

APPLICATION OF GIS TO SUPPORT URBAN WATER MANAGEMENT IN ADAPTING TO A CHANGING CLIMATE: A CASE STUDY IN CAN THO CITY, VIETNAM

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ABSTRACT

This paper provides a summary of an application of GIS for urban water systems in Can Tho city, Vietnam. The system aimed at providing the city's agencies a spatial presentation and tool for planning and management. A large amount of secondary data and information of the city urban water systems has been collected from the related city's agencies. There was a need to ensure that these information be made available in a systematic and useful form that can be easily accessed and could inform the city's agencies in planning and development decision making. For this purpose, the data and information were summarized into a GIS database, and visualized in the forms of a Map Book and a WebGIS. These products provide simple and effective ways to present complex data and relationships, and to enable a more intuitive and rapid data interpretation than data embedded in large reports or spreadsheets. Currently the Map Book and the WebGIS for Can Tho city contain 25 maps, presenting information across four main themes: (i) social economics, (ii) surface and ground water quality and quantity, (iii) water supply and sanitation infrastructures, current and planned, and (iv) spatial analysis of households' access and satisfaction of current water services. The Map Book and the WebGIS have generated significant interests from local departments/agencies, as they provide them with a better understanding on key issues, a useful reference for planning and development decisions, and an effective platform for collaboration between agencies in managing the city urban water systems and environment.

Keywords: GIS, urban water management, climate change

1. INTRODUCTION

Can Tho city is located in the central of the Mekong Delta, Vietnam, which is a low-lying region that has been identified as one of the most vulnerable to climate change. Moreover, the city's rapid growth rates of population, urbanization, and industrialization have placed many pressures on environmental conditions of the city. The city therefore needs to consciously adapt to changing climate through planning and designing a climate-adapted built environment. A large amount of data on urban water systems needs to be stored, managed and analyzed by the related city's agencies to support urban water management. Moreover, there is a need to ensure that these data and information be made available in a systematic and useful form such as thematic maps, charts, and tables that can be easily accessed and could facilitate the city's agencies in planning and development decision making. This paper provides a summary of an application of GIS for urban water systems in Can Tho city. This work was one of the outputs from a recent research for development project named 'Climate Adaptation through Sustainable Urban Development', which was

jointly conducted by Can Tho University and CSIRO of Australia (CSIRO, 2012).

2. METHODOLOGY

The system was developed through the following steps:

Defining user requirements:

Series of meeting and workshop were organized to define user requirement for the GIS. Thematic map types and urban water management required information and WebGIS user interface were designed with the participation of local stakeholders. In this study, local stakeholders are: Water Supply and Sewerage One member Co.LTD (WSSC), Centre for Rural Water Supply and Environmental Sanitation (CERWASS), Department of Natural & Environment (DONRE), and Department of Construction (DoC) of Can Tho City.

Designing system and database structure:

In this step, based on the users' requirements recognized from the first step, system components such as data flows, data analyses, and database structure were designed.

Selecting software and hardware:

The criteria for selection of software was: open and low cost or free, simple and manageable by the system' management agency, in this case it is the WSSC, and sharable through local network and Internet. The final selection was: (i) Webserver: Apache Webserver (<http://httpd.apache.org>); (ii) Map Server: GeoServer (<http://geoserver.org>); (iii) GIS database management: PostGIS extender (PostGIS.net) for PostgreSQL (<http://www.postgresql.org>); (iii) WebGIS interface: Openlayers (<http://openlayers.org>); and (iv) data preparation, analysis: MapInfo (www.mapinfo.com) and QGIS (www.qgis.org). Besides, the functions provided from OpenLayers library, Google Chart library were also used to design the WebGIS.

Data collection and standardization:

Based on the database structure designed in previous step, secondary data are acquired from the local stakeholders. The additional required data was collected through household survey. In this study, a survey of 1,200 households was carried out to understand the relationship between levels of access to water services and socio-economic indicators.

Implementing and testing the system:

In this step, the following works have been performed: (i) Installing hardware and software, (ii) conversing data, (iii) analyzing data, (iv) visualizing information, (v) coding user interface, and (vi) publishing maps and WebGIS.

3. RESULTS

3.1 GIS for urban water management

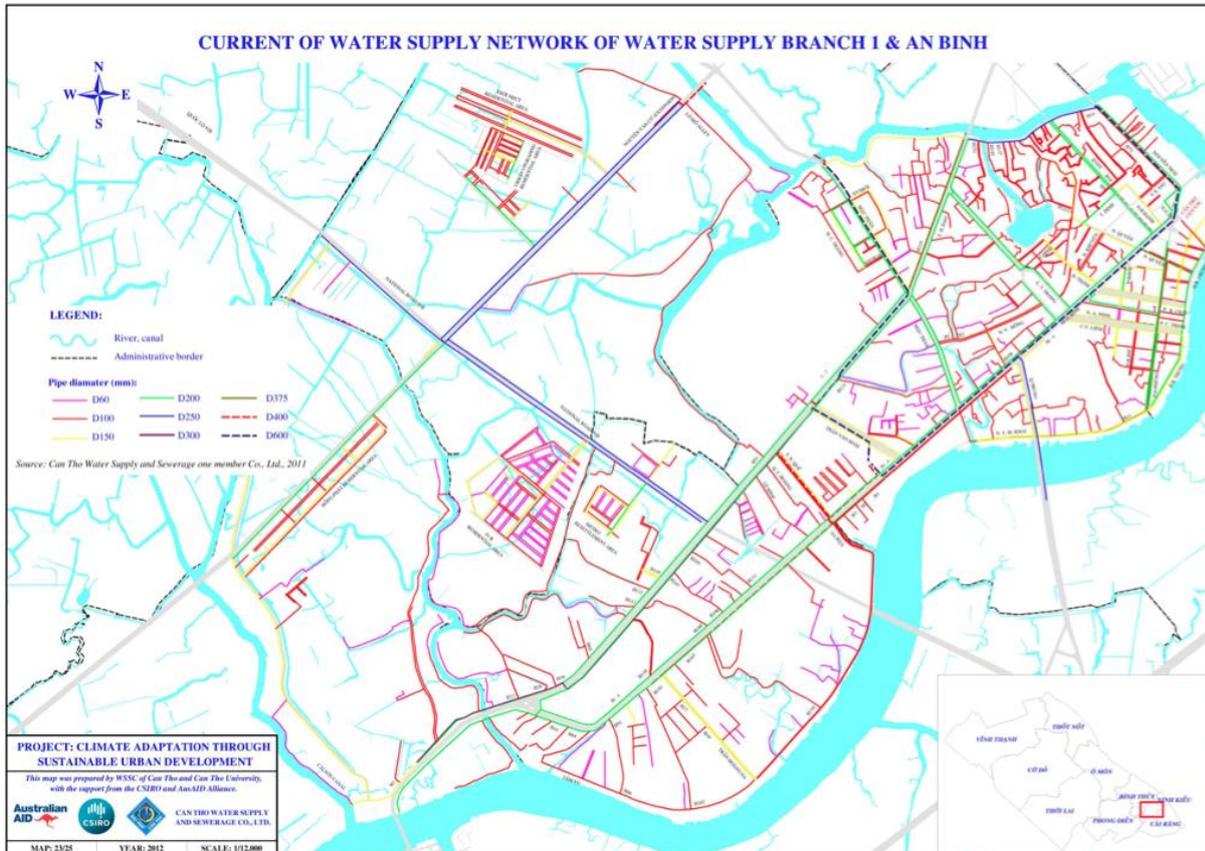


Figure 2 An example of maps in the Map Book. The map shows the current water supply network of An Binh water supply branch number 1. The pipes' colors present their diameters (Nguyen Hieu Trung, 2012)

3.2 The WebGIS on Urban Water Information of Can Tho City.

The WebGIS workflow is simplified as Figure 3. Data from various GIS data formats is transformed (by QGIS) into PostGIS database. Users, through the OpenLayers interface, send map requests to PostGIS. Finally, OpenLayers, after received data from PostGIS, generates and presents thematic maps, table and charts into the WebGIS interface.

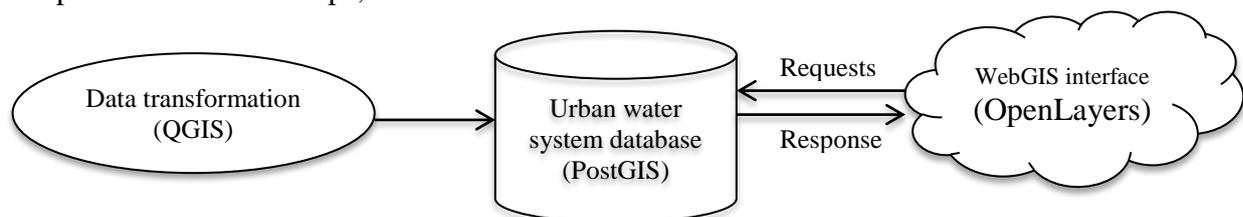


Figure 3. A simplified workflow of the WebGIS's.

Since the WebGIS users are non-GIS professional, the interface in Vietnamese and was designed as simple as possible. The WebGIS interface is showed as Figure 4. The left menu bar provides the users information about the project, the WebGIS and the thematic map lists. The map window, located in the middle of the WebGIS, presents the selected thematic map. The map window also allows user to zoom in/out and layers turn on/off. When user move the cursor over a map object, the right part of the WebGIS shows the object's attributes and associate charts. Map legend is also showed here.

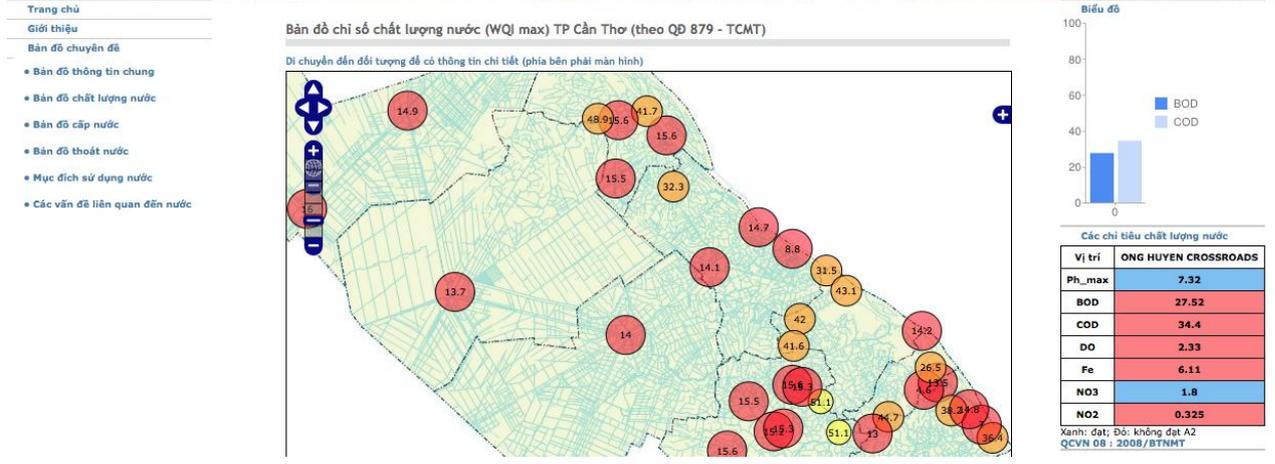


Figure 4. The WebGIS interface.

Figure 5 presents a thematic map of the percentage of households served by water supply station in Can Tho city. The pie charts are located at the districts' centers showing the percentage of water supply by WSSC, CERWASS or none of them.

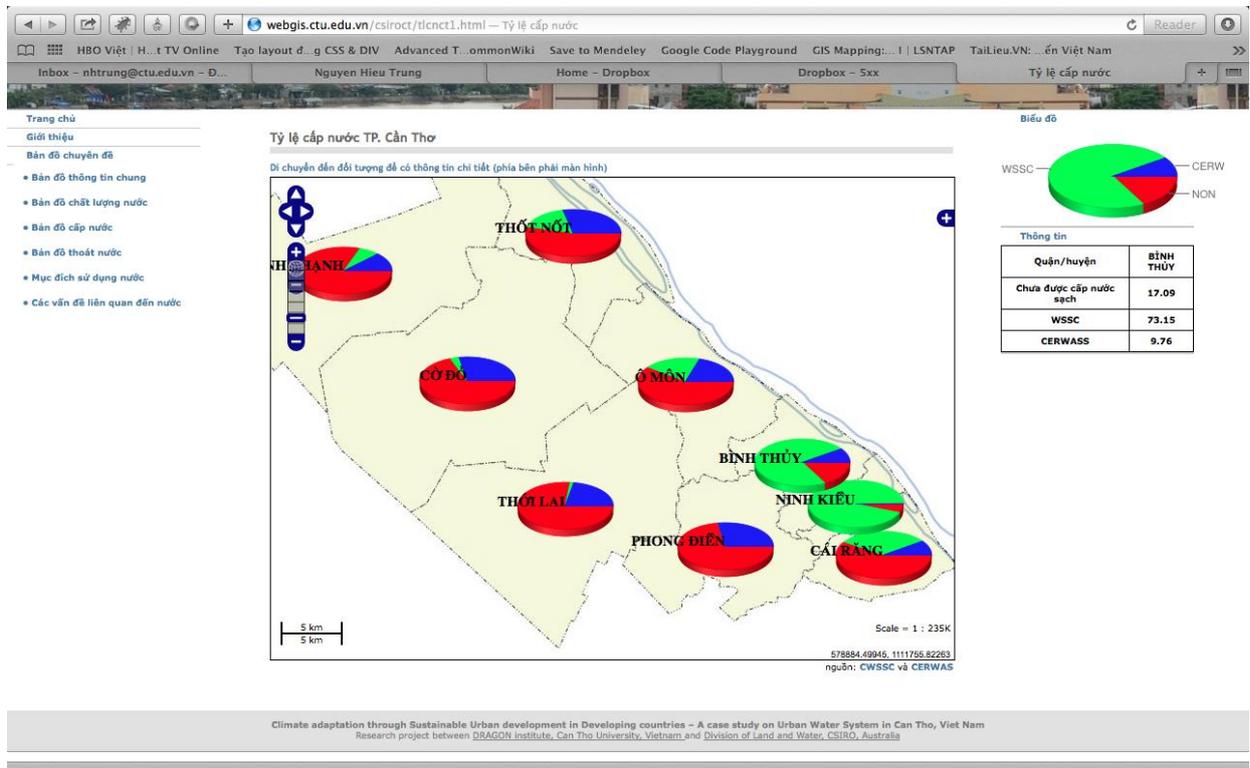


Figure 5 Percentage of households served by water supply station in Can Tho city

4. CONCLUSION

GIS has been applied successfully in urban water management of Can Tho city. Besides the system have been developed and implemented. A GIS expert team has been trained for Can Tho City. This is a very important element to ensure the sustainability operation and development of the system in the future. The published Map Book and WebGIS have generated high interests from local urban water management stakeholders, as they provide them with a better understanding on key issues, a useful reference for planning and development decisions, and an effective platform for collaboration between agencies in managing the city urban water systems and environment.

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