WATERCARE POST INTEGRATION – ASSET MANAGEMENT SYSTEM IMPROVEMENTS

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ABSTRACT

On 1 November 2010 Watercare became responsible for water and wastewater services within the Auckland region from Wellsford in the north to Pukehohe to the south. This involved the amalgamation of asset data from six water retail organisations, with Watercare's bulk water and wastewater treatment and transmission systems. At integration the local water and wastewater networks had been combined into one asset management system (Hansen7), represented spatially within Watercare's Geographic Information System (ESRI GIS).

Without time to standardise and validate the asset information prior to integration, Watercare embarked on an asset information improvement programme. This paper outlines the asset data validation and correction processes that have been carried out to improve the quality and reliability of asset information over the last five years and discusses the improvement initiatives currently underway.

The standardisation of engineering standards and asset metadata has enabled the development of an automated as-built capture process for local network assets. This has reduced the time taken to capture new network assets which would have taken days to capture to now being able to be captured within hours.

KEYWORDS

Asset management, asset metadata, GIS, data validation, standards

1 INTRODUCTION

This paper discusses the asset management system improvements that have been implemented over the last five years since Watercare took over responsibility for water and wastewater services within the Auckland region.

Without time to standardise and validate the asset information prior to integration, Watercare has embarked on an asset information improvement programme to improve the quality and reliability of its asset information.

The standardisation of engineering standards and asset metadata has enabled the development of an automated as-built capture process for local network assets. This has reduced the time taken to capture new network assets which would have taken days to capture to now being able to be captured within hours.

2 BACKGROUND

In 2009, the Government passed the Local Government (Tamaki Makaurau Reorganisation) Act 2009 to establish the Auckland Council as a unitary authority for Auckland and that Watercare Services Limited would become the Auckland water organisation for the Auckland region.

For Watercare this involved the amalgamation of the water and wastewater services of the following six water retail organisations or Local Network Operators (LNOs):

- Metrowater – Council Control Organisation (CCO) of Auckland City Council
- Manukau Water Limited – CCO of Manukau City Council
- North Shore City Council

- Waitakere City Council
- Rodney District Council
- Franklin District Council
- Plus ownership of the water and wastewater assets of Papakura District.

The water and wastewater assets of these organisations were amalgamation with Watercare's bulk water and wastewater treatment and transmission system assets. At integration the local water and wastewater networks had been successfully combined into one asset management system (Hansen7) and represented spatially within Watercare's Geographic Information System (ESRI GIS).

Watercare services a population of 1.4 million, supplying 120 billion litres of water and collecting and treating 149 billion litres of wastewater per year.

The water and wastewater assets owned by Watercare are list in Table 1, with a current asset value of $8.3 billion.

Table 1: Summary of Watercare's water and wastewater assets

Asset Type	Supply, Treatment and Transmission	Local Network	Total
Water supply dams	12		27
Ground water sources	12		12
River abstraction	3		3
Water treatment plants	16		16
Water pump stations	42	48	90
Water reservoir sites	52	37	89
Watermains	571 km	8,495	9,066 km
Customer water meters		433,611	433,611
Wastewater treatment plants	18		18
Wastewater pump stations	59	447	506
Wastewater pipes	439 km	7,458 km	7,896 km
Wastewater manholes	3,585	162,025	165,610

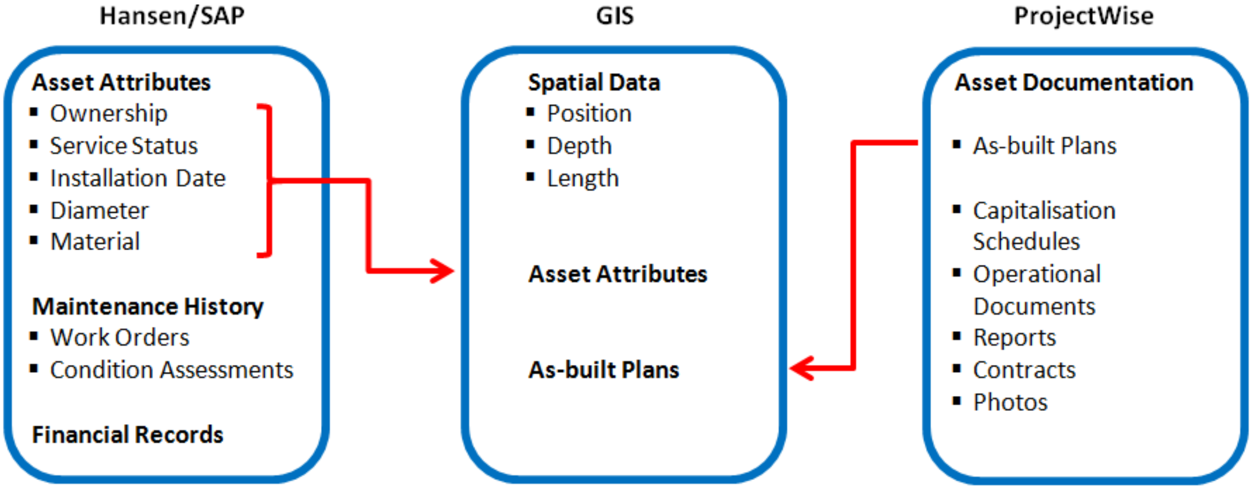
3 WATERCARE'S ASSET MANAGEMENT SYSTEMS

The overall principle for corporate data is "capture once and accessible by many". This applies to asset management with the most appropriate system containing the master data and integration between systems to allow seamless access to information irrespective of its source.

For Watercare, GIS is responsible for the spatial data with asset attributes within either SAP for supply, treatment and transmission assets and Hansen for the local network assets. As-built, operational and maintenance documentation is stored in Watercare's electronic records document management system (ERDMS) system, ProjectWise. The integration of these systems enables the user to view the assets from multiple points of view. For example, a local network asset can be first identified spatially in GIS and as the user requests further details, GIS recovers this information from Hansen. The link between these systems is Hansen's compkey, a unique identifier. Further investigation enables the user to access Hansen directly via GIS. Similarly, the as-built documentation for the assets is accessible via the GIS/ProjectWise link.

The links between Watercare's asset management systems and the master data within each system is shown in Figure 1.

Figure 1: Asset Management Systems



4 DATA INTEGRITY PROJECT

The local network asset data inherited at integration varied across the region with mismatches between asset information in the LNOs' asset management systems and that captured spatially in GIS. With insufficient time to investigate and validate asset data prior to integration some 566,000 key attributes were unknown. A summary of unknown data for local network assets is shown in Table 2.

Table 2: Summary of Critical Unknown Asset Attributes

Asset Type	Ownership	Service Status	Installation Date	Diameter	Material	Total
Watermains	7,870	20,487	9,178	4,513	54,371	96,419
Valves	3,935	9,013	3,513	89,105		105,566
Hydrants	1,664	3,826	2,047	57,854		65,391
Total water assets	13,469	33,326	14,738	151,472	54,371	267,376
Wastewater pipes	6,364	8,581	1,326	4,265	55,739	76,275
Valves	361	240	277	5,005		5,883
Manholes	6,827	5,546	1,702	202,064		216,139
Total wastewater assets	13,552	14,367	3,305	211,334	55,739	298,297
Total water and wastewater assets	**27,021**	**47,693**	**18,043**	**362,806**	**110,110**	**565,673**

Not only was this asset data important for the long-term operation and maintenance of these assets, it was critical for the valuation of the company's assets. Watercare therefore initiated asset information improvement programmes prior to the 2013 and 2015 asset revaluations.

4.1 VALIDATION PROCESS AND BUSINESS RULES

The asset validation process was divided into five stages:

- Analysis of discrepancies between GIS and the Hansen
- Data mining of the former LNO systems
- Asset attribute validation based on surrounding asset data
- Detailed spatial analysis

- Validation and standardisation of pump station and reservoir assets

To maintain audit capability and to ensure the users of the asset data were aware of the changes made, asset reliability fields were populated as listed in Table 3.

Table 3: Asset Data Reliability Ratings

Reliability Code	Reliability Rating	Description
As-built	High	As built plans with valid source for asset attribute data.
Field inspection	High	Field inspection survey (using GPS) by appropriate authority to verify the actual attributes of the asset with source document.
CCTV	High	CCTV inspection assessment of pipes using CCTV containing key attributes and source document.
Known	Medium	One or more attributes plus installed date are known from the legacy datasets but source document may or may not be available.
Validation rules	Medium	Assessment based on local experience and knowledge using business intelligence validation rules.
GIS	Low	GIS operator assumption based on judgment to verify the logic of the network e.g. connectivity, edge matching, diameter, material.
Further investigation required	Low	Engineer's assumption or further investigation and validation required.
Unknown	Nil	No information available for any attribute data

4.1.1 ANALYSIS OF DISCREPANCIES BETWEEN GIS AND HANSEN

In parts of the region the number of assets migrated to Hansen did not have a one to one relationship with the data in GIS. This was believed to be due to a lack of synchronisation between their asset management system and GIS, exacerbated where the GIS system and water and wastewater were managed by separate departments. It appeared that changes in one system had not always carried been out in the other.

The business decision was made that all linear assets without a corresponding spatial representation in GIS would have their status changed to error in Hansen. For example, if a pipe or manhole could not be located in GIS and there was no location or address information within Hansen, then the asset was assumed to be an error. The exceptions to this rule were water and wastewater service lines, as historically these had not always been captured spatially.

Similarly, a process was established to enable the capture of found assets where a site inspection identified assets not shown in GIS/Hansen.

4.1.2 DATA MINING OF THE FORMER LNO SYSTEMS

Due to the different asset management systems used prior to integration and variances between LNOs as to where the master data was stored, some data had not been correctly mapped to Watercare's systems. Further analysis, which had not been possible at integration, enabled asset attributes to be recovered. These were then able to be correctly assigned to the corresponding asset.

4.1.3 ASSET ATTRIBUTE VALIDATION BASED ON SURROUNDING ASSET DATA

The next stage relied extensively on geo-processing techniques within GIS to determine and validate missing attributes based on the attributes of the surrounding assets. Essentially this involved the bulk analysis of asset attributes either side of assets with missing attributes. This analysis is outline in 'Watercare GIS – Amalgamation and Moving Forward' (Perrie, 2015).

For example, if the diameters of the pipes upstream and downstream of a pipe with a missing diameter are both known, then it can be assumed that the diameter of the middle pipe would be the same. Similarly, the installation date of a pipe can be assumed based on the installation dates of its surrounding assets.

4.1.4 DETAILED SPATIAL ANALYSIS

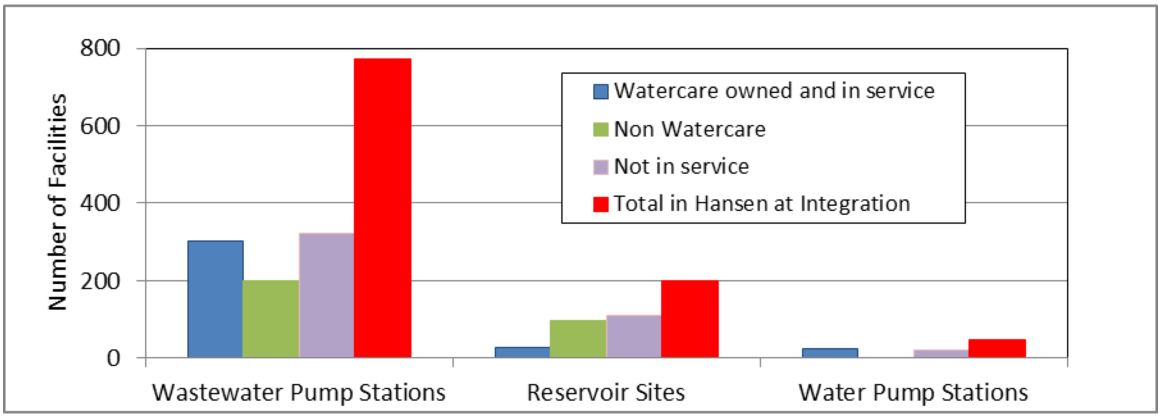
Further spatial analysis and investigation beyond the immediate vicinity enabled attributes that could not be determined from 4.1.3 above to be populated.

4.1.5 VALIDATION AND STANDARDISATION OF PUMP STATION AND RESERVOIR ASSETS

The final stage of the asset validation project involved the validation and standardisation of the level of assets captured for local network pump stations and reservoirs.

Investigation of asset ownership confirmed that a number of facilities had been incorrectly included in the transfer of assets to Watercare as these were in fact pump stations relating to Council's parks, privately owned or were no longer in service. The number of facilities in each category is shown in Figure 2.

Figure 2: Ownership of Local Network Pump Stations and Reservoir Facilities



The level of asset equipment capture within the pump stations across the region varied from as few as six assets to over 120 assets. This has been standardised to provide consistency, based on operational and maintenance requirements.

5 LOCAL NETWORK ENGINEERING STANDARDS

In July 2011, Watercare released its Code of Practice for Land Development and Subdivision based on the water and wastewater chapters of the New Zealand Standard NZS4404:2010 Land Development and Subdivision Infrastructure. This amalgamated the six different engineering standards from across the region and was a prerequisite to defining the metadata to be captured for the local water and wastewater networks. The Code has been updated to incorporate industry feedback, with the latest release in May 2015. This is available at www.watercare.co.nz along with the accepted materials list and the local network wastewater pumping station standard. Compliance with the Code is now required under the Auckland Council Water Supply and Wastewater Network Bylaw 2015.

One of the key variances to be standardised across the region was the point of supply. For new connections, these have been defined as follows:

Water Point of Supply
For water this is immediately downstream of the customer water meter with all water meters to be installed at the public road reserve/property boundary. Watercare will not own watermains installed within private roads or right-of-ways.

Wastewater Point of Supply – Gravity System

For the gravity wastewater system the point of supply is where the gravity pipe crosses the boundary of the property being serviced or if the public sewer is within the property, the point of supply is the connection between the service lateral and public sewer.

Wastewater Point of Supply – Pressurised System

With the increased use of pressurised wastewater collection (PWC) systems, the point of supply is the boundary box installed at road reserve/property boundary. The PWC pumping unit and rising main continues to be owned operated and maintained by the property owner.

6 AUTOMATED CAPTURE OF AS-BUILTS

With the standardisation of the metadata to be captured for local network assets, Watercare has developed a tool to automate the capture of local network as-builts in GIS/Hansen. The tool, utilising A2K Technologies Blackbox22, ensures that as-built CAD drawings comply with Watercare's metadata requirements and incorporates data validation checks to confirm continuity, pipe grades, flow direction etc.

Currently this is being utilised for construction contracts managed by Watercare as these are generally the larger and more complex as-builts (refer Figure 3). As consultants become familiar with the automated as-built capture tool it is expected that it will be used for developer constructed assets.

6.1.1 ANALYSIS OF AS-BUILT PLANS AND POTENTIAL COST SAVINGS

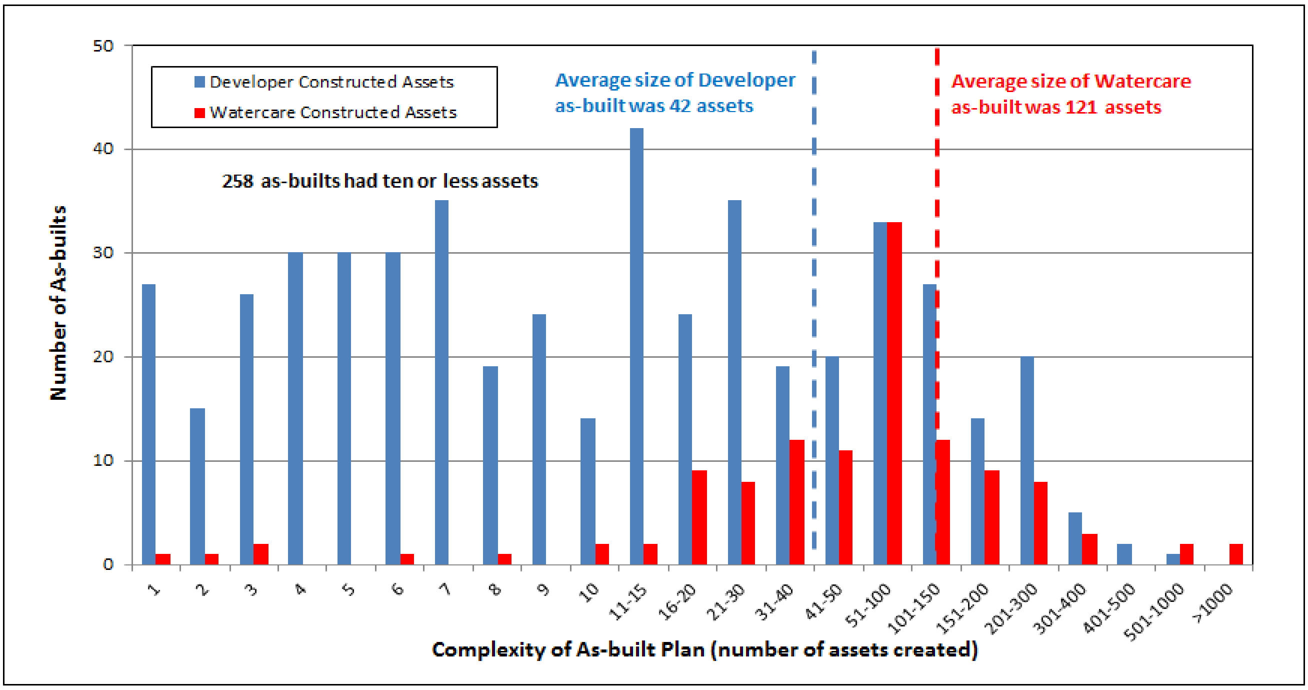
In the 2014 calendar year Watercare received 611 local network as-built plans which resulted in the capture of 35,204 new assets. This included both developer and Watercare constructed assets as summarised in Table 4.

Table 4: Summary of As-built Plans Received in 2014

2014 As-built Plan Analysis	Developer Constructed Assets	Watercare Constructed Assets	Total
As-built plans received	492	119	611
As-built plans with ten or less assets	250	8	258
Average number of assets per as-built plan	42	121	
Water Assets			
Water Mains	3,159	3,859	7,018
Water Valves	1,546	1,666	3,212
Hydrants	451	879	1,330
Water Nodes	1,428	1,871	3,299
Water Service Lines	2,003	2,016	4,019
Total Water Assets	**8,587**	**10,291**	**18,878**
Wastewater Assets			
Sewer Mains	3,072	1,242	4,314
Sewer Manholes	2,318	281	2,599
Sewer Valves	1,059	1,014	2,073
Sewer Nodes	649	558	1,207
Sewer Service Lines	5,072	1,061	6,133
Total Wastewater Assets	**12,170**	**4,156**	**16,326**
Total Water and Wastewater Assets	**20,757**	**14,447**	**35,204**

The distribution of the number as-built plans by complexity (number of assets contained within the as-built) is represented in Figure 3.

Figure 3: Number of As-built Plans by Complexity



This distribution shows that the majority of the 258 as-built plans with ten or less assets were produced by developers. These low risk as-built plans are generally referenced off an existing asset and would not need to be captured by the automation tool.

Watercare has two full time resources to capture local network assets which, based on the 2014 analysis, equates to an average of ten assets captured per hour. If the automated as-built capture tool was adopted for all as-built plans with more than ten assets, it is estimated that this would result in savings of up to 80% in terms of time and cost to capture new assets. To achieve this potential saving, Watercare is liaising with Auckland Council to encourage developers to utilise the automation tool.

7 CONCLUSION

Although all of the water and wastewater assets in the former Council's water and wastewater organisations had been migrated into a common GIS and asset management system at integration, the magnitude of the task and short timeframe meant that a data cleansing and validation process could not be carried out. Watercare therefore instigated a data integrity project to validate and populate missing asset attributes. This was not only required from an asset management perspective but was critical for the valuation of the company's assets. A total of 566,000 attributes have been populated along with an asset attribute reliability code to identify and track the changes made. With the development of Watercare's mobile applications for operational and maintenance staff the ability to field validate data is being implemented.

The standardisation of local network asset metadata has enabled Watercare to develop an automated as-built plan capture tool. This is currently being used for network assets constructed by Watercare, however, it has been estimated that time and cost saving of up to 80% could be achieved if applied across the region. Watercare's goal is for the as-built capture tool to be extended to all stages of works from concept, design and consent approval, construction, through to completion. Captured spatially in GIS, this would integrate with the forward works programme and provide project clash and works over protection during the construction phase. The final as-built information would also be captured prior to testing and commissioning. This is particularly important for transmission and network assets as they become 'live' on commissioning with all of the hazards, risks and public safety issues associated with water and wastewater systems.

REFERENCES

Perrie N (2015) 'GIS – Surviving Amalgamation and Moving Forward', Water New Zealand Conference 2015.

NOMENCLATURE

AMS	Asset Management System, SAP for the transmission assets and Infor Hansen 7 for the local network assets.
CCO	Council Controlled Organisation that is either wholly owned or wholly controlled by the Council and is responsible for the delivery of a significant service (water and wastewater) on behalf of the Council.
Compkey	The Hansen component key being a unique identifier of each asset used to link asset information between Hansen and GIS.
GIS	Geographic Information System, ESRI ArcGIS.
LNO	Local Network Operator, the water and wastewater service provider of the Councils prior to integration.
Local network assets	Water and wastewater network assets formerly owned and operated by the water and wastewater service provider of the Councils prior to integration.
PWC	Pressurised Wastewater System.
Supply treatment and transmission assets	Water assets relating the supply, treatment and bulk transmission of water and wastewater assets associated with the bulk collection of wastewater, treatment and discharge to the environment.