Esri News
for State & Local Government

Summer 2021

SANDAG Proposes 5 Big Moves to Forever Change Transportation in the San Diego Region

If given the right transportation alternatives, would people change their travel patterns? Leaders at the San Diego Association of Governments (SANDAG) are posing that very question to elected officials, stakeholders, and the public. Through a data-driven approach, they are aiming to understand community characteristics, lifestyles, and travel patterns to and from destinations such as employment and activity centers. These leaders' objective is a transformative plan that will provide a faster, fairer, and cleaner transportation system for generations to come.

The San Diego region of Southern California is one of the fastest growing areas and economies in the nation. By 2050, San Diego County will be home to more than 3.75 million people.

With this growth come new challenges: increased traffic, new travel patterns, and changing transportation needs. So much depends on resolving these transportation challenges as the area's economy thrives on efficient connections between housing and jobs, retail centers and business hubs, students and education, and visitors and attractions.

SANDAG, a Metropolitan Planning Organization (MPO), serves the governments of San Diego County and the 18 cities in it. One of SANDAG's primary

roles is to develop a long-range regional transportation plan that provides efficient transportation systems and improves quality of life. In a bold move to design a new vision that would deliver a world-class transportation system for the region, SANDAG turned to data and location intelligence from a geographic information system (GIS). The technology supported the organization's work in crafting a vision—which

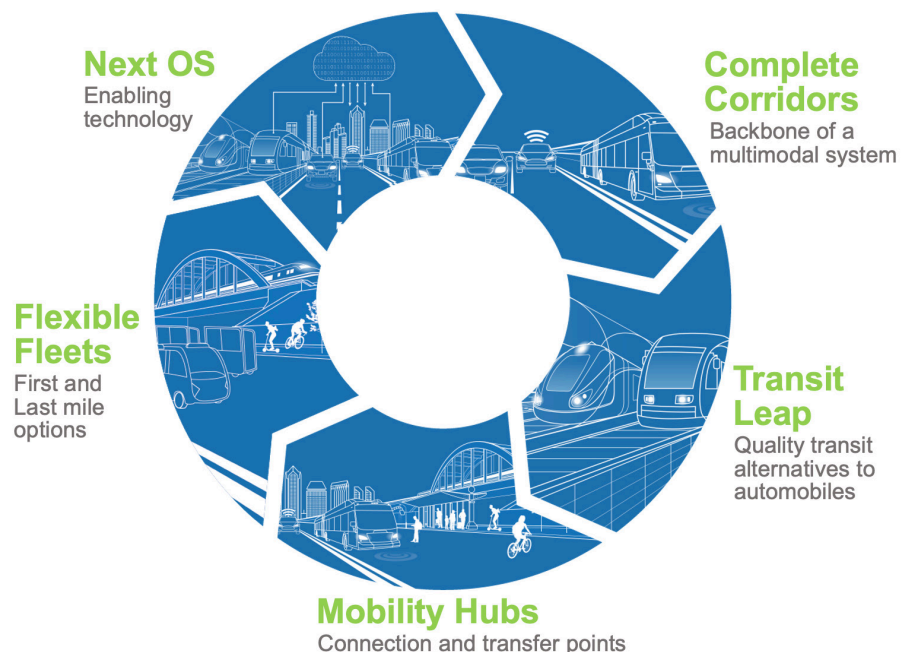SANDAG calls the 5 Big Moves—that will take the region into the future.

Creating the 5 Big Moves

Below are the key strategies needed to execute SANDAG's vision:

• **Next OS**—Enable new and better services for residents, transportation operators, and planners through technology
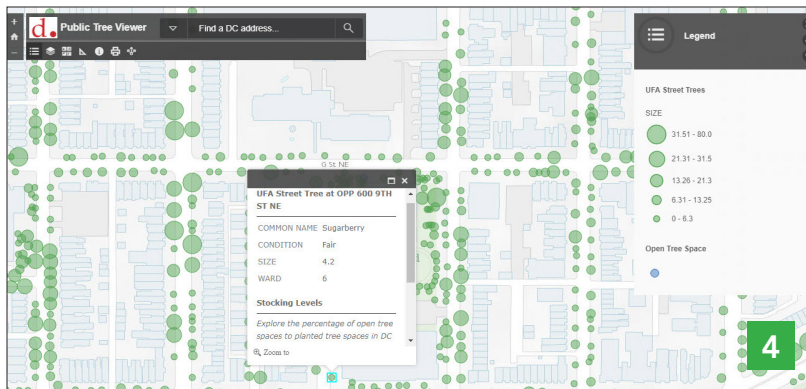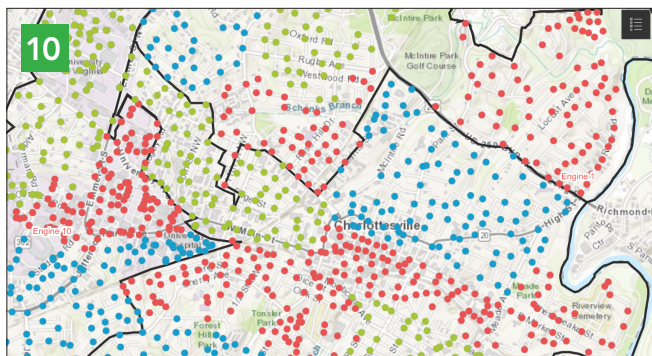
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SANDAG's 5 Big Moves

Next OS
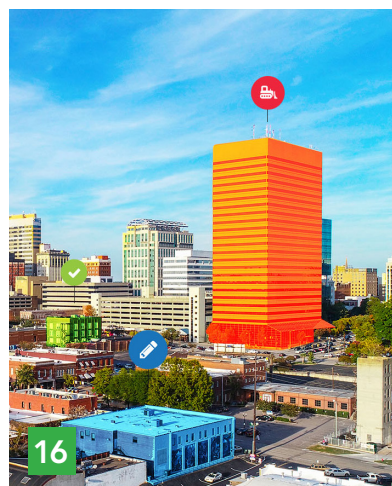Enabling technology

Complete Corridors
Backbone of a multimodal system

Flexible Fleets
First and Last mile options

Transit Leap
Quality transit alternatives to automobiles

Mobility Hubs
Connection and transfer points

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Urban Forestry in DC: Resource Equity and Data Transparency

The District Department of Transportation (DDOT) Urban Forestry Division (UFD) is the primary steward of Washington, DC's 170,000 public trees and has a mission to keep this resource healthy, safe, and growing. Each year, the UFD prunes, plants, and removes thousands of public trees. These decisions impact the lives of both residents and visitors, as trees are critical to the city's well-being. These trees improve the air and water quality; cool the neighborhoods; provide critical habitat for birds, bees, and urban wildlife; and more.

With a long history of caring for the extensive forest canopy in DC, the UFD has meticulously assembled datasets and applications to help in the division's forest management mission as well as to communicate with a variety of audiences.

The UFD has also been a longtime proponent of Esri technology, using it not only to help people understand and connect with the forest that surrounds them but also to provide transparency into the process of allocating service resources equitably. This has been accomplished over the years through ArcGIS StoryMaps, ArcGIS Dashboards, configurable web applications, and custom mapping applications. However, what has been missing was a cohesive framework to bring all the components together under one digital roof.

To address this need, UFD has created an interactive community engagement site using ArcGIS Hub technology. UFD worked in collaboration with Esri Silver partner SymGEO, a Maryland-based GIS company specializing in ArcGIS

Hub, ArcGIS Online, and state and local government solutions. The hub site is designed to let users explore information describing the history, value, and management of the urban forest in Washington, DC, and can be found at ddot-urban-forestry-dcgis.hub.arcgis.com/.

The UFD's hub site has been accessed more than 32,000 times over the last year and has been a popular destination for the public to learn about UFD services and resources. The urban forest story begins with a look to the past, introducing the audience to the long history and important role of trees in DC. The hub site also lets users explore the impressive variety of trees available for community enjoyment and leverages several applications and digital stories developed by the UFD. The flagship dataset, the

↑ DDOT Urban Forestry Division feeds work order data in real time into ArcGIS Hub to inform residents faster.

Public Tree Map, elegantly displays a tremendous amount of current information about the urban tree canopy. Links are provided to both the map and the underlying data for the community to use and explore.

The Services section of the hub site provides complete transparency into existing work requests, open work orders, and planned and recently completed services. The data is sourced from the UFD's internal work order management system and aggregated by geography, and summary statistics are presented using ArcGIS Hub and ArcGIS Dashboards technology. The Planting by Ward dashboard has been viewed thousands of times over the last year and provides a high-level overview of the equitable distribution of planting resources. Interactive web applications enable users to explore local work orders and were designed using ArcGIS Web AppBuilder. Often, tabulated results and the beneficial impact of these projects go unrecognized. UFD staff created several ArcGIS StoryMaps stories to convey the importance of the work being done equitably across all geographic wards. In addition, an ArcGIS Survey123 form can be found at the bottom of the hub site for two-way community engagement to continually improve service offerings.

As part of the UFD's hub site, several subinitiatives were developed for specific project purposes. One of these

subinitiatives, Urban Wood Reuse: for Schools, discusses the benefits of urban wood reuse; where the wood comes from; and the variety of products available for schools including benches, stumps, and woodchips. It also provides a link to an order form as a convenient and easy way to request wood products.

Another section of the site, Forest Health, was designed to educate the community on how DDOT staff and DC residents help keep the urban canopy vibrant, healthy, and productive. The Forest Health pages discuss a range of preventive measures—including the Early Detection Rapid Response (EDRR) and the Cryptic Wood-Borer Insect (CWBI) programs—that the UFD takes to guard against pests, and tell how DC residents can identify and report invasive species.

For More Information

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↑ Service requests, open work orders, scheduled work, and completed work reports provide complete visibility into UFD's service cycle.

"We are excited to share our forest health programs with the public in this new format. The [hub site] is dynamic and easy to use. It allows users to learn about pests and pathogens to look out for, while also giving them the opportunity to report their observations."

—Kasey Yturralde, Forest Health and Community Outreach Specialist, DDOT Urban Forestry Division

The Property Mappers

The thousands of dashboards that have been created using ArcGIS Dashboards, from Esri, keep organizations and the public in the know, with a vast amount of valuable information provided daily.

A dashboard can track election results, 3-1-1 requests for service, bird migrations, building permit information, opioid overdoses, capital improvement and real estate development projects, and crime statistics, to name a few examples.

Creative thinkers always come up with new ideas for dashboards, such as the Real Estate Sales Dashboard from the Franklin County Auditor's Office in Ohio. The dashboard on the auditor's website displays residential transactions data, including the following:

- The residential real estate sales total for Franklin County as well as more than 80 local municipalities, area commissions, school districts, and townships
- The median sales price for homes in each area
- The number of sales in each area
- The number of sales per school district, displayed in a pie chart
- The location of each building sold, shown on a map (Pop-ups on each feature include a photograph and the address of the building, the property's acreage, and the parcel ID. The

parcel ID links to more detailed information about the building, including the date it was sold, its owners' names, the year the structure was built, its square footage, the current market value of the property, and the current taxable value.) The data is updated monthly.
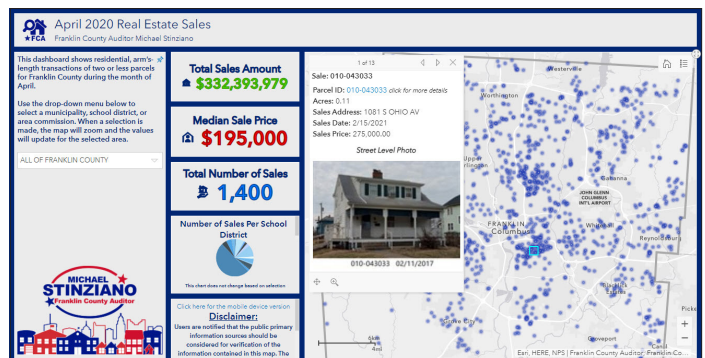
↑ The dashboard includes a map showing the location of the properties sold, photos of the buildings, and the median sales price in the area.

Franklin County auditor Michael Stinziano said development of the Real Estate Sales Dashboard resulted from a request from neighborhood groups. They wanted the auditor's office website

to provide authoritative, easily accessible, and hyperlocalized real estate sales information, due to the impact that the current booming real estate market is having on neighborhoods' property values and school districts' funding in Franklin County.

"Ohio is one of the hottest real estate markets in the country," Stinziano said in a recent interview."

"Having such a competitive housing market means buyers, sellers, and agents are constantly reviewing properties for sale," Stinziano said. "Our dashboard gives accessible and transparent data to help inform those choices."

Franklin County (pop. 1.3 million) is home to Ohio's state capital, Columbus, named by *Forbes* magazine in 2019 as the top real estate market in the nation. Columbus was also recently included in the Top 10 Outperforming Metro Markets Report by the National Association of REALTORS, meaning that over the next three to five years, real estate sales should be strong based on factors that make home buying more achievable. Some of those factors include housing affordability for residents new to the area, home price appreciation, and consistent job growth relative to the national average.

Realtors like the dashboard because it's a good resource to search for comparable sales. School district officials also will find the dashboard useful because they can see, at a glance, the number of home sales in their particular district each month, along with the total sales amount and the median sales price.

Matt Shade, the GIS manager for the auditor's office, said that this project was the first time his team had created a configurable web app using ArcGIS Dashboards and that it was easy to do.

Each month, the previous month's real estate transfer data is plotted as points on a map. The points are queried to ensure that they are valid arm's-length transactions. Using an ArcPy script, boundaries for each area are overlaid, and summary statistics are generated to get the number of transactions, the median sales price, and the total number of sales for the month.

"We publish that through ArcGIS Online, and it goes to the dashboard," Shade said.

Once the geoprocessing script was developed, design considerations became the main focus. The GIS team kept the amount of information on the dashboard to a minimum, with only four major data points plus the map.

"We utilized Esri's training when we [went] to share this data," Shade said. "The recommendation from Esri is to keep it simple. You don't want to overload people [with information]."

To find a solution for mobile viewing, the team developed a second dashboard that only displays statistics for each area and not the map. Users are redirected based on screen width. Another consideration was the basemap. The team decided to combine Esri's World Light Gray Base map with labels from Esri's Human Geography basemap. Developing the dashboard took the GIS team about a month from start to finish.

The GIS team used ArcGIS Dashboards for this project because it provides a seamless and efficient way to share key statistics generated in ArcGIS, according to Shade. The team plans to release an ArcGIS StoryMaps app highlighting annual sales trends by compiling monthly data from the Real Estate Sales Dashboard and perspectives from local real estate experts.

↑ Viewers of the dashboard can find vital information about each property sold, including the address, sales date, and parcel identification number.

For information on how assessors and local governments can use GIS to increase residents' trust and confidence with public-facing technology, visit go.esri.com/PublicPropInfo.

Four Key Takeaways from the 2021 Esri Health & Human Services GIS Conference

On April 21 and 22, Esri hosted the virtual 2021 Esri Health & Human Services GIS Conference. The conference brought professionals in public health, social services, hospitals, health-care systems, insurers, academia, and commercial segments together to share best practices on the use of spatial thinking and GIS technology to promote health. Four clear patterns emerged from the experiences shared by the various speakers—and these patterns will impact the health GIS industry. Below is a summary of these four key takeaways that you can share with your organization to help it use GIS to advance quality of life and promote healthier communities.

1. Infrastructure Needs to Be Reusable for Multiple Health Use Cases

Organizations must set up the IT infrastructure and train their staff on GIS tools that they not only can use under ordinary circumstances but also can quickly adapt for future emergencies. The organizations that were able to quickly respond and provide information tools to the public at the start of the COVID-19 pandemic were those that had GIS in place for rapid deployment to support continuity of operations. Staff who are comfortable in geographic information systems and workflows are able to adapt GIS technology when new health challenges arise.

2. Innovation on Demand Is Possible

Organizations are leveraging ArcGIS Solutions in massive numbers to scale GIS across departments and workflows. These maps and apps that were designed with health professionals in mind have allowed organizations to quickly deploy powerful dashboards, information products, and decision-making tools for situations ranging from natural disasters to disease outbreaks, point-in-time counts of people experiencing homelessness, the opioid crisis, and vector control as well as everyday health-care workflows. These free tools have increased

business impact for organizations of all sizes for decades. The COVID-19 pandemic response continued to prove that ArcGIS Solutions allows for innovation on demand as organizations adapted these solutions and deployed them to meet unforeseen workflows including providing testing site locators, contact tracing, and vaccine distribution.
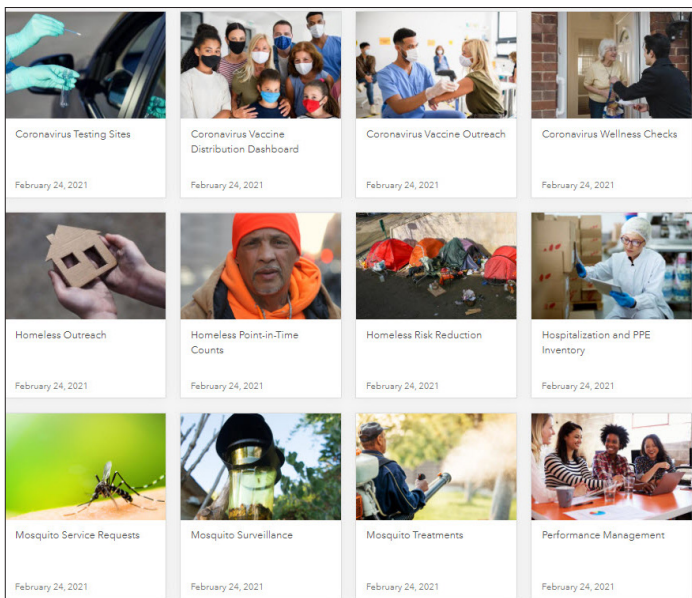

↑ Explore the gallery of free ArcGIS Solutions built to support health and human services workflows

3. Equity Must Be Part of Everything We Do

We must acknowledge that some communities become more vulnerable than others, and we must hold ourselves accountable by exposing barriers in neighborhoods that have consistently been left behind. GIS has been acknowledged as a foundational platform for meeting the needs of communities, whether you're making decisions about where to place resources, who needs more education on available services, who is at a disadvantage, or where the at-risk groups are. On topics such as health-care access, vaccine distribution, health services placement, access to healthy and affordable foods, easy access to parks, and identification of vulnerable populations in areas with poor air quality, health professionals are at the forefront of the discussion through efforts in achieving health equity. You

must apply an equity lens to everything you do. By using data, maps, spatial analysis, and dashboards, you can ensure that you are delivering equitable experiences and healthy outcomes for all in the community.
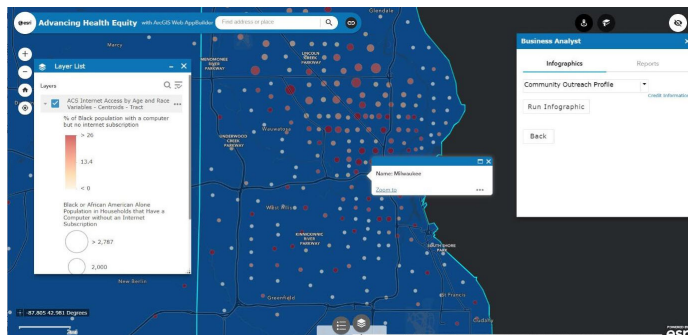
↑ Data, applications, and dashboards help you address health equity.

4. ArcGIS Is Now More Secure and Privacy Standards Compliant

Esri announced a new, exciting technological advancement that will become the best of breed in the GIS industry and improve the security and privacy standards compliance posture for ArcGIS users in health: Health Insurance Portability and Accountability Act (HIPAA)-aligned geocoding. Being in alignment with HIPPA means that Esri's ArcGIS World Geocoding Service—which finds patterns that associate addresses with locations—has the ability to identify protected health information (PHI) and personally identifiable information (PII) data and treat it with privacy and security in mind.

Now, ArcGIS is able to do the following: filter PHI/PII data from requests to the service—in other words, it can separate PHI data from PII data; limit the viewing of log files—restrict who can view the log files as well as how long the files exist; and create a secure area with limited Esri employee access—and those employees have had all the required trainings. Together, these capabilities benefit the user with the knowledge that Esri has safety controls for PHI/PII data that is processed by the service.

To check out the event proceedings and additional resources about the above-mentioned topics, visit go.esri.com/2021-health-recap.
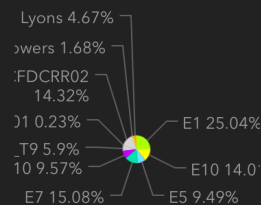
At a Glance

1,515	72	34
Registrants	Countries Represented	Speakers

CFD Hydrant Inspections Fall 2020

Hydrants Inspected

1,382

Last update: a few seconds ago

Inspections by Unit

Lyons 4.67%
owers 1.68%
FDCRR02 14.32%
01 0.23%
E1 25.04%
T9 5.9%
10 9.57%
E10 14.0
E7 15.08%
E5 9.49%

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Hydrants Left to Inspect

9
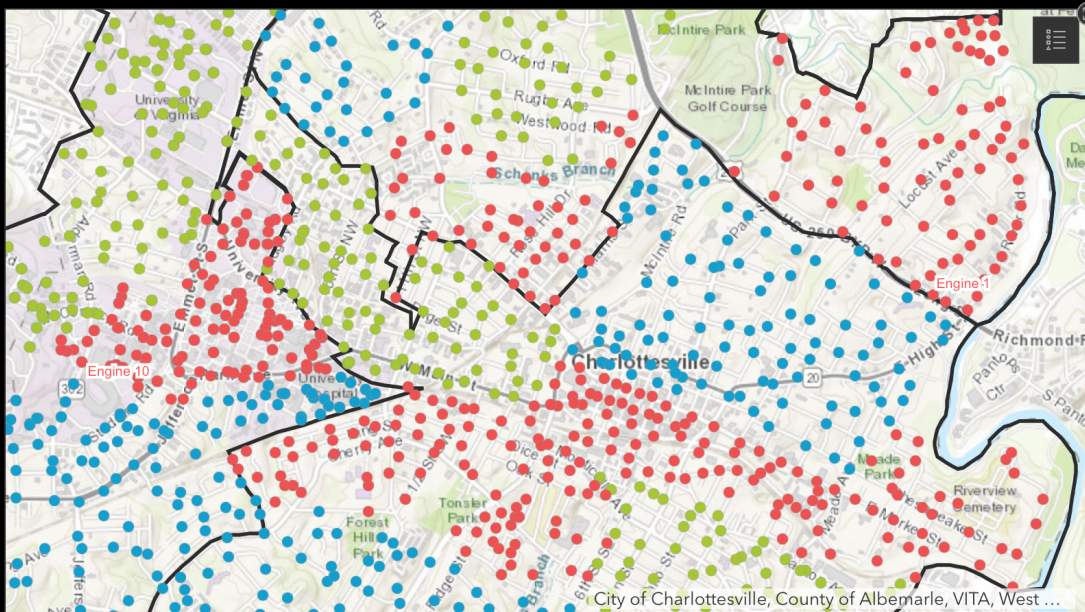
Hydrant Inspections by Shift/Unit
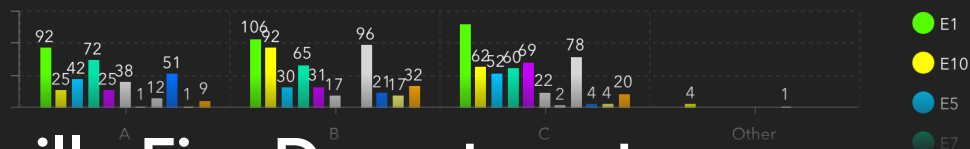
● E1
● E10
● E5
● E7

Charlottesville Fire Department Tracks Fire Hydrant Inspections with an All-in-One Mobile Work App

↑ A dashboard is used to monitor the annual fire hydrant inspections project status.

The Charlottesville Fire Department (FD) serves and protects the residents of Charlottesville, Virginia, by providing fire protection and emergency response to the city as well as the University of Virginia. With a wide range of services offered by Charlottesville FD, including fire response, hazmat, and emergency medical services, the department has implemented best practices to deliver the comprehensive emergency services the city needs.

Accreditation is one aspect of deliver-ing superior services. The model set forth by the Commission on Fire Accreditation International requires fire departments to foster an environment of continuous improvement and sets the fire department apart by affirming that it meets the highest standards of excellence.

As an additional layer of review, the Insurance Services Office (ISO) creates ratings for fire departments that calculate how well-equipped fire departments are to put out fires in a community. The City of Charlottesville has a Class 1 ISO rating, which is the highest ISO rating granted by this body. One requirement necessary to uphold this rating is an annual inspection of fire hydrants within the Charlottesville city limits and the University of Virginia.

Previously, inspections performed by firefighters consisted of a paper-based workflow that had those in the field manually taking notes, writing emails, and making calls to get repairs done, which was a time-consuming process. To more efficiently perform this inspection, the fire department implemented a new

app designed for mobile workforces to collect data and complete assignments, streamlining the hydrant inspection process and giving stakeholders access to real-time information.

Challenge

After the reorganization of the Charlottesville FD in summer 2020, Joe Powers, MPA, CFO, deputy chief of community risk reduction for the City of Charlottesville, began managing the department's ISO rating and the differ-ent requirements needed to maintain it, including fire hydrant inspections. The previous method for inspection was a manual process that involved firefighters printing a spreadsheet with a list of fire hydrant locations, inspecting the hydrants

in the field, and recording findings on a piece of paper.

These findings would then be transferred to a form by the firefighter and emailed to the Charlottesville Public Works division, which maintains the fire hydrants. This would be followed up by a phone call from the firefighter to confirm any needed repairs. The public works department would then create a work order to complete the fixes. To move away from the manual inspection process, a digital hydrant inspections process was created in 2018 by Lucas Lyons, a systems performance analyst for Charlottesville FD, with a mobile data collection app. However, the app had limitations and didn't allow for advanced enhancements or features.

"The digital hydrant inspections process went okay, but users in the field were asking for developer-level requests. I found we quickly hit walls, and I became somewhat frustrated by the limited features within [the app]," says Lyons.

Also, the City of Charlottesville employs a spatial database to organize all the data in the city, but according to Lyons, user permissions were a challenging obstacle.

"We have a master hydrant point file, and I had no ability to edit that and neither did the firefighters. It kind of took some lobbying to get access to things like that. The database is just a legacy system. It's not very open and editable, making collaboration difficult," says Lyons.

With improvement needed in the digital inspection process, Powers began the search for a more efficient method that would save the firefighters valuable time and enable them to more expediently complete inspections.
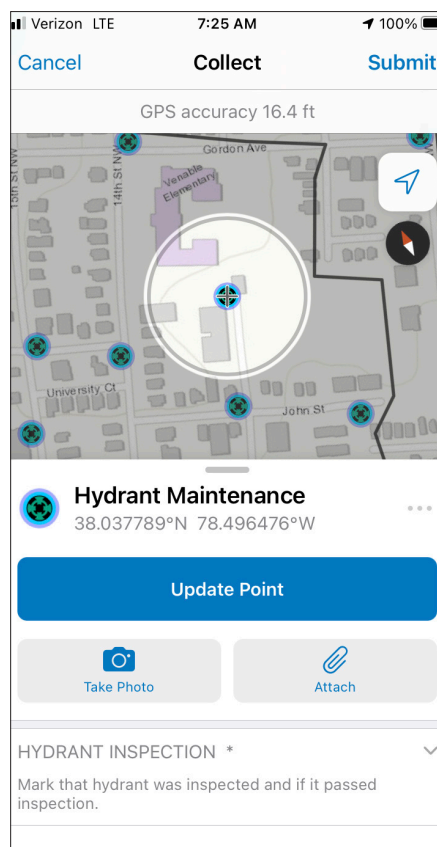
Solution

To establish an easy and efficient method that was simple for firefighters to use, Powers began working with Renee Bernstein, an Esri solution engineer, and Mike Cox, fire and emergency medical service (EMS) industry manager at Esri, who suggested testing a new product that would streamline hydrant inspection: ArcGIS Field Maps. ArcGIS Field Maps is an app designed to enable mobile

workers to view their organization's digital maps, collect and edit data, and capture location tracks.

Powers wanted to tie in the hydrant record with the inspection performed and move away from a paper-based process, so the combination of capabilities, like mobile data collection and editing, seemed to be exactly what they needed.

"We knew Charlottesville had obstacles it was trying to find solutions for. We also knew that Chief Powers and Lucas [Lyons] were pretty progressive and would . . . be good storytellers for the use of technology to improve day-to-day operations," says Cox. "So, it just seemed like a perfect fit for an early rollout of Field Maps to a fire department."

Bernstein adds, "I was learning from Chief Powers and Lucas [Lyons] that some users might not be as familiar with GIS or Esri, and they wanted a simplified process for that end user. When you can simplify everything you need into one application [like Field Maps], that's a huge thing."

↑ Data can be easily captured using the ArcGIS Field Maps mobile app.

Lyons created the solution with just a feature layer of the hydrants, and the app has inspections grouped by A, B, and C shifts and by unit, enabling firefighters to see what other shifts have completed. Lyons made it a priority to ensure all the work was divided equitably among each shift. Also, the zones are colored to provide quick information at a glance; for example, zones colored green include hydrants that have already been inspected.

"With Field Maps, you have a way to collect data without having to go through this whole process of [asking], Where should this data live? You just need to set up a feature layer, and you're good to go, and I like that," says Lyons. "I think we'll have more and better data in the future [by] having an application like this in users' hands."

After Powers and Lyons received some Field Maps training from Esri, Powers created a short three-minute training video, which he made with a teleconferencing service, to educate the firefighters on Field Maps. The video showed Lyons using the app and walking through a hydrant inspection, and the fire department's normal documentation for inspections was sent with it. Powers says the app was so straightforward, people were out inspecting hydrants using an iPad or mobile device the same day.

"I think it's a game changer for the fire service. It allows firefighters to record information and collect data [with one application], and it's what the fire department needs to be successful in collecting data," says Powers.

Result

Since the successful implementation of Field Maps, the Charlottesville FD has plans to deploy it every year in May to inspect city fire hydrants. Charlottesville firefighters have been able to expediently inspect close to 1,300 fire hydrants even with schedule limitations, such as no inspections on weekends, and they only have 267 left. According to Powers, the streamlined process has helped to decrease the workload while still increasing productivity.

"Almost all of our fire departments have

City of Tacoma Streamlines the Strategic Planning Process to Address Affordable Housing and Housing Inequalities with GIS

Tacoma, Washington's third-largest city, is facing a housing crisis amid rapid population growth. City officials recognized that the lack of affordable housing continues to affect lower-income and historically marginalized communities from securing a place to live. Over the last year, the economic impact of the COVID-19 pandemic has resulted in even more residents experiencing financial hardships. From 2010 to 2019, the region added three new residents for every new housing unit. This challenge has moved city officials and the planning department to address inadequate housing supply and increase housing affordability for the Tacoma community.

To respond to the affordable housing crisis, the city created Tacoma's Affordable Housing Action Strategy (AHAS). This strategy addresses challenges such as the lack of affordable housing for vulnerable communities and the scarcity of housing assistance resources and proposes solutions for low-income residents to secure housing. In 2020, the city initiated further action that would prioritize public engagement and feedback on the AHAS, with a deadline of six months. This led to the creation of the Home in Tacoma Project, built using ArcGIS StoryMaps, an interactive storytelling application. This project-focused approach educated the community

about the benefits of diversifying housing types; the history of redlining, a discriminatory practice that made it difficult for people of color to become homeowners; and how the city is revisiting previous housing policies.

"When people hear the phrase *affordable housing*, they tend to imagine their neighborhood changing for the worst, with inappropriately sized apartments looming over their house. But Tacoma's strategy is about creating a strategic and inviting mix of housing types," says Christina Chelf, GIS supervisor at the City of Tacoma.

Chelf and her team, including Adriana Abramovich and John Shell, decided to lead with a geospatial approach as the most efficient and user-friendly tool to expedite the process of sharing information with the community. They created an application with interactive maps and a narrative to inform residents about the city's need to address its housing challenges and promote equitable, affordable housing solutions for all.

"We needed to show residents the benefits of diversifying affordable housing types across the city. We created an ArcGIS StoryMaps [story] that presented the urgent need for housing supply,

"As the city moves forward with modifications to land use, we will definitely continue to present data by using ArcGIS StoryMaps to show the justifications for proposal changes. This project illustrates the importance of data and spatial analysis as well as how telling a story with spatial data can have a real impact on our community."

Christina Chelf, GIS Supervisor, City of Tacoma
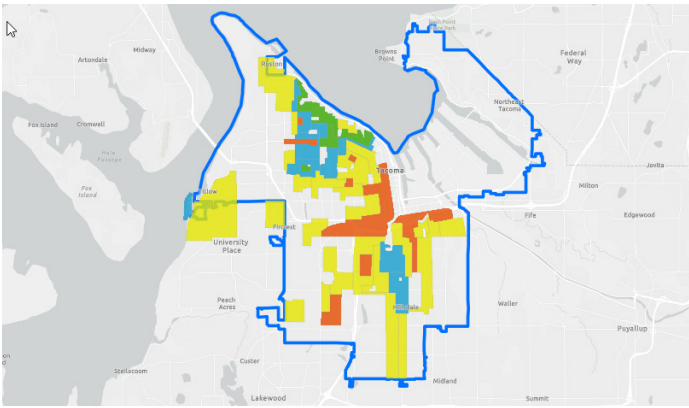
↑ This map displays historical documentation comparing which areas experienced redlining with those whose population had greater access to affordable housing.

addressed misconceptions about what a community with more diverse housing types might look like, and showed the historical housing inequities in the region and their enduring consequences," states Chelf. "This online tool helped us to quickly streamline the process of creating and sharing a new housing strategy with our community."

Mapping to Visualize Racial Inequities

With Tacoma's history of redlining in the 1920s, today's city officials wanted to address these racial inequities within the community. The city's planning department worked with the GIS team to incorporate maps into the Home in Tacoma Project to help residents understand the direct impact redlining had on under-resourced communities.
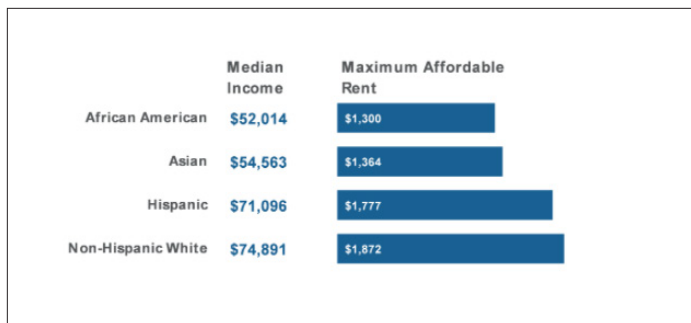
↑ Tacoma Median Income and Affordable Rent by Race and Ethnicity

To visualize the relationship between affordability and the lack of housing, the department used the city's Equity Index map to show how historic housing policies were negatively impacting people of color. The data presented in the equity index influenced Tacoma's decision to prioritize creating more housing in areas with higher opportunity and to avoid gentrifying areas with racially diverse populations.

The project also showed that housing costs for many residents has continued to rise while household income has remained stagnant. This has resulted in around 40 percent of residents paying more than they can afford for housing. In response to the affordable housing inequities, Chelf and her

team also used the map narrative to educate residents on how a diverse housing mix that included duplexes, townhomes, and single-family homes would serve the community more effectively. As a result, the map narrative gave the public greater insight and understanding about the community's need for a revitalized housing mix.

Gathering Feedback from the Community with GIS

As city staff reviewed plans for creating more affordable housing, they knew community feedback was an important part and attempted to engage with residents at every stage. Coinciding with the release of the Home in Tacoma Project, the city used an online survey to collect general feedback on the direction of the initiative. Since the launch of this story, over 800 community members have submitted their feedback on the affordable housing proposal.

Several months later, as the city began reviewing more specific future land-use changes, the city's GIS team again created a tool to support the project. Using Esri's ArcGIS Web AppBuilder, an app creation tool that requires no coding skill, the team collected over 200 location-specific comments on the Home in Tacoma Growth Scenarios map in just a few short weeks. The comments will be used to guide the final proposed change.
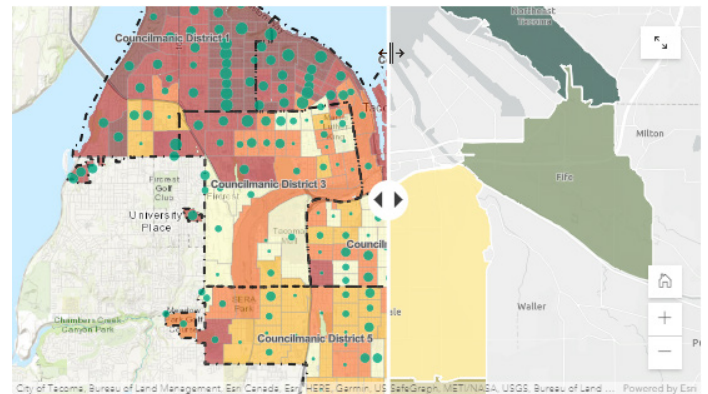
↑ Equity and housing costs slider map of Tacoma displays the overlap between residents' access to affordable housing.

Future Plans for Regional Collaboration

While the City of Tacoma continues to gather valuable feedback from the community, the GIS and planning departments are collaborating with regional partners to explore affordable housing solutions regionally. Based on a regional analysis, they know they will need to increase housing units by 60,000 dwellings by 2040 to meet the demand of population growth. GIS technology will remain ingrained in the city's housing strategy to ensure that Tacoma continues to understand the community's needs, create programs based on data and analysis, and prioritize equity.

For more information on using focused citizen engagement tools to cultivate a partnership with your residents, visit go.esri.com/Tacoma-CE.

SANDAG Proposes 5 Big Moves to Forever Change Transportation in the San Diego Region

• **Complete Corridors**—Provide safe and reliable travel for everyone, whether they walk, bike, take public transit, or drive

• **Transit Leap**—Build on the current transit services through new and enhanced commuter rail, light-rail, and bus services

• **Mobility Hubs**—Bring together better transit and travel options for people to explore communities without relying on a car

• **Flexible Fleets**—Include micromobility strategies, ride share, and microtransit options that would make first- and last-mile options safer and more convenient.

Using Data to Draft the 5 Big Moves

SANDAG has been leveraging data and GIS to support transportation planning and modeling since 1971. It has a long history of using Esri technology—in fact, the organization was Esri's 54th customer. This long history includes developing and maintaining regional datasets and performing spatial analysis to inform decision-making. The work has provided a solid foundation for preparing the long-range regional transportation plan every four years.

With SANDAG's recent strategic initiative to become a data-driven organization, staff saw the regional plan development cycle as an opportunity to apply data and analytics in creating a transformative vision for the region.

For their plan to have the most impact and to arrive at data-driven alternatives, staff used GIS and a wide range of socioeconomic and transportation data. They analyzed travel patterns, land-use and employment characteristics, and demographics as well as resident feedback. Seeing so much crucial information together on a map helped SANDAG better understand how people want and need to travel around the region. Building on recent analysis of where people live and work—which identified a wide range of accessibility characteristics around SANDAG's employment center data—was the next step. SANDAG planners, data

analysts, and modelers—with support from their consultant, HNTB—took a deeper dive into the previous analysis to determine travel characteristics for the region's activity centers for nonwork-related commute purposes.
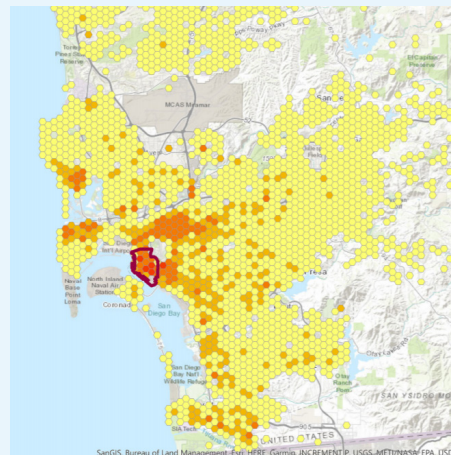

↑ Analysis of the relationship between where people live and work

The staff also conducted proximity and propensity analyses to identify potential system demand and accessibility needs. This helped create a more integrated system with higher-speed transit connected by flexible fleet modes such as microtransit, Transportation Network Companies (TNC), and micromobility (e-scooters, e-bikes, etc.). Planners were able to define mobility hubs based on geographic focus areas.

The idea centers on a seamless operating system supported by emerging technologies. This regional vision will create a future transportation system that improves access to jobs, education, services, and places of recreation. It will ultimately support the overarching goals of greater equity and improved quality of life for future generations.

For more details on SANDAG's data-driven approach and the supporting technical methodology of developing the 5 Big Moves, see *SANDAG's Vision for the 2021 Regional Plan Network Development Summary Report* (go.esri.com/SANDAG-Report),

a companion document to the *ArcGIS StoryMaps story "A Transformative Transportation Vision"* (https://arcg. is/1CqeGS0).
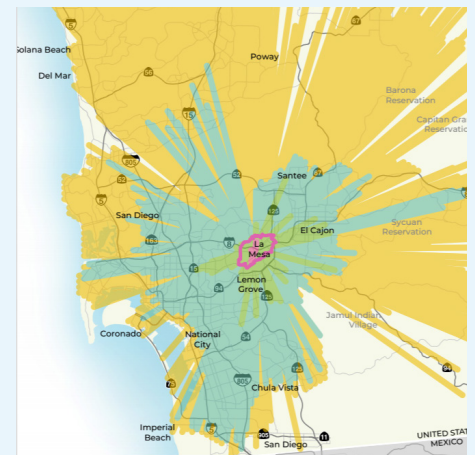
↑ Analysis of where people desire to live and work

Implementing Human-Centered Design to Meet Resident Needs

With the goal of analyzing and better understanding current travel patterns, SANDAG members focused on listening to their community's concerns and needs. They used a human-centered design approach that included stakeholder workshops and interviews. Community input provided insight into how current transportation experiences affect people's daily lives, and the types of transportation choices that could improve quality of life.
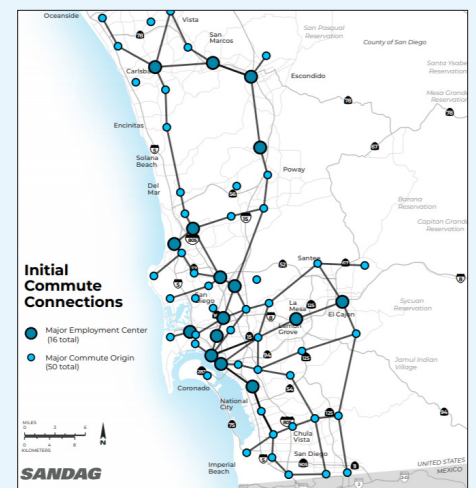
↑ Visualization of major employment centers and commute origins

Using community input, the SANDAG team developed personas showing how residents would interact with the 5 Big Moves and the region's transportation systems. Based on common behaviors and lifestyles, these personas—or, as SANDAG called them, user journeys—allowed the team to explore how residents such as students, young professionals, or retirees would be affected by proposed projects, programs, and policies. The team also considered travel patterns and human movement in relation to development, events, and proposed or existing infrastructure to better match each transportation system to the way people interact with and move about that system.

One of the most difficult tasks in developing a visionary, long-term plan is communicating it in a way people understand as well as conveying the personal impact it may have. Using the StoryMaps story and SANDAG'S on-site Vision Lab, SANDAG leaders shared their vision, engaged with the public, and presented complex ideas

in a simplified way. The StoryMaps story includes details about the 5 Big Moves, the different personas people could identify with, and the data-driven process behind the strategies. The work shows the thought behind this new approach and policies—how SANDAG would create faster, smarter, and more accessible and flexible transportation options for all residents. This work has also helped SANDAG overcome one of the biggest challenges of trying to execute a long-range plan with massive infrastructure changes and impact: building community consensus.

Improving the Lives of Residents Comes First

SANDAG's vision, 5 Big Moves, is a bold approach to rethinking mobility in a region. It addresses current needs while prioritizing and preparing for long-term trends. And SANDAG is not waiting for these trends to happen—the organization is planning for them now.

GIS played a role in almost every element of SANDAG's planning process. Relying on decades of experience with GIS technology and out-of-the-box thinking, staff were able to do the following:

- Use spatial analysis to understand presententzz conditions and existing stresses on the transportation network

- Leverage demographic and lifestyle data to understand the current and future needs of residents based on population, housing and employment growth, proposed development patterns, and potential recreational opportunity areas

- Provide an open line of communication with residents, letting them voice their concerns or provide feedback

- Create a suite of transportation alternatives that promote social equity values and meet state and federal requirements

"We have and will continue to leverage GIS to support our regional plan," said Pat Landrum, director of data and modeling for SANDAG. "We have demonstrated to our policy committees, board of directors, various stakeholders, and residents that spatial analysis allows us to make more data-driven decisions and promote social equity throughout the region."

SANDAG is a model for other regional governments, using GIS to rethink regional planning and transportation projects, quality-of-life improvements for more residents, and communication with the community.
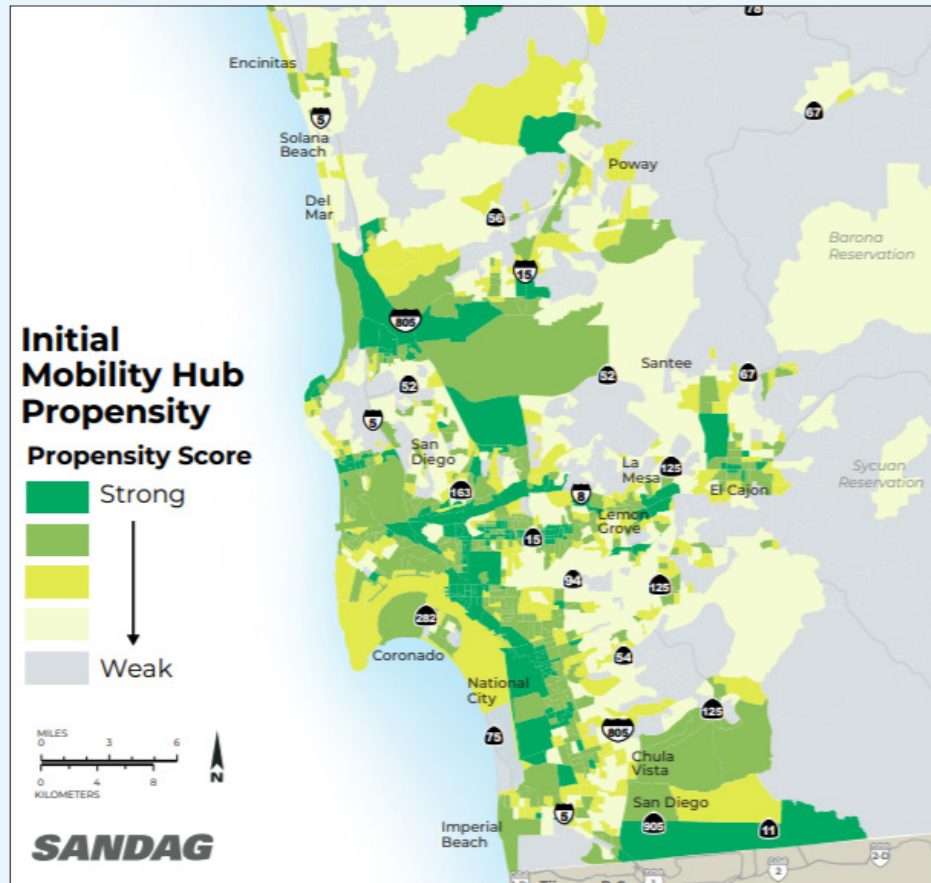
↑ Initial Mobility Hub Propensity score

# Leveraging Site Suitability Analysis to Validate Policy

By Keith Cooke, Industry Manager for Planning and Community Development at Esri

If you've followed my blog series (at **go.esri.com/KeithBlogs**) for the last few months, you know that a recurring theme I emphasize is the importance of a data-driven approach to planning. It's a key tenet in being able to justify specific designs and developments in a community, because it moves away from a strictly anecdotal approach (e.g., "I think this type of design would look good in this neighborhood") to one that focuses on attainable metrics (e.g., "This design will bring in x number of residents, y number of jobs, etc."). As a planner, you have an advantage over others in your organization in that you understand the types of designs and developments that are likely to look and work best in a neighborhood. This data-driven approach helps you further quantify and qualify your recommendations.

While this is true in the planning of specific developments, it's equally true in validating policy about where and why these developments are needed. Often, these policies are created at a higher level than the person designing the development (e.g., city manager, planning commissioner, elected official).

Planners and GIS play an integral role in decision-making regarding housing policy because location is at the epicenter of this topic. Planners and policy makers must define the needs, benefits, and challenges in assigning areas for affordable housing and economics, mitigating homelessness, and understanding the capacity for growth in neighborhoods.

This starts with identifying and analyzing demographic and socioeconomic variables for neighborhoods to successfully assess their needs. ArcGIS Community Analyst enables users to view over 1,700 variables to understand the makeup and needs of neighborhoods down to the census block group level.
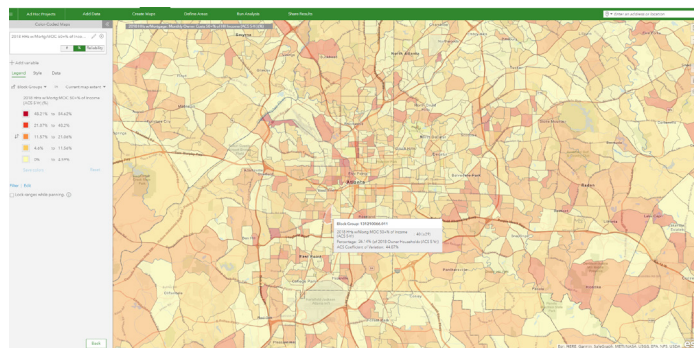
↑ This is a map of the metro Atlanta area showing households that have a mortgage and spend at least 50 percent of their income on housing. The darker colors represent the highest concentrations of these households.

From a policy standpoint, this data helps us understand where affordable housing—combined with a sustainable economic mobility policy—is most needed. But it's not just homeowners who are struggling. Renters also make up a large percentage of the need for affordable housing, especially with younger

generations. The Esri Maps for Public Policy app, part of ArcGIS Living Atlas of the World, provides free access to data that can be used to help validate policy decisions.
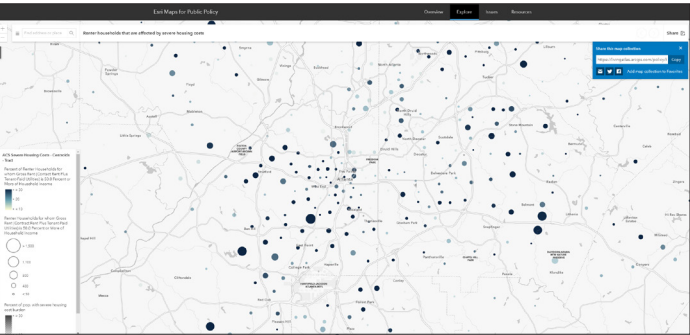
↑ On this map, we can see where renters in the metro Atlanta area are burdened by severe housing costs.

I can overlay my Renters map and my Homeowners map to understand where the most crucial needs are for affordable housing. However, there are often more factors that would drive our policy making. This is where the Policy Validation Application (PVA), a free add-on to ArcGIS Urban, would come into play. This allows me to take multiple variables at once, assign weights to each metric, and identify the best location for affordable housing down to the parcel level.

Specifically, I can look at the parameters that would drive the feasibility of affordable housing in a neighborhood, such as proximity to transit, grocery stores, schools, and health services. Affordable housing as a policy doesn't work unless it's coupled with economic mobility, so I would also want to look at

employment opportunities (both present and planned) in the area.

Assigning values to each of these metrics allows me to assess site suitability based on what's important to me as a policy maker.

Now, administrators, elected officials, stakeholders, and—of course—planners can have a data-driven discussion about where affordable housing needs to be. We've identified the need and the best locations and methods to address that need. There's no ambiguity about the data. It's clear-cut, and everyone can be on the same page.

Taking a data-driven approach to site suitability, planners can develop multiple housing scenarios in neighborhoods and measure their potential effectiveness. Policy makers can then evaluate and visualize these scenarios, collaborate with community leaders, and engage the public to meet their transparency and accountability expectations.

For more information on how you can begin leveraging GIS to determine how, where, and when your community designs would have the greatest impact in your community, visit go.esri.com/GIS-Validate-Policy.
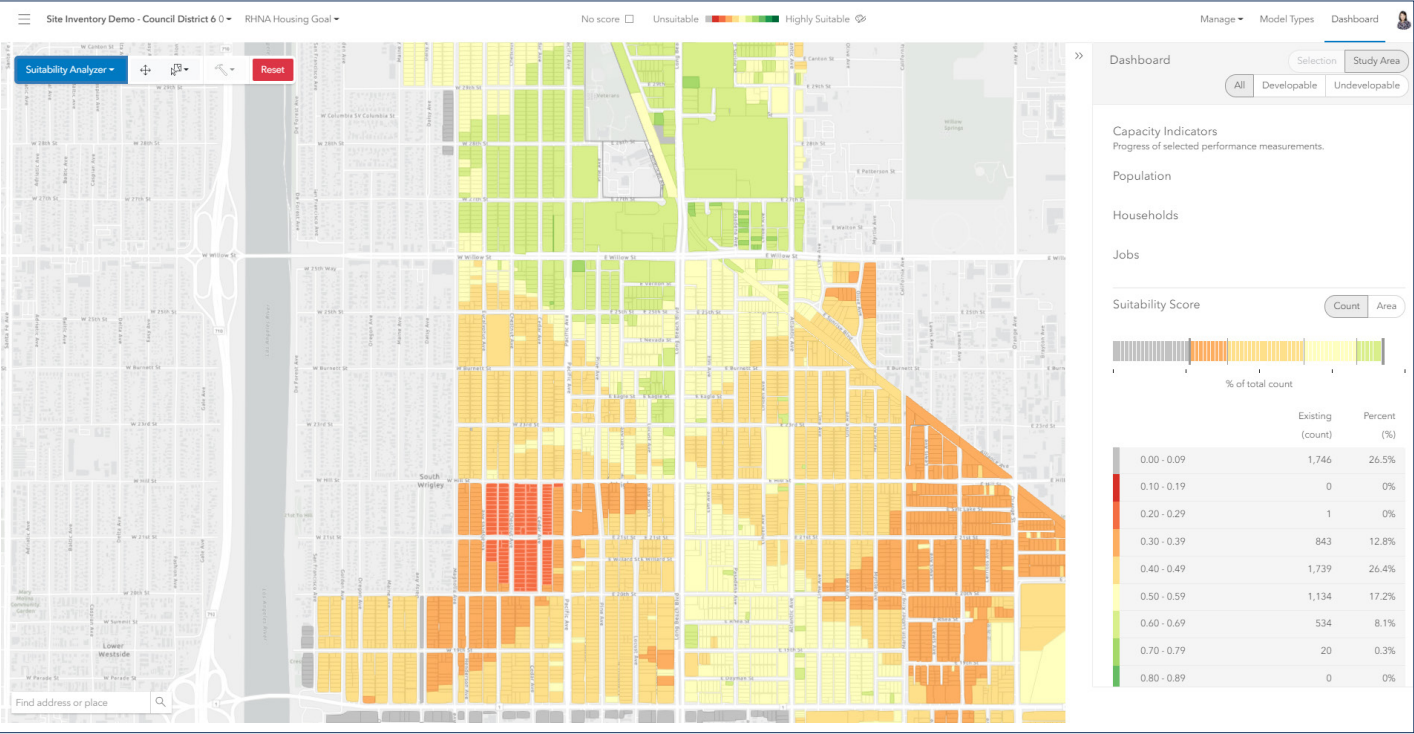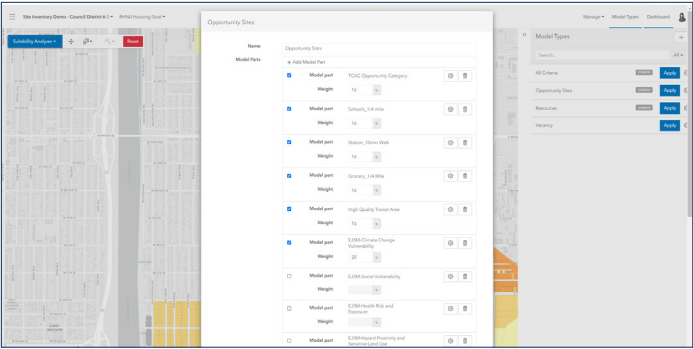
↑ With the Policy Validation Application, users can easily toggle on and off the variables that matter to them and quickly visualize the site suitability of a specific area.

Addressing Recycling Challenges

By Jim Landwehr

A Wisconsin county devised a system to improve the quality of its recycling program using GIS for identifying and educating citizens who contributed unacceptable items.

The Land Resources/Recycling Division of the Department of Parks and Land Use at Waukesha County, Wisconsin, oversees a multijurisdictional recycling program that has 27 municipalities within its borders. For several years, Waukesha County owned a material recovery facility (MRF) that sorted collected materials and then marketed them to various mills to be used for new products.

The county facility was reaching the end of its life cycle, as was a similar facility operated by the City of Milwaukee. After extensive studies, it became clear that Waukesha County and the City of Milwaukee should co-invest in an MRF. Under an agreement to collaborate, the single-stream facility for processing fully commingled recyclables began operating in March 2015.

After single-stream bins and educational materials were distributed to county residents, haulers resumed collection operations using automated collection vehicles. The single-stream program has been highly successful. Every year, it keeps 30,000 tons of material out of landfills by processing it for recycling.

↑ Employees work at the Waukesha County and the City of Milwaukee jointly funded MRF facility.

However, it is not a perfect system. Nonrecyclable or contaminated items are undesirable and expensive to process or re-sort. Inbound material contamination has been on the rise. At the same time, allowable contamination percentages in outbound material have fallen to as low as 0.5 percent. Soft demand for recycled raw materials allows buyers to more closely scrutinize material for contaminants. Materials turned away by buyers result in lost income for the county. It also diminishes the county's credibility as a quality source of recycled material even as it competes in an already tight market space.

Unacceptable materials that residents place in recycling bins are the source of contamination. Plastic bags, hoses, and propane tanks are just a few examples of these materials. Noncompliant materials—such as bowling balls, automotive brake rotors, and even deer carcasses—have come through the sorting line at the MRF. In addition to the cost of properly disposing of these items, they can potentially damage expensive sorting

and compacting equipment and cause bottlenecks in processing as repairs are conducted.

The County Addresses the Problem—Literally

Waukesha County implemented an educational program called Recycle Right, focused on public outreach and education. Its goal is to encourage recycling, but perhaps as important is educating residents so that they know which items are acceptable and which are not.

In addition to social media blasts, postcards and flyers were sent to residents with clarification on proper recycling practices. Truck drivers were instructed to use reminder tags on offending carts. Drivers were reluctant to do this because the process was time-consuming and put drivers at risk when exiting vehicles.
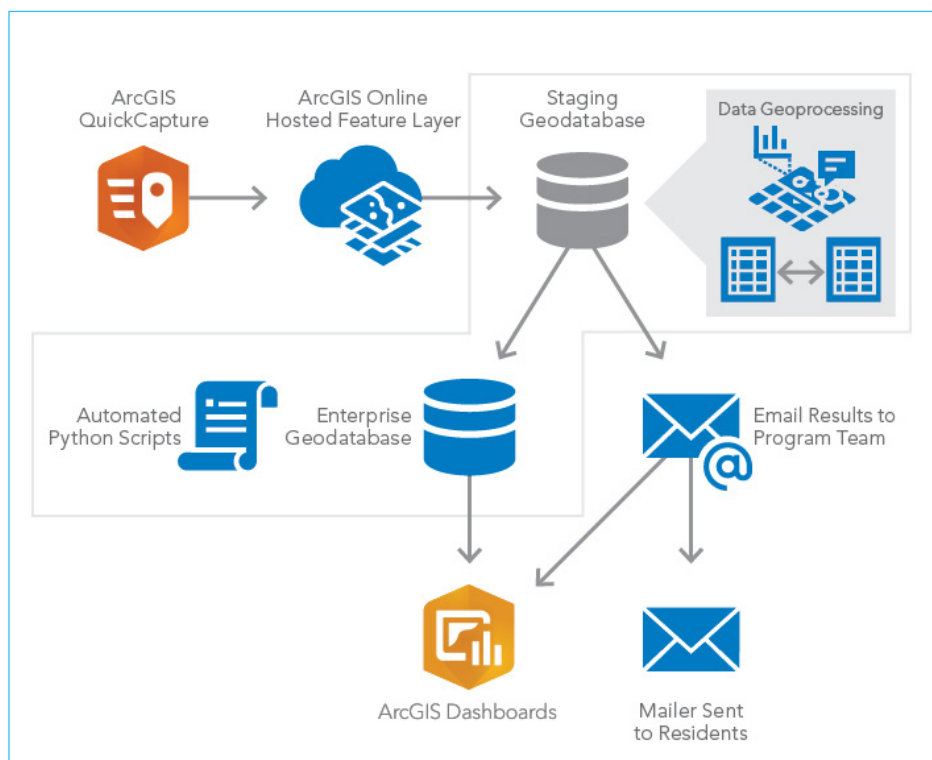
To improve the purity of recycled materials received, Analiese Smith, recycling and solid waste supervisor for Waukesha County, turned to the Land Information Systems (LIS) division

for assistance in locating, identifying, notifying, and educating residents who placed nonconforming items in recycling bins. Smith had seen GIS used for other applications at the county and thought it might be a good fit for the Recycle Right program

At an initial assessment meeting, Smith described the situation. She explained that some trucks allowed the drivers to see materials as they tip the bins. Other trucks are equipped with remote cameras that point toward the receiving bin of the vehicle, which allows drivers to see obvious contaminants and nonconforming items.

Once the LIS staff members had a clear understanding of these logistical parameters, they inquired whether drivers would have access to portable tablets for data capture. One of the two hauling contractors already had tablets in its trucks for other purposes. The other hauler agreed to purchase tablets if needed to help increase compliance.
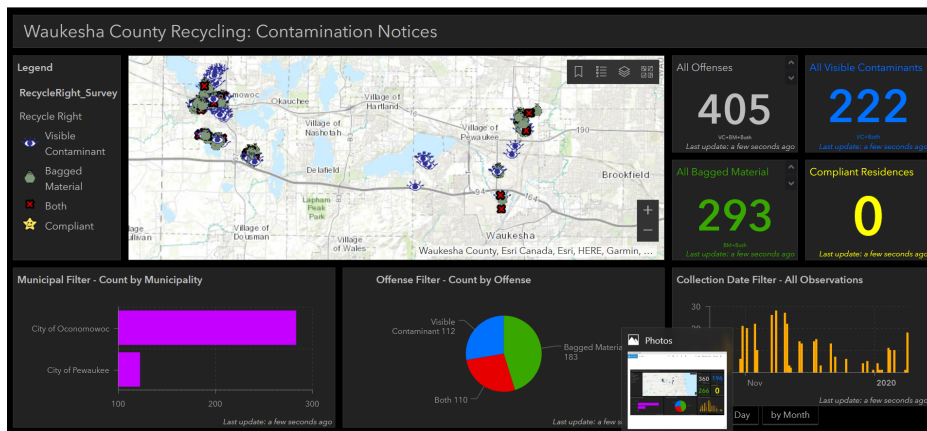
Attendance at the Esri UC Pays Dividends

At the 2019 Esri User Conference (Esri UC), the LIS staff heard about a new product called ArcGIS QuickCapture and thought it might be useful for the project. The QuickCapture interface is simple. Large, single-function buttons are used for on-the-move data collection.

Chris Dickerson, an LIS analyst, was tasked with designing the application and its related data model. The data structure was kept simple. Initially, a single point feature could have three core subtypes: visible contaminants, bagged materials, and visible contaminants and bagged materials. A fourth subtype, compliant, was included so that drivers could note locations of known offenders who had cleaned up their bins.

After the application was designed, the LIS and Land Resources/Recycling staff did some localized testing for a few weeks to see if the locational accuracy was good enough using phone and tablet GPS technology. Testing

↓ The workflow improving recycling begins with identifying offenders and their locations, deriving their addresses, and using a Python script to generate reminder postcards that are sent to offenders. The data acquired in this process populates an ArcGIS Dashboards app that provides an executive-level look at data distribution and transaction-level trends.

↑ An executive-level dashboard provides a concise aggregation of data on offenders.

Python plus Geoprocessing Equals Data Enrichment

With some test data to work with, Dickerson wrote a script in Python that takes the x,y point feature and—using the Near geoprocessing function—finds the nearest parcel polygon. Once a selection set is complete, the script joins the parcel polygon with the resident address point, using the tax key number as the common field.

Next, the script exports the joined tables into a Microsoft Excel spreadsheet that is emailed to the recycling staff. Using the spreadsheet as well as mail merge in Excel, recycling staff members create the mailing labels for postcards that gently remind offending residents of recycling guidelines.

A Dashboard Brings It Together

In September, a pilot project lasting over a month was undertaken. A single truck in the hauler fleet collected the location points for offenders, and the card notification process was initiated and tested. Anticipating that the full implementation of this plan would generate a large, dynamic dataset, LIS supervisor Jim Landwehr requested that Dickerson put together a Recycle Right operations dashboard.

Dale Shaver, director of parks and land use, is a big proponent of using data tracking, quantification, and visualization as part of his ongoing initiatives to better serve the citizens of Waukesha County. ArcGIS Dashboards provides an executive-level look at data distribution and transaction-level trends in real time, using interactive graphs, charts, and heat maps.

Within a few days, Dickerson assembled an intuitive and informative dashboard for the recycling staff's review. Staff members were excited by the easy-to-use dashboard, which gave them a deep-dive view into their data. The graphs, charts, and maps in the dashboard are linked, so clicking on one component changes the data in the other panels dynamically to make the data easily discernible to users.

Another advantage of the dashboard is that it can be used to brief supervisors, managers, and elected officials on the progress of the initiative. It provides tangible numbers for reports and can even be used to educate the public on problem areas and contaminant trends over time.

With a successful pilot project, the Land Resources/Recycling division is preparing to equip every truck in the contractor fleets with the QuickCapture app. The division is preparing to deal with the projected increase in contaminant locations as well as the efforts required to mail reminder cards to residents at those locations. While a 30 percent decrease in contaminant material is an aggressive goal, the division hopes that significant progress can be achieved through the education and awareness focus of the Recycle Right program. Using GIS to help zero in on offending areas is just one small part of a broader initiative toward a greener county and a better planet.

About the Author

Jim Landwehr has more than 30 years of experience in the AM/FM/GIS mapping industry in both the public and private sectors and is a certified geographic information system professional (GISP). He has been working with Esri software for over 20 years and is proud of his division's accomplishments, which include receiving the Esri Special Achievement in GIS (SAG) Award in both 2004 and 2018. Landwehr earned a bachelor's degree in geography/anthropology from the University of Minnesota.

↓ Postcards are mailed to residents, notifying them that nonconforming materials were found in their recycling bin.

Charlottesville Fire Department Tracks Fire Hydrant Inspections with an All-in-One Mobile Work App

some sort of mobile technology, either in their pocket or in the front seat of a fire truck, and we can deploy Field Maps on those pieces of technology," says Powers. "And [firefighters are] done with collecting data before they get back to the station. We had the opportunity through Field Maps to refine our entire process and make it firefighter-friendly."

The simple deployment of Field Maps was an added benefit of using this all-in-one mobile work app. Lyons says Field Maps was a strong app to begin with, so they were confident they were launching a solution that would work.

"We made a few little tweaks to [the app] once we were out on the street testing hydrants. Then we deployed it to our firefighters, who were testing hydrants within hours, and there were very few questions. It's relatively simple," says Lyons.

The simplified digital inspections process has also saved valuable time for the firefighters, allowing them to perform other activities. Powers says the daily calendar of a firefighter is filled with everything

from hazmat training to physical fitness and online training, and with the added responsibility of hydrant inspections, it takes them out of the firehouse and away from other tasks. Now, with a streamlined process, firefighters can more easily do the inspection and move on.

"From a staffing perspective, my fire trucks are not spending as much time on the street doing hydrant inspections because they're not writing it all down. They're doing it one time, and it's done. They can do other activities rather than sitting there doing emails, making phone calls, and scanning paper work," says Powers.

He adds, "When you say we're going to increase your productivity and save you time, it's almost a pipe dream. But with Field Maps and the hydrant inspections, that's exactly what we did."

The ability to visualize hydrant inspection data in real time and see where hydrants were being inspected, and by what crews and shifts, was another significant benefit. Seeing all completed inspections

eliminated the duplication of work because it was easy to see work that had already been done. Lyons says building an online dashboard, which helps organize the information, was an intuitive process that only took an hour because of the reliable data. Previously, dashboards created with a different data visualization program took two to four hours.

"In the past, administrators and the crews didn't have that kind of insight. So, it was just when the last hydrant was inspected and that form was turned in, then the whole process was done. But now we can track in real time how that's happening using dashboards," says Lyons.

The real-time updates with Field Maps have also improved communications with Charlottesville Public Works. The data collected in Field Maps and the documentation of inspections are given to the public works department in real time, which allows staff to more quickly create work orders for repairs.

With the favorable deployment of Field Maps, the Charlottesville FD plans to expand its use, including tracking the installation of free smoke alarms through a city program. Powers believes that from an administrative level, team members have gained a huge amount of organizational equity because they saw the opportunity to improve an inefficient process for firefighters.

"One of the big benefits is the goodwill of our workforce who now believe in technology and see it can work. Whenever we can show a win and show that life is easier with technology, that's good, because that hasn't always been the case," says Lyons.

"ArcGIS Field Maps provides us an opportunity to track our productivity in a meaningful way."

—Joe Powers, City of Charlottesville

What's New from Esri Press

Building a Smarter Community: GIS for State and Local Government

Edited by Christopher Thomas and Keith Mann

Smart communities don't wait for someone to deem them smart; they take action. State and local governments worldwide have taken that first step using GIS technology. Applying GIS to planning and urban design, public works operations, and racial equity and social justice has helped meet citizens' needs and improve government operations. And with advancements in smart technology, location intelligence for state and local governments is not just for GIS specialists.

Building a Smarter Community: GIS for State and Local Government shows how government leaders in cities, counties, and states have applied GIS for improved planning, operations, and civic inclusion. Through case studies and step-by-step guidance to get started, you will see how several governments across the country are leveraging GIS in their specific business operations to meet their greatest challenges and stay agile.

To order *Building a Smarter Community: GIS for State and Local Government*, visit go.esri.com/GIS4SLGBook.
Esri Press, 2021, 120 pp. ISBN: 9781589486850 (digital);
ISBN: 9781589486843 (paperback).

Delivering Water and Power: GIS for Utilities

Edited by Pat Hohl and Keith Mann

Location is at the core of many utilities' daily and long-term planning, but it's about more than making a map. It's improving the reliability of your water and energy infrastructure by reducing service interruptions. It's using data analysis to make informed operational decisions, both in the office and in the field. It's strengthening your network safety and security while increasing customer satisfaction.

With advancements in smart technologies, location intelligence for utilities management is becoming more practical for non-GIS professionals. In *Delivering Water and Power: GIS for Utilities*, see how public and private utilities around the world have implemented GIS to visualize and analyze data for situational awareness, operational efficiency, and asset management.

To order *Delivering Water and Power: GIS for Utilities*, visit go.esri.com/GIS4UtilitiesBook. Esri Press, 2021, 150 pp. ISBN: 9781589486850 (digital); ISBN: 9781589486751 (paperback).
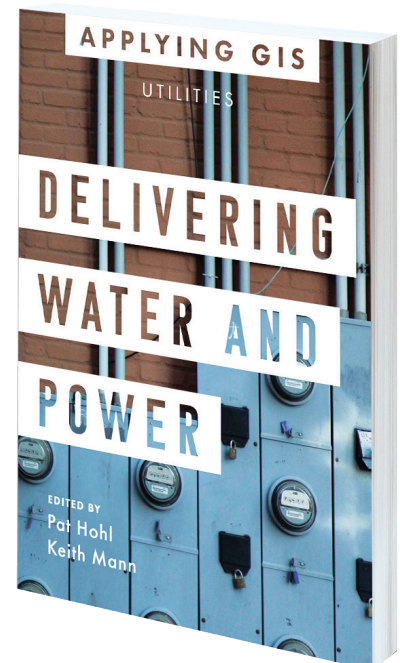
These titles are part of a book series, Applying GIS, from Esri Press. Each book will explore how location intelligence is used in different organizations and across various industries around the globe. Check back on esripress.esri.com as more books are released.

American Rescue Plan—Now What Do You Do?

By Richard Leadbeater, State/Provincial Government Industry Solutions Manager at Esri

On March 11, 2021, the American Rescue Plan (HB 1319) was signed into law, and the release of funding is about to begin. To be honest, as I read HB 1319 and the various summaries and analyses, a single image kept popping up in my mind. That image is of the dog that finally catches the car. And what the next thing the dog must think is this: "Now what?"

When released, there will be a tidal wave of funding to do the following:

• Help continue to combat the spread of COVID-19

• Mitigate the needed quarantine actions' effects on our local economies and businesses

• Help stabilize our public health systems and reopen schools and government offices safely

• Build out and improve our ability to provide broadband where it is needed most

• Repair both local government and personal finances

In total, HB 1319 is just shy of 250 pages containing just over 103,000 words—that's 10 pounds of paper. Most advocacy groups are producing summaries of the bill to help their members understand the various parts and procedures that pertain to their assorted members. To be honest, I think I have reviewed more pounds of summary pages than there are in the bill itself. Does that make me feel like an expert? Far from it, though I have gotten a feel for how GIS practitioners within state and local governments can assist their community. Let me perform a little dissection on what I have seen and heard over the last month.

The Breakdown

The bill provides $350 billion to help states, counties, cities, and tribal governments. This is to help cover increased expenditures, replenish lost revenue to fill budget coffers, and mitigate economic harm from the COVID-19 quarantine actions. There is $195.3 billion to go to states as well as $130.2 billion to local governments, with $65.1 billion for counties, $45.6 billion for metropolitan cities, and $19.5 billion for towns and municipalities with fewer than 50,000 people. Additionally, there is $4.5 billion being provided to US territories and $20 billion to tribal governments. Separately, there is $10 billion for coronavirus capital projects to support safe work and education environments as well as continue health monitoring programs, vaccine tracking, and vaccination efforts. These capital funds are meant for building new space or retrofitting existing facilities. Finally, there are funds to make capital improvement investments in water, sewer, and—especially—broadband infrastructure.

These funds will be part of the general funds and fit into the standard structure of each state or local government's budget.

GIS practitioners should be aware of the functions and, in the end, be ready to be useful. There is an old challenge: name a function of government that does not benefit from the application of GIS. It's nearly impossible. This is truer today than ever.

Federal Funding

The state and local funding is only part of the bill. It includes additional funding for almost every federal program that intersects with state and local governments. In short, if your agency has accessed federal formula grant funding or any other funding from a federal source, now is the time to revisit this issue.

There are education grants to identify socially disadvantaged children, especially those with limited access to broadband. Think about a broadband map for analyzing the proximity to poor-coverage areas, showing school locations and social indicators of poverty and education attainment.

There are energy and environment grants for identifying low-income households that do not have adequate access to water and sewer services or are disproportionately exposed to poor air quality.

Obviously, there is funding for health and human services for tracking COVID-19 and monitoring vaccinations, but soon we will be pressed to identify when we reach herd immunity; where are the people who are inoculated as compared to those who still need to be vaccinated—and what is their social status? There is funding for social service, childcare, nutrition programs, and too many other programs to list here. Auditing what we have accomplished and analyzing where we still need to work is a big part of the funding.

There is funding for economic development, housing assistance, and help for the homeless. Rural jurisdictions receive special attention in the financing of broadband build-out and service and inventory mapping. And transportation has funding to retrofit airports and train stations for improvements to combat the spread of future diseases.

In closing, almost everything I've read about that is included in the American Rescue Plan's funding targets has a location-based function. Many of the funding targets require analysis to identify and understand where the need is. At the very least, state and local governments will have to report back how the monies are used and whom they help.

There also will be questions to answer. Were we aware of social inequities within our community? Where did the funds land as compared to the social inequality? Did we measure the impact of funding? Did we move the arrow in the right direction?

To answer these questions is the unique ability of GIS.

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