Spatial Vision

2018 – 2019 Water Industry GIS Capabilities Survey Results

Final Report

March 2019

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Executive Summary

Geospatial Information Systems (GIS) are widely used by the water industry for decision making and planning, including effective operations, asset management, and reporting. Geospatial technologies are advancing at a seemingly ever-increasing rate. The water industry continues to be challenged as to how to best utilise these technologies.

The purpose of this report to assist water industry authorities across Australia to benchmark their respective GIS capabilities against industry counterparts and to identify gaps and thus possible opportunities for improvements, and leading practices.

This report is based on a national survey of water authorities. In total 33 authorities participated in this survey from Victoria, Queensland, New South Wales and Western Australia. Since the water authorities differ according to their size and services offered, respondents were classified into four categories in this report, namely Councils, Regional, Urban or Rural authorities. Spatial Vision conducted similar Water Industry GIS Benchmark surveys in 2009, 2006 and 2002.

KEY CHALLENGES

There are many challenges facing water authority GIS teams to ensure that their organisation's investment in GIS technology, data and services is fully utilised and delivers value to customers. The following summarises the eight main challenges reported in this year survey. The first five were also reported in 2009.

1. **Integration with business systems.** In 2009, systems integration was by far the most common concern. In 2018, integration of GIS with other platforms still poses a challenge, including data sharing between platforms, building a live "digital twin" of network operation, or linking GIS and AMS.

2. **Data management and quality**. In 2009, authorities reported that data capture and cleansing tasks are resource intensive and time consuming and often required field verification. In this year's survey, data quality, accuracy, field capture, and verification are still important.

3. **Implementation of Mobile GIS.** In 2009, authorities reported great potential for mobile GIS although there were significant limitations in communications in regional areas. In this survey, adopting field data collection tools and going completely mobile is still proving a challenge to implement especially completing the integration of such systems with the enterprise data platform.

4. **GIS awareness and roadmap.** Many authorities noted the need for greater training and the broadening of staff awareness of GIS technology in 2009. Authorities continue to report concerns about training needs, training requirements and staff skills development. In addition, authorities are concerned about limited planning of new initiatives, and the absence of corporate GIS strategies and/or roadmaps.

5. **Implementation of new technology.** In this survey, concerns regarding the development of corporate web-based GIS applications for internal and external use were highlighted. GIS teams are also finding it difficult to keep up with technologies and trends. These may include 3D, new utility network management tools, UAVs/RPAs, and the development of digital twins.

6. **Senior management and organisation structure**. A large number of authorities regard senior management's lack of understanding of GIS as a major challenge. This impacts senior management's understanding and support for further investment in GIS, or new initiatives from the GIS team to deliver additional business benefits.

7. **Maximise the operational services and benefits of GIS**. GIS is a widely used decision-support tool. It remains a constant challenging to maximise operational efficiencies. The most common challenge is to continue to improve the accuracy of the geospatial representation of the asset network and the required aspatial data (e.g. asset condition), each of which is required to deliver reliable GIS decision and planning support tools and applications.

8. **Staff resourcing and budget.** There is a growing demand for immediate access to reliable digital information upon which to make informed decisions. However, a large number of water authorities

report constrained resources (*being spread too thin*..). The challenge is to continue to find new ways to demonstrate the value and significance of GIS to the business and those making decisions on budgets.

CONCLUSIONS

The vast majority of authorities participating in this survey rated the contribution of GIS systems to improving corporate operations as high or very high.

The implementation of GIS has enabled self-serve or automated processes; geospatial analysis; public web-based GIS interfaces to publish corporate data; network tracing on mobile devices in field operations; and support for design cost estimation.

Some of the key technical conclusions from the survey included:

- **Application integration** with corporate GIS increased notably since the last survey, particularly with asset management systems. For other corporate systems, integration remains primarily a future challenge.

- Respondents indicated that **increased adoption of sensor technologies** (an example of "the internet of things" or IOT) and a **greater sharing of corporate data** (i.e. open data policies) is expected.

- A notable improvement from 2009 is the higher use being made of **authoritative cadastre** updates (either incremental or full). Difficulties in accessing **other third party data** for a better operational planning such as telecommunications, gas and electricity network data, and satellite imagery data were commonly reported.

- A significant proportion of organisations have **yet to deploy web-based GIS** (and therefore missing out on some key benefits of corporate GIS systems).

- Whilst **commercial products** remain the dominant solution, costs of software licence agreements, and access to technical support and training were reported as significant issues for both desktop GIS and corporate web-based GIS.

- Use of free and **open source** (FOSS) **solutions**, particularly for desktop use (eg QGIS) has increased. Yet the vast majority of authorities don't see open source as making a significant contribution to their organisation's GIS.

- High quality, accurate data remains a key challenge for organisations. Data validation and costs of data acquisition remain significant (both in 2009 and 2018). Considerable interest was expressed regarding the potential for modern data collection technologies (eg drones/UAVs) to assist improve this issue by reducing cost, improving quality and shortening the time required for data acquisition.

- The **use of mobile technologies** and devices for field data collection remains challenging for most organisations. Whilst use of mobile mapping has increased, almost half of authorities have yet to implement geospatial-aware field applications integrated with their enterprise GIS. Only a few have been successful in developing geospatial network tracing for mobile devices. Many more authorities have yet to leverage the advances in mobile geospatial technologies for work-order dispatch, efficient field operation and asset data collection and validation.

- Only one-third of authorities currently provide a **public-facing GIS** application. Obtaining information from the public (crowd sourcing) remains a relatively new area of operations for most organisations.

There were three potentially inter-related conclusions from the survey:

- The **under-utilisation of GIS systems and services** was noted and may be related to the **limited technical GIS resources available** within many organisations.

- L**ow levels of senior management support** and awareness of corporate GIS systems and capabilities were observed.

- Few organisations appeared to be undertaking **strategic planning** of their corporate GIS and related systems and capabilities.

Faced with continuing significant change in spatial and related technologies and evolving business needs, it is believed that most organisations would benefit from more regularly producing a strategic geospatial roadmap to plan how these dynamics are both accommodated and used to achieve better organisational outcomes. Such strategies need to be based on a comprehensive review of the organisation, its people, processes and technology. This type of exercise can be used to raise senior management awareness of the business value arising from any investment in GIS and achieve a better understanding of and support for contribution of GIS to the organisation.

Spatial Vision would like to thank the water authority respondents for their time and contributions to the survey.

Glossary of Terms

ACDC	As Constructed Design Certification
AMS	Asset Management System
BOM	Bureau of Meteorology
CAD	Computer-Aided Design
COTS	Commercial Off-the Shelf
CRM	Customer Relationship Management
DMS	Document Management System
FOSS	Free and Open Source Software
GIS	Geographic Information System
GWUG	GIS Water User Group
IOT	Internet-Of-Things
NSW	New South Wales
QLD	Queensland
RPA	Remotely Piloted Aircraft
SCADA	Supervisory Control and Data Acquisition
UAV	Unmanned Aerial Vehicle
VIC	Victoria
WA	Western Australia

1. Introduction

1.1. Background

The water industry has a common goal of meeting water resources regulations, customers' satisfactions, and effectively managing their assets infrastructure. Across the country, water services are managed by state and territory appointed water authorities ranging widely in the services provided, number of connected clients, geographic factors and service area.

Geospatial Information Systems (GIS) are widely used by the water industry for decision making and planning, including effective operations, asset management, and reporting. Geospatial technologies are advancing at a seemingly ever-increasing rate. The water industry continues to be challenged as to how to best utilise these technologies.

In 2002, Spatial Vision completed the first Water Industry GIS Benchmark survey for Victoria. This survey was followed by national surveys in 2006 and 2009. The main goal of these surveys was to develop GIS benchmarks to assist the water industry across Australia in achieving efficient operation and services delivery using GIS.

Water authorities first started using GIS in the early 1980s. Since that time, GIS technology has continued to rapidly evolve, becoming far more accessible. By 2009, 100% of authorities surveyed operated web-based geospatial systems that were available enterprise-wide – a huge shift from just 40% in 2002.

A decade later, Spatial Vision is again supporting the water authorities in benchmarking their current GIS capabilities.

1.2. Survey Methodology

The survey was conducted via an online questionnaire. Spatial Vision invited water authorities from across Australia to participate. Most surveys were completed by those responsible for the operation of the authority's GIS. A breakdown of the responses received is given in Section 2, Respondent Profile.

1.3. Limitations

Spatial Vision endeavoured to contact all water authorities that completed the previous surveys. However, not all of these authorities responded in 2018. The 2018 survey was responded to by a further 10 authorities. The report draws comparisons to 2009 although there is not a direct match in responses.

Notwithstanding these issues, we believe the survey results have captured the major trends impacting the use of GIS across the water industry in Australia.

1.4. How to use this Report

As a water authority, you can use this report to:

- benchmark operational deployment of your organisation's GIS capabilities against industry counterparts
- identify gaps and thus possible opportunities for improvements
- raise awareness and possibly adoption of leading practices.

You will need to identify the category of authority to which you most relate. You can use this category to benchmark your authority against industry counterparts.

Please note responses by individual authorities remain confidential.

2. Profile of Respondents

2.1. Water Authority Categories

Water authorities vary considerably in size and services offered.

In presenting the survey results, we have allocated authorities to one of the following four categories.

- **Councils** delivering drinking water services to customers (NB Councils often are responsible for a wide variety of services to their municipalities and communities, including roads and parking management, buildings and developments, waste and animal management, environmental and public health services, and compliance activities).
- **Regional** organisations dedicated to delivering drinking water services typically with less than 150,000 connections
- **Urban** (including metropolitan or state-wide) organisations dedicated to delivering drinking water services to customers normally with more than 250,000 connections. At times urban water utilities are also responsible for stormwater and flood mitigation services, and water conservation. These organisations are generally government owned entities.
- **Rural** organisations dedicated to managing and delivering water supply resources, often including delivery for agriculture, irrigation and domestic and stock purposes. Some these organisations also deliver township drinking water services.

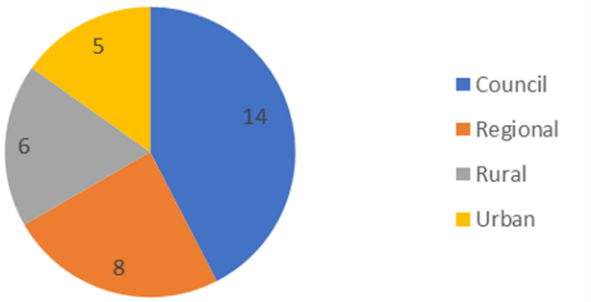

Exhibit 1: Respondents by water authority category

2.2. States and Territories Covered

The survey invitations were distributed to water authorities in all states. The respondents covered four states: New South Wales (NSW), Queensland (QLD), Western Australia (WA) and Victoria (VIC). Council respondents were obtained from NSW and QLD, while regional authorities mainly came from VIC, see Exhibit 2.

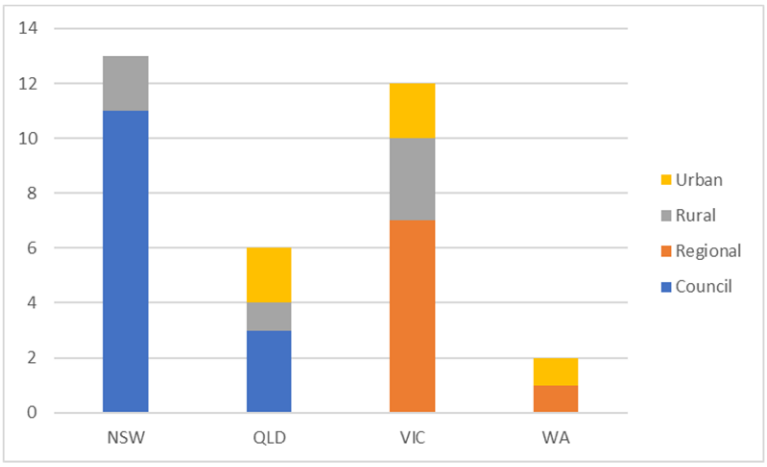

Exhibit 2: Respondents by state and water authority category

2.3. Average Connections and Workforce

Clearly the Urban authorities have a much larger number of connections, ranging from 290,000 to 1 million connections, as they span urban and state-wide organisations.

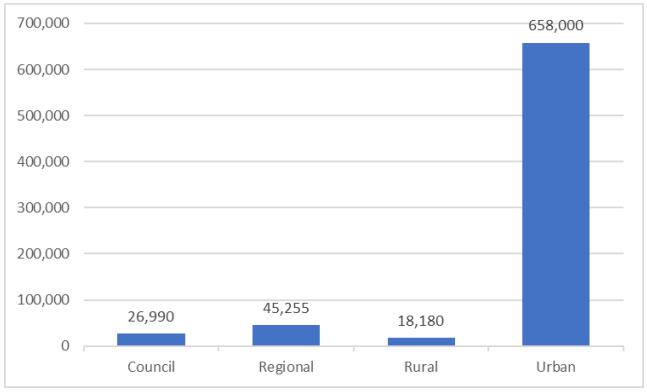

Exhibit 3: Average property connections by water authority category

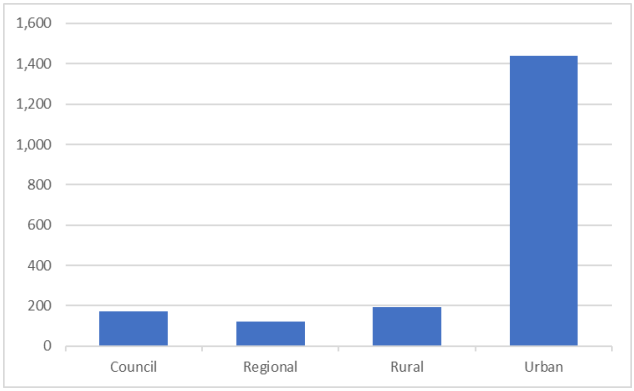

Exhibit 4: Average of workforce (permanent and on-going contractors) by water authority category

The average workforce in Regional, Rural, and Council authorities are similar as shown in Exhibit 4. However the average workforce in Urban authorities is significantly higher, particularly when they have staff or ongoing contractors providing field services.

2.4. GIS Team Profile

2.4.1. GIS Administration and User Support

The team responsible for GIS administration and user support, varies significantly both across and within the different water authority categories. Overall, authorities average three full time staff in the GIS team. Rural authorities have the smallest average number of staff. Urban authorities have the highest.

Average GIS administrative and user support staff	Full Time Equivalent (average & range)									
	1	2	3	4	5	6	7	8	9	10
National										
Councils										
Regional										
Rural										
Urban										

Exhibit 5: Average number of GIS staff by water authority category

2.4.2. GIS Team Placement

A large percentage of the individuals completing the survey had a GIS role. Others were either from Asset Management or IT management positions.

Overall, GIS teams are mostly placed within IT services (47% of respondents), particularly in Rural and Urban authorities. In Regional and Council organisations, GIS teams are mostly placed in the Asset Management services.

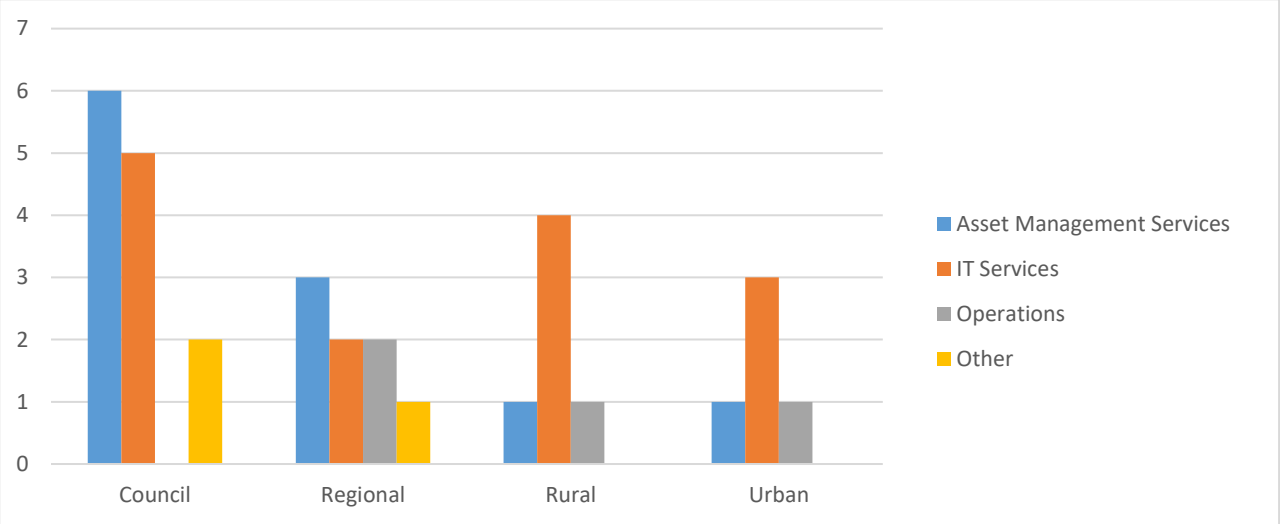

Exhibit 6: Placement of GIS team by water authority category

3. Corporate GIS Solution

In 2009, all of the authorities surveyed had implemented a corporate GIS solution. In this survey, 97% use GIS solutions (32 responses out of 33), of which 81% operate a corporate web-based GIS solution. All Urban authorities operate a corporate web-based GIS solution.

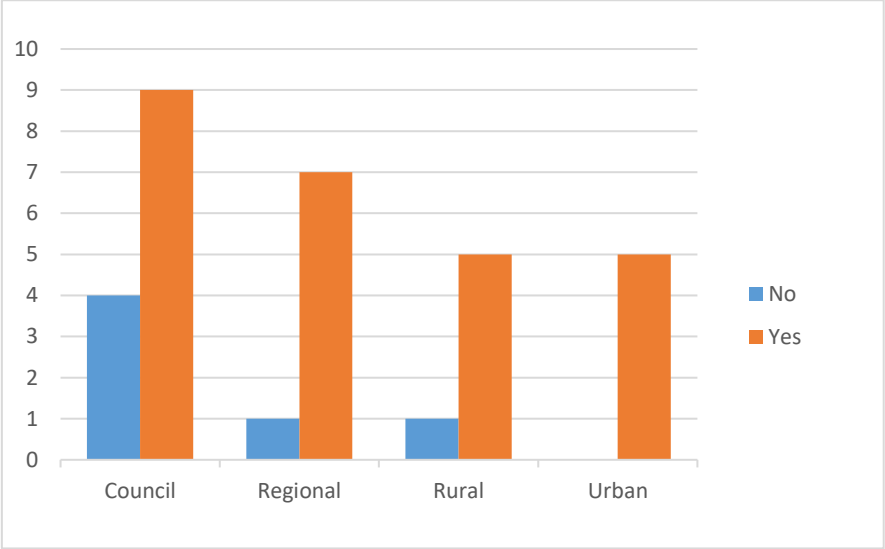

Exhibit 7: Respondents with corporate web-based GIS solutions by water authority category

3.1. Status of the Corporate GIS

To classify the status of the corporate GIS, the following four life cycle stages are used.

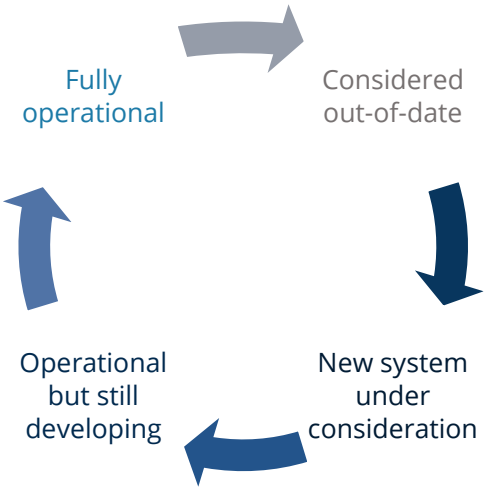

Exhibit 8: Corporate GIS life cycle stages

In 2009, 95% of GIS implementations were fully operational or still developing. In 2018, 80% responded as fully operational or still developing, and 20% of authorities consider their systems out-of-date and/or are considering new systems.

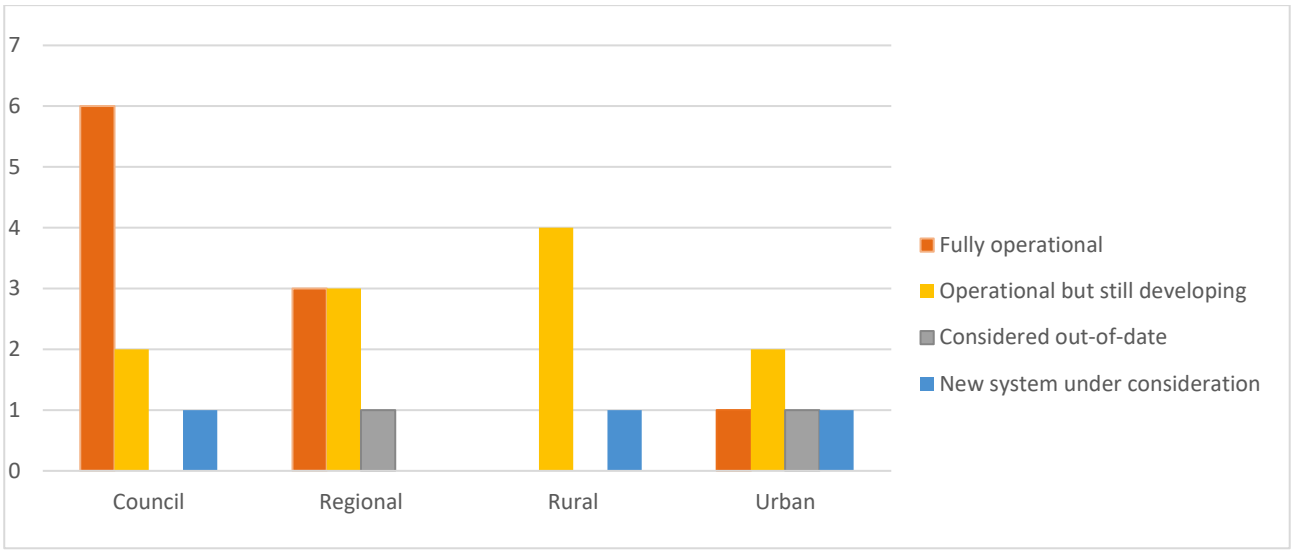

Exhibit 9: Corporate GIS life cycle stage by water authority category

3.2. Corporate GIS Solution – Product Use

Esri software remains the dominant corporate GIS solution as it was in 2009. Esri and Geocortex has emerged to represent 50% of corporate GIS solutions across all four categories. Geocortex was not available in 2009.

Open Spatial Enlighten - Munsys has declined from 30% in 2009 to 13% in 2018. According to respondents in this survey, this product combination is primarily used by Regional and Urban authorities.

Other solutions included: Technology One - Intramaps, Hexagon - Geomedia, GE Smallworld, Cohga – Weave; Pitney Bowes - MapInfo-Spectrum Spatial Analyst and Exponare; MapServer, and Ubisense Myworld.

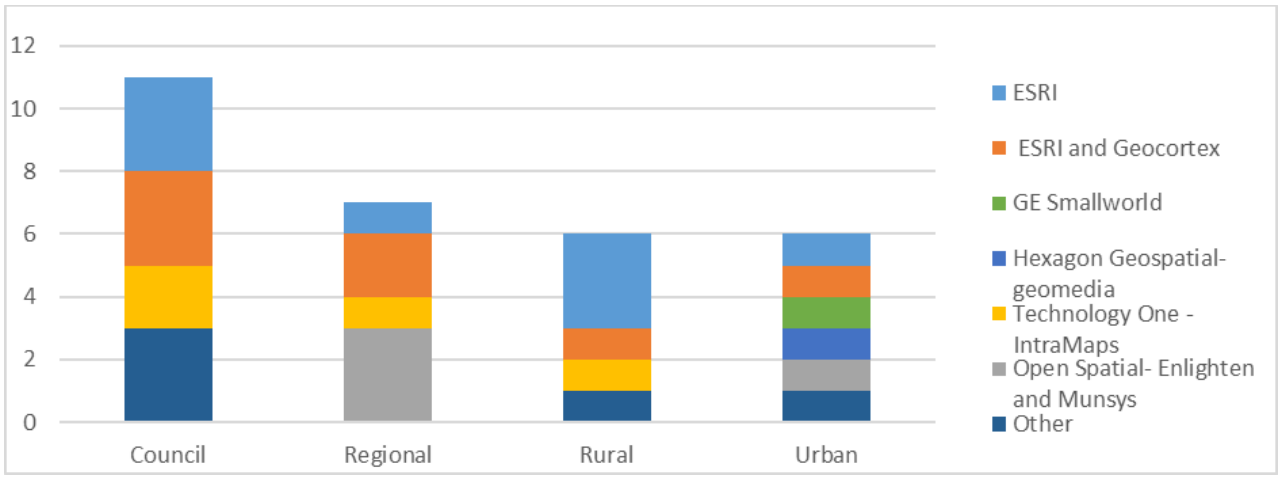

Exhibit 10: Respondents by GIS product by water authority category

3.3. Deployment Cost

On average, Urban authorities spent more than $1,000,000 on their most recent GIS deployment. Most other water authorities typically spent between $50,000 to $150,000.

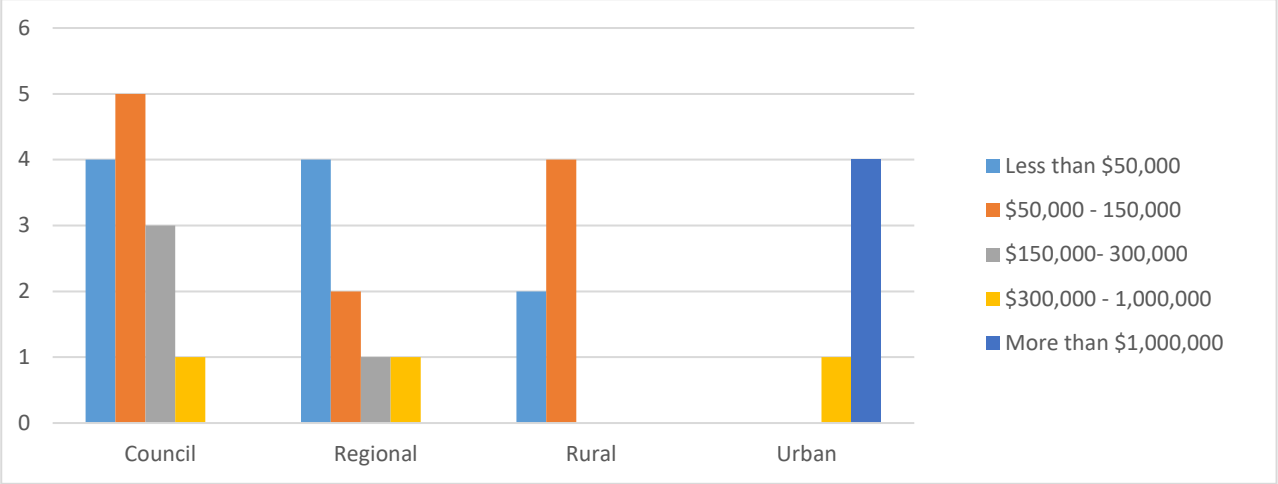

Exhibit 11: Average cost of deployment, latest corporate GIS system by water authority category

3.4. Access to GIS

So who has access to GIS and actually uses it?

On average, the percentage of staff with access to corporate GIS system is almost 100% for Urban, Rural and Regional authorities, falling to 71% for Councils. However, the level of regular users is considerably lower, ranging between 36 and 55%.

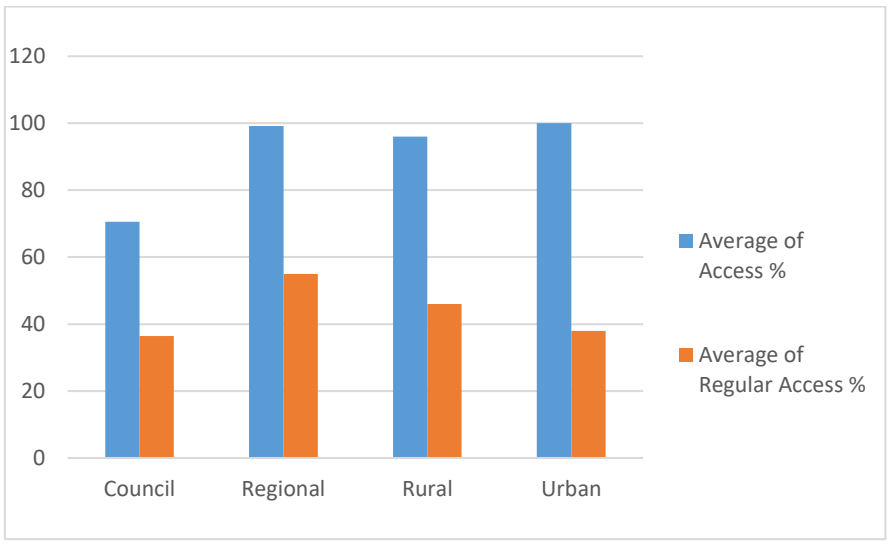

Exhibit 12: Percentage of staff with access to the corporate GIS system, and percentage of regular users, by water authority category (2018)

It is interesting to compare these figures over time. Overall, the average percentage of staff with access has increased from 81% in 2009 to 89% in 2018, and the proportion of regular users has remained largely unchanged.

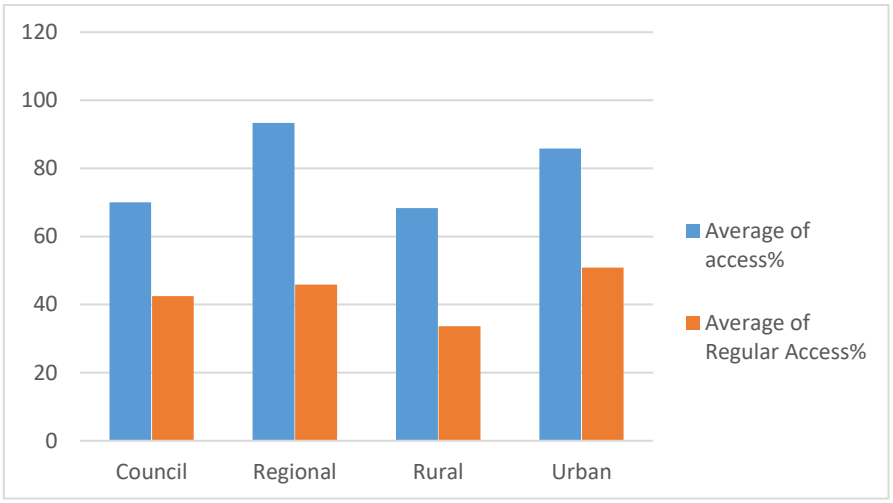

Exhibit 13: Percentage of staff with access and regular access to the corporate GIS system and percentage of regular users, by water authority category (2009)

3.5. Role of Cloud Resources

A new question was added to the 2018 survey regarding cloud hosting. The survey reveals that overall the majority of water authorities have deployed their GIS exclusively on-premise (65%). The remainder use a combination of both on-premises and cloud hosted solutions. No authority has adopted a complete cloud-based solution.

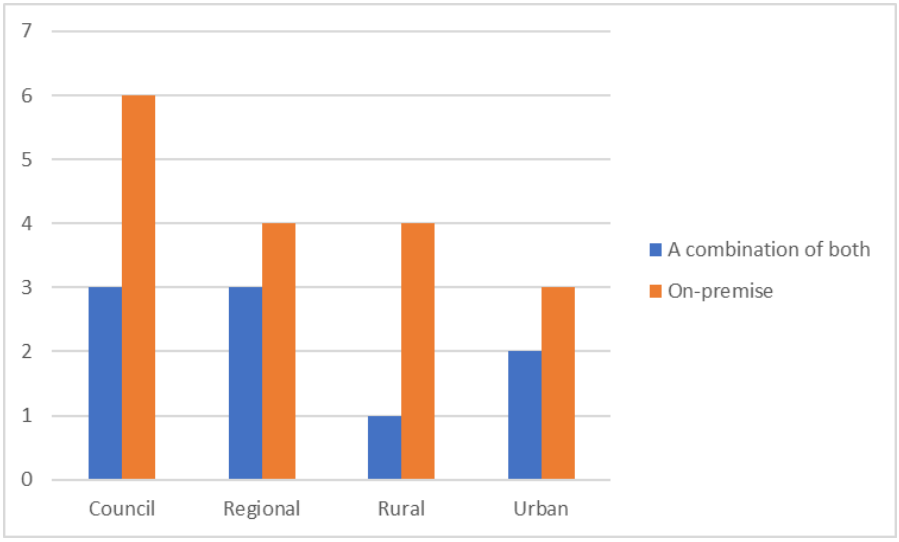

Exhibit 14: GIS solution hosting by water authority category

3.6. Desktop GIS Solution – Product Use

Esri software remains the dominant product for desktop GIS. AutoCAD ranked second and QGIS third. QGIS is a desktop GIS which is Free and Open source software (FOSS). It is expected that the use of QGIS will continue to rise as some authorities indicated their plan to shift to QGIS next year.

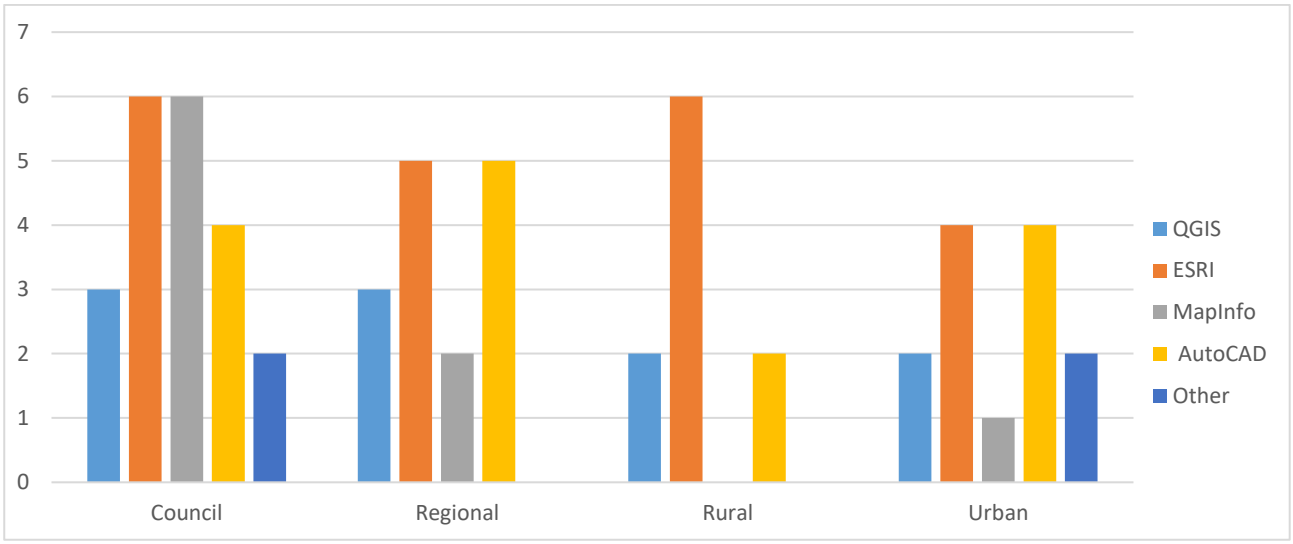

Exhibit 15: Desktop GIS product use by water authority category

4. System Integration

4.1. Applications Operationally Integrated with GIS Solution

The number of applications integrated with an authority's corporate GIS solution has increased notably since the 2009 survey.

The most integration occurs with asset management systems, but integration with a range of other corporate systems including finance, document management, client management and CAD systems are becoming common.

Integration with Internet-of-things (IOT) devices including meters is only just becoming evident, but may well increase over time.

As an overall, Urban authorities were more successful in application integration than the other water authorities categories.

Application Type	Urban	Regional	Rural	Councils	Overall 2018	Overall 2009
Asset Management System (AMS)	80%	88%	33%	71%	70%	57%
CAD drafting	40%	3%	17%	43%	33%	26%
Client information/ CRM	20%	6%	0%	50%	39%	-
Document Management System (DMS)	60%	3%	0%	36%	30%	9%
Finance/billing database	40%	5%	17%	43%	39%	4%
The Hydro/network model	60%	1%	17%	7%	18%	17%
SCADA	20%	1%	0%	14%	12%	4%
Internet-of-things (IOT)	20%	0%	0%	14%	9%	-

Exhibit 16: Application integration by water authority category (2018 and 2009)

4.2. Network Models

A new area for exploration with GIS is the establishment of a *live* operational model of the network. In other words, linking the corporate GIS data with AMS and SCADA. At this time, 9% of water authorities have these models operational, however 36% of respondents indicated that they are planning to implement such models in the future.

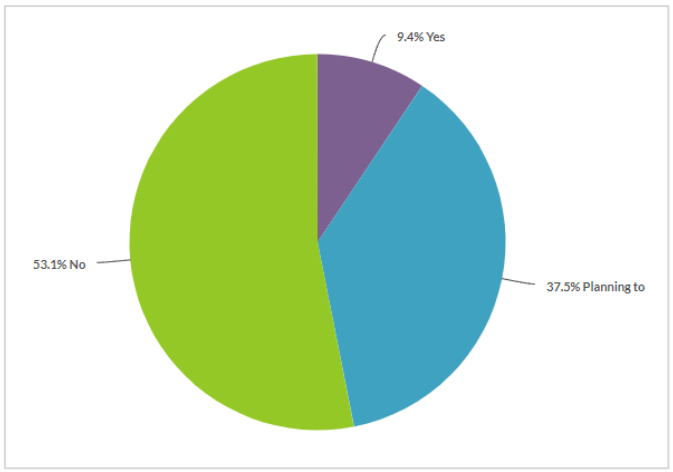

Exhibit 17: Respondents operating a live network model

4.3. Open Source GIS

Open source GIS in the survey is represented by free stand-alone QGIS or software components of commercial Off-the Shelf (COTS) solutions. In 2006, around 28% of authorities were considering the implementation of corporate solutions using open source GIS technologies. In 2009, 19% authorities had implemented open source GIS solutions with such solutions being considered by another 14%.

Interestingly in 2018, although the authorities using open source rose to 33%, only 19% of respondents considered open source as significant to their GIS operations.

The open source GIS in use includes:

- QGIS for analytics and mapping
- MapGuide Maestro as the map component of Enlighten (Open Spatial)
- PostGIS GeoServer in conjunction with Leaflet as part of a COTS solution

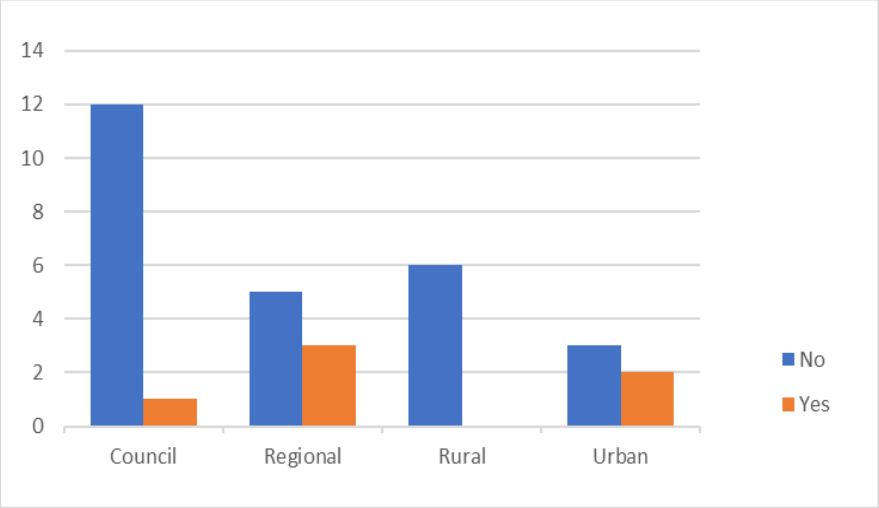

Exhibit 18: Use of Open Source GIS solutions by water authority category

5. GIS Functions

5.1. Functions Provided by the Corporate GIS Solution

Not surprisingly, the dominant function of corporate GIS solution within authorities is the provision of dynamic maps and views (91%). This is followed by database connection and reporting (82%), Information portal/ interface to other systems (67%), and location of and reporting on complaints, customers, or assets (64%).

More tellingly, these functions vary significantly according to the authority category, with the highest GIS utilization at the Urban authorities.

GIS Function	Urban	Regional	Rural	Councils	Overall
Dynamic maps and views	100%	88%	83%	93%	91%
Location of and reporting on complaints, customers, or assets	100%	75%	33%	57%	64%
Generation of map books	40%	0%	67%	43%	36%
Database connection and reporting	100%	100%	50%	79%	82%
Information portal/ interface to other systems	100%	63%	50%	64%	67%
Identification of customers to contact via letter, email or sms	60%	25%	17%	50%	39%
Network tracing for desktop GIS	80%	50%	17%	36%	42%
Network tracing for web GIS	60%	63%	17%	21%	36%
Network tracing for mobile devices	0%	25%	17%	0%	9%
Access to external web mapping/feature services	80%	38%	33%	50%	48%
Operational dashboard for live reports	20%	13%	50%	14%	21%
Spatial analysis and modelling to identify opportunities and risks	60%	50%	50%	36%	45%
3D visualisation of assets in landscape context	0%	0%	17%	7%	6%
Groundwater level mapping	0%	0%	17%	0%	3%
Design Cost Estimation	20%	0%	0%	0%	3%

Exhibit 19: Functions provided by corporate GIS by water authority category

5.2. Field Services

5.2.1. Field-based Geospatial-aware Applications

The use of field-based geospatial-aware applications increased steadily from 48% in 2002, 59% in 2006, to over 65% in 2009.

However, by 2018, only 38% of authorities reported operating *field-based geospatial-aware applications integrated with the corporate GIS*. The apparent reduction is most likely due to the 2018 survey requirement to link back to enterprise GIS in contrast to independent handheld GPS devices.

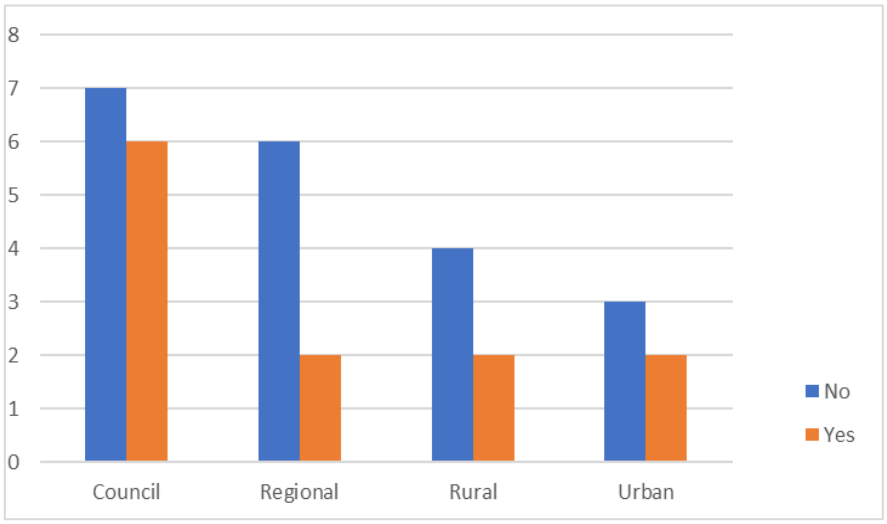

Exhibit 20: Use of field-based geospatial aware applications by water authority category

5.2.2. Field-based Geospatial-aware Applications – Product Use

There is no one dominant vendor solution for field-based geospatial-aware applications. However, of those making use of these products, Esri and Esri/Geocortex are used by 4 and 2 authorities, respectfully.

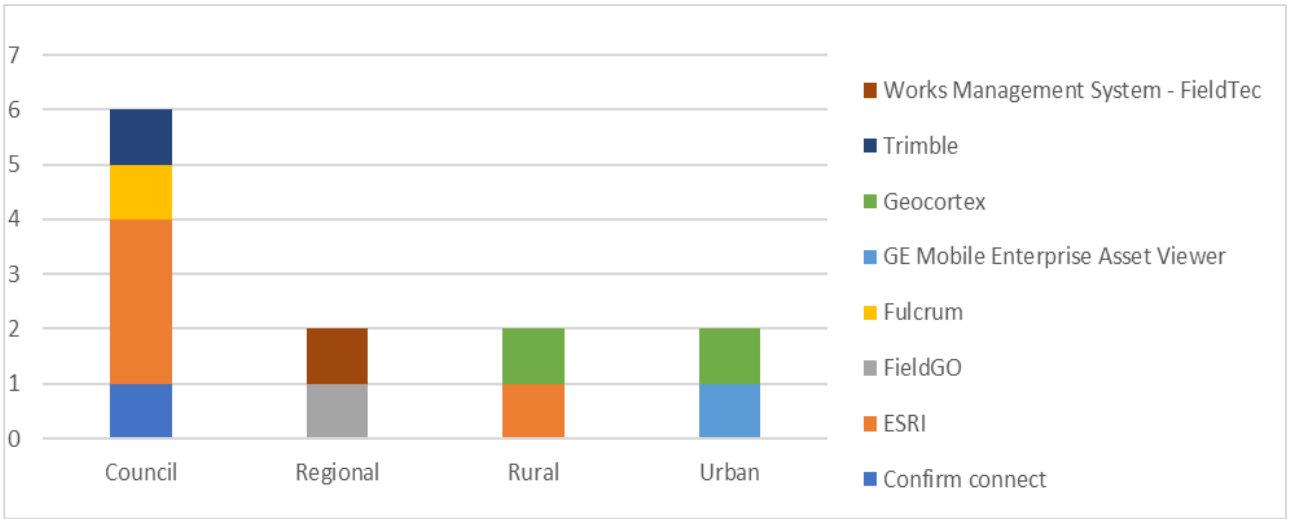

Exhibit 21: Field-based geospatial-aware applications by water authority category

5.2.3. Field-based Geospatial-aware Applications – Functions

The dominant function for using field geospatial applications is finding the location of network assets (92%). This is followed by data (other than assets) collection (83%) and mapping and updating of assets (58%).

None of the authorities reported using field geospatial applications for work-order dispatch and status updates.

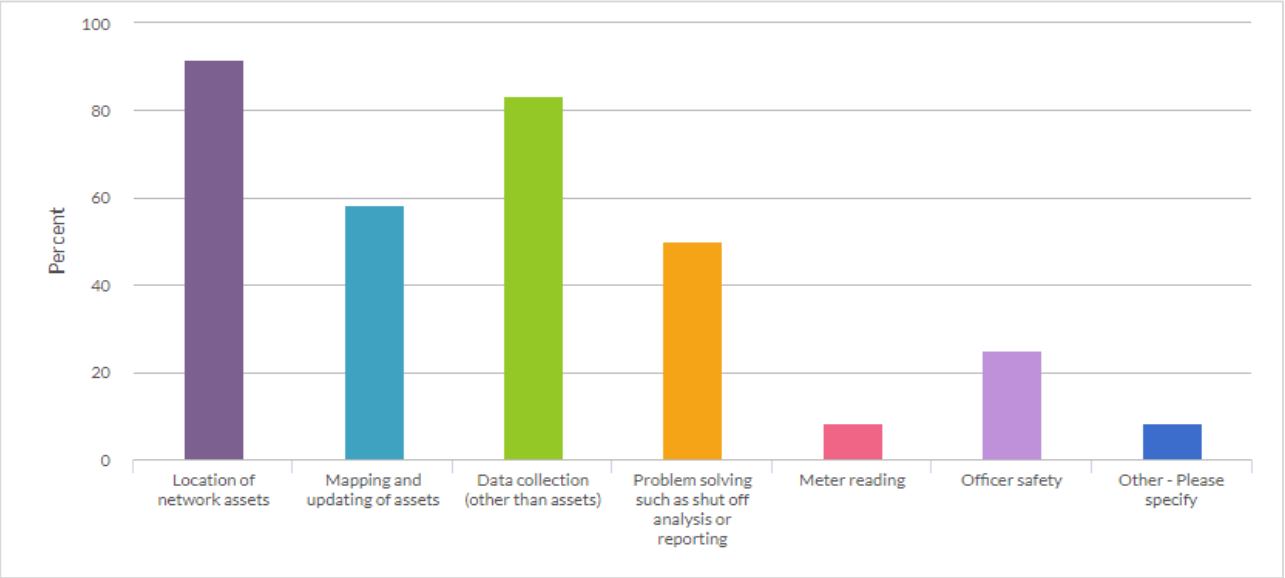

Exhibit 22: Functions for field-based geospatial-aware applications

5.3. Public GIS Applications

A relative new area of operations is the provision of public GIS applications to provide customers and stakeholders with information about authority operations and services.

Overall, the survey revealed that 27% of authorities provide a public-facing GIS application, most common in Urban (40%) and Council (36%) Authorities.

Whilst the typical purpose of public GIS applications is to enable customers to locate network assets, an interesting set of other uses for these systems have been identified.

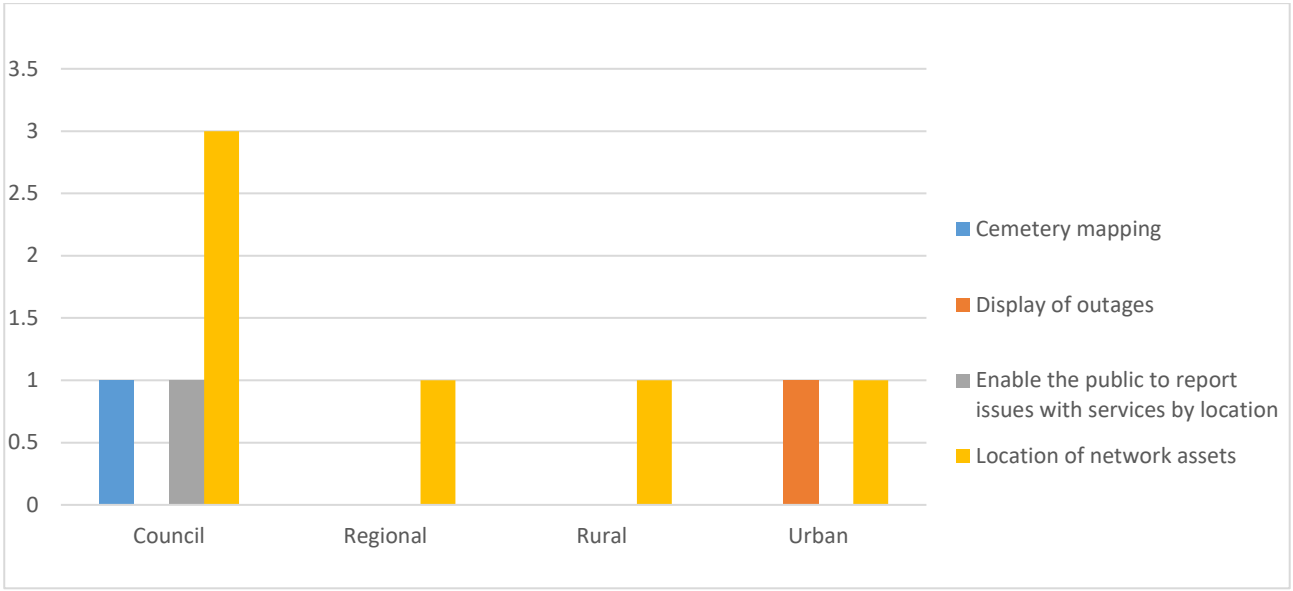

Exhibit 23: Purposes for public GIS applications by water authority category

5.4. Open Data Policies

Another relative new area of practice for GIS operations in water authorities is the move to adopt open data policies (ie policies to give effect to the idea that some authority data should be freely available to everyone to use and republish as they wish, without restrictions). Overall, 16% of water authorities now publish “open” data or operate open web-services, and a further 16% are planning to publish. This is most common amongst Urban authorities with 80% either already publishing data or planning to do so in the future.

Currently this data is published either on the authority’s own website; wa.data.gov.au; data.gov.au or data.gov.arcgis online.

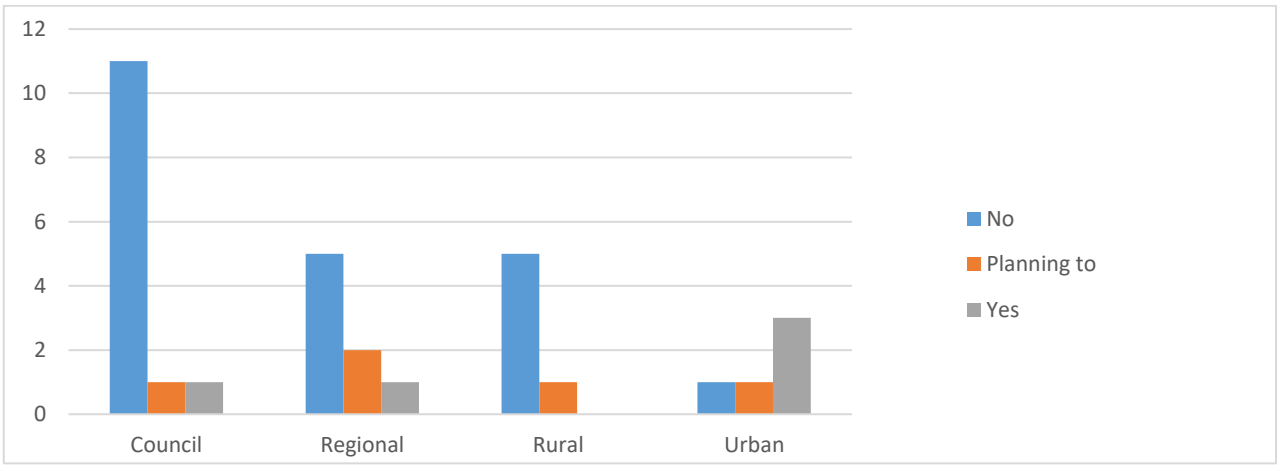

Exhibit 24: Respondents publishing “open” data or web-services by water authority category

5.5. UAVs/RPAs

5.5.1. Authority Use

The awareness of the benefits of Unmanned Aerial Vehicles (UAVs) or Remotely Piloted Aircraft (RPAs) in the water industry is rising. In this survey, 55% of authorities are using UAVs/RPAs, either with internal resources or via contractors. A further 6% are planning to use the technology. The major users are Rural (87%) and Urban authorities (80%).

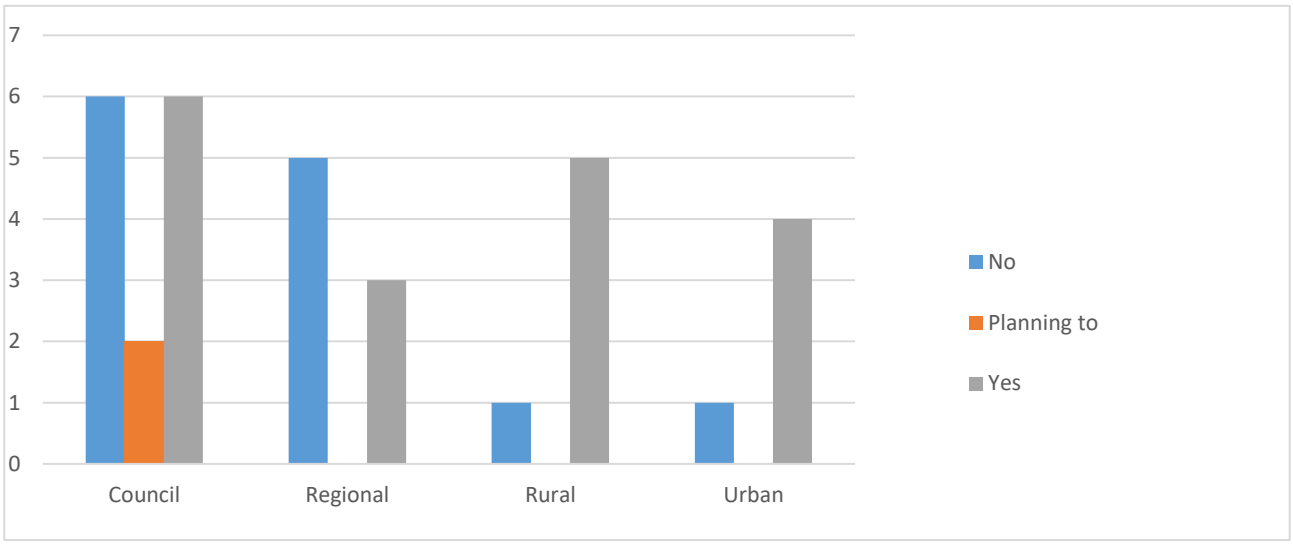

Exhibit 25: Use of UAVs/RPAs by water authority category

5.5.2. UAV/RPA Functions

UAVs/RPAs are commonly being used to capture of imagery (35%), monitor assets (20%). Other uses include environmental assessment; project site reviews; research/ innovation; weed spraying; surveying including topographic or volume surveys, and water sampling.

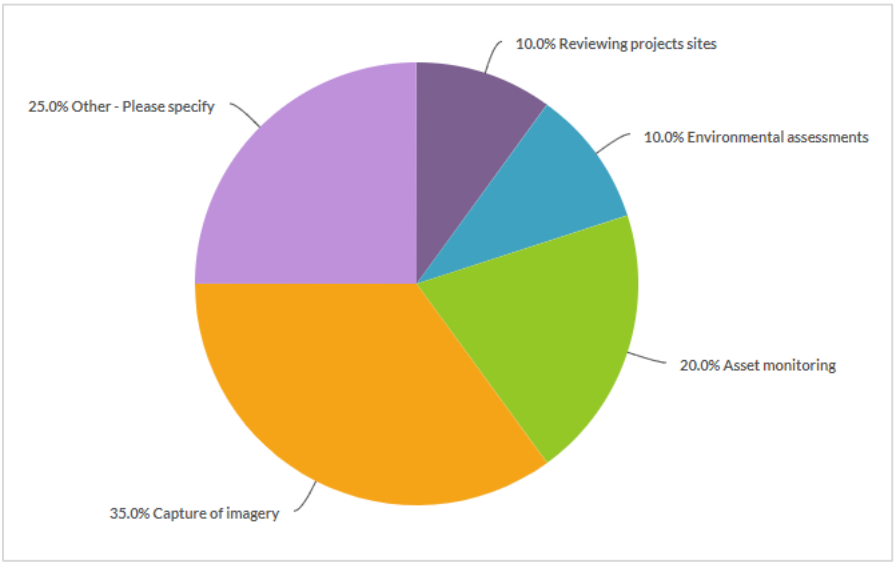

Exhibit 26: Common UAV/RPA Functions

6. Business Drivers for Corporate GIS Solutions

Survey respondents were asked about the factors influencing the use of corporate GIS solutions in their water authority.

6.1. Benefits

6.1.1. Overall Contribution

A clear majority of authorities rated the overall contribution of the corporate GIS solution to improving business operations as high or very high, a marked increase over the 2009 survey.

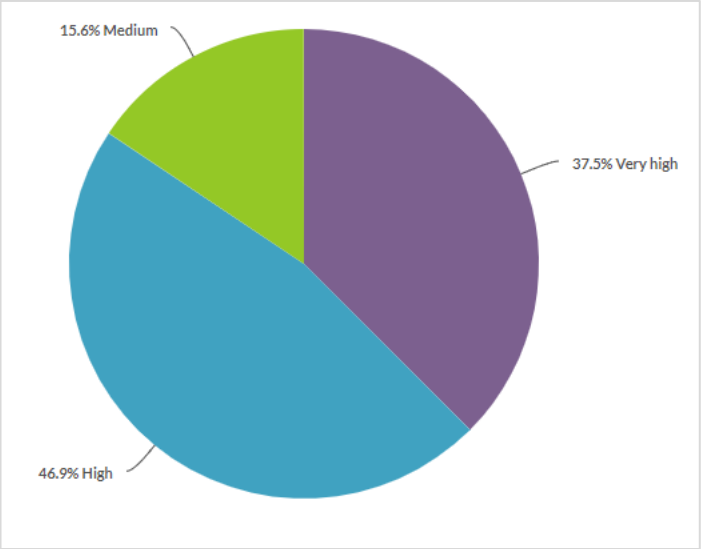

Exhibit 27: Rating of the overall contribution of authorities' GIS to improving business operations

Contribution to business operations	2018	2009
Overall	high- very high	medium-high
Councils	high	high
Regional	high	medium-high
Rural	high- very high	medium-high
Urban	high- very high	high

Exhibit 28: Contribution of GIS to business operations, 2018 and 2009, by water authority category

6.1.2. Specific Benefits

The range of benefits resulting from implementing GIS varied according to the category of authority.

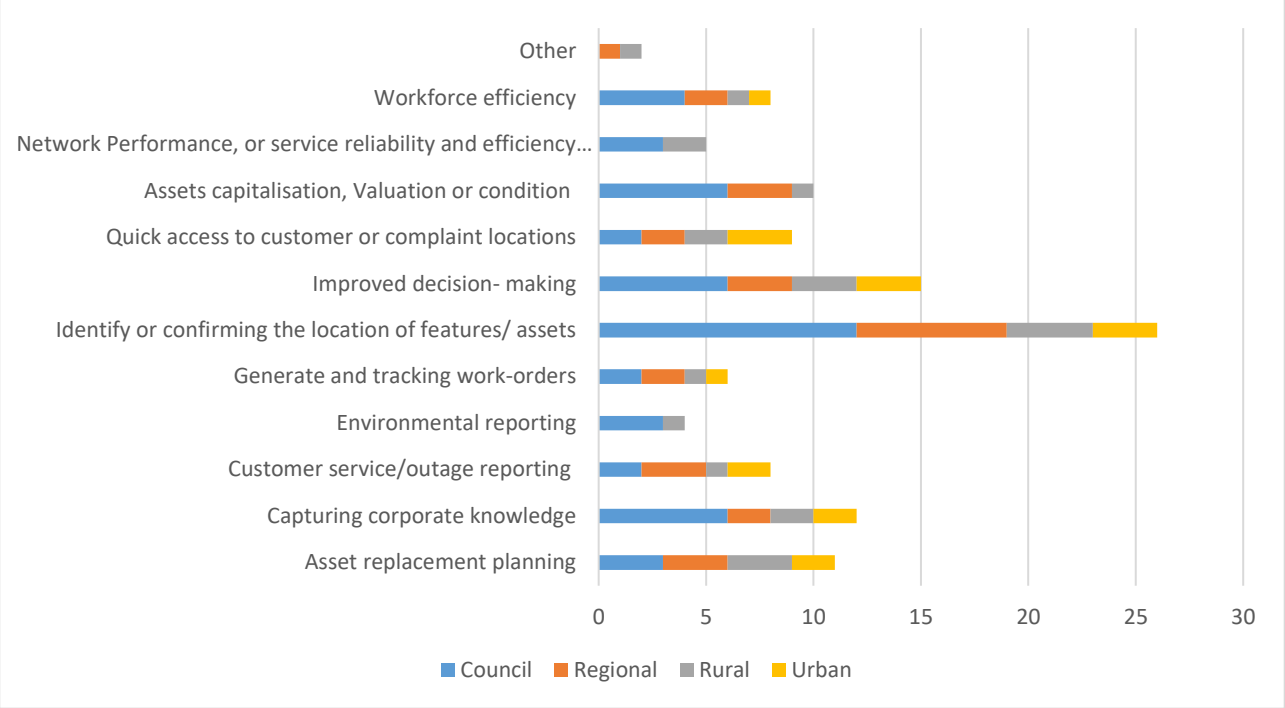

Exhibit 29: Corporate GIS solution - highly ranked benefits

The other benefits resulting from implementing GIS were:

- Development of dashboards for operational and incident management
- DBYD, Block Plans, Asset Plans, As Constructed Design Certification
- Asset condition reporting and analysis

6.2. Senior Management Support

A common issue facing many authorities is a lack of recognition of the value that GIS can bring to the business by Senior Management. Unfortunately, it would appear that the level of recognition has fallen since 2009.

Overall, 28% of respondents feel that Senior Management values their authority's investment in GIS technology as "high" (down from 38% in 2009); 47% rates the contribution of GIS as "medium" (57% in 2009), and 25% as "low" (only 5% in 2009).

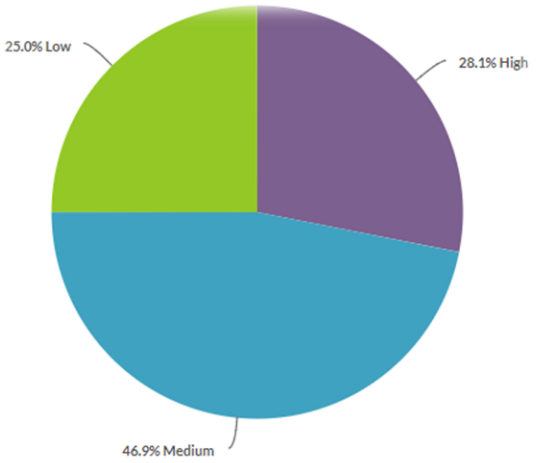

Exhibit 30: Level of senior management's recognition to the contribution of GIS

Some variability was observed between water authority categories.

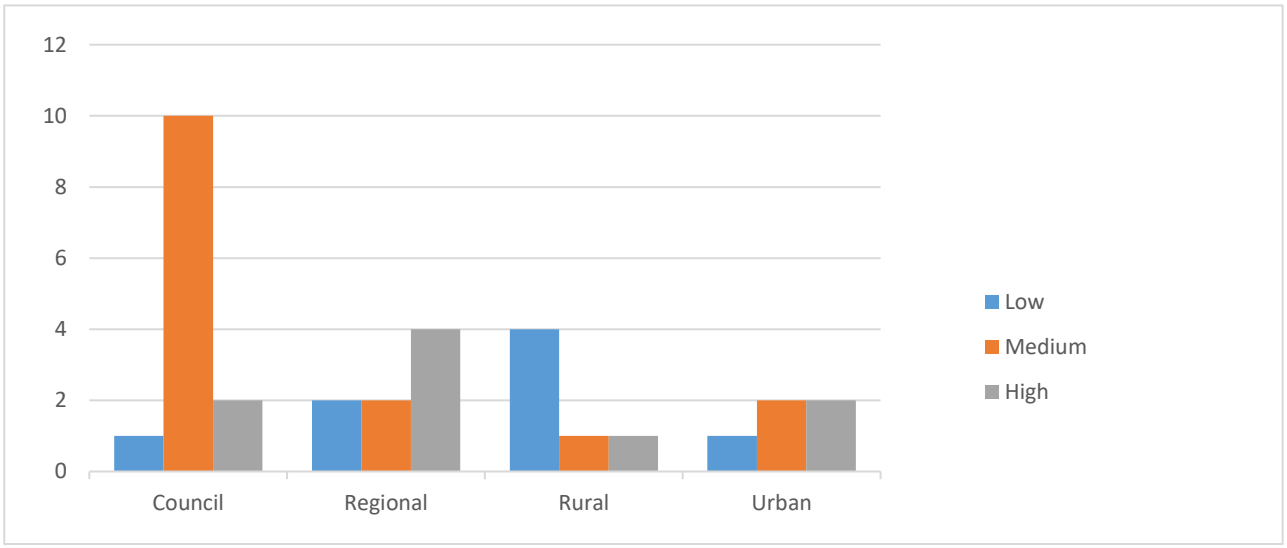

Exhibit 31: Level of senior management recognition to the contribution of GIS by water authority category

6.3. Other Outcomes

A fascinating range of other achievements were recorded, derived from the implementation of corporate GIS solutions:

- Creating "single point of truth" for data resources, improving data quality and data management
- Implementing digital as-constructed (ACDC) processes and records
- Automating "Dial Before You Dig" responses
- Monitoring groundwater levels
- Developing a GIS system strategy

- Maintaining regular GIS services, and increasing the number of users
- Upgrading to the latest GIS software and implementing a new web-based portal/viewer
- Developing a web-mapping solution in-house that can be managed by internal staff
- Significantly improving the useability of a corporate web-based GIS
- Supporting self-served processing of capitalisation of gifted assets projects
- Improvements including: better outage management; isolation tracing; planning, design and construct pipelines; updating asset layers with true coordinates; and completing a rural addressing project (major administrative and field-based property infrastructure).
- Developing mobility mapping and trialling new methods of field data capture and verification
- Integrating GIS and AMS, CRM, FieldGo and Drawing Information System
- Providing external public GIS services and public web browser
- Sharing asset GIS information internally and with external users, contractors and public, and supporting internal projects

6.4. Disappointments

Not everything proceeds as expected. The survey also recorded a range of issues that did not achieve the desired outcomes. The most common disappointment from implementing a corporate GIS relates to issues around data management and costs. This factor was repeated across each of the water authority categories.

Item	Overall Rank	Rank Distribution
Data management issues and costs	1	
Lack of broad utilisation of GIS maps & services	2	
Cost of ongoing software licence agreements	3	
Cost of/unavailability of technical support	4	
Cost of on-going user training and support	5	
None of the below apply	6	
Other	7	

Exhibit 32: Issues of greatest disappointment (1 highest and 6 lowest)

6.5. Factors Constraining Corporate GIS Utilisation

The two most common factors constraining full and effective utilisation of corporate GIS solutions by water authorities are *lack of senior management support* and *insufficient resources to support GIS*. No doubt these two factors are linked. The following Exhibit highlights the variability amongst types of water authorities and a comparison to the same question in 2009.

Water Authority Category	2018 Top Constraints	2009 Top Constraints
Overall	▪ Insufficient resources to support GIS ▪ Lack of senior management support ▪ Lack of GIS strategy	▪ Cost of data acquisition ▪ Difficulty in recruiting and retaining local technical staff ▪ Cost of software support agreements
Councils	▪ Lack of senior management support ▪ Lack of general staff interest ▪ Insufficient resources to support GIS	▪ Cost of data acquisition ▪ Cost of software support agreements ▪ Lack of general staff interest
Regional	▪ Insufficient resources to support GIS ▪ Lack of GIS strategy ▪ Unable to demonstrate business case	▪ Cost of data acquisition ▪ Cost of software support agreements ▪ Difficulty in recruiting and retaining local technical staff
Rural	▪ Lack of senior management support ▪ Insufficient resources to support GIS ▪ Difficulty in recruiting and retaining local technical staff	▪ Cost of data acquisition ▪ Difficulty in recruiting and retaining local technical staff ▪ Unable to demonstrate business case
Urban	▪ Insufficient resources to support GIS ▪ Cost of data acquisition ▪ Cost of software support agreements	▪ Difficulty in recruiting and retaining local technical staff ▪ Cost of data acquisition ▪ Cost of software support agreements

Exhibit 33: Factors constraining effective corporate GIS utilisation by water authority category

7. Data Management

7.1. Cadastral Data

Most authorities (64%) obtain their cadastral data from a third party source, typically State Government agencies either as a full or incremental update. Only 27% of authorities maintain their own cadastral base.

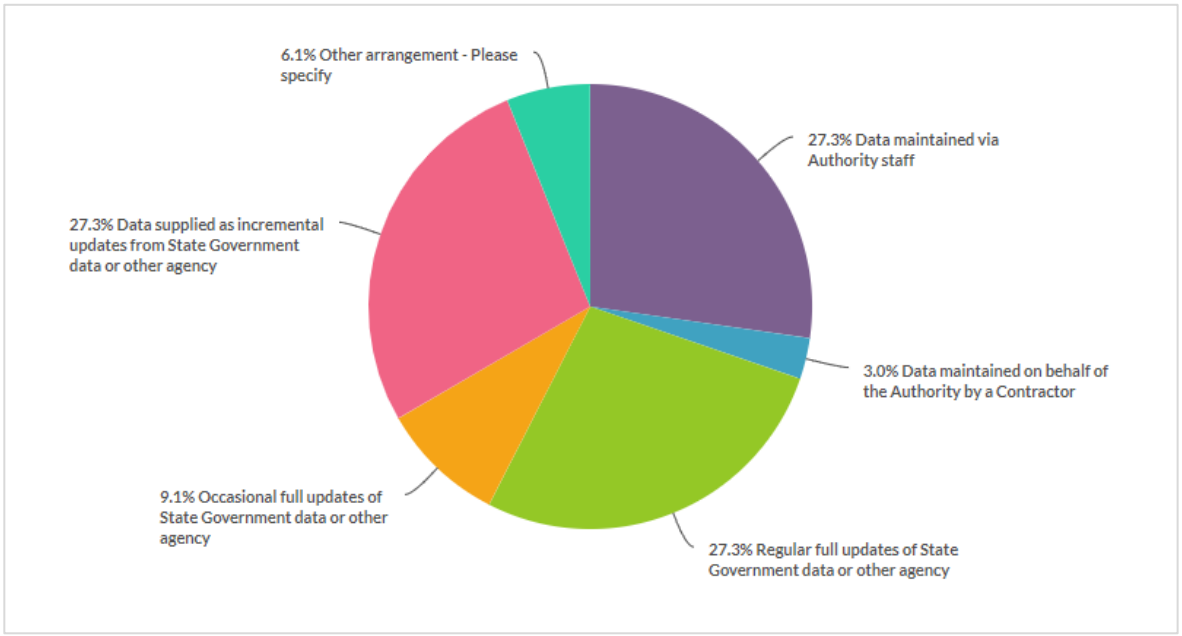

Exhibit 34: Source of cadastral (property) data

7.2. Data Management Issues

Effective data management is vital to a healthy and reliable corporate GIS. However, data management may well cause the most headaches for GIS teams. The survey asked respondents to rate the importance of a variety of data management issues. Access to accurate, high quality and timely spatial data were found to be the most important issues.

Data management issue	High	Medium	Low	Not Applicable
Access to timely updates of cadastre	70%	24%	6%	0%
Accuracy/quality of available spatial data	88%	9%	3%	0%
Cost of data management	52%	36%	12%	0%
Sharing data between agencies	39%	49%	12%	0%

Technical advice on data management	30%	42%	27%	0%
Version management to keep data history	30%	42%	27%	0%
Data governance rules and custodianship roles	21%	52%	27%	0%
Other	6%	6%	0%	88%

Exhibit 35: Rating of the importance of data management issues

8. Key Challenges

There are many challenges facing water authority GIS teams to ensure that their organisation's investment in GIS technology, data and services is fully utilised and delivers value to customers. The following summarises the eight main challenges reported in this year survey. The first five were also reported in 2009.

1. **Integration with business systems.** In 2009, systems integration was by far the most common concern. In 2018, integration of GIS with other platforms still poses a challenge, including data sharing between platforms, building a live "digital twin" of network operation, or linking GIS and AMS. Authorities are concerned about the impacts of changing other corporate systems for the corporate GIS, and building an active web-based connection/integration between corporate databases and other enterprise services.

2. **Data management and quality**. In 2009, authorities reported that data capture and cleansing tasks are resource intensive and time consuming and often required field verification. In this year's survey, data quality, accuracy, field capture, and verification are still important. In particular, establishing data quality control procedures, improving the accuracy of GIS asset data (both location and condition) to enable business intelligence around asset performance.

3. **Implementation of Mobile GIS.** In 2009, authorities reported great potential for mobile GIS although there were significant limitations in communications in regional areas. In this survey, adopting field data collection tools and going completely mobile is still proving a challenge to implement especially completing the integration of such systems with the enterprise data platform.

4. **GIS awareness and roadmap.** Many authorities noted the need for greater training and the broadening of staff awareness of GIS technology in 2009. Authorities continue to report concerns about training needs, training requirements and staff skills development. In addition, authorities are concerned about limited planning of new initiatives, and the absence of corporate GIS strategies and/or roadmaps.

5. **Implementation of new technology.** In this survey, concerns regarding the development of corporate web-based GIS applications for internal and external use were highlighted. GIS teams are also finding it difficult to keep up with technologies and trends. These may include 3D, new utility network management tools, UAVs/RPAs, and the development of digital twins. Other associated challenges include securing resources to review existing GIS platforms to either upgrade or move to newer solutions providing better support for future business needs.

6. **Senior management and organisation structure**. A large number of authorities regard senior management's lack of understanding of GIS as a major challenge. This impacts senior management's understanding and support:

    - For further investment in GIS, or new initiatives from the GIS team
    - Of GIS, its benefits, existing software capabilities, and potential cost savings
    - Of the impacts of changes to the organisational structure for GIS services
    - Of how GIS can deliver additional business benefits

7. **Maximise the operational services and benefits of GIS**. GIS is a widely used decision-support tool. It remains a constant challenge to maximise operational efficiencies. Some examples include:

    - Identifying and reporting water service delivery (e.g. how many customers are affected by a main break, complaints and other aspects of authority performance).
    - Keeping the business moving forward, continuously improving and implementing new tools, and an Operational Control Roadmap
    - Managing business-as-usual support of GIS and maintaining a single-point-of-truth for geospatial data

    The most commonly reported challenge is to continue to improve the accuracy of the geospatial representation of the asset network and the required aspatial data (e.g. asset condition), each of which is required to deliver reliable GIS decision and planning support tools and applications.

8. **Staff resourcing and budget.** There is a growing demand for immediate access to reliable digital information upon which to make informed decisions. However, a large number of water authorities report constrained resources (*being spread too thin*..). The challenge is to continue to find new ways to demonstrate the value and significance of GIS to the business and those making decisions on budgets.

9. Conclusions

The vast majority of authorities participating in this survey rated the contribution of GIS systems to improving corporate operations as high or very high.

The implementation of GIS has enabled self-serve or automated processes; geospatial analysis; public web-based GIS interfaces to publish corporate data; network tracing on mobile devices in field operations; and support for design cost estimation.

Some of the key technical conclusions from the survey included:

- **Application integration** with corporate GIS increased notably since the last survey, particularly with asset management systems. For other corporate systems, integration remains primarily a future challenge.
- Respondents indicated that **increased adoption of sensor technologies** (an example of "the internet of things" or IOT) and a **greater sharing of corporate data** (i.e. open data policies) is expected.
- A notable improvement from 2009 is the higher use being made of **authoritative cadastre** updates (either incremental or full). Difficulties in accessing **other third party data** for a better operational planning such as telecommunications, gas and electricity network data, and satellite imagery data were commonly reported.
- A significant proportion of organisations have **yet to deploy web-based GIS** (and therefore missing out on some the key benefits of corporate GIS systems).
- Whilst **commercial products** remain the dominant solution, costs of software licence agreements, and access to technical support and training were reported as significant issues for both desktop GIS and corporate web-based GIS.
- Use of free and **open source** (FOSS) **solutions**, particularly for desktop use (eg QGIS) has increased. Yet the vast majority of authorities don't see open source as making a significant contribution to their organisation's GIS.
- High quality, accurate data remains a key challenge for organisations. Data validation and costs of data acquisition remain significant (both in 2009 and 2018). Considerable interest was expressed regarding the potential for modern data collection technologies (eg drones/UAVs) to assist improve this issue by reducing cost, improving quality and shortening the time required for data acquisition.
- The **use of mobile technologies** and devices for field data collection remains challenging for most organisations. Whilst use of mobile mapping has increased, almost half of authorities have yet to implement geospatial-aware field applications integrated with their enterprise GIS. Only a few have been successful in developing geospatial network tracing for mobile devices. Many more authorities have yet to leverage the advances in mobile geospatial technologies for work-order dispatch, efficient field operation and asset data collection and validation.
- Only one-third of authorities currently provide a **public-facing GIS** application. Obtaining information from the public (crowd sourcing) remains a relatively new area of operations for most organisations.

There were three potentially inter-related other conclusions from the survey:

- The **under-utilisation of GIS systems and services** was noted and may be related to the **limited technical GIS resources available** within many organisations.
- **Low levels of senior management support** and awareness of corporate GIS systems and capabilities were observed.

- Few organisations appeared to be undertaking **strategic planning** of their corporate GIS and related systems and capabilities.

Faced with continuing significant change in spatial and related technologies and evolving business needs, it is believed that most organisations would benefit from more regularly producing a strategic geospatial roadmap to plan how these dynamics are both accommodated and used to achieve better organisational outcomes. Recently it was found that the annual cost savings attributable to just use of spatial information in water utilities sector in NSW was $16 million in 2017 based on net productivity impacts of 3 per cent of labour costs (source: Economic Value of Spatial Information in NSW, 2017).

Such strategies need to be based on a comprehensive review of the organisation, its people, processes and technology. This type of exercise can be used to raise senior management awareness of the business value arising from any investment in GIS and achieve a better understanding of and support for contribution of GIS to the organisation.

Thank you

Spatial Vision would like to thank the water authority respondents for their time and contributions to the survey.

A1: About Spatial Vision

Spatial Vision is a private company that provides geospatial solutions to a broad range of clients. Spatial Vision is especially committed to supporting the Australian water industry through the delivery of solutions and support through the industry survey. In addition, Spatial Vision convenes a user group for water authorities, known as GWUG (GIS Water User's Group) and has done so for well over ten years.

The range of services provided by Spatial Vision include delivery of:

- **Geospatial Advisory Services**

  Advice to organisations on how to effectively use their information to advance decision-making and improve operational efficiency to execute lasting beneficial change. Services include GIS strategies, business requirements and solution architectures, and independent reviews of spatial technologies.

- **Enterprise Spatial Solutions**

  The design and delivery of geospatial solutions to support business functions and information management. Solutions may be web, desktop or mobile using open source or commercial platforms. Our commercial platform skillsets cover Esri and Geocortex.

- **Spatial Information Services**

  Service to find, create or convert data into usable digital information ready to be consumed by systems. We are licenced third party data provider. Our expertise includes the identification and spatial matching of assets and construction of geometric networks.

- **Training**

  Delivery of GIS training courses that can be tailored to suit your needs and can be held on premise or at our office. We offer training in the use of Esri ArcGIS and ArcGIS Pro software, and in open source GIS software, QGIS.

- **Enterprise & Mobile Applications**

  The design and deployment of web and mobile application to provide targeted, effective solutions for organisations managing complexity associated with natural resources, land, hazards and threats, licensing and regulation, and community engagement.

- **Data Visualisation**

  Source, collate and enhance what can be disparate data sets, and present them in a manner that provides insight and clarity to tell compelling stories and support your mission.

For more information about any our services, the company or GWUG, please refer to our web-site (www.spatialvision.com.au) or contact our office on (03) 9691 3000.

A2: References

- *Economic Value of Spatial Information in NSW*, CRC for Spatial Information/ACIL Allen*, 2017*
- *Use of GIS by Australian Water Authorities (Results of an 2009 Industry-Wide Survey),* Spatial Vision Innovations Pty Ltd, *2009*
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