# WEB MAPPING IN SOCIAL PROGRAMME MONITORING: A CASE STUDY OF UNICEF SOMALIA

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**Abstract**
Humanitarian organisations require reporting to donors on the programmes that they undertake, their location, and the number of beneficiaries reached. United Nation Children's Fund for Somalia uses a Microsoft Excel spreadsheet called the 4W Matrix to capture programme data. Donor reports contain information from this matrix. It takes time sorting through the rows and columns of this matrix, to address various requirements such as; "getting the number of complete water projects in a district?" etc. It is also not easy to evaluate how well humanitarian aid is spatially distributed or visualise the programme locations and their extents. This research presents an endeavour to address such challenges encountered. The principle objective was to enhance the sharing of spatial information and addressing spatial analytical requirements. To achieve this, the 4W Matrix was converted into GIS vector data file format and then imported into a *PostGIS* database. *GeoServer* was used as the map server to publish data from *PostGIS* database. *Heron Mapping Client* was utilised to provide the front-end user interface, while *Apache* Web Server was deployed to enable online access. The developed web application provides tools to run queries based on feature attributes, spatial searches by drawing geometrical shapes on the web-based map and searches by features from other layers. Additional capabilities include tools to compute point-to-point distances and the areas enclosed by individual administrative districts. Feature layers can also be turned on or off, to provide clear maps devoid of too many features. Some of the visualisation challenges that UNICEF Somalia faced are addressed by the web application which disseminates spatial information related to the social programmes to stakeholders in different locations. It is recommended that the web server runs behind a firewall to provide a secure platform for data, some of which could be of confidential nature.

**Keywords:** Social programme monitoring, 4W matrix, UNICEF Somalia, GIS, web mapping, GeoServer, heron, apache, POSTGIS

## 1.0 Introduction

Humanitarian aid is material or logistical assistance provided in response to a crisis that may be natural or man-made. The primary objectives being to save lives, alleviate suffering, and maintain human dignity - (West Hartford, 2002). In order to show that the objectives are being achieved, United Nations (UN) agencies are expected to continuously report on the programmes undertaken and on the number of people that benefit from these programmes.

Since many of the United Nations agencies may be involved in providing assistance in a particular country like Somalia, it is important that these activities are well coordinated. Knowing the time (WHEN), the place (WHERE), the organisation (WHO) and the activity (WHAT) that is being carried out, is essential if the organisations and their activities are to be coordinated in a way that ensures that humanitarian needs are met. The WHEN, WHERE, WHO and WHAT are known as the 4W's and are put together in a matrix called the 4W matrix.

The 4W matrix is a Microsoft Excel spreadsheet that contains the following columns: reporting date, donor, funding agency, implementing partner/s, activity description, location, beneficiaries, status, start date, end date, contact person and remarks. It essentially contains all programme data. The location column is captured in terms of latitude and longitude. There is therefore a huge amount of untapped geographic information stored within the 4W matrix that could form a strong basis for a good decision if the data is visualised and analysed on appropriate platforms.

Data visualisation communicates information clearly and effectively through graphical means. When done correctly, data visualisation is an effective way to analyse large amounts of data to identify correlations, trends and patterns. Geospatial information systems (GIS) software provides the best platform available currently with which effective visualisation can be achieved.

GIS technologies are revolutionising the ability to communicate the full scope of humanitarian work accurately, openly, comprehensively and in a visual fashion. For organisations with limited budget for software licenses, Open Source GIS software can be implemented in order to reduce overhead costs.

Open source software is software that gives access to the source code used to create the program, and is freely available for the public to view, edit, and redistribute - (Sherman, The Geospatial Desktop, 2012)

Mogadishu, the commercial as well as cultural capital of Somalia was taken as the case study area for this research. Mogadishu is located at 2°4'N 45°22'E, on the shores of the Indian Ocean. Its importance is paramount within Somalia as it is the financial centre. It is located in the southern part of Somalia. The southern and central parts of Somalia are areas that have had a large number of humanitarian activities. The areas are characterised by harsh and difficult environment that makes it very difficult in data collection. Donors need to be made spatially aware of the conditions existing in these areas so that funding for the social and humanitarian programmes can be secured. Mogadishu is administratively divided into sixteen districts (Figure 1).

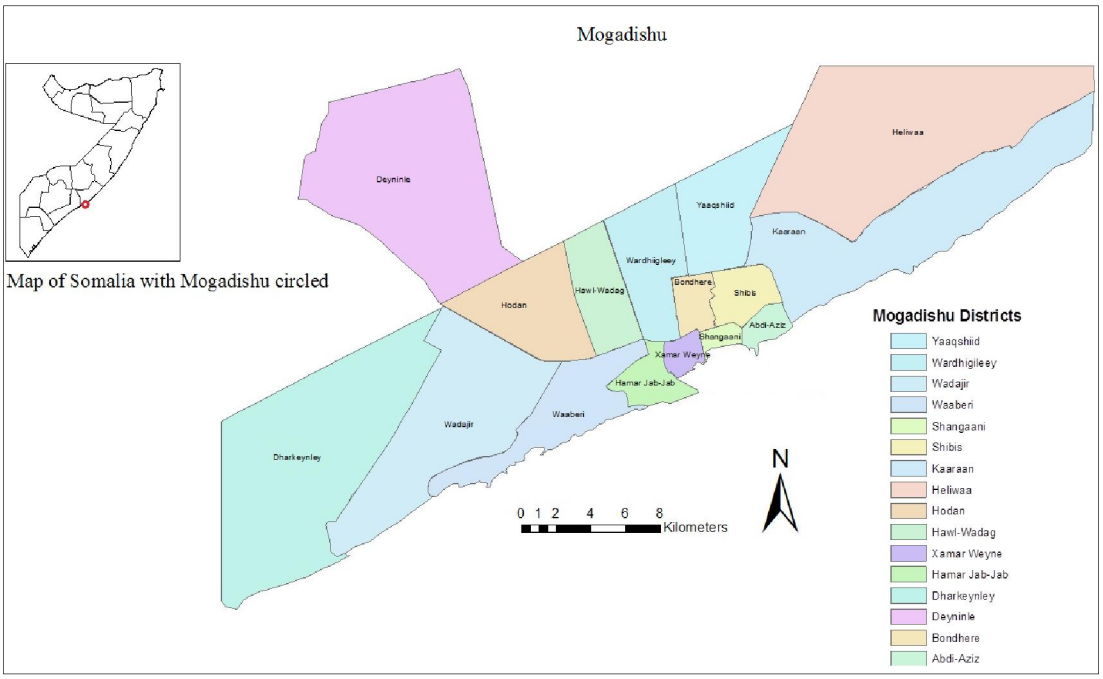


*Figure 1: Map of Somalia with Mogadishu Districts illustrated*

In addition to the challenges faced in implementation of the various programmes inside Somalia, implementing partners also face challenges in filling out the 4W matrix. Sometimes implementing partners submit 4W matrices that are incorrectly filled, some are partially filled, and others have outdated data or data that does not add up. It is also difficult to verify the information submitted from some areas and this is sometimes due to inaccessibility of these areas due to security reasons. There is also movement of population groups from one place to another and this brings in the challenge of maintaining accurate information about the location of these groups at any particular time. Local people also refer to the same location using different names and so in filling location names on the 4W matrix there is need for consistency. A platform for sharing of geospatial data is critical in addressing some of the challenges encountered and this is best fulfilled using a web application.

Web applications are popular due to the ubiquity of web browsers and the convenience of using a web browser as a client. The web application provides an interactive map that visualises programme data from the 4W matrix to help show distribution of donor projects and allow stakeholders from different geographical locations access it concurrently. The map is interactive and allows for spatial queries to be run against feature attributes and the results of these queries exported to a Microsoft Excel spreadsheet. These results are then used in the donor reports to show the current status of programmes being undertaken by UNICEF Somalia.

## 2.0 Material and Methods

A one on one interview was initially carried out with staff at UNICEF Somalia responsible for programme monitoring and evaluation, in order to establish their current workflow processes and identify any bottlenecks encountered in their daily operations.

The interview with staff from UNICEF Somalia established that current visualisation of projects is done by converting the 4W matrix data to ESRI shapefiles (vector GIS data format) and using ArcGIS to visualise programme locations; that sharing spatial data with zone offices inside Somalia involved sending the shapefiles on compact discs (CDs) and other media which required each zone office to have the necessary software in order to open and visualise; and that sharing the files between colleagues in the same office was through a shared network location to be accessed by those granted the necessary file access permissions.

The interviews realised that there was necessity of developing a web mapping application to enhance information sharing and improve on data visualisation and analysis. A review of literature was then undertaken, and a combination of available Open source geospatial software was adopted for the development of the web mapping application.

The web mapping application developed consists of a database, a map server, a web server and a front-end application that acts as a user interface. *PostgreSQL* with *POSTGIS* extension was used as the database, *GeoServer* as the map server, *Apache* as the Web Server and *Heron Mapping Client* as the front-end user interface. The work flow (Figure 2) started with a needs assessment that informed the scope of the work that was done and ended in the dissemination of the results, conclusions and recommendations of the research.

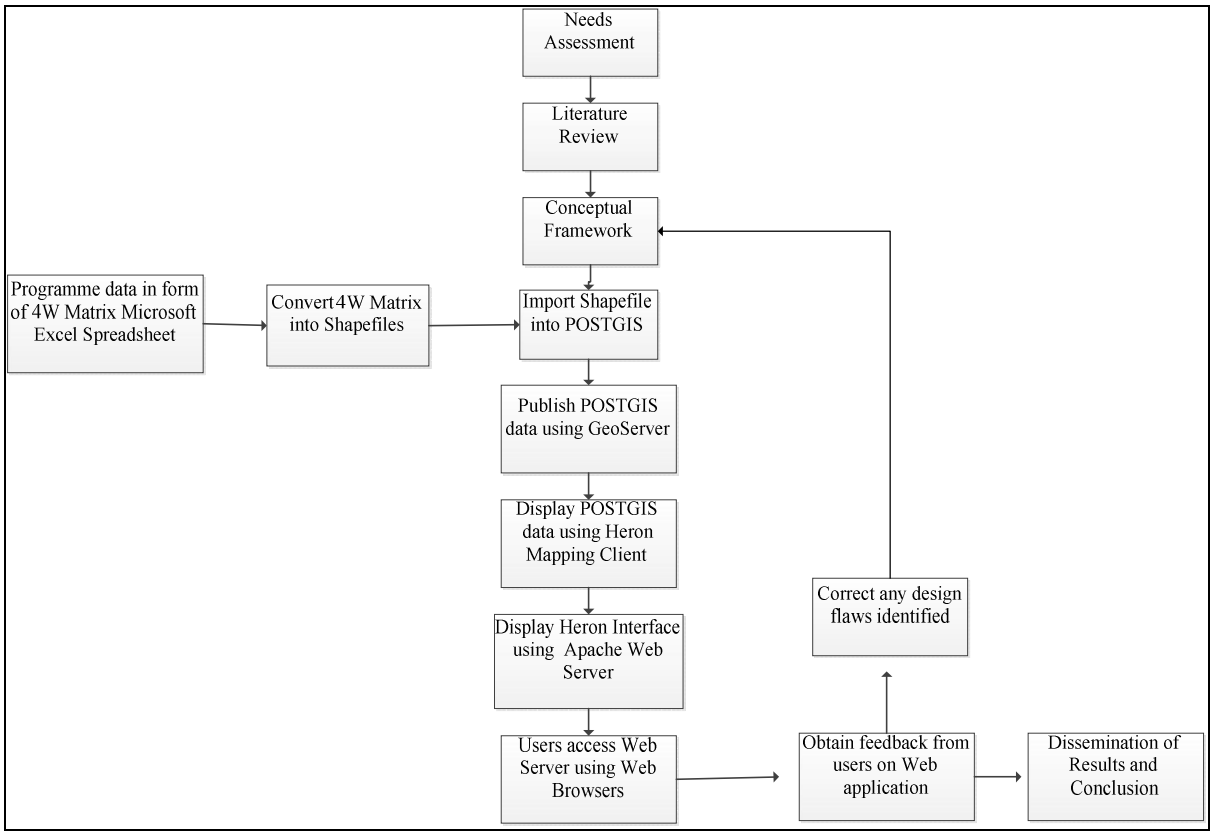


*Figure 2: Research workflow*

A web mapping application that could utilise the already existing network within the UNICEF Somalia offices and the Internet was designed (Figure 3).

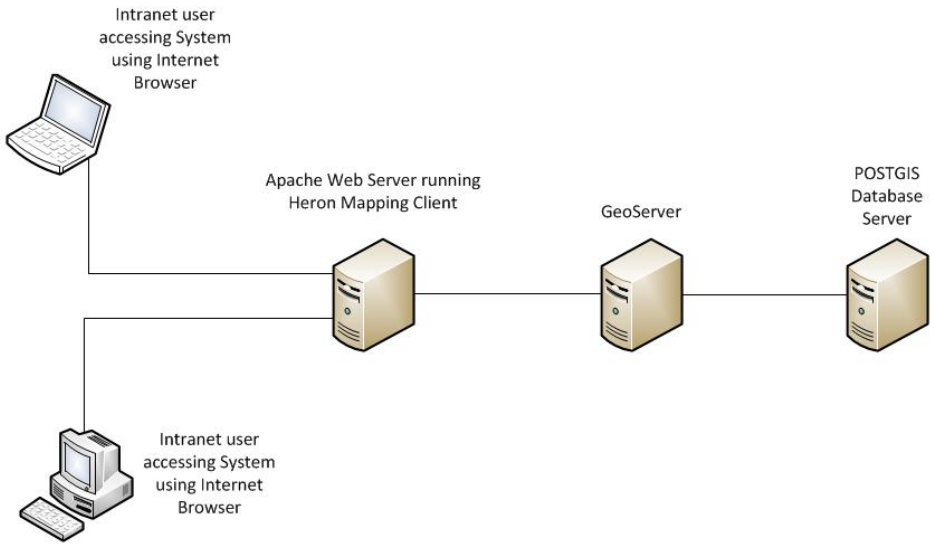


*Figure 3: Layout of the network infrastructure of the web application*

## 3.0 Results

The Heron mapping client which provides the front-end user interface is accessed via the web server through the usual internet browsers. Heron together with the other web mapping components provide visualisation of project locations as well as related attribute information extracted from the 4w matrix. Heron mapping client can also provide other spatial background data, through the use of base maps, that are freely available such as Google Street or open street map layers. Feature attribute information on water projects in Mogadishu overlaid by goggle street map (Figure 4) is displayed by a simple click of the point feature on the web-based map.

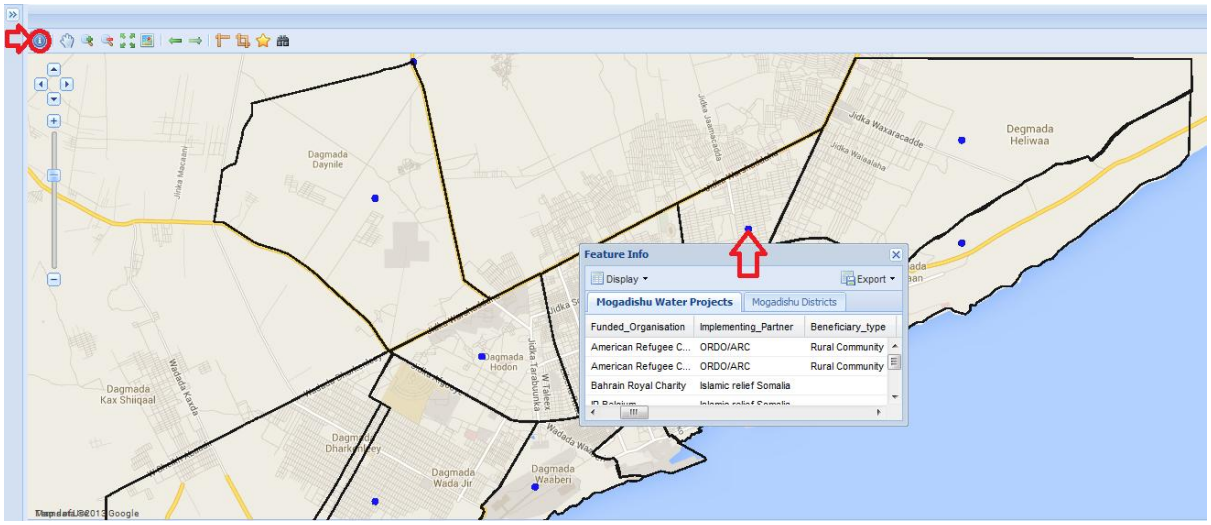


*Figure 4: Visualisation of data from the 4W matrix*

The web mapping application developed provides also some spatial analytical capabilities where one can search for features through: search by drawing, search by feature selection and search by feature attributes. Search by feature attributes (Figure 5a) can produce results that are used in donor reports such as finding out the schools in Mogadishu that have both a water point and a latrine. The results of the search by feature attributes (Figure 5b) can further be downloaded into different file-formats e.g. Microsoft Excel, Coma-Separated Value etc. to be attached to donor reports.

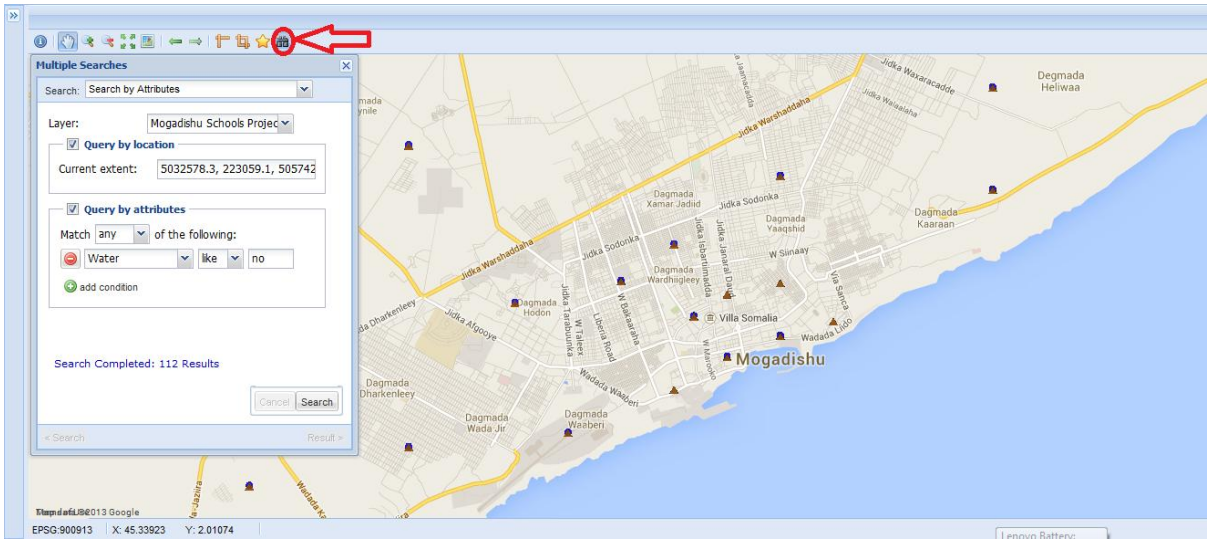


*Figure 5a: Executing of "search by feature attributes" query*

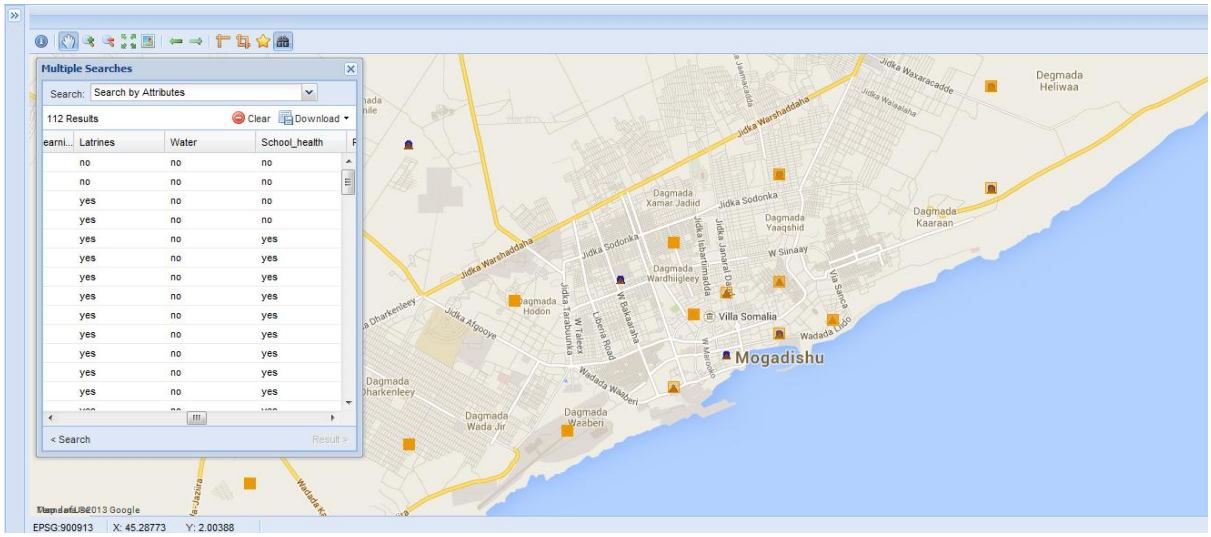


*Figure 5b: Executing of "search by feature attributes" query*

The other type of search that can be run is search by drawing. Geometrical shapes of concentric circle, polygon, rectangle, are interactively drawn on the map. Programme features that fall within or are intersected by the drawn geometrical shapes are then selected (Figure 6a) and the search results (Figure 6b) can also be downloaded into the different file formats.

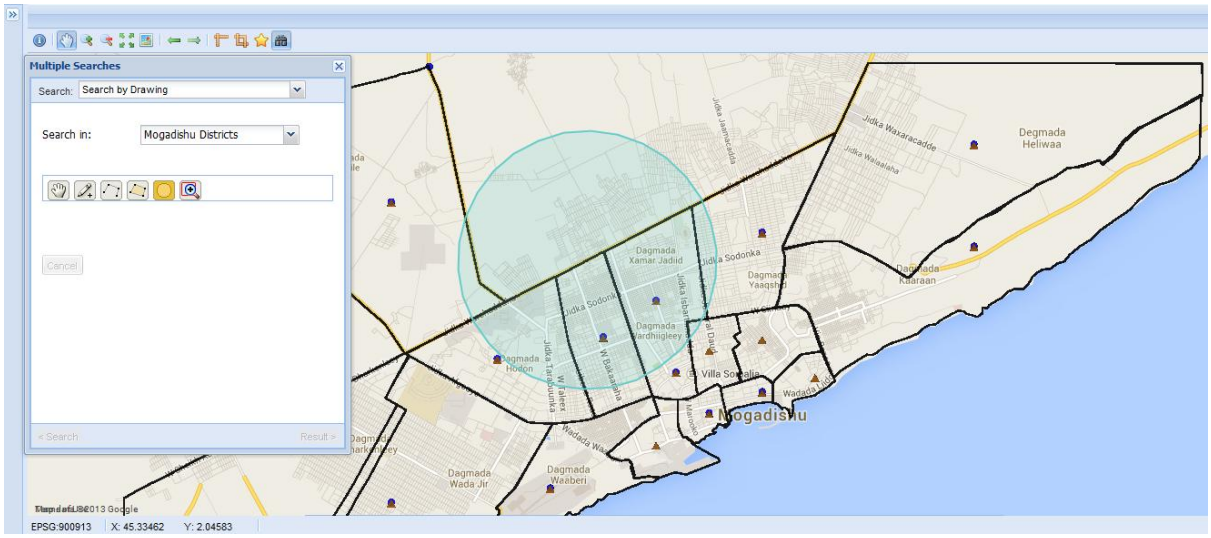


*Figure 6a: Executing "search by drawing", query*

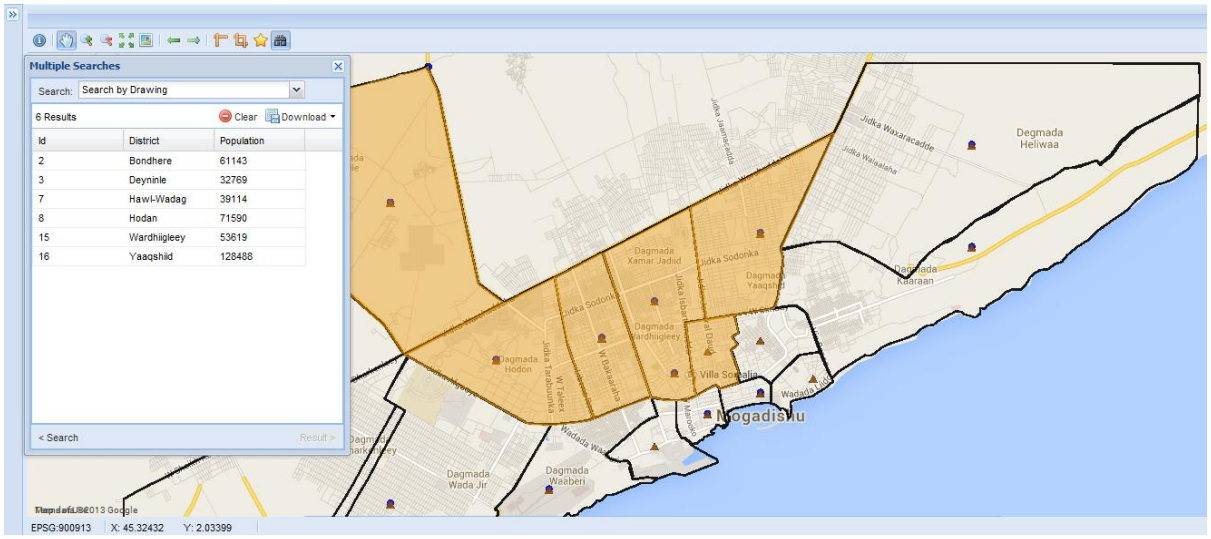


*Figure 6b: Results of Search by Drawing (selected features are highlighted in yellow)*

Search by feature selection is used when a layer needs to be searched against another layer (Figure 7). This occurs when a search needs to be performed to find out for example which water points exist in a particular district. This search involves searching for water points in the district layer i.e. one layer being searched against another layer.

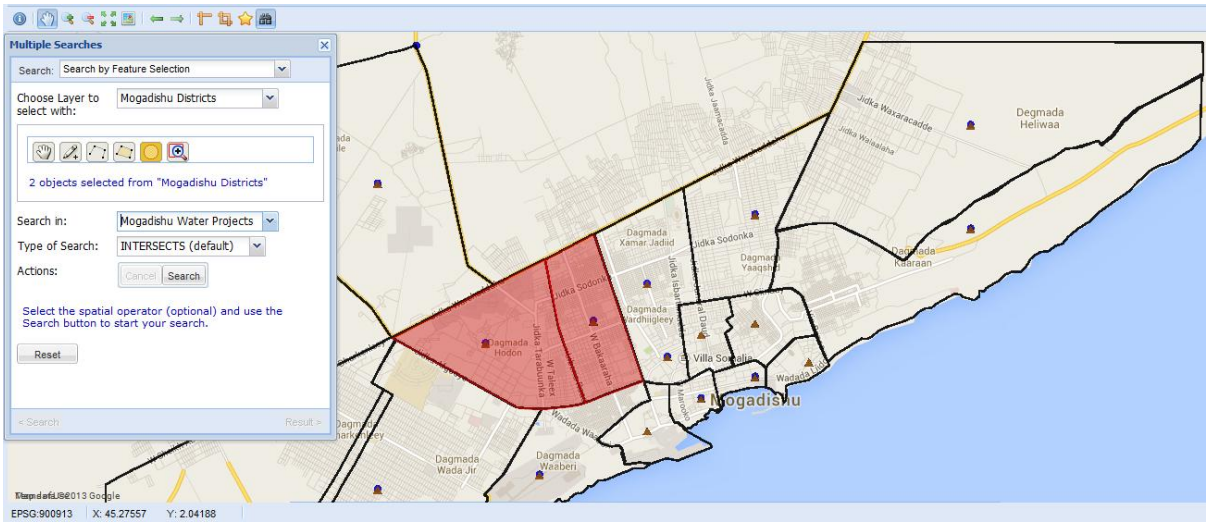


*Figure 7: Search by feature selection*

The results of this search (Figure 8) can also be downloaded into the different file formats.

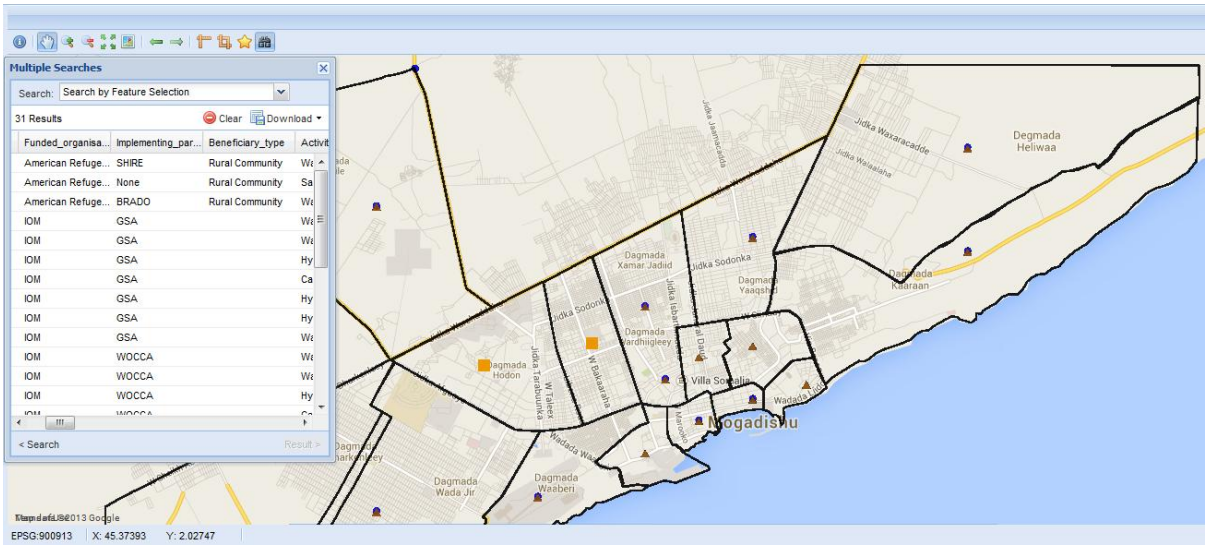


Figure 8: Search by feature selection results

## 4.0 Discussion and Conclusions

In conclusion: the developed web mapping application addresses some of the visualisation challenges with the 4W matrix. It provides for a smooth workflow process since previously spatial results were derived from the 4W matrix through a tedious sorting of rows and columns, the same results are now seamlessly derived from the web application and are also visualised. There is also a more efficient and improved way of getting spatial queries resolved. This leads to a quick way of compiling donor reports which use the programme data to show that the objectives have been met. Ultimately it is hoped that staff travelling for field missions in Somalia will have a more focused terms of reference on what to achieve since geospatial programme data is more easily accessible.

However there is still reluctance in sharing geospatial information. There is concern that terrorists or criminals could use geospatial information availed on the web to hamper progress on programme implementation. Even though much of the information is very general and already in the public domain, this fear persists. Nonetheless, there is a need for clear security policy guidance that delineates what is sensitive and why, and which also provides guidance on how to share sensitive data assets. Other barriers to sharing of social programme data result from information technology policies and procedures between different organisations

as they may have their own information systems and firewalls, and often the data cannot be easily shared between them.

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