



ATTACHMENT I – General Qualifications
**ANNUAL REQUEST FOR QUALIFICATIONS AND EXPERIENCE NO:
ADSP015-00004729**

STATE PROCUREMENT OFFICE
Department of Administration
100 North 15th Avenue, Suite 201
Phoenix, Arizona 85007

(If a firm has branch offices, complete for each specific branch office seeking work.)

1. **Annual Request for Qualifications**

a. FIRM (OR BRANCH OFFICE) NAME:	TerraSystems Southwest, Inc.
b. FIRM (OR BRANCH OFFICE) STREET:	738 N. 5 th Avenue, Suite 203
c. FIRM (OR BRANCH OFFICE) CITY:	Tucson, Arizona 85705
d. FIRM (OR BRANCH OFFICE) STATE:	Arizona
e. FIRM (OR BRANCH OFFICE) ZIP CODE:	85705
f. YEAR ESTABLISHED:	1998
(g1). OWNERSHIP - TYPE:	Corporation
(g2) OWNERSHIP - SMALL BUSINESS STATUS:	Small Business with less than 100 employees & gross revenues of less than \$4 million
h. POINT OF CONTACT NAME AND TITLE:	Cheryl Thurman, Vice President/Senior Analyst
i. POINT OF CONTACT TELEPHONE NUMBER:	520.322.0334 or 520.990.8366
j. POINT OF CONTACT E-MAIL ADDRESS:	ckthurman@terrasw.com
k. NAME OF FIRM (If block 1a is a branch office):	TerraSystems Southwest, Inc.



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2. EMPLOYEES BY DISCIPLINE

a. Discipline Title	b. Function: Primary (P) or Secondary (S)	c. No. of Employees - Firm	d. No. of Employees - Branch
Geographic Information System Specialist	P	2	2
Other	S	2	2
Total		2	2



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3. PROFILE OF FIRM'S EXPERIENCE AND ANNUAL AVERAGE REVENUE FOR LAST YEAR

a. Approximate No. of Projects	b. Experience	c. Revenue Index Number (see below)
10	Aerial Photography; Airborne Data and Imagery Collection and Analysis	1
10	Cartography	1
2	Conservation and Resource Management	1
1	Digital Elevation and Terrain Model Development	1
10	Digital Orthophotography	1
1	Ecological and Archeological Investigations	1
10	Mapping Location/Addressing Systems	1
10	Surveying; Platting; Mapping; Flood Plain Studies	1
2	Transportation	1
1	Urban renewals; Community Development	1
5	Zoning; Land Use Studies	1

PROFESSIONAL SERVICES REVENUE INDEX NUMBER

- | | |
|---|---|
| 1. Less than \$100,000 | 6. \$2 million to less than \$5 million |
| 2. \$100,000 to less than \$250,000 | 7. \$5 million to less than \$10 million |
| 3. \$250,000 to less than \$500,000 | 8. \$10 million to less than \$25 million |
| 4. \$500,000 to less than \$1 million | 9. \$25 million to less than \$50 million |
| 5. \$1 million to less than \$2 million | 10. \$50 million or greater |



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4. Resumes of Key Personnel Proposed for this Contract *(Complete one Section 4 for each key person.)*

a. NAME Howard Ward	b. ROLE IN THIS CONTRACT Principal	c. YEARS EXPERIENCE	
		1. TOTAL 27	2. WITH CURRENT FIRM 17

d. LOCATION *(City and State)*
Tucson, Arizona

e. EDUCATION <i>(DEGREE AND SPECIALIZATION)</i> Bachelor of Science - Natural Resources Planning; Masters of Business Administration	f. PROFESSIONAL TRAINING - REGISTRATIONS Certified Geographic Information Systems Professional (GISP) by the GIS Certification Institute
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g. OTHER PROFESSIONAL QUALIFICATIONS *(Organizations, Awards, etc.)*
Tucson Clean and Beautiful
Past Vice President, Executive Board
2012 Board Member (14 years)

Arizona Geographic Information Council (AGIC) – Private Sector Representative (2007-2012)
AGIC – Data Committee member

Past President, AZ Chapter of Geospatial Information Technology Association

Associate Member, Arizona Public Land Surveyors

H. RELEVANT PROJECTS

1. (1) TITLE AND LOCATION <i>(City and State)</i> State of Arizona – Arizona Broadband Mapping Project Statewide - Arizona	(2) YEAR COMPLETED 2010-2014	
	Professional Services GIS Project Manager	Construction (if applicable)
(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE Beginning in late 2009 through December 2014, Mr. Ward provides GIS services for this leading-edge nationwide project. Mr. Ward and staff are responsible for a variety of complex database design and processing tasks. This work required extensive coordination with technical staff at the National States Geographic Information Council and the National Telecommunications Information Administration to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the submittal of broadband information. Mr. Ward developed, tested, and refined a very detailed workflow to process data coming from scores of different broadband providers into a standardized series of tables and geodatabase feature classes. This work is documented in a series of working papers, checklists and applications that ensure repeatability when the State takes over the maintenance of the broadband database in 2015. Millions of records of raw data have been processed, and almost 500,000 features are submitted to the NTIA bi-annually. Mr. Ward also provides post submittal analysis and mapping products to the Arizona Broadband Mapping team, including mapping maximum download speed and number of providers across the State and across both rural and urban geographies. Analysis of coverage by technology, speed and residential densities is performed each submittal cycle, both statewide and for six regional subareas. Mr. Ward also creates 3D cartographic products for illustration of various spatial analyses conducted.	<input checked="" type="checkbox"/> Check if project performed with current firm	
The database design, tracking mechanism, documentation and related analyses TSSW developed were acknowledged by the Geospatial Information Officer (GIO) of the Federal Communications Commission as an important contribution to the development and maintenance of the National Broadband Map.		
This project was a large, multi-year project, with the overall scope crossing multiple organizations and disciplines. The overall cost of the GIS portion of this project was \$425,000.		



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<p>(1) TITLE AND LOCATION (<i>City and State</i>) State of Arizona – 9-1-1 Professional Services Map Development and Enhancement Project Statewide – Arizona</p>	<p>(2) YEAR COMPLETED 2012- 2014</p> <table border="1"> <tr> <td data-bbox="933 304 1218 388">Professional Services GIS Project Manager</td> <td data-bbox="1218 304 1477 388">Construction (if applicable)</td> </tr> </table>		Professional Services GIS Project Manager	Construction (if applicable)
Professional Services GIS Project Manager	Construction (if applicable)			
<p>2. (3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE Starting in March 2012 to the present, TSSW has provided GIS support services for the 9-1-1 Program Office related to the assessment, development and enhancement of 9-1-1 GIS data layers including street centerlines, addresses, ESN/ESZ boundaries and community boundaries. Mr. Ward and TSSW staff, together with the 9-1-1 Program Office, have worked to coordinate with rural counties for the development of Scopes of Work related to street network development for three rural Arizona counties, as well as enhancement of existing datasets. An important part of this effort includes identifying and correcting GIS errors with aforementioned 9-1-1 GIS data layers to ensure conformance with the <i>Attribute Accuracy Requirements</i> section of the <i>Arizona 9-1-1 GIS Standards</i>. Mr. Ward and TSSW staff are developing and implementing complex quality-assurance procedures for work completed by the selected Contractor(s) for the street network development. Mr. Ward and TSSW staff are also developing programs and procedures for at least bi-annual assembly of statewide geocodable street networks based on county-level E-911 road networks. This project demonstrates Mr. Ward’s ability to work with multiple parties in evaluating and documenting their existing data sets, defining and justifying an E-911 database schema based on our data evaluation, identifying and developing very specific requirements for creation of street networks, Emergency Service Zone and MSAG Community boundaries and integrating all resulting datasets with a comprehensive data quality assurance program. This has been a multi-year effort, with a time & materials cost of roughly \$150,000.</p>	<p><input checked="" type="checkbox"/> Check if project performed with current firm</p>			
<p>(1) TITLE AND LOCATION (<i>City and State</i>) State of Arizona – Address Improvement Project Statewide – Arizona</p>	<p>(2) YEAR COMPLETED 2014</p> <table border="1"> <tr> <td data-bbox="933 1071 1218 1155">Professional Services GIS Project Manager</td> <td data-bbox="1218 1071 1477 1155">Construction (if applicable)</td> </tr> </table>		Professional Services GIS Project Manager	Construction (if applicable)
Professional Services GIS Project Manager	Construction (if applicable)			
<p>3. (3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE Mr. Ward and TSSW staff provide project management and technical assistance to the State E 9-1-1 Program Office in their efforts to create a statewide address database as well as the tools and workflows to support its adoption and maintenance by local data providers. Mr. Ward and TSSW staff supervise a team of 12 professionals and student interns to (1) collect, inventory, prepare and process parcels and/or address points from 7 of the 15 Arizona Counties, the ones that lacked an address point database at the time of the project; (2) develop a web-based address-editing application to allow community-wide participation in reviewing address point locations and attributes; and (3) develop GIS desktop-based tools for data inventory, quality assurance and loading into a statewide address repository. The address processing involved flagging addresses with attribute errors that need priority attention and moving address points onto the primary structure on each parcel based on current aerial imagery. The web-based address editor was implemented in Javascript and HTML5 using open source mapping libraries and an open source GeoServer backend. The data loading tools were developed in desktop FME and integrated into ArcGIS 10.x desktop software. The scope of this project crosses various institutions, including the University of Arizona and Arizona State University. The estimated project cost for this effort is \$160,000.</p>	<p><input checked="" type="checkbox"/> Check if project performed with current firm</p>			
<p>4. (1) TITLE AND LOCATION (<i>City and State</i>) Maricopa Association of Governments Phoenix, Arizona On-Call GIS Consulting Services – Modeling and Research Support: Existing Land Use Database Enhancement</p>	<p>(2) YEAR COMPLETED 2011-2012</p> <table border="1"> <tr> <td data-bbox="933 1753 1218 1879">Professional Services GIS Project Manager</td> <td data-bbox="1218 1753 1477 1879">Construction (if applicable)</td> </tr> </table>		Professional Services GIS Project Manager	Construction (if applicable)
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(3) BRIEF DESCRIPTION (*Brief scope, size, cost, etc.*) AND SPECIFIC ROLE

Check if project performed with current firm

As an On-Call Professional Services consultant, Mr. Ward supervised and participated in a complex data creation/update process for inclusion in MAG’s Arizona Socioeconomic Modeling, Analysis and Reporting Toolbox (AZ--SMART) modeling suite. AZ-SMART is a platform from which MAG builds, calibrates and analyzes socioeconomic projections and model projections for its’ 25 member jurisdictions, as well as other Councils of Government and Metropolitan Planning Organizations throughout the State of Arizona. The existing land use dataset is critical to this process and its’ update and improvement was necessary to improve model output. Mr. Ward and TSSW staff innovatively overcame several technical obstacles created from the 1.4 million polygon Maricopa County parcel base, resulting in an “empty space” feature class defining neighborhood and major road right-of-ways (ROWs) as well as other areas not defined in the County parcel base. Multiple specific datasets were then created to fill “holes” in the parcel fabric, supplement additional detail of a secondary land use on a specific parcel, and correctly identifying land use on existing parcels where the previous land use was incorrect or a new land use code was added to the defined MAD LU codes. Mr. Ward implemented and supervised the use of inventive techniques to facilitate the creation of this data, minimizing any slivers created and ensuring that parcel line integrity was maintained in the new feature classes (i.e. any new linework which shared boundaries with an existing parcel was identical or “snapped” to each node in the parcel linework). Public ownership, major road and freeway ROWs, railroad and canal ROWs, parks (municipal and neighborhood/hoa) and desert preserves, watercourses, gravel/sand operations and multi-family common areas were all created to fit seamlessly into the existing parcel fabric where appropriate, overriding existing parcel boundaries where necessary, and redefining land use where required. This project was completed within one year, at a cost of \$58,000.

(1) TITLE AND LOCATION (*City and State*)

**Central Arizona Association of Governments, GIS Support Services
Apache Junction, Arizona**

(2) YEAR COMPLETED 2010

Professional Services GIS Project Manager	Construction (if applicable)
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(3) BRIEF DESCRIPTION (*Brief scope, size, cost, etc.*) AND SPECIFIC ROLE

Check if project performed with current firm

5.

From 2006 to 2010, Mr. Ward provided GIS management and on-call GIS support for CAAG. Work includes the creation of a job and population build out model, creation of numerous data processing and analysis utility applications, and production of an updated Pinal County land use layer and Census 2000 geography re-aligned to GIS roads, parcels and imagery. Mr. Ward also provides database design and conversion assistance to CAAG staff for each of the dozen or so socio-economic database CAAG maintains and technical guidance for annual aerial imagery acquisition through commercial providers. Through this project, Mr. Ward has established numerous data contacts throughout the State and Pinal County. This GIS support effort was offered and completed under a time and materials budget.



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4. Resumes of Key Personnel Proposed for this Contract *(Complete one Section 4 for each key person.)*

a. NAME Cheryl Thurman	b. ROLE IN THIS CONTRACT Senior Analyst	c. YEARS EXPERIENCE	
		1. TOTAL 20	2. WITH CURRENT FIRM 17

d. LOCATION *(City and State)*
Tucson, Arizona

e. EDUCATION <i>(DEGREE AND SPECIALIZATION)</i> Bachelor of Science - Geosciences	f. PROFESSIONAL TRAINING - REGISTRATIONS Certified Geographic Information Systems Professional (GISP) by the GIS Certification Institute
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g. OTHER PROFESSIONAL QUALIFICATIONS *(Organizations, Awards, etc.)*

Arizona Geographic Information Council (AGIC) –
AGIC – Conference Committee member, Map and App Challenge - Chairperson
AGIC – Outreach Committee member

Tucson Area GIS Cooperative member
Southern Arizona Geographic Information Systems Consortium

H. RELEVANT PROJECTS

(1) TITLE AND LOCATION <i>(City and State)</i> State of Arizona – Arizona Broadband Mapping Project Statewide - Arizona	(2) YEAR COMPLETED 2010-2014	
	Professional Services Senior Analyst	Construction (if applicable)
(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE Beginning in late 2009 through December 2014, TSSW provides GIS database and conversion support for this leading-edge nationwide project. The TSSW Team is responsible for a variety of complex database design and processing tasks that have required extensive coordination with technical staff from the National States Geographic Information Council (NSGIC) and the National Telecommunications Information Administration (NTIA) to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the submittal of broadband information. The TSSW Team developed, tested, and refined a very detailed workflow to process data coming from scores of different broadband providers into a standardized series of tables and geodatabase feature classes. This work is documented in a series of working papers, checklists and applications that ensure repeatability when the State takes over the maintenance of the broadband database in 2015. Millions of records of raw data have been processed, and almost 500,000 features are submitted to the NTIA bi-annually. TSSW team also provides post submittal analysis and mapping products to the Arizona Broadband Mapping team, including mapping maximum download speed and number of providers across the State and across both rural and urban geographies. Analysis of coverage by technology, speed and residential densities is performed each submittal cycle, both statewide and for six regional subareas. Specifically, Ms. Thurman had participated in many areas of this project over the past 5 years, including but not limited to, conducting many specific spatial analyses and created untold number of cartographic products in support of this project. This project was a large, multi-year project, with the overall scope crossing multiple organizations and disciplines. The overall cost of the GIS portion of this project was \$425,000.	<input checked="" type="checkbox"/> Check if project performed with current firm	



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2.	<p>(1) TITLE AND LOCATION (<i>City and State</i>) State of Arizona – 9-1-1 Professional Services Map Development and Enhancement Project Statewide – Arizona</p> <p>(3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE Starting in March 2012 to the present, TSSW was selected to provide GIS support services for the 9-1-1 Program Office related to the assessment, development and enhancement of 9-1-1 GIS data layers including street centerlines, ESN/ESZ boundaries and community boundaries. Ms. Thurman and TSSW staff, together with the 9-1-1 Program Office, has worked to coordinate with rural counties for the development of Scopes of Work related to upcoming street network development for 3 rural Arizona counties, as well as enhancement of existing datasets. An important part of this effort includes identifying and correcting GIS errors with aforementioned 9-1-1 GIS data layers to ensure conformance with the <i>Attribute Accuracy Requirements</i> section of the <i>Arizona 9-1-1 GIS Standards</i>. Ms. Thurman and TSSW staff are developing and implementing complex quality-assurance procedures for work completed by the selected Contractor(s) for the street network development. Ms. Thurman and TSSW staff are also developing programs and procedures for at least bi-annual assembly of statewide geocodable street networks based on county-level E-911 road networks. Specifically, Ms. Thurman created a new fire districts GIS dataset for Navajo and Apache Counties, which required the research and coordination with local fire departments and districts within these two counties to ascertain legal descriptions for each department/district boundary. Also mapped from legal descriptions were the EMS boundaries. Ms. Thurman also analyzed and recreated a jurisdictional boundaries dataset for all city and town boundaries within Navajo and Apache Counties. This required the resolution of various boundary conflicts to create an update, accurate boundary dataset. These three datasets together were used to create, through a series of complex joins and unions, a new Emergency Service Zone dataset, which is being deployed in the 911 dispatch centers for Navajo and Apache County. Given a location, this dataset will inform 911 dispatchers which emergency response agency should be dispatched. This project demonstrates TSSW’s ability to work with multiple parties in evaluating and documenting their existing data sets, defining and justifying an E-911 database schema based on our data evaluation, identifying and developing very specific requirements for creation of street networks, Emergency Service Zone and MSAG Community boundaries and integrating all resulting datasets with a comprehensive data quality assurance program. This has been a multi-year effort, with a time & materials cost of roughly \$150,000.</p>	<p>(2) YEAR COMPLETED 2012- 2014</p> <table border="1"> <tr> <td data-bbox="938 457 1219 537">Professional Services Senior Analyst</td> <td data-bbox="1219 457 1477 537">Construction (if applicable)</td> </tr> </table>	Professional Services Senior Analyst	Construction (if applicable)	
Professional Services Senior Analyst	Construction (if applicable)				
3.	<p>(1) TITLE AND LOCATION (<i>City and State</i>) State of Arizona – Address Improvement Project Statewide – Arizona</p> <p>(3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE Ms. Thurman and TSSW staff provide project management and technical assistance to the State E 9-1-1 Program Office in their efforts to create a statewide address database as well as the tools and workflows to support its adoption and maintenance by local data providers. Ms. Thurman, together with fellow Principal Howard Ward, supervise a team of 12 professionals and student interns to (1) collect, inventory, prepare and process parcels and/or address points from 7 of the 15 Arizona Counties, the ones that lacked an address point database at the time of the project; (2) develop a web-based address-editing application to allow community-wide participation in reviewing address point locations and attributes; and (3) develop GIS desktop-based tools for data inventory, quality assurance and loading into a statewide address repository. The address processing involved flagging addresses with attribute errors that need priority attention and moving address points onto the primary structure on each parcel based on current aerial imagery. The web-based address editor was implemented in Javascript and HTML5</p>	<p>(2) YEAR COMPLETED 2014</p> <table border="1"> <tr> <td data-bbox="938 1491 1219 1570">Professional Services Senior Analyst</td> <td data-bbox="1219 1491 1477 1570">Construction (if applicable)</td> </tr> </table>	Professional Services Senior Analyst	Construction (if applicable)	
Professional Services Senior Analyst	Construction (if applicable)				
		<p><input checked="" type="checkbox"/> Check if project performed with current firm</p>			



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using open source mapping libraries and an open source GeoServer backend. The data loading tools were developed in desktop FME and integrated into ArcGIS 10.x desktop software. The scope of this project crosses various institutions, including the University of Arizona and Arizona State University. The estimated project cost for this effort is \$160,000.

(1) TITLE AND LOCATION (*City and State*)
State of Arizona – Secretary of State Office
GIS Support Services for Election Mapping Software
Statewide – Arizona

(2) YEAR COMPLETED v 2012, 2014
Professional Services Senior Analyst
Construction (if applicable)

(3) BRIEF DESCRIPTION (*Brief scope, size, cost, etc.*) AND SPECIFIC ROLE
Beginning in summer 2010, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS support for use in the development of a third party Election Night Reporting (ENR) web-based software. For the years of 2010 and 2012 election cycles, Ms. Thurman created statewide Congressional and Legislative District datasets following the necessary input requirements of the ENR software. Ms. Thurman uncovered and corrected serious topological issues with the original Legislative dataset provided to the State by the AIRC contractor. She also created a precinct level dataset for Greenlee County, as they had no GIS dataset showing 2012 precinct locations. Using strict QA/QC procedures and requirements, she also reviewed all 14 additional county datasets for the State of Arizona, creating outputs necessary for the ENR software.

Check if project performed with current firm

Ms. Thurman also conducted a similar project for SOS Office in 2014, recreating the Greenlee County Voter Precinct District GIS dataset using Bing Imagery to digitize in natural feature boundaries to create much more accurate representations of the Voter Precincts boundaries than had previously existed. Ms. Thurman recreated the voter precinct linework defined by streets or highways by snapping new linework to the TSSW recently created Statewide 911 Street Centerline dataset. The scope of this project crossed multiple years and was done on a time and materials budget. Total cost for work completed on all three election cycles was under \$5,000.

(1) TITLE AND LOCATION (*City and State*)
Maricopa Association of Governments
On-Call GIS Consulting Services – Modeling and Research Support:
Existing Land Use Database Enhancement

(2) YEAR COMPLETED 2011/2012
Professional Services Senior Analyst
Construction (if applicable)

(3) BRIEF DESCRIPTION (*Brief scope, size, cost, etc.*) AND SPECIFIC ROLE
As an On-Call Professional Services consultant, Ms. Thurman, together with fellow Principal Mr. Ward, supervised and participated in a complex data creation/update process for inclusion in MAG’s Arizona Socioeconomic Modeling, Analysis and Reporting Toolbox (AZ--SMART) modeling suite. AZ-SMART is a platform from which MAG builds, calibrates and analyzes socioeconomic projections and model projections for its’ 25 member jurisdictions, as well as other Councils of Government and Metropolitan Planning Organizations throughout the State of Arizona. The existing land use dataset is critical to this process and its’ update and improvement was necessary to improve model output. TSSW staff innovatively overcame several technical obstacles created from the 1.4 million polygon Maricopa County parcel base, resulting in an “empty space” feature class defining neighborhood and major road right-of-ways (ROWS) as well as other areas not defined in the County parcel base. Multiple specific datasets were then created to fill “holes” in the parcel fabric, supplement additional detail of a secondary land use on a specific parcel, and correctly identifying land use on existing parcels where the previous land use was incorrect or a new land use code was added to the defined MAD LU codes. TSSW implemented and supervised the use of inventive techniques to facilitate the creation of this data, minimizing any slivers created and ensuring that parcel line integrity was maintained in the new feature classes (i.e. any new linework which shared boundaries with an existing parcel was identical or “snapped” to each node in the parcel linework). Public ownership, major road and freeway ROWs, railroad and canal ROWs, parks (municipal and neighborhood/hoa) and desert preserves, watercourses, gravel/sand operations and multi-family common areas were all created to fit seamlessly into the existing parcel fabric where appropriate,

Check if project performed with current firm



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overriding existing parcel boundaries where necessary, and redefining land use where required. Ms. Thurman was specifically responsible for the creation of the parks and desert preserves, watercourses and gravel/sand operations and multi-family common areas portion of the project. This project was completed within one year, at a cost of \$58,000.



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5. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present no more than five (5) projects. Complete one Section 5 for each project.)

a. TITLE AND LOCATION <i>(City and State)</i> ARIZONA BROADBAND MAPPING PROJECT	b. YEAR COMPLETED 2009-2014	
	PROFESSIONAL SERVICES GIS Services	CONSTRUCTION <i>(If applicable)</i>

23. PROJECT OWNER'S INFORMATION

c. PROJECT OWNER State of Arizona – State Cartographer's Office	d. ORIGINAL BUDGET/NTE AMOUNT OF PROJECT Overall Project Budget – 5 million	e. TOTAL COST OF PROJECT Cost of GIS portion: \$425,000
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f. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and length of project)
 Beginning in late 2009, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS database and conversion support for this leading-edge nationwide project. The TSSW Team is responsible for a variety of complex database design and processing tasks that have required extensive coordination with technical staff from the National States Geographic Information Council (NSGIC) and the National Telecommunications Information Administration (NTIA) to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the submittal of broadband information.

The TSSW Team developed, tested, and refined a very detailed workflow to process data coming from scores of different broadband providers into a standardized series of tables and geodatabase feature classes. This work is documented in a series of working papers, checklists and applications that ensure repeatability when the State takes over the maintenance of the broadband database in 2015. Millions of records of raw data have been processed, and almost 500,000 features are submitted to the NTIA bi-annually.

The TSSW team's database design, tracking mechanism, documentation and related analyses were acknowledged early on by the Geospatial Information Officer (GIO) of the Federal Communications Commission as an important contribution to the development and maintenance of the National Broadband Map; and our analytical approach was noted by the GIO as a technique that the National Broadband Mapping unit and other states could learn from. He further commented that our novel insightful approach, together with our long history of GIS expertise, has resulted in exceptional data.

TSSW team also provides post submittal analysis and mapping products to the Arizona Broadband Mapping team, including mapping maximum download speed and number of providers across the State and across both rural and urban geographies. Analysis of coverage by technology, speed and residential densities is performed each submittal cycle, both statewide and for six regional subareas.

Over the years, untold numbers of spatial analyses were conducted for various purposes, as well as associated 2D and 3D cartographic products.

“TerraSystems Southwest (TSSW) provided GIS services for the Arizona Broadband Mapping Project. As the Arizona State Cartographer, I coordinated with TSSW on the project. The services TSSW provided included processing data obtained from broadband service providers into NTIA and FCC compliant geospatial data format, conducting QC/QA on the processed data and developing improved data processing methodologies. In addition, TSSW provided GIS services for the Broadband Address Mapping Project. This included working with the Arizona 9-1-1 State Office to complete the development of 9-1-1 address data throughout the state, developing improved statewide GIS address data standards, integrating Arizona county GIS data into a statewide address database and developing an Arizona geocoding service for use by the Broadband Mapping Project and authorized agencies. TSSW has also contributed advice on a wide variety of topics. Their extensive knowledge of GIS and project management has proved to be a very valuable asset to the Broadband Mapping Project and State Cartographer's Office.” – Gene Trobia, former State Cartographer for the State of Arizona, retired Jan 2014, May 2014

“TerraSystems Southwest, Inc. (TSSW) has been a subcontractor and valued partner for the last five years on high-level broadband data collection and mapping projects. TSSW's knowledge of the telecom and technology arena, especially GIS, is phenomenal. Working with TSSW on projects is a pleasure and the professional and committed efforts have proved consistently reliable and invaluable over time.” – Mark Goldstein, Project Manager, Data Site Consortium, Inc. May 2014



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100 North 15th Avenue, Suite 201
Phoenix, Arizona 85007**

5. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present no more than five (5) projects. Complete one Section 5 for each project.)

a. TITLE AND LOCATION <i>(City and State)</i> State of Arizona – 9-1-1 Professional Services Map Development and Enhancement Project Statewide – Arizona	b. YEAR COMPLETED	
	PROFESSIONAL SERVICES GIS Services	CONSTRUCTION <i>(If applicable)</i>

23. PROJECT OWNER'S INFORMATION

c. PROJECT OWNER State of Arizona – 911 Program Office	d. ORIGINAL BUDGET/NTE AMOUNT OF PROJECT Under Master Blanket PO, service cost as needed	e. TOTAL COST OF PROJECT \$150,000
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g. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and length of project)
Starting in March 2012 to the present, TSSW was selected to provide GIS support services for the 9-1-1 Program Office related to the assessment, development and enhancement of 9-1-1 GIS data layers including street centerlines, ESN/ESZ boundaries and community boundaries. Mr. Ward, together with the 9-1-1 Program Office, has worked to coordinate with rural counties for the development of Scopes of Work related to upcoming street network development for 3 rural Arizona counties, as well as enhancement of existing datasets. An important part of this effort includes identifying and correcting GIS errors with aforementioned 9-1-1 GIS data layers to ensure conformance with the *Attribute Accuracy Requirements* section of the *Arizona 9-1-1 GIS Standards*. Mr. Ward and TSSW staff are developing and implementing complex quality-assurance procedures for work completed by the selected Contractor(s) for the street network development. Ms. Thurman and TSSW staff are also developing programs and procedures for at least bi-annual assembly of statewide geocodable street networks based on county-level E-911 road networks. This project demonstrates TSSW's ability to work with multiple parties in evaluating and documenting their existing data sets, defining and justifying an E-911 database schema based on our data evaluation, identifying and developing very specific requirements for creation of street networks, Emergency Service Zone and MSAG Community boundaries and integrating all resulting datasets with a comprehensive data quality assurance program.

5. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present no more than five (5) projects. Complete one Section 5 for each project.)

a. TITLE AND LOCATION <i>(City and State)</i> State of Arizona – Address Improvement Project Statewide – Arizona	b. YEAR COMPLETED 2014	
	PROFESSIONAL SERVICES GIS Services	CONSTRUCTION <i>(If applicable)</i>

23. PROJECT OWNER'S INFORMATION

c. PROJECT OWNER State of Arizona – 911 Program Office, State Cartographer's Office	d. ORIGINAL BUDGET/NTE AMOUNT OF PROJECT 162,000	e. TOTAL COST OF PROJECT \$160,000
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f. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and length of project)
TSSW provides project management and technical assistance to the State E 9-1-1 Program Office in their efforts to create a statewide address database as well as the tools and workflows to support its adoption and maintenance by local data providers. TSSW supervised a team of 12 professionals and student interns to (1) collect, inventory, prepare and process parcels and/or address points from 7 of the 15 Arizona Counties, the ones that lacked an address point database at the time of the project; (2) develop a web-based address-editing application to allow community-wide participation in



ATTACHMENT I – General Qualifications

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reviewing address point locations and attributes; and (3) develop GIS desktop-based tools for data inventory, quality assurance and loading into a statewide address repository. The address processing involved flagging addresses with attribute errors that need priority attention and moving address points onto the primary structure on each parcel based on current aerial imagery. The web-based address editor was implemented in Javascript and HTML5 using open source mapping libraries and an open source GeoServer backend. The data loading tools were developed in desktop FME and integrated into ArcGIS 10.x desktop software.

5. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present no more than five (5) projects. Complete one Section 5 for each project.)

a. TITLE AND LOCATION <i>(City and State)</i> State of Arizona – Secretary of State’s Office - GIS Support Services for Election Mapping Software Statewide – Arizona	b. YEAR COMPLETED 2010, 2012, 2014	
	PROFESSIONAL SERVICES GIS Services	CONSTRUCTION <i>(If applicable)</i>

23. PROJECT OWNER'S INFORMATION

c. PROJECT OWNER State of Arizona – Secretary of State's Office	d. ORIGINAL BUDGET/NTE AMOUNT OF PROJECT Done as Time/Expenses	e. TOTAL COST OF PROJECT Under 10k
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f. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and length of project)
 Beginning in summer 2010, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS support for use in the development of a third party Election Night Reporting (ENR) web-based software. TSSW created statewide Congressional and Legislative District datasets following the necessary input requirements of the ENR software. TSSW uncovered and corrected serious topological issues with the original Legislative dataset provided to the State by the AIRC contractor. TSSW also created a precinct level dataset for Greenlee County, as they had no GIS dataset showing 2012 precinct locations. Using strict QA/QC procedures and requirements, TSSW also reviewed all 14 additional county datasets for the State of Arizona, creating outputs necessary for the ENR software.

TSSW also conducted a similar project for SOS Office in 2014, recreating the Greenlee County Voter Precinct District GIS dataset using Bing Imagery to digitize in natural feature boundaries to create much more accurate representations of the Voter Precincts boundaries than had previously existed. Ms. Thurman recreated the voter precinct linework defined by streets or highways by snapping new linework to the TSSW recently created Statewide 911 Street Centerline dataset.



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5. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present no more than five (5) projects. Complete one Section 5 for each project.)

<p>a. TITLE AND LOCATION <i>(City and State)</i> On-Call GIS Consulting Services – Modeling and Research Support: <i>Existing Land Use Database Enhancement (2010-2012)</i></p>	<p>b. YEAR COMPLETED 2011</p> <table border="1"> <tr> <td data-bbox="982 447 1252 558"> <p>PROFESSIONAL SERVICES GIS Services</p> </td> <td data-bbox="1252 447 1554 558"> <p>CONSTRUCTION <i>(If applicable)</i></p> </td> </tr> </table>		<p>PROFESSIONAL SERVICES GIS Services</p>	<p>CONSTRUCTION <i>(If applicable)</i></p>
<p>PROFESSIONAL SERVICES GIS Services</p>	<p>CONSTRUCTION <i>(If applicable)</i></p>			

23. PROJECT OWNER'S INFORMATION

<p>c. PROJECT OWNER Maricopa Association of Governments</p>	<p>d. ORIGINAL BUDGET/NTE AMOUNT OF PROJECT \$58,417</p>	<p>e. TOTAL COST OF PROJECT \$58,417</p>
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f. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and length of project)
As an On-Call Professional Services consultant, TSSW completed a complex data creation/update process for inclusion in MAG's Arizona Socioeconomic Modeling, Analysis and Reporting Toolbox (AZ-SMART) modeling suite. AZ-SMART is a platform from which MAG builds, calibrates and analyzes socioeconomic projections and model projections for its' 25 member jurisdictions, as well as other Councils of Government and Metropolitan Planning Organizations throughout the State of Arizona. The existing land use dataset is critical to this process and its' update and improvement was necessary to improve model output. TSSW innovatively overcame several technical obstacles created from the 1.4 million polygon Maricopa County parcel base, resulting in an "empty space" feature class defining neighborhood and major road right-of-ways (ROWs) as well as other areas not defined in the County parcel base. Multiple specific datasets were then created to fill "holes" in the parcel fabric, supplement additional detail of a secondary land use on a specific parcel, and correctly identifying land use on existing parcels where the previous land use was incorrect or a new land use code was added to the defined MAD LU codes. TSSW employed inventive techniques to facilitate the creation of this data, minimizing any slivers created and ensuring that parcel line integrity was maintained in the new feature classes (i.e. any new linework which shared boundaries with an existing parcel was identical or "snapped" to each node in the parcel linework). Public ownership, major road and freeway ROWs, railroad and canal ROWs, parks (municipal and neighborhood/hoa) and desert preserves, watercourses, gravel/sand operations and multi-family common areas were all created to fit seamlessly into the existing parcel fabric where appropriate, overriding existing parcel boundaries where necessary, and redefining land use where required.



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6. ADDITIONAL INFORMATION

a. PROVIDE ANY ADDITIONAL INFORMATION YOU FEEL MAY BE NECESSARY TO DESCRIBE YOUR FIRMS QUALIFICATIONS. (ATTACH ADDITIONAL SHEETS AS NEEDED.)

Company Overview

TerraSystems Southwest, Inc. (TSSW) is a Geographic Information Systems (GIS) consulting firm and an ESRI Business Partner with the main office located in Tucson, Arizona. Founded in 1998, the mission of TerraSystems is to assist organizations, both public and private sector, efficiently acquire and successfully apply GIS technology to enhance planning and decision-making processes. TSSW offers a full spectrum of GIS-related services including strategic planning, system design and installation, data conversion, spatial analyses, application development, decision support tools, on-call technical support and customized training. Our team of professionals has a wide range of experience, with over 35 years of GIS technical and managerial experience. TSSW is nationally recognized for our innovative use of technology, analytical methodologies and sharp attention to detail resulting in exceptional products and accomplished goals for our clients.

Valued Clients

Since its inception, TSSW has been involved with a number of progressive GIS projects throughout the southwestern United States, as well as such diverse locals as the Triangle-J area in North Carolina, Bozeman Montana, and Oahu, Hawaii. As a client-oriented consulting firm, TSSW has fostered a long list of successful projects and satisfied clients ranging from governmental agencies to planning and consulting firms, utilities, non-profit organizations and for-profit corporations.

As demonstrated by our partial list of clients, they are as varied in their size as they are in their mission. TSSW works closely with each client to define and customize a solution that meets their specific needs. From simple data conversion to complex application development, on-call technical support or strategic planning, TSSW has the flexibility to respond to the needs of our varied clientele.

AREAS OF EXPERTISE

Needs Analysis and Strategic Planning – TSSW has conducted and participated in numerous GIS needs assessments and strategic planning processes for organizations of varying size and complexity. Beginning with Mr Ward’s leadership of Pima County’s effort to acquire and deploy an enterprise-wide GIS database in the early 1990’s through successful plans for Tucson Water, the Town of Oro Valley, the City of Casa Grande and the Central Arizona Association of Governments, TSSW has a proven record of listening to clients and helping them design GIS approaches that fit their culture and budget. TSSW can help any size organization adopt and adapt to the ever-changing GIS technology landscape by thinking carefully about what needs to be done and then identifying the right technology at the right scale to accomplish the goals.

Database Design and Implementation – TSSW staff have designed and implemented numerous complex spatial and non-spatial databases over the course of their careers. While at PCDOT, Mr. Ward directed the creation of the multi-million dollar parcel and street network databases. This was a complex task involving the design and implementation of workflows, programs and procedures for converting parcel data from its source in AutoCAD into a single, county wide GIS layer. TSSW staff assisted Tucson Water in the conceptual design of the GIS representation of their AutoCAD valve map database. TSSW Staff assisted the Maricopa Association of Governments convert and quality control numerous socio-economic and transportation databases for use in their GIS modeling efforts in Maricopa County. We regularly research, acquire, evaluate, convert and quality check spatial databases using ESRI products. This work includes a number of spatial and attribute cross-checks as well as topology rules and validation. We build and maintain our own internal SQL Server geodatabase and we are familiar with the workflows for installation, operation and maintenance of enterprise-level geodatabases. We are also power users of Access and Excel products and use them to do extensive database translation and prototyping.

Data Creation/Conversion, Spatial Analyses, GIS Support Services – TSSW has completed countless data creation/conversion efforts for a variety of clientele, from small consulting and engineering firms, to large governmental entities, to local and national non-profit entities working under tight budget constraints. Often intertwined with data acquisition/creation/conversion is geospatial analyses – ranging from simple overlay analyses to complex suitability analyses built in ModelBuilder. TSSW has the capacity to meet the specialized needs of each client regardless of their size or the scale of their needs.

TSSW has extensive experience in supporting Conceptual Plan and General Plan project requirements, using innovative techniques to support the often complex planning process, as well publication quality cartographic products to communicate clearly to those unfamiliar with mapping and planning conventions. We routinely work as an extension of several planning firms which we have developed long lasting, supportive relationships over the years. Community by Design (CBD) is one such firm. TSSW and CBD have had a very successful collaborative relationship since 2000. CBD, nationally recognized for its dynamic urban design and sustainable community development, has included TSSW as a team member in countless Conceptual Plans, General Plans, Growth Management Plans as well as Downtown Development plans in Arizona, New Mexico and Colorado. TSSW provides CBD with a range of services from data research and acquisition, data creation/conversion, cartography, to complexity suitability analyses and growth modeling. Another long time collaborative partner is David Williams & Associates. DWA has utilized TSSW for GIS services support on a wide



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variety of projects ranging from small rezoning applications, to large scale planning projects such as the Town of Oro Valley Environmentally Sensitive Lands Project, culminating in a new ESL ordinance for the Town in 2010.

GIS Application Development and Integration - TSSW staff and our independent contractors have written numerous GIS applications for data processing and analyses, including apps for data translation and loading, data quality control, infrastructure management programs, and spatial analysis. We program using Python, .NET/ArcObjects, VB/ArcObjects, JavaScript, VBScript, VBA and others. TSSW built a population Build-Out Model (BOM) for the Central Arizona Association of Government and a Spatial Growth Model (SGM) for the Global Climate Change Program at Prescott College. The CAAG BOM is written in Python, runs in ArcToolbox, and estimates the total dwelling units, population and jobs in Pinal County at build out. This application has reduced the time for model update from weeks to less than one hour. The Spatial Growth Model (SGM) is designed to assist communities address future growth issues and help them better manage and prepare for that growth. SGM has been applied in various communities nationwide and was part of a project that won a National Reinventing Government Award.

Cartography - TSSW is known for its high quality cartographic products and inventive use of desktop graphics software to display GIS data, analyses and model results. TSSW works with clients to create 3D visualizations which can be used as an effective decision-making support tool.

****Please see our TerraSystems Southwest References and Project Description document for additional information, including Reference names and contact information, as well as testimonial quotes provided by our clients.**

7. ANNUAL AVERAGE PROFESSIONAL SERVICES REVENUES OF FIRM FOR LAST 3 YEARS

a.	Percentage of Total Work Attributable to State, Federal and Municipal Government Work:	90%
b.	Percentage of Total Work Attributable to Non-Government Work:	10%

8. AUTHORIZED REPRESENTATIVE. The foregoing is a statement of facts.

Signature: Cheryl Thurman Date: 12/19/14

Name: Cheryl Thurman Title: Vice President, Senior Analyst

TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support



STATE OF ARIZONA – ARIZONA STATE CARTOGRAPHER'S OFFICE, ARIZONA DEPARTMENT OF ADMINISTRATION & DATA SITE CONSORTIUM, INC.

ARIZONA BROADBAND MAPPING PROJECT

GIS Database Design, Creation, Verification and Collaboration for the National Broadband Mapping Project (2009-Present)

Beginning in late 2009, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS database and conversion support for this leading-edge nationwide project. The TSSW Team is responsible for a variety of complex database design and processing tasks that have required extensive coordination with technical staff from the National States Geographic Information Council (NSGIC) and the National Telecommunications Information Administration (NTIA) to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the submittal of broadband information.

The TSSW Team developed, tested, and refined a very detailed workflow to process data coming from scores of different broadband providers into a standardized series of tables and geodatabase feature classes. This work is documented in a series of working papers, checklists and applications that ensure repeatability when the State takes over the maintenance of the broadband database in 2015. Millions of records of raw data have been processed, and almost 500,000 features are submitted to the NTIA bi-annually.

The TSSW team's database design, tracking mechanism, documentation and related analyses were acknowledged early on by the Geospatial Information Officer (GIO) of the Federal Communications Commission as an important contribution to the development and maintenance of the National Broadband Map; and our analytical approach was noted by the GIO as a technique that the National Broadband Mapping unit and other states could learn from. He further commented that our novel insightful approach, together with our long history of GIS expertise, has resulted in exceptional data.

TSSW team also provides post submittal analysis and mapping products to the Arizona Broadband Mapping team, including mapping maximum download speed and number of providers across the State and across both rural and urban geographies. Analysis of coverage by technology, speed and residential densities is performed each submittal cycle, both statewide and for six regional subareas.

"TerraSystems Southwest (TSSW) provided GIS services for the Arizona Broadband Mapping Project. As the Arizona State Cartographer, I coordinated with TSSW on the project. The services TSSW provided included processing data obtained from broadband service providers into NTIA and FCC compliant geospatial data format, conducting QC/QA on the processed data and developing improved data processing methodologies. In addition, TSSW provided GIS services for the Broadband Address Mapping Project. This included working with the Arizona 9-1-1 State Office to complete the development of 9-1-1 address data throughout the state, developing improved statewide GIS address data standards, integrating Arizona county GIS data into a statewide address database and developing an Arizona geocoding service for use by the Broadband Mapping Project and authorized agencies. TSSW has also contributed advice on a wide variety of topics. Their extensive knowledge of GIS and project management has proved to be a very valuable asset to the Broadband Mapping Project and State Cartographer's Office.

" – Gene Trobia, former State Cartographer for the State of Arizona, retired Jan 2014, May 2014

"TerraSystems Southwest, Inc. (TSSW) has been a subcontractor and valued partner for the last five years on high-level broadband data collection and mapping projects. TSSW's knowledge of the telecom and technology arena, especially GIS, is phenomenal. Working with TSSW on projects is a pleasure and the professional and committed efforts have proved consistently reliable and invaluable over time." – Mark Goldstein, Project Manager, Data Site Consortium, Inc. May 2014

Gene Trobia
(Former Arizona State Cartographer)
Research Social Scientist
College of Social and Behavioral Sciences
University of Arizona
Tucson, Arizona 85705
(602) 373-4126
gtrobia@email.arizona.edu

Mark Goldstein
Project Manager, Data Site Consortium, Inc.
President, International Research Center
(602) 470-0389
markg@researchedge.com



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont.)



STATE OF ARIZONA – ARIZONA DEPARTMENT OF ADMINISTRATION

E-911 Program Office – GIS Project Contractor

Professional Services Map Development and Enhancement Project

Starting in March 2012 to the present, TSSW was selected to provide GIS support services for the 9-1-1 Program Office related to the assessment, development and enhancement of 9-1-1 GIS data layers including street centerlines, ESN/ESZ boundaries and community boundaries. TSSW, together with the 9-1-1 Program Office, has worked to coordinate with rural counties for the development of Scopes of Work related to upcoming street network development for 3 rural Arizona counties, as well as enhancement of existing datasets. An important part of this effort includes identifying and correcting GIS errors with aforementioned 9-1-1 GIS data layers to ensure conformance with the *Attribute Accuracy Requirements* section of the *Arizona 9-1-1 GIS Standards*. TSSW is developing and implementing complex quality-assurance procedures for work completed by the selected Contractor(s) for the street network development. TSSW is also developing programs and procedures for at least bi-annual assembly of statewide geocodable street networks based on county-level E-911 road networks. This project demonstrates our ability to work with multiple parties in evaluating and documenting their existing data sets, defining and justifying an E-911 database schema based on our data evaluation, identifying and developing very specific requirements for creation of street networks, Emergency Service Zone and MSAG Community boundaries and integrating all resulting datasets with a comprehensive data quality assurance program.

'TerraSystems Southwest has proven to be an instrumental part of the success achieved in the projects they have participated in for the Arizona 9-1-1 Program. The level of expertise possessed by TerraSystems Southwest along with their professionalism provides confidence in their abilities to accomplish any goal that may be presented to them. Their willingness to participate, the guidance they have provided and the flexibility which has been needed many times is a testament to their level of commitment.' - Sandra Gilstad, State of Arizona 9-1-1 Project Manager May 2014

Sandra Gilstad

9-1-1 Project Manager

Arizona 9-1-1 Program

ADOA - Arizona Strategic Enterprise

Technology (ASET) Office | State of Arizona

100 North 15th Avenue, Suite 400

Phoenix, AZ 85007

(602) 771-3911

Sandra.Gilstad@azdoa.gov



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont.)



STATE OF ARIZONA – ARIZONA DEPARTMENT OF ADMINISTRATION

E-911 Program Office – GIS Project Contractor

ADDRESS DATA IMPROVEMENT PROJECT 11/1/14 – PRESENT)

TSSW provides project management and technical assistance to the State E 9-1-1 Program Office in their efforts to create a statewide address database as well as the tools and workflows to support its adoption and maintenance by local data providers. TSSW supervised a team of 12 professionals and student interns to (1) collect, inventory, prepare and process parcels and/or address points from 7 of the 15 Arizona Counties, the ones that lacked an address point database at the time of the project; (2) develop a web-based address-editing application to allow community-wide participation in reviewing address point locations and attributes; and (3) develop GIS desktop-based tools for data inventory, quality assurance and loading into a statewide address repository. The address processing involved flagging addresses with attribute errors that need priority attention and moving address points onto the primary structure on each parcel based on current aerial imagery. The web-based address editor was implemented in Javascript and HTML5 using open source mapping libraries and an open source GeoServer backend. The data loading tools were developed in desktop FME and integrated into ArcGIS 10.x desktop software.

Curtis Pulford

Arizona State Cartographer

State of Arizona

1616 W. Adams

Phoenix, Arizona 85007

(602) 373-4126

CPulford@azland.gov



STATE OF ARIZONA – SECRETARY OF STATE OFFICE

GIS Support Services for Election Mapping Software

Beginning in summer 2012, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS support for use in the development of a third party Election Night Reporting (ENR) web-based software. TSSW created statewide Congressional and Legislative District datasets following the necessary input requirements of the ENR software. TSSW uncovered and corrected serious topological issues with the original Legislative dataset provided to the State by the AIRC contractor. TSSW also created a precinct level dataset for Greenlee County, as they had no GIS dataset showing 2012 precinct locations. Using strict QA/QC procedures and requirements, TSSW also reviewed all 14 additional county datasets for the State of Arizona, creating outputs necessary for the ENR software.

TSSW also conducted a similar project for SOS Office in 2014, recreating the Greenlee County Voter Precinct District GIS dataset using Bing Imagery to digitize in natural feature boundaries to create much more accurate representations of the Voter Precincts boundaries than had previously existed. Ms. Thurman recreated the voter precinct linework defined by streets or highways by snapping new linework to the TSSW recently created Statewide 911 Street Centerline dataset.

"I would be happy to serve as a reference for you. You were instrumental in our project and we were very pleased. Feel free to list me!" Gina Roberts, Election Office Manager, May 2014

Gina Roberts

Election Office Manager

Arizona Secretary of State

1700 W. Washington St., 7th Floor

Phoenix, Arizona 85007

(602) 364-3216

groberts@azsos.gov

Ms. Roberts can attest to TerraSystems exceptional quality of work and ability to respond quickly to immediate needs. While SOS was working with a third party vendor for the development of Election Night Reporting software, TSSW was often required to respond on very short notice to technological changes to the input requirements of the GIS datasets. TSSW worked nights and weekends to accommodate their tight scheduling needs, providing election district datasets in the required format and meeting specialized technological requirements of the ENR software provider.



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont.)



STATE OF ARIZONA – ARIZONA STATE LAND DEPARTMENT

Conceptual Land Use Planning

From 2000 to 2010, TSSW has provided GIS data conversion, spatial analyses and suitability model development for numerous Arizona State Land Department Conceptual Land Use Conceptual projects.

As a sub-consultant to Community By Design and The WLB Group, TSSW has researched, collected, processed, analyzed hundreds of datasets, created high quality maps and conducted complex suitability model development for ASLD projects in areas across the State of Arizona including the Arroyo Grande area north of Oro Valley, Eloy, Coolidge, Stanfield, Peoria, Prescott, Lake Havasu, Marana, Rincon and greater Tucson areas. The HTML front-end data delivery CD format developed by TSSW in 1999 to facilitate the delivery, review and evaluation of all State mandated requirements for the Conceptual Plan process was adopted by ASLD as the State standard for data delivery for all State consultants hired to complete Conceptual Plans. Included in this mandate for all future Conceptual Plans was the inclusion of a suitability analysis, first designed and completed by TSSW. TSSW's innovative products were provided as examples to other consultants.

Ron Huettner

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Charlie Deans, Principal, AICP

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(505) 508-3361
(520) 444-1267
charlie@communitybydesign.biz



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont.)



MARICOPA ASSOCIATION OF GOVERNMENTS (MAG)

On-Call GIS Consulting Services – Modeling and Research Support: *Existing Land Use Database Enhancement (2010-2012)*

As an On-Call Professional Services consultant, TSSW completed a complex data creation/update process for inclusion in MAG's Arizona Socioeconomic Modeling, Analysis and Reporting Toolbox (AZ-SMART) modeling suite. AZ-SMART is a platform from which MAG builds, calibrates and analyzes socioeconomic projections and model projections for its' 25 member jurisdictions, as well as other Councils of Government and Metropolitan Planning Organizations throughout the State of Arizona. The existing land use dataset is critical to this process and its' update and improvement was necessary to improve model output. TSSW innovatively overcame several technical obstacles created from the 1.4 million polygon Maricopa County parcel base, resulting in an "empty space" feature class defining neighborhood and major road right-of-ways (ROWs) as well as other areas not defined in the County parcel base. Multiple specific datasets were then created to fill "holes" in the parcel fabric, supplement additional detail of a secondary land use on a specific parcel, and correctly identifying land use on existing parcels where the previous land use was incorrect or a new land use code was added to the defined MAD LU codes. TSSW employed inventive techniques to facilitate the creation of this data, minimizing any slivers created and ensuring that parcel line integrity was maintained in the new feature classes (i.e. any new linework which shared boundaries with an existing parcel was identical or "snapped" to each node in the parcel linework). Public ownership, major road and freeway ROWs, railroad and canal ROWs, parks (municipal and neighborhood/hoa) and desert preserves, watercourses, gravel/sand operations and multi-family common areas were all created to fit seamlessly into the existing parcel fabric where appropriate, overriding existing parcel boundaries where necessary, and redefining land use where required.

Anubhav Bagley

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Jason Howard

*GIS Program Manager
Maricopa Association of Governments
phone: (602) 254-6300
fax: (602) 254-6490
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Mr. Bagley and Mr. Howard can address TSSW's work ethic, use of innovative techniques to overcome difficult technical problems and outstanding attention to detail. Our dedication to providing the best product possible to our clients has been evident in our long standing relationship with MAG since 1999.



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont)



CENTRAL ARIZONA GOVERNMENTS (CAG)

Ongoing GIS Technical Support/Application Development for Land Use Planning and Modeling in a Rural Community

From 2007 - 2012, TSSW provided CAG with a wide variety of on-call and project GIS support. On-call includes phone support and ad-hoc training to upgrade their ability to perform advanced GIS tasks in-house. Projects range from GIS strategic planning, through hardware and software specification, database design, data collection and maintenance, complex spatial analysis, application development and custom training. TSSW helped CAG staff design and implement a simple GIS database, including maintenance, documentation and distribution workflows. TSSW developed and applied innovative and creative approaches to re-align census blocks polygons and update existing land use layers saving thousands of dollars in conversion time and providing CAG with more accurate data than had ever been available prior to this effort. TSSW designed, built and implemented an ESRI ModelBuilder and Python application to simulate future build-out scenarios. TSSW used ESRI ArcObjects in the Microsoft.NET programming environment to design and implement an application designed to more efficiently identify changes in geometry and land use attributes for future updates to the existing parcel-based land use data. TSSW staff facilitated a data sharing opportunities between CAG and private data providers for the acquisition of previously unavailable data related to foreclosures in Pinal County. TSSW continues to pursue all avenues and opportunities to assist CAG in their pursuit of using GIS technology to develop and improve critical growth management policies.

Angela Gotto, Management Analyst II

Central Arizona Governments
1075 South Idaho Road, Suite 300
Apache Junction, Arizona
Phone: (480) 671-0059
agotto@cagaz.org



Local, State and Federal Government GIS Services Support (cont)



TOWN OF ORO VALLEY, ARIZONA

GIS Strategic Plan, Implementation and On-call Support Services (1999-2005)

In 1999, TerraSystems Southwest, Inc. (TSSW) assisted Global Systems Modeling Ltd. with a comprehensive GIS Strategic Plan for the Town of Oro Valley. This included a Departmental User Needs Analysis, recommendations for workflows and personal, software/hardware recommendations, cost analyses and proposed implementation scheduling. From 1999-2005, TSSW provided the Town with GIS Support services including a variety of data creation, conversion and update projects and provided on-call technical support ranging from simple technical issues to complex spatial analyses guidance.

“Having worked with TerraSystems Southwest on data conversion and GIS implementation projects at the Town of Oro Valley, I have found that their staff’s knowledge and expertise in small government GIS indispensable. They not only have the ability to manage complex projects and deliver diverse deliverables on time but they take pride in their work to insure the highest quality product is delivered to their clients. It is important to know about GIS data and systems, but knowing how it can best benefit and work within your organization is a skill that TerraSystems does best. I would highly recommend them to anyone looking for a highly skilled and knowledgeable GIS Firm.” – Raul Duato, former GIS Analyst for the Town of Oro Valley

Raul Duato *

*GIS Data/Programmer/Analyst
Eugene Water & Electric Board
500 E. Fourth Avenue
Eugene, Oregon 97401
(541) 685-7000*

** Coordinating Town Staff from 1999-2003, is no longer with the Town and current contact information is unknown. The subsequent GIS Analyst for the Town from 2003-2005 was Raul Duato. His contact information is listed.*

David Williams

*Former Town of Oro Valley Planning Director
Vice President, Planning
Urban Engineering
877 S. Alvernon Way
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520-318-3800
520-360-5790 (cell)*

Mr. Duato can speak to the GIS Support Services that TerraSystem’s provided during his time as GIS Analyst for the Town. He is also aware of the extensive work done previous to his employment, the attention to detail we have, and the quality of the numerous end products created and updated.

Mr. Williams has worked with TSSW for over 14 years and can speak to the quality of our work, our responsiveness and dedication to our clientele to provide the most cost effective solution, while maximizing organizational benefits.



TerraSystems Southwest, Inc. – Project Descriptions & References

Local, State and Federal Government GIS Services Support (cont)



TOWN OF ORO VALLEY, ARIZONA

David Williams & Associates – Town of Oro Valley Environmentally Sensitive Lands Ordinance

TSSW provided GIS analytical and modeling support for this critical project in the rapidly growing community of Oro Valley, Arizona. The Town of Oro Valley’s goal was to blend their concerns for the Sonoran Desert environment with their desire for quality sustainable development. TSSW used highly accurate mapping techniques together with spatial analyses and modeling to define environmental sensitive land areas, while also integrating significant community input. TerraSystems was one member of a team of professionals headed by David Williams & Associates and incorporating planning policy experts, field biologists, legal and public relations professionals. The result of this project will include new Environmental Sensitive Land Ordinances drafted and approved by the Town Council including accurate maps of annexed critical habitat lands for natural resource and wildlife preservation. This process of determining areas of open space important to community constituents involved a lengthy and thorough involvement of the public, supported by timely, comprehensive GIS maps, analysis and modeling from TSSW. More than 100 datasets were collected, converted, created or updated during the course of this project, and more than 110 high quality cartographic products were produced for both internal Town use and public meetings.

David Williams & Assoc.
David Williams, AICP Principal
1421 W. Chapala
Tucson, Arizona 85704
(520) 360-5790

Mr. Williams has worked with TSSW for over 14 years and can speak to the quality of our work, our responsiveness and dedication to our clientele to provide the most cost effective solution, while maximizing organizational benefits.



TerraSystems Southwest, Inc. – Project Descriptions & References

On-Call GIS Support Services – Private Sector



COMMUNITY BY DESIGN – ALBUQUERQUE, NM & TUCSON, AZ

On-call GIS Support (2000-Present)

TSSW has provided Community by Design, a nationally recognized and accomplished planning firm in the area of dynamic urban design and sustainable communities, with GIS services since 2000. From data research and acquisition, to complex spatial analyses and modeling, TSSW routinely provides responsive service with the anticipation and flexibility of a seasoned staff member. In some situations, turnaround time for produced maps and analysis can be extremely short, as little as the same day. TSSW routinely is able to meet tight deliverable deadlines, while still producing the quality product expected. Projects includes Taos County, Colorado Growth Management Plan; La Plata County, Colorado Comprehensive Community Plan; Galisto, New Mexico Village Plan, Las Vegas, New Mexico

Downtown Action Plan; Los Duranes Sector Development Plan (Albuquerque, New Mexico); Lovington, New Mexico Downtown Master Plan; Sawmill Land Trust/Wells Park Metropolitan Redevelopment Plan (Albuquerque, New Mexico); Silver City Downtown Action Plan (Silver City, New Mexico); Virden Comprehensive Plan (Virden, New Mexico); and numerous Arizona State Land Department (ASLD) Conceptual Plans for the greater Tucson and southern Arizona area.

“CommunityByDesign has utilized TSSW’s GIS services for over 16 years on a variety of innovative modeling and analyses related to land use planning, growth and development scenarios, and population projections and governmental jurisdiction needs assessments. We have found TSSW to be responsive and thorough with a high level of quality control. We look forward to working with them for another 15 years!” – Charlie Deans, Principal & AICP, CommunitybyDesign

Community By Design Albuquerque, New Mexico & Tucson, Arizona

*Charlie Deans
Principal, AICP
621 Vassar Dr. NE
Albuquerque, New Mexico
(505) 508-3361
(520) 444-1267*

Mr. Deans has over 16 years of experience working with TerraSystems Southwest in a wide variety of jurisdictional planning projects ranging from General Plans and county-wide Comprehensive Plans, to urban design and sustainable community planning. Mr. Deans can speak to our ability to work on projects remotely, responsiveness under tight deadlines, exceptional quality of work and ability to work well with governmental entities, especially the challenges facing smaller and rural communities.



TerraSystems Southwest, Inc. – Additional Project Descriptions

Global Change Program, Prescott College – Spatial Growth Model Development, Fire Model Development, and Application of Models in Community Decision Support Forums

TSSW, together with the Global Change Program at Prescott College, designed, developed and implemented the Spatial Growth Model (SGM). SGM is an interactive application developed to assist communities in predicting future growth patterns by applying “growth rules” determined through public. Through additional funding provided by National Aeronautics and Space Administration (NASA) grants, the collaborative team utilized the models in a variety of communities across the US, including the northern Rocky Mountain community of Gallatin County.

Gallatin County is the most populated and fastest growing counties in Montana. The County covers 2500 sq miles of mountain lands of varying topography and climate, as well as contrasting land uses. Through the use of the SGM and the nationally recognized public participation/ involvement process developed by the Global Climate Change Program team, a consensus for future conservation actions was developed among competing stakeholder groups. This process was facilitated using the Spatial Growth Model to analyze and visualize the results of development and conservation policies captured during interactive stakeholder involvement sessions. The project culminated in the issuance of land preservation bonds during a subsequent election cycle. The project team, including TSSW, received the National Partnership for Reinventing Government – Innovative Use of Technology “Hammer Award” from Vice President Gore’s office at the annual International ESRI Conference held in San Diego, CA.

Maui County, Hawaii - LTIM-Fire Risk Model

LTIM-Fire Risk Model is an extension developed by TerraSystems for the ArcMap 9.x environment. The application was designed to implement The Maui County Hazard Mapping and Wildland/Urban Risk Assessment (HAZMAP) Assessment procedure. Using a variety of input datasets, including scenarios created using TerraSystem’s Spatial Growth Model (SGM) which depict future land use growth based on community input and developed values, the application identifies areas of fire hazard concern within Maui County. It takes into account data related to local weather, ENSO Cycle impacts, changes in fuels or development patterns and other criteria that may have a significant impact on fire hazards.

