Clean Water Act was enacted in the 1970s, industry, environmentalists, litigators, and politicians have fought over its semantics. To an outsider looking in, it is perhaps one of the most fascinating and contentious pieces of environmental legislation in our country's history. When it was first enacted, few state or local governments had water regulations of their own, and since then, many governments have continued to rely on federal oversight to manage their water resources.

We have learned a lot about the role that clean water plays in our health and the health of the environment since the '70s. Wetlands play a significant role in buffering the impacts of flooding, filtering harmful pollutants, and protecting sensitive plants and animals. The products of a healthy wetland impact our communities' economies positively, with benefits to the GDP and local home values and providing outdoor recreational opportunities.

A recent ruling by the Supreme Court of the United States (SCOTUS) is already making waves among regulators and the regulated community alike. Federal permit determinations are at a standstill while federal agencies seek guidance on what this latest ruling means for their regulatory programs, and some states are fielding calls from landowners about what this means for them. According to the Environmental Law Institute, only 19 states have varying levels of regulations beyond that of what the definition of *Waters of the United States* covers.

While the full impact of this ruling remains to be seen, one conclusion is that communities and states will play a larger role in protecting their wetlands and water resources. Many viewed the announcement Phoenix made the same week as the SCOTUS ruling as evidence of this.

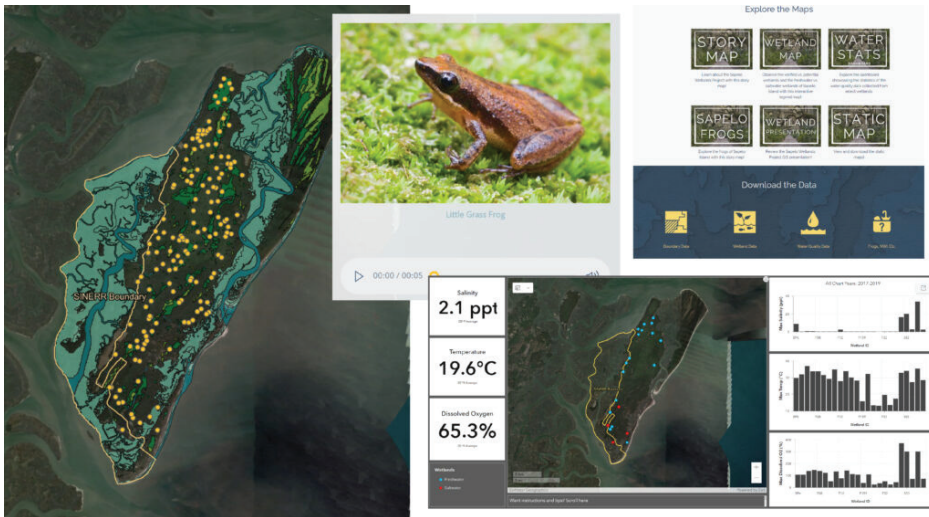
Fortunately, since the 1970s, GIS technology has vastly improved our ability to quickly deploy the tools necessary to understand intersectional issues of the environment, the economy, and our social systems and make data-driven decisions that keep our needs in harmony with our environment.

Let's examine how GIS is already being used to help us facilitate a variety of workflows related to wetland protection.

A screenshot of a web application titled "West Virginia Wetland Mapping 2022 - 2023". The page features a background image of a lush green wetland. Below the title, there is a "Follow" button and a paragraph of text explaining the project's goal: "Ducks Unlimited, Inc. is working with the West Virginia Department of Environmental Protection, Division of Water and Waste Management to generate updated National Wetland Inventory (NWI) spatial data for 23 counties in northern West Virginia. You can read more about the West Virginia Wetland Mapping Initiative [here](#). The NWI is a public resource, easily accessible on the US Fish and Wildlife's [Wetland Mapper](#)." At the bottom, there is a summary table with three columns: "Miles Rivers Mapped", "Wetlands Mapped (Acres)", and "Counties in Draft Form".

Miles Rivers Mapped	Wetlands Mapped (Acres)	Counties in Draft Form
7,948.19	5,177.9	5

↑ West Virginia's wetland mapping hub site is used to summarize progress and share data.



↑ Screenshots from the SINERR Wetlands GIS Hub illustrate the variety of media types the organization uses to help inform and educate the public.

Using Digital Tools for Collecting Field Observations

Wetland delineation is a critical step in understanding how a given development project may or may not impact water resources in the project area. Wetland delineation is conducted by trained scientists who understand the hydrologic, floristic, and soil characteristics that define a wetland’s boundary. To document these observations quickly, environmental scientists use tools like ArcGIS Survey123 and ArcGIS Field Maps. These tools provide organizations with the capabilities to configure data collection to meet regulatory requirements and standards, while the end user is given an intuitive

interface that walks them through collecting the right information. This reduces the overhead time required to train new staff, while ensuring that all staff are entering information consistently and accurately, on- or offline.

The Washington State Department of Ecology publishes two wetland rating systems to account for unique conditions found in the western and eastern parts of the state. These rating systems allow stakeholders to understand the value a given wetland may provide, whether that is ecological, economical, recreational, aesthetic, or some combination of these. The Washington State Department of Transportation (WSDOT) converted these

system ratings to an ArcGIS Survey123 tool that can be used to help scientists in the field collect this information in a standard way.

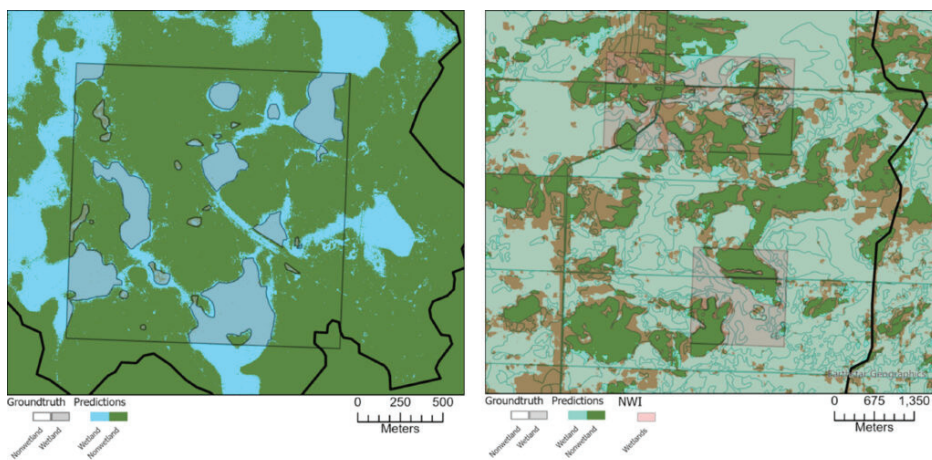
Environmental consultants are also using GIS tools to facilitate this work. For example, Fisher Associates, an architecture, engineering, and construction (AEC) consulting company, uses ArcGIS Field Maps to accurately depict conditions in the field while also ensuring that staff’s data collection processes are up to the latest regulatory requirements, which can change often and vary across a landscape. This allows staff to review field information on the fly, correct jurisdictional attributes on wetlands as necessary, and amend other biological and environmental information.

Streamlining Applications and Reviews

Geographic tools can also facilitate the preparation of project review and application processes. For example, Survey123 capabilities, like being desktop or mobile friendly combined with the app’s ability to enforce conditional logic and business rules, makes the app invaluable for facilitating application processes.

Rhode Island Department of Environmental Management was tasked with providing statewide standards that municipalities must meet when assessing wetland impacts. The department created a new permit type for certain eligible projects that have little or no wetland impact, with the intent of streamlining the permitting process. Staff used Survey123 in a desktop setting to facilitate the application process. An intuitive interface walks applicants through the required fields and leverages conditional logic to ensure that they are eligible for the general permit. Once the permit application is submitted, it automatically generates a formatted email to the applicant to review and finalize the submission.

South Carolina Department of Natural Resources leverages its enterprise GIS to facilitate environmental review for



↑ The map on the left illustrates machine learning predictions using WIM with lidar-derived explanatory variables. The map on the right illustrates this method in combination with National Agriculture Imagery Program (NAIP) imagery and compares these predicted outputs to National Wetland Inventory (NWI)-mapped wetlands for reference (in pink).

continued on page 22

Delineating the Future of Wetlands continued from page 21

sensitive species through a public-facing portal. Hierarchical access to datasets ensures that collaboration can occur for all stakeholders at the appropriate level. Environmental professionals can submit reviews and receive automated reports, with more complex reports being sent to internal staff for a more thorough review. Staff biologists are no longer overburdened with hundreds of manual reviews and can reallocate their time to other valuable business processes they are responsible for. Stakeholders have more trust in the processes because reviews are now consistent and standard across the program.

Achieving Better Planning with Better Data

Data that has been collected using ArcGIS field mobility tools comes into a centralized location with consistent standards and structure, so it can easily be leveraged in artificial intelligence (AI) models to

predict where else wetlands may occur. This provides all stakeholders with greater insight early in the process, reducing time and costs during preconstruction planning. Widely available datasets, like lidar, satellite imagery, and other types of remotely sensed data, can be combined with the wetlands delineated by environmental scientists to develop these AI models with Esri technology.

Arc Hydro is a no-cost extension for ArcGIS Pro that contains the Wetland Identification Model (WIM) toolset. WIM transforms lidar elevation data into hydrologic patterns that indicate wetland formation. These elevation-derived indicators can be combined with other remote sensing data to develop either machine learning or deep learning models.

The results of these outputs can be shared with the public so that communities, planners, and prospective developers can understand ahead of time where wetlands may or may not exist, which reduces time and cost during the design phase of project planning.

Engaging and Educating Stakeholders on Water Quality Benefits

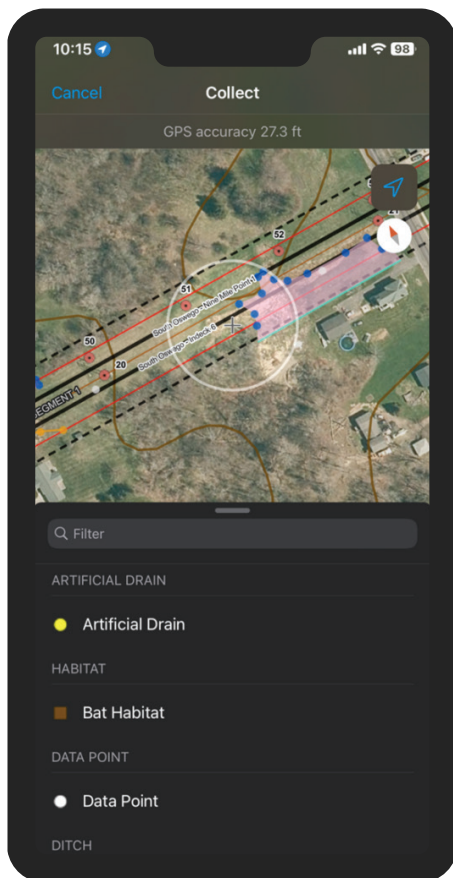
The same data leveraged in a regulatory workflow can be used to illustrate the benefits of these healthy resources to all stakeholders. Gaining public support for projects that have multiperspective benefits can be made easier by visualizing these relationships on a map and allowing stakeholders to explore them virtually. Maps are intuitive, and the audience can immediately imagine themselves as part of the project and provide valuable feedback that helps inform and improve project outcomes.

A hub site—created using ArcGIS Hub—from the Sapelo Island National Estuarine Research Reserve (SINERR) combines ArcGIS StoryMaps, ArcGIS Dashboards, and ArcGIS Instant Apps to tell a rich story of wetlands on barrier islands along Georgia's coast.

West Virginia Department of Environmental Protection, Division of Water and Waste Management, is working with staff at Ducks Unlimited to help update their wetland maps, which contribute to the National Wetland Inventory. As part of this effort, they used ArcGIS Hub to create a simple but effective hub site that communicates high-level metrics related to the project's status, as well as a status map. Interested stakeholders can follow the initiative to stay up-to-date on project events and milestones.

Tools such as ArcGIS Dashboards can be used to communicate a wide variety of summary statistics, such as an interesting example out of Saint Mary's University of Minnesota that depicts both wetlands and streams in the Upper James River Watershed relative to their protected status under the 2020 definition of Waters of the United States.

These examples from our user community illustrate how states and local governments can leverage the science of geography and a geographic approach to strengthening or implementing wetland programs. Field mobility tools such as Survey123 and Field Maps can be shared with the scientific community to ensure that users follow standards and guidance and quickly capture data in the field. These same tools can be used to facilitate application processes for permits or other requirements. Valuable data collected during these processes can then be used to predict where else wetlands may occur, for targeting mitigation actions or prescreening purposes. Finally, visualizing our natural resources on a map allows us to understand their relationship to ourselves as well as how wetlands play a vital role in the health of our communities and economies.



To learn how Esri GIS supports other environmental workflows, go to go.esri.com/WetlandsSLG.

Esri News for State and Local Government



State and Local Government | ArcGIS Solutions Video Series

ArcGIS Solutions is a collection of industry-specific configurations that align with your organization's needs, transform your use of ArcGIS, and help you maximize your investment in location-based data and technology. They use your authoritative data and are designed to help you improve operations, provide new insight, and enhance services. Go to go.esri.com/SLGSolutions for a full library of ArcGIS Solutions resource videos.



Four Steps to Develop an Equity Strategic Plan | Brochure

Every government, nonprofit, and business has an intent for how it wants to address inequities in its communities and operations. GIS technology is foundational in the approach to carry out four essential steps. Learn what these steps are at go.esri.com/4StepPlan.



Reinventing Planning | Podcast

Reinventing Planning, an Esri original podcast, will empower you to take a modern approach to working with planning, housing, and economic development policy. Gain industry insight as Keith Cooke, global industry manager for planning and community development, facilitates interviews with planning professionals on using GIS for their innovative projects. Listen to the podcast at go.esri.com/PlanningPod.



ArcGIS Living Atlas of the World | US Census American Community Survey Update

The 2018–2022 American Community Survey (ACS) five-year estimates are now available within ArcGIS Living Atlas. These ready-to-use layers empower people to instantly begin to explore, map, analyze, and download the data at state, county, and tract levels. Learn more at go.esri.com/ACSUpdate.



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