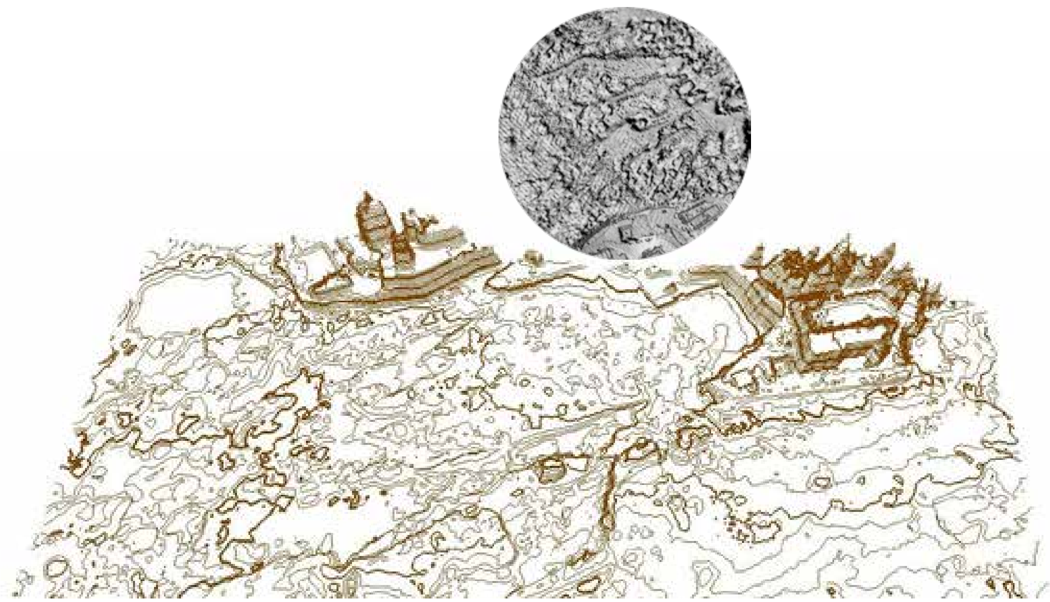
Pivot I

Technological Constructs as Foundations for Change



Ta' l-Għazzenin Rock-Cuts

Underwater rock-cut identified by Saviour Formosa on 15 June 2015
UTM 33N (ED50) (446211.297, 3978812.634, -8.006 m),
35° 57' 05.8990" N, 14° 24' 12.9159" E

CHAPTER 1

Using Brains Rather than Brawn: How the Water Services Corporation uses GIS-based Applications

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Introduction

Making sure that water continues to flow irrespective of population growth, increases in tourism numbers and other seasonal demands, requires a large infrastructure, sophisticated technology, and a dedicated organisation behind it. The Water Services Corporation (WSC) in Malta has evolved over the past two decades into a modern corporation adopting innovative technological solutions and sophisticated technology that has helped deliver the best-quality service to customers.

One way is by using geographic information system (GIS) based applications. Adopting this "spatial" strategy has enabled the WSC to determine how core business can exploit location data to improve decision-making, reduce risks, and optimise operations. The WSC is, as far as is known, the first large local organisation to adopt GIS to manage, control, and plan internal projects. Over the years the corporation has built up a very comprehensive GIS capacity that includes the geo-located points of all water meters, valves, taps, and pipes that exist on the Islands. Since the WSC is also responsible for Malta's wastewater, the company also has the same facilities in this sector too, complete with slope angle and elevation data.

An enterprise GIS solution is implemented and integrated throughout the organisation so that a large number of users can manage, share, and use spatial data and related information to address a variety of needs such as the creation, modification, visualisation, analysis, and dissemination of data in line with legislative (GoM, 2014; Cassar and Formosa, 2013). GIS benefits organisations of all sizes, and in almost every industry, because it allows strategic operators to visualise, question, analyse, and interpret data to understand relationships, patterns, and trends. There is a growing interest in and awareness of the economic and strategic value of GIS. Proper planning is the most important investment any organisation can make in building a GIS. Understanding one's GIS needs, selecting the right technology at the right time and establishing documented implementation milestones to measure the progress can ensure success.

In order to fully benefit from this solution and maximise return on investment, a long-term strategic plan was needed (ESRI, 2016). This chapter describes some examples of critical business functions where GIS plays a major role at the WSC (WSC, 2017).

AquaDot CRM

Within the customer care department incoming reports are geo-referenced directly on maps complete with accurate and fast search facilities. The objective of this newly introduced facility, is for so-called notifications i.e. reported technical issues, to be entered through a GIS application to SAP ERP, which is the standard information system. SAP ERP integrates the key business functions of the Corporation; which are mainly asset management, supply chain management, finance and accounting. Notifications are then automatically communicated to the relevant region and the officer in-charge of works.

The system has a number of features that would not be possible without a GIS. For example, searching for streets and locations, especially when reports are incoming over the phone, is certainly much simpler and visually verifiable. Switching between orthographic and street map views enables call centre personnel to confirm a reported location visually by giving back to the reporter on the other side of the line visual cues (Figure 1).

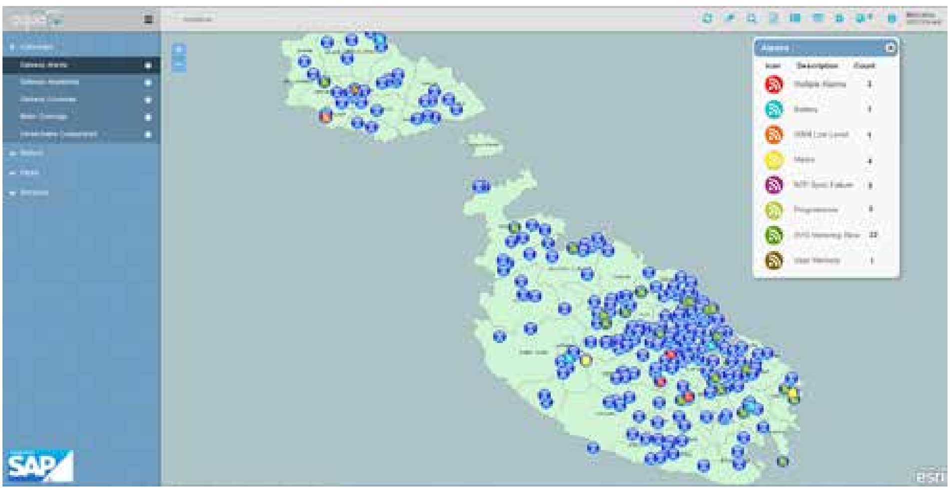
Figure 1: Customer care notifications

AquaDot AMM

The AMM AquaDot web-based solution has been developed with the primary scope of effectively managing and monitoring the WSC's smart metering system using GIS as the main driver. Given that the nature of the Smart Metering solution is essentially spatially-based, the AquaDot solution had to be a GIS-centric one. In order to obtain effective GIS interfaces and functionality, the solution was completely developed utilising the GIS spatial capabilities and functionalities which through its multiple tasks and methods proved to be extremely helpful.

The AquaDot AMM solution has become the main monitoring tool being used at operational level. To achieve this effective monitoring level, feature and geometry map services published through internal ArcGIS servers were used to monitor smart meter system components namely RF receiver gateways and meter module transmitters (Figure 2). Through visual aids users can rapidly identify the spatial location of, for example, a particular RF receiver gateway alarm (Figure 3). Users can also spatially locate meter-transmitter issues such as a meter-to-transmitter wire cut, tampering and low battery.

Figure 2: RF Receiver gateway monitoring



The AMM AquaDot solution also incorporates GIS in order to effectively monitor the radio reception between meter transmitters and receivers (Figure 4). By making use of appropriate geometry services, the reception area for every transmitter is stored and periodically analysed for any negative variations. Such variations are very often the result of antenna problems which give rise to requests for repairs. Stored reception area data in terms of metres squared is also providing information about overlapping reception areas.

With the use of GIS these overlaps can be identified and analysed for possible removal of redundant antennas which are very costly to maintain (Figure 5).

The AquaDot AMM solution can also provide users with information on which gateways have serviced a specific consumer meter over a period of time. Alternatively, users can specifically select a particular antenna to visually analyse which meters have been serviced within a specified time period. The GIS functionality within the AquaDot AMM solution also caters for the administration of meter-transmitter installation and maintenance management. Personnel can locate meters which require either a transmitter installation or an inspection. The planning of installations and maintenance have eased the operational construct.

Figure 3: RF reception comparison showing improvements in coverage through GIS based monitoring

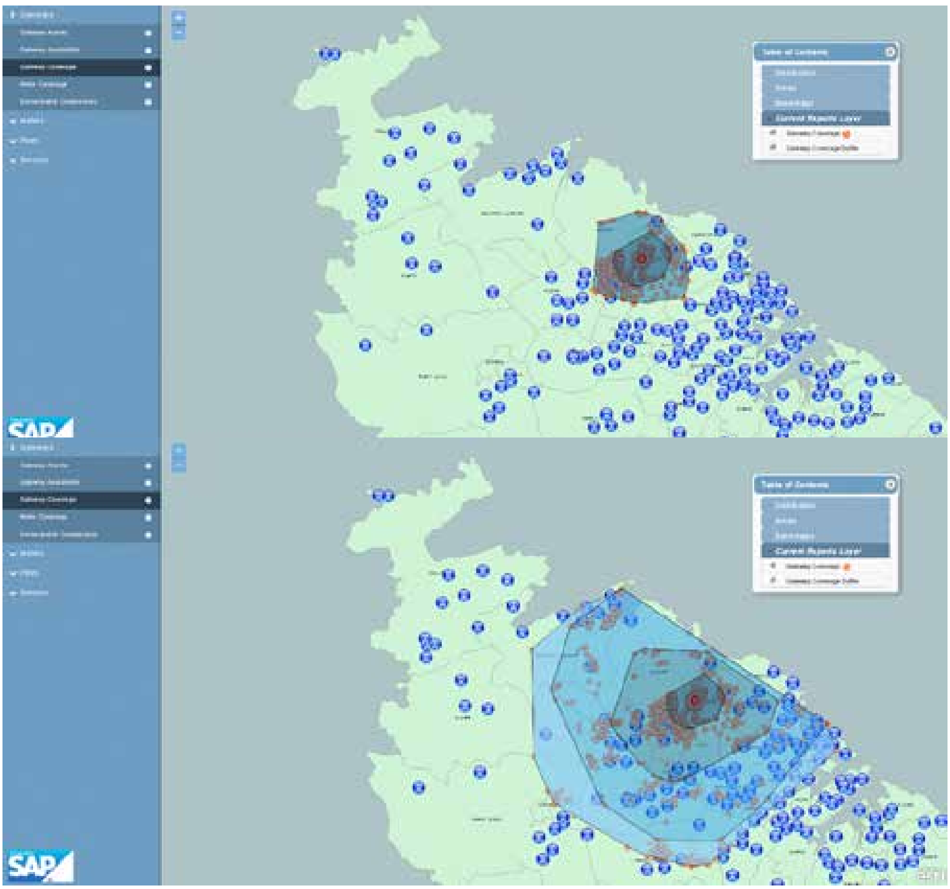


Figure 4: Meter to gateway reachability

Figure 5: Meter reachability spatial analysis

This solution makes use of the power of GIS to spatially analyse water leaks in predefined or on the fly selection of zones and to monitor water consumption versus water being pumped in the network to identify any possible water leaks in the system (Figures 6 to 8).

Figure 6: Water consumption analysis

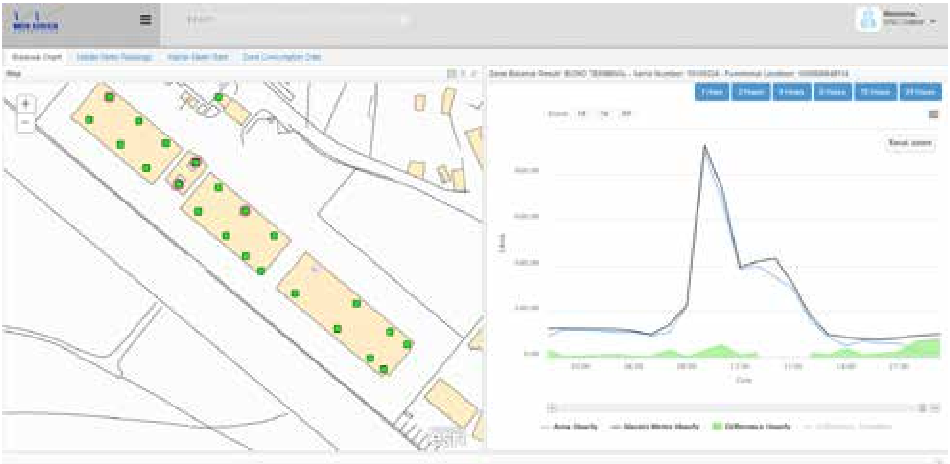
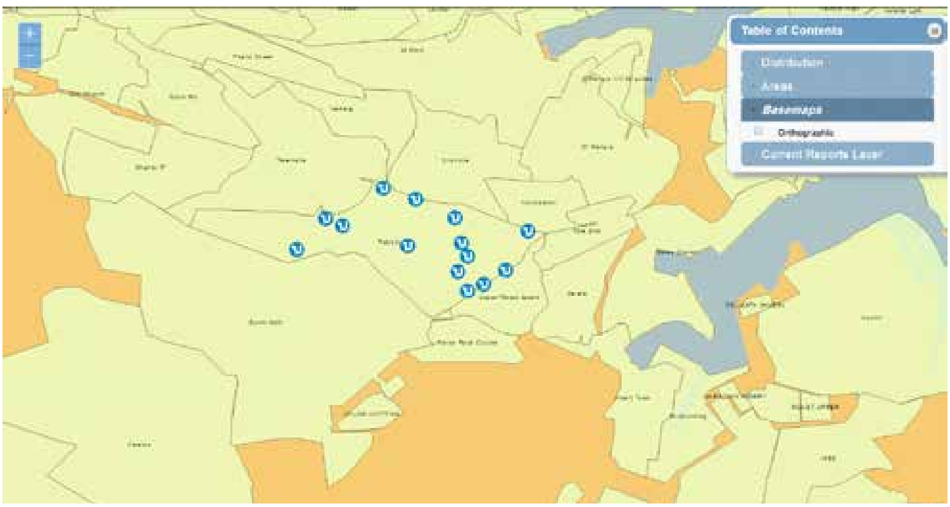


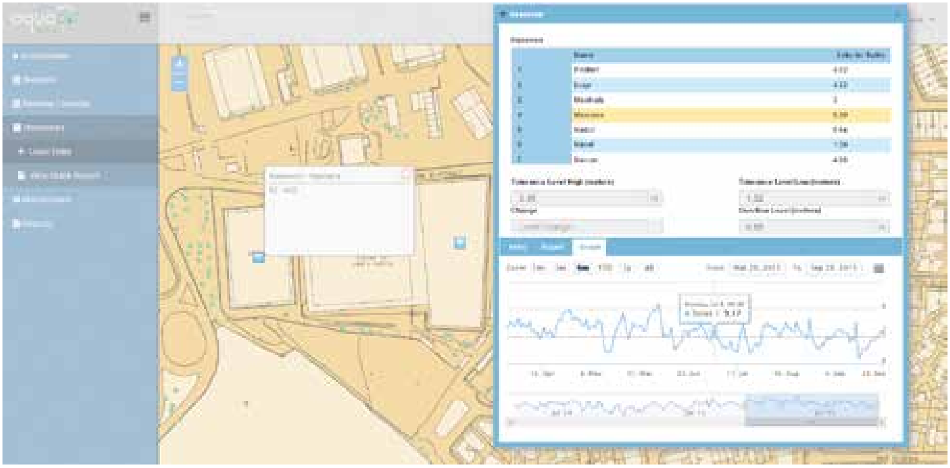
Figure 7: Meter reachability



AquaDot Projects

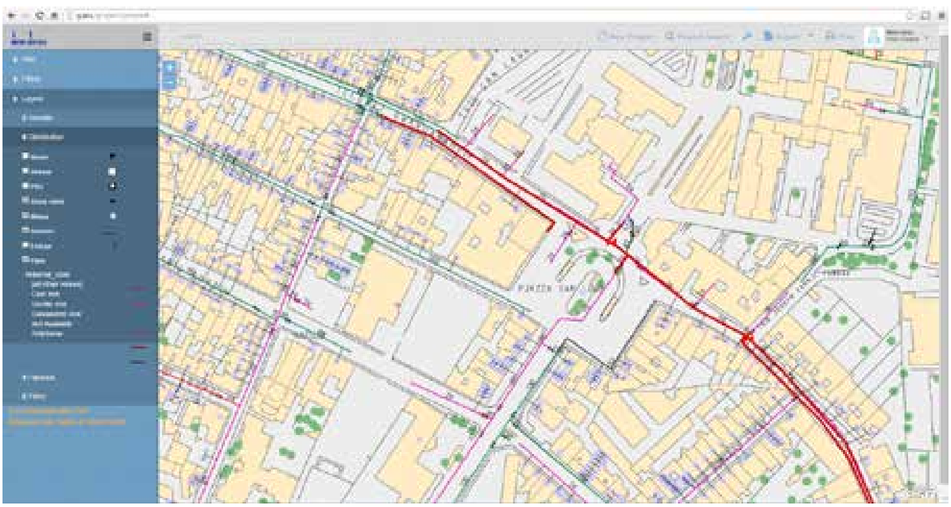
One of the main functions of the water services corporation is to undertake projects to maintain and extend the distribution and sewerage pipe network. The AquaDot projects system is a GIS centric in-house developed solution to manage these projects throughout their life cycle. Any planned project is system initialised through asset geocoding mainly pipes and other fittings. Consequently any attributes related to pipes and other assets such as pipe diameters and material types are stored with every geocoded feature.

Figure 8: Reservoirs monitoring



The GIS element within this solution has after a year of use proved to be extremely useful. Primarily it has become easy to locate the concentration of projects through heat maps. Moreover, as all projects are now being geocoded, various benefits provided by GIS tools are now being reaped. Amongst others, calculations of project pipe length, new service points and their costs, in the context of project locations can be carried out much more efficiently (Figure 9).

Figure 9: Geocoding of planned projects in red in conjunction with current distribution network



AquaDot Insight

AquaDot Insight is a Business Intelligence (BI) solution which provides high-level management reports and KPIs generated from data gathered by various solutions. Through the use of user-friendly dashboards, managers can effectively make fast decisions and evaluate trends. The GIS factor has been significantly integrated in order to provide relevant geographic information, such as specific dashboard provides managers with a visual display of a consumer meter transmitter percentage for every locality (Figure 10).

Figure 10: The red shading indicates local councils which have reached a meter transmitter installation percentage threshold

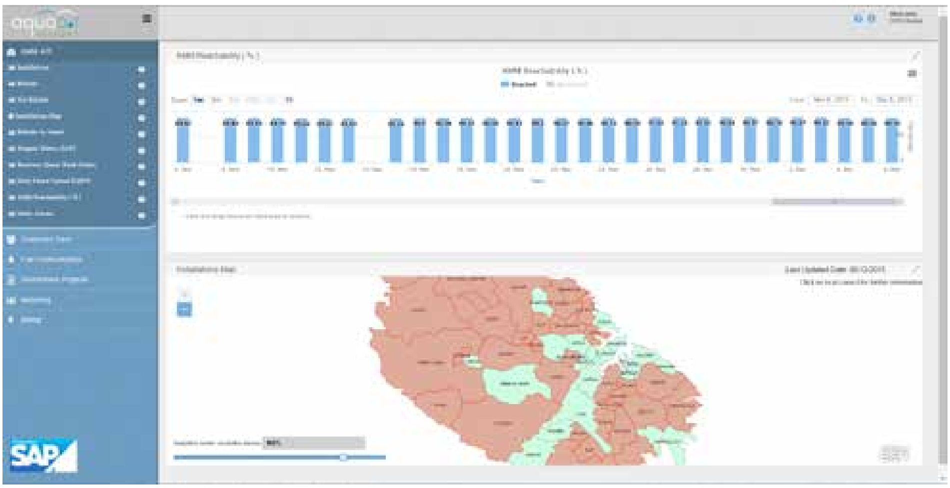


Figure 11: Heat map indicating customer notification concentrations

Another dashboard provides heat maps showing customer notification concentrations by notification types. Furthermore, spatial analysis is also being applied by generating heat maps based on the type of customer notification and their predetermined service level agreement (SLA). It is also being carried out to provide information about WSC projects through appropriate heat maps (Figures 11 and 12).

Figure 12: Heat map of notifications

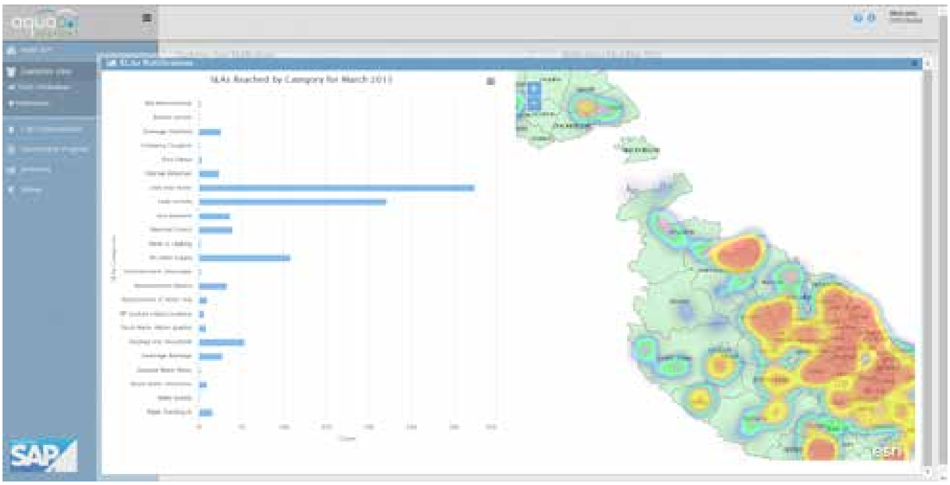
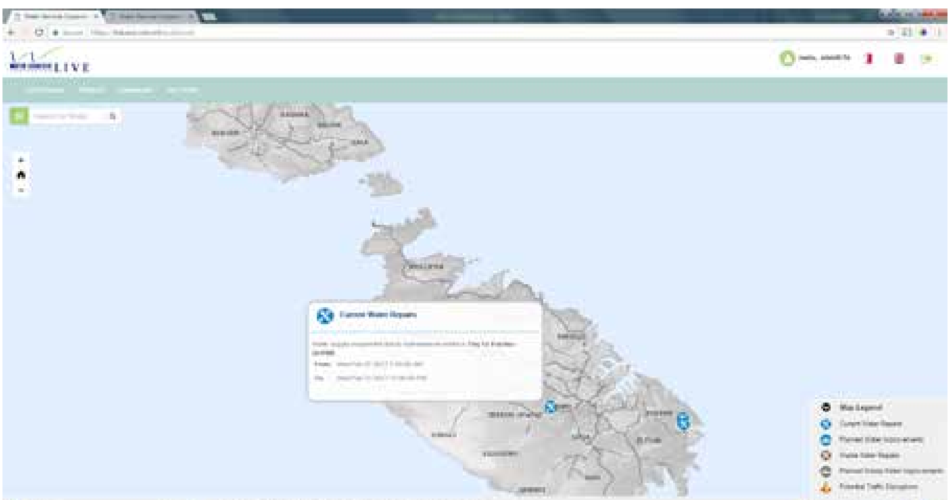


Figure 13: Water Quality monitoring

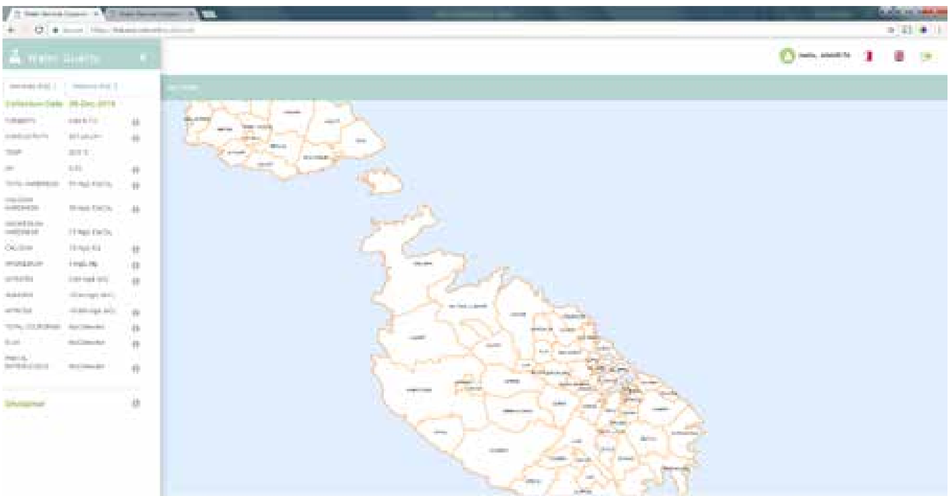


AquaDot WSC Live

The GIS-centric portal of the Water Services Corporation was designed and developed with the customer in mind. Maintenance works and planned future works and network upgrades are also depicted in Figure 13. A feature which is open to the general public, meaning that no registration is required, is the provision of water quality parameters. Water quality parameter values are obtained after meticulous tests on potable water taken from various sampling points are carried out.

Water is tested for various elements which may include amongst other chemical levels, possible bacteria and pH values. The portal makes it easy to view these values by simply clicking on a specific map zone whereby all the water parameters of that zone are consequently displayed. For knowledge purposes, water parameter descriptions are also being provided (Figure 14).

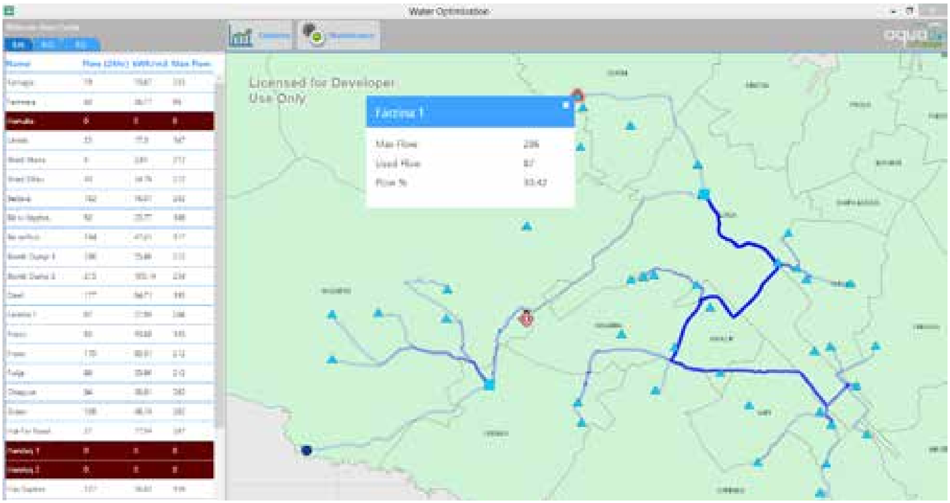
Figure 14: Water Quality monitoring - localities interface



AquaDot GIS Optimser

An area which greatly benefitted from GIS is the water production process. At present, the local management of water production is done manually without any formal consideration of optimisation. The Water Services Corporation integrated the GIS water hydraulic simulation model with Genetic Algorithms to optimise this process to meet demand, water quality specifications and minimise energy consumption. The results obtained from this model are very encouraging and indicates that there is room for drastic improvements (Figure 15).

Figure 15: GIS based water production optimiser



Conclusion

In conclusion, the system caters for the entire data cycle within a functional context that is governed by a core-GIS system, a decades-long activity to integrate systems and create a user interface that brings the input-output flow through a full-circle. The progressive applications described in this chapter have served as a case-study for the implementation of the integrated systems highlighted in Chapter 1 through the SIntegraM concept and project implementation. The WSC applications have enabled the spread of the spatial-information systems, as built around a central core, to other governmental agencies and entities.

References

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