Application of GIS Analysis for Planning an Efficient Water Supply System for Matara District in Sri Lanka

By

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Declaration of the Candidate

I do hereby declare that work described in this thesis was carried out by me under the supervision of Prof. G.M. Bandaranayake and Mr. H.H Leelananda and report on this thesis has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

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Chapter Structure

Abbreviations

NWSDB	National Water Supply & Drainage Board
GIS	Geographical Information System
GPS	Global Position System
UNICEF	United Nations International Children's Emergency Fund
DAIM	Developing Area Identification Model
NBRO	National Building Research Organization
RDA	Road Development Authority
UDA	Urban Development Authority
KEITI	Korean Environmental Industry & Technology Institute
DCSE	Design Create Sustain Empower
DS	Divisional Secretory
GND	Grama Niladari Devision
ESRI	Environmental Research Institute
WGS	World Geodetic System
TIN	Triangulated Irregular Network
DEM	Digital Elevation Model
CAD	Computer Aided Design
SPRDA	Southern Province Road Development Authority
WSS	Water Supply System

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Abstract

Water plays a major role in surviving of all living beings including plants and animals on the earth. With the rapid growth of population, the demand on water for drinking and sanitation has increased. Thus, providing safe water for people is a greater responsibility of any government of a country. In Sri Lanka, the National Water Supply & Drainage Board does this service. But NWSDB has many problems. The major problem is lack of appropriate methodology to identify the most suitable places to provide water. The methodology that is now being adopted by NWSDB is problematic. This study is an attempt to introduce most suitable model built with GIS application in order to identify the areas that need to be given the priority. Study was done based on Matara district as many water supply schemes have been implemented there but with many problems from both customers and the NWSDB itself.

The main objective of the study is to identify the areas, which have potential development trend as it is assumed that such areas will be the most vital areas in the future. These areas were identified with the help of many sources and especially with the use of GIS.

In this study, secondary data were collected from the survey department and other relevant authorities. Primary data were collected using GPS (water supply system data and low-pressure areas) and proceeded. The data in order to prepare the twelve layers. Listed as Land use, Slope, Highway interchange, A &B roads, C&D roads, all roads, Railway tracks, National schools and universities, Town centers, declared urban areas and railway stations. Data analysis was performed using DAIM (Developing Area Identification Model).Then output of DAIM was created. Finally existing water supply coverage data was overlaid into output of DAIM in order to get the findings.

Key words. Population, safe water, identify, suitable place, problematic, most suitable, GIS application, potential development, twelve layers

Chapter One

Introduction

1.1 Background

Water is a gift of nature. A limited resource is essential for the survival of all plants and animals on the earth. If there were no water, there would be no life on earth. People use water for their day-to-day requirements such as drinking, cooking, washing, bathing, recreations and preserving vegetation in home gardens and parks.

It is important to use clean water for their day-to-day needs. The water must be free of germs and chemicals and be clear. Water, which is safe for drinking is called potable water. Germs and chemicals, which cause diseases, find their way into waterways. Because of these, the water becomes polluted or contaminated and when people drink it or contact with it in other ways they can become very sick. Non-potable water is defined as unsafe to drink. There have been many evidence that millions of people have died due to diseases caused by Germs. Therefore, authorities should pay their attention to provide water free of germs and chemicals. If the water is not, safe to drink it is treated and this process is known as water treatment (Australian Government, 2016).

The water balance of the world comprises of 97 % of water in the oceans and the remaining 3% are fresh water. Fresh water component is 22 % of ground water ,77 % frozen,1 % in lakes, reservoirs and Streams .The water foot print of national consumption defined as the total amount of fresh that is used to produce the goods and services consumed by inhabitants of the nations. The global average water footprint found to be 1385 m^3 /Year per capita in the period 1996-2005 There are large difference between countries in the world (Water Foot Prints Nations, 2005).

"The Millennium development Goals drinking water target, to have the proportion of the population without sustainable access to safe drinking water coverage 76% to 88% between years 1990 to 2015. Between 1990 and 2012, 2.3 billion people gained access to an improved drinking water source" (UNICEF, 2014).

In Sri Lankan context, there are many types of water sources. While protected wells within premises provide 31.4 % of the total, protected wells outside the premises provide 14.7% of the same. The contribution of unprotected wells represents 4% Tap Within unit represent 21.1% and tap within premises but outside unit add 6.9%. The contribution of tap outside is 3.4%. Rural water project provide 9.2% of the total. Tube wells add 3.4% and Rivers, Tanks, Streams, springs provide 4.6 of the total. Contribution of other sources is 4% (Department of Census and Satatistics, 2012).

Due to the rapid growth of population, it increases the demand for the safe water because of better health and socio-economic development .Safe water has become an essential requirement of the same. Therefore, with the intention of addressing the major issues and challenges facing water supply of the country, a framework was introduced by National Drinking water policy of Sri Lanka.(See appendix B) This emphases the "Drinking water is Basic right" (Ministry of Water Supply and Drinage, 2004).

"The Government of Sri Lanka has acknowledged the importance of health and wellbeing of its people for social and economic development and has set a goal of providing access to safe drinking water and basic sanitation to all citizens by the year 2010. Water and sanitation are basic human needs for sustaining life. Fresh water is a renewable but a scarce natural resource that could be easily polluted. The demands on the natural sources of water are ever increasing due to high competition among users for domestic, agricultural, services and commercial purposes making water a social good as well as an economic good. The policy for the rural water supply and sanitation sector has recognized the value of water, and the need for institutional arrangement for the efficient management of facilities with community participation and the stakeholders (Ministry of Urban Development, Construction & Public Utilities,, 2001).

The National Water Supply and Drainage Board is the Organization, which is responsible in providing safe drinking water and sanitation to the nation of Sri Lanka. The organization had its beginning as a sub department under the Public Works Department for water supply and drainage. In 1965, it became a division under the Ministry of Local Government. From 1970, this division functioned as a separate department under the Ministry of Irrigation, Power and Highways and remained so until the present board was established in January 1975 by an act of Parliament of Sri Lanka. National water Supply and drainage board which comes under the ministry of water supply and Town planning renders many services such as operation and maintenance of water supply and sewerage schemes, implementation of new urban and rural water supply projects, carrying out sector planning, feasibility studies, detailed designs, tender documentation, contract administration, project supervision and research and development work in the water and sanitation sector (NWSDB, 2016). Vision and the mission of the organization are as fallows "To be the most prestigious utility organization in Sri Lanka through technological and service excellence", "Serve the nation by providing sustainable water & sanitation solutions ensuring total user satisfaction". There are five goals of the organization. They are, Increase the water supply and sanitation coverage, Improve Business Efficiency, Improve Business Efficiency, Ensure greater accountability and transparency, and Ensure safe drinking water supply and sanitation to rural and underserved communities (NWSDB, 2016).

The country is divided in to eleven Regional support centers, which are named as Northern, North central, Eastern, North western, Central, Uva, Southern, Sabaragamuwa, Western North, Western Central and Western south. Southern region consists of three districts Matara, Gallle and Hambantota. Administrative set up of Southern Regional Supporting Center functions under the Deputy General Manager and the Assistant General Manager. They look after the operations and maintenance including, development functions. The Manager Operation and Maintenance often coordinates with the AGM for his day-to-day O&M functions. There are number of water supply schemes in regionally established. They are Galle, Hambantota and Matara. Galle region maintains 16 water supply schemes and serves about 100,052 service connections, Hamabantota region maintains 18 water supply schemes and serves 93,769 service connections and