

Maricopa County, Arizona

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Gary Bilotta, Director of IT & GIS at Maricopa County Recorder’s Office (Arizona), shared the following information on how they geo-enabled their elections about fifteen years ago.

In the beginning

Around the year 2006, it was decided Maricopa County move towards geo-enabling elections. At that time, the county was using street index files, graph paper, and atlases to assign voters to districts along with a stand-alone geographic information system (GIS) to help visually QA/QC the data (the real beginning did not have a GIS system to assist in the QA/QC of the data). Below is a sample of the street index records at the time.

Street Records

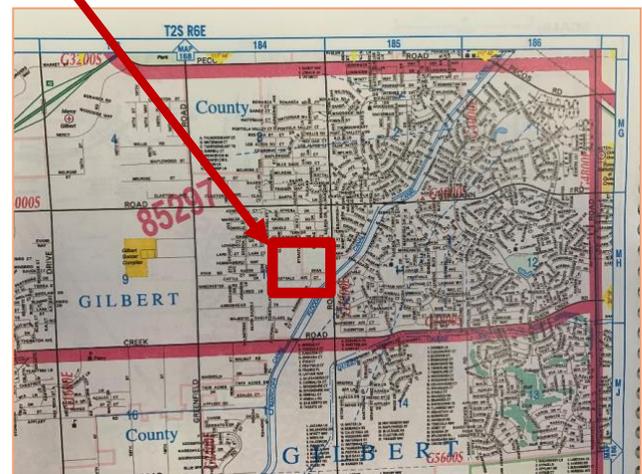
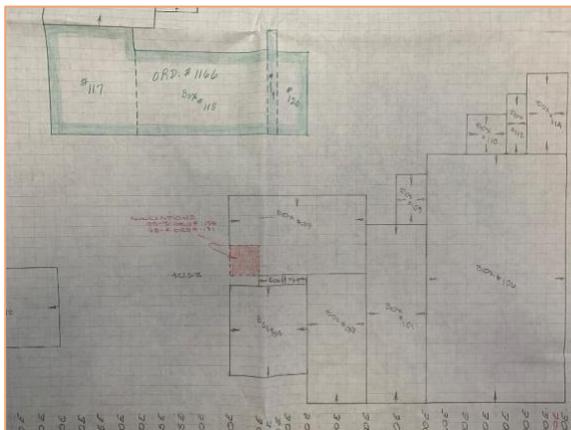
STDIR	STNAME	STSFX	STTYPE	ALIGN	FMDLMT	TODLMT	ALIGNAX	SIALIGN	SIFMDLMT	SITODLMT	CTYCD
E	SUPERSTITION		DR	4205	2835	2965	S	-4205	2835	2965	GI
E	RYAN		RD	4410	2830	3020	S	-4410	2830	3020	GI
S	164TH		ST	2800	4287	4227	E	2800	-4287	-4227	GI
S	165TH		WAY	2855	4373	4223	E	2855	-4373	-4223	GI

Boundary Records – City, Precinct, School, Tech, Fire, etc.

BDVAL	BDTYPE	BOXNO	NALIGN	EALIGN	SALIGN	WALIGN	HALIGNAX	VALIGNAX	NSIALIGN	ESIALIGN	SSIALIGN	WSIALIGN	NSTSIDE	ESTSIDE	SSTSIDE	WSTSIDE	CTYCD
GI	C	347	4150	2960	4750	2875	S	E	-4150	2960	-4750	2875	S	W	N	E	GI
1053	P	1	4000	3200	4800	2400	S	E	-4000	3200	-4800	2400	S	W	N	E	GI
60	S	1	800	5600	5600	2400	S	E	-800	5600	-5600	2400	S	W	N	E	GI

Area described by index records above

Sample of graph paper used in 2006



At the time, the above were used, as well as a stand-alone GIS system that contained street centerlines, parcels, aerial photography, and district boundaries. The GIS district boundaries and street centerlines were maintained by the department as local jurisdictions grew and annexed, as well as when redistricting and reprecincting occurred. Once the spatial data was created in the stand-alone GIS system, the visual information that was created was used to produce the graph-paper sketches and ultimately, by hand, the index file tabular data.

Today

Today, in the Maricopa County Recorder's Office, GIS is completely embedded in the voter registration and election database and processes. The database contains many spatial datasets; the two most important are the address points and district polygons. The address point dataset initially took about three years to develop, is updated daily, and currently has just under two million records. All voters are matched against this dataset. The second is the district polygons, currently just over 18 thousand records. They are spatially associated to each address and then in turn assigned to each voter. If an address is newly created or moved to a different location, or if a new district is drawn or an existing one edited, the district/address/voter associations are updated almost instantaneously. One thing to note, since polygon boundaries take time to create and edit, there are staging datasets where this occurs before making changes to the production dataset.

Additionally, the department generated and maintains a zip code polygon dataset; this is used to assign and update zip codes as addresses are created and edited. The department has regular contact with the Post Office in order to manage zip code changes.

One enhancement that is currently being developed is assigning voters to a unit number within a multi-unit housing development (apartment, mobile home park, etc.). When the system's datasets were first being developed, unit numbers were held for a later date due to the thousands of multi-unit developments and the time it would have taken to gather the required information. To do this, the GIS team has been reaching out to leasing offices and management companies for site maps, as well as to local fire and emergency services departments for pre-emergency maps. It is planned for this phase of the project to go live in summer 2020, and there are approximately 615,000 address points with an assigned unit number.

In the image below, only the area in lavender has been annexed by the city.



The image below shows an apartment complex divided by two school districts.



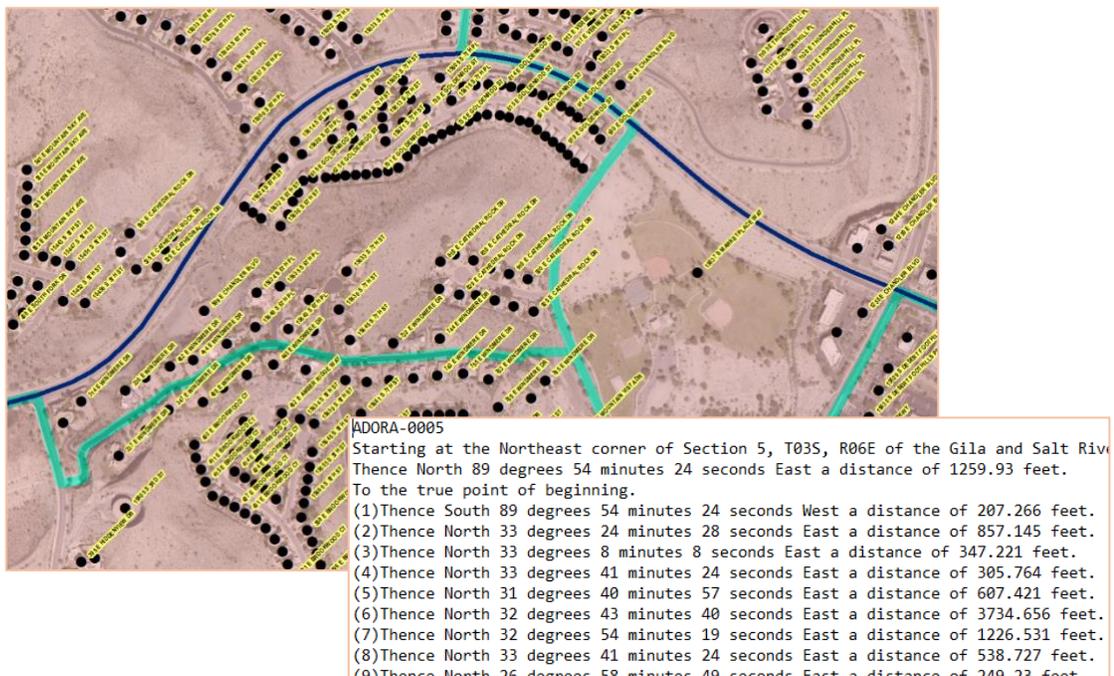
3. Overlapping numbering systems. In Maricopa County, there are many address numbering systems in use and occasionally they overlap. Managing the tabular data when this happens is very time consuming and difficult. In this image, 7058 S. Pima Rd is between 217 and 291 N. Pima Rd.



4. Cities and towns annexing a single parcel at a time. In the image below, only the areas in pink have been annexed. The examples above, if combined with this example, again, make it very difficult to manage the tabular data.



5. Any address within the number range on the street is accepted. This can and did lead to voters becoming registered at invalid addresses and to the office sending out mail that was ultimately returned as undeliverable. Additionally, when the full address range on the street is valid, it is more difficult to uniquely identify and separate business addresses from residential address. This can lead to voters successfully registering at business addresses.
6. After redistricting, it takes hundreds of hours to change tabular records to reflect the new district boundaries. Changing the cyan boundaries to the navy boundaries in the image below takes minutes in the GIS. If there are multiple redistricting plans being developed, any one of them could be placed into production very quickly. In Maricopa County, it is also required to create legal descriptions after redistricting is completed. Utilizing GIS, hundreds of legal descriptions can be created in minutes, rather than having to create each by hand.



Quality checking the data

During the development of the address and district datasets, the department consistently crosschecked voter/district assignments between the tabular system and the spatial system to ensure accuracy.

Now that only one system is being used, there are a few ways the department ensures accurate data.

1. Every new address and district boundary entered into the system is verified by two GIS users within the department.
2. The department shares all address and district boundaries with the County Assessor's GIS Office where additional checking occurs.
3. The County's Planning & Development GIS Department conducts additional checks on city and town boundaries.
4. Before each jurisdictional election, all addresses and associated boundaries are passed to the entity having an election for verification.
5. All addresses and boundaries are shared with the Sheriff's Department who reviews any changes made to the datasets.
6. When creating ballots for upcoming elections and associating voters to them, audits are completed to ensure voters are receiving the correct ballot with the correct contests.

WHO?

In 2006, when the project began, very few countywide datasets were available outside of what the Recorder's Office already had that could be used for this project. The department did have district boundaries but did reach out to the Assessor's Office and Planning and Development Office for their district boundaries to crosscheck the department's boundaries. The Recorder's Office district boundaries are now the official district boundaries for the county when sharing with internal and external entities. Address points were non-existent at that time, and the data needed to be built from the ground up.

IMPROVEMENTS

Discussed earlier was the idea of creating address points for each individual unit in multi-unit housing complexes. The importance of this lies with district boundaries splitting these complexes. In Maricopa County, two locations have been identified where this occurs: a mobile home park split between a city boundary and an unincorporated area, as well as an apartment complex split between two school districts. Having address points down to the unit number will allow each voter in complexes where this issue occurs, now and in the future, to be assigned to the appropriate districts. During redistricting in 2011, one of the Congressional District proposals had a boundary split a mobile home park. Having unit numbers for as many complexes as possible will help reduce potential

problems in the future. Another benefit of having unit numbers is the value it gives to the Sheriff's Office and Regional 911. Unit numbers help first responders locate units quickly without having to search pre-emergency PDF maps.

Aside from multi-unit housing complexes, there are many instances within the County where a district boundary falls on someone's home. In these situations, the department attempts to place the address point in the district where the majority of the home is, more specifically, hopefully where the bedrooms within the residence are located. There have been discussions regarding enacting legislation to help correct both of these issues, but only discussions.

CHALLENGES

There are a few constraints the Maricopa County Recorder's Office has when it comes to geo-enabling elections.

1. Being provided with the source documents the spatial data is created from. If annexation or subdivision plat documents are not regularly received, spatial data cannot be maintained for voter registration and election use. This would be the same if the office was still using tabular index files.
2. In addition, having a land survey spatial file containing township, range, and section polygons, as well as a parcel polygon file is very important. Just about every legal description received in the office references township, range, and section boundaries or corners; the ones that do not, reference parcel numbers. Not having these spatial files for reference would make geo-enabling elections very difficult.

SUCSESSES

Lessons learned

It was definitely learned early that it was going to take a long time to build the required datasets in order to geo-enable elections in Maricopa County. In the beginning, there were four GIS personnel working on different aspects of the system: developing the address data, reviewing legal descriptions and the corresponding district boundaries, and developing desktop spatial applications. In addition, there was one application developer preparing for changes to the voter registration and election systems and one database administrator preparing for the integration between the voter registration database and the spatial database.

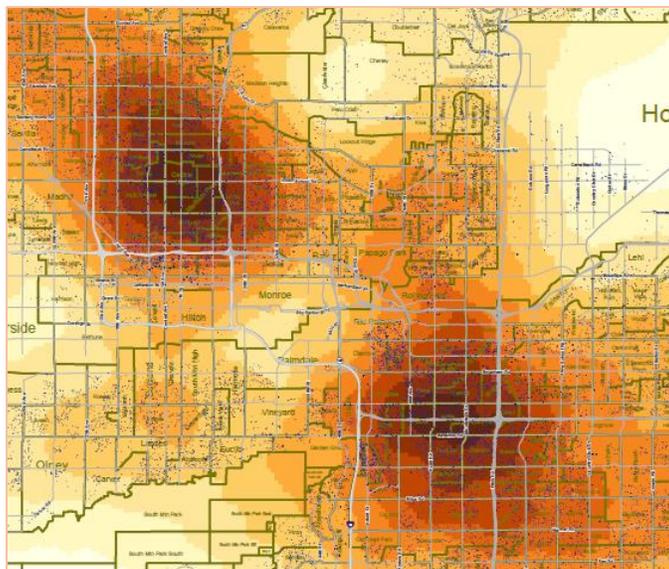
We also learned that planning is necessary and crucial; that you must plan for these changes.

To round out the list of lessons learned, a discussion of the plan to integrate GIS with any and all stakeholders so they are comfortable in their understanding of the changes - and ensure they are comfortable knowing how to talk about them - is essential.

Additional benefits

The many benefits of geo-enabling elections were definitely not realized at the time of the initial conversations. At the time, the discussions mostly revolved around managing data more efficiently, having the ability to visualize exactly where voters were assigned to districts, and implementing redistricting plans quickly after plan adoption. Additional benefits that have been identified include:

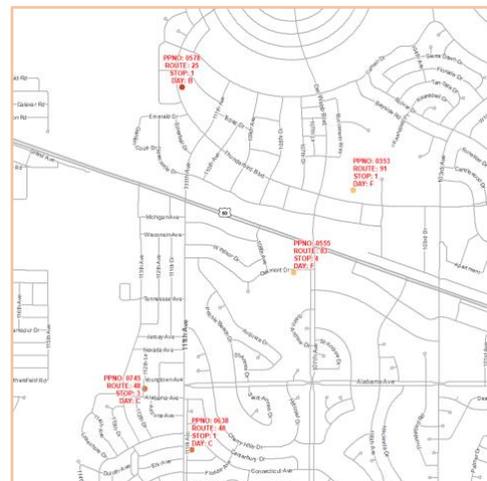
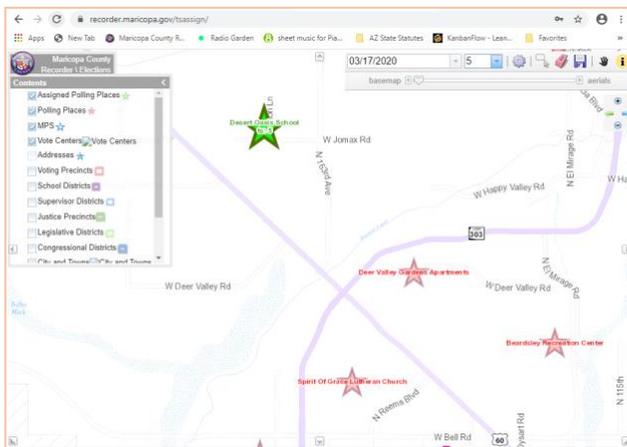
1. Address and street centerline data are being utilized by Regional 911, as well as the State's Next Generation 911.
2. Address and street centerline data are being requested and utilized by local school districts for routing buses.
3. Address and street data are being utilized by Blue Stake, an organization that identifies underground utility lines. Blue Stake also contacts us if they believe there is an error in the data.
4. By identifying voters who voted in-person in past elections and where they live today helps the department make informed decisions on polling location placement. Below is a dot density map of voters who voted in-person in the past few elections and where they are located today to help plan for this year's elections.



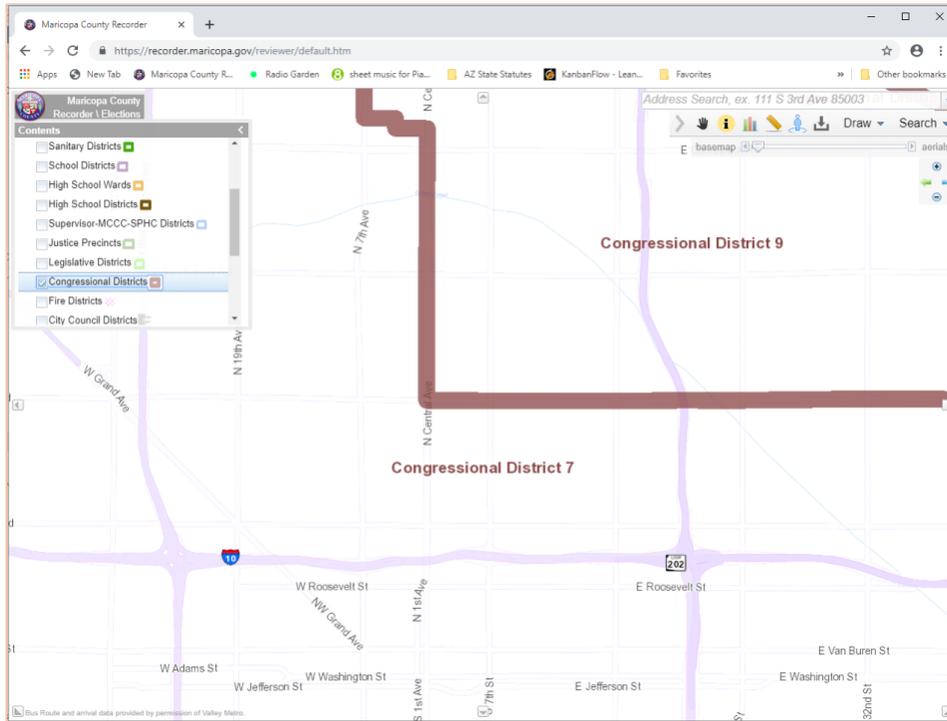
This map contains more detailed projections derived from the data used in the analysis above.



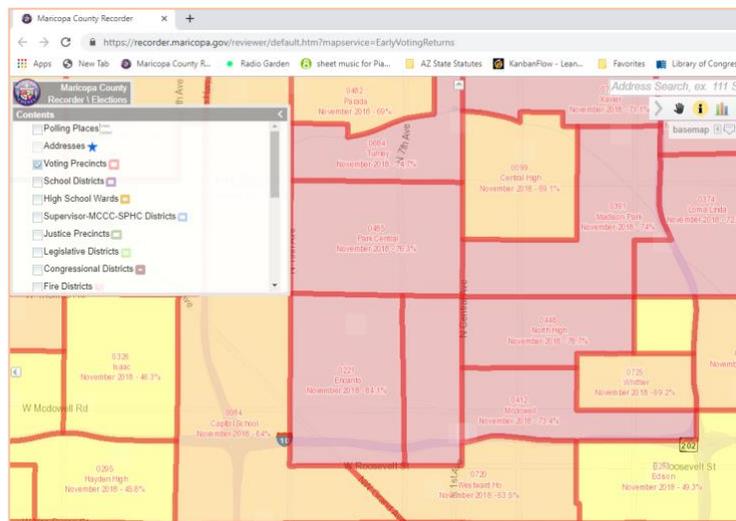
5. Additionally, election day resources can be assigned using spatial interfaces rather than tabular. The images below show applications that manage election day troubleshooter assignments and routing of deliveries.



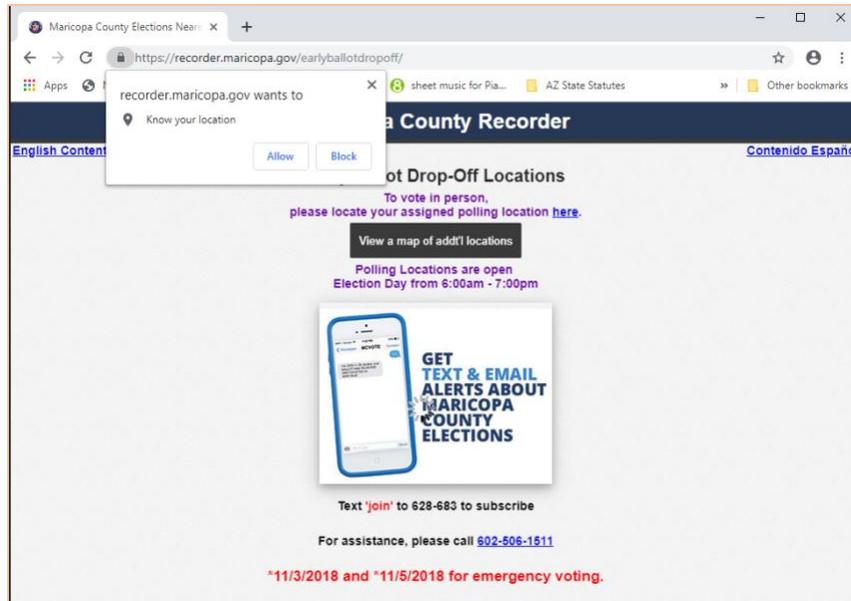
- Having spatial data in online mapping applications lets citizens, candidates, and voters view address locations and district boundaries and the relationships between them.



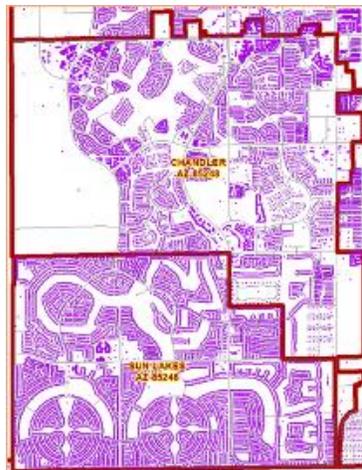
- This online interactive map shows early ballot returns by voting precinct and is updated as ballots are received, and signatures are verified so 'get out the vote' campaigns can work to increase voter turnout.



- This online resource, though absent a map, uses spatial technology to find the closest location to drop off an early ballot by using the global positioning systems (GPS) coordinates of a voter's mobile device.



- There are multiple zip codes in Maricopa County that have two primary city names associated with them. Having the spatial system differentiate which addresses are associated to which city name for addressing election mail increases voter confidence.



10. One very large benefit of having a geo-enabled election system is transparency. Anyone at any time can view an address point and all the election districts that intersect it to understand how the system works. In a tabular system, visualizing the data, and understanding how the system works, is very difficult and can lead to doubts about the accuracy.

Please contact Gary Bilotta if you have any questions. Thank you.

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