Available online at www.sciencedirect.com

ScienceDirect

Procedia Environmental Sciences 23 (2015) 110 – 115

Procedia Environmental Sciences

International Conference on Tropical and Coastal Region Eco-Development 2014(ICTCRED 2014)

Seawater Intrusion Modeling On Groundwater Confined Aquifer In Semarang

Edy Suhartono[1,2,*], P. Purwanto[1,3], S. Suripin[1,4]

[1] Doctorate Program Of Environmental Studies, Post Graduate Program, Diponegoro University*
Jl. Imam Barjo, SH No. 5, Semarang-Indonesia-50000

[2] Polytechnic State Of Semarang, Jl. Prof.Sudarto, SH, Semarang - Indonesia- 50000

[3] Department Of Chemical Engineering, Faculty Of Engineering, Diponegoro University, Jl. Prof.Sudarto, SH, Semarang - Indonesia- 50000

[4] Department Of Civil Engineering, Faculty Of Engineering, Diponegoro University, Jl. Prof.Sudarto, SH, Semarang - Indonesia- 50000

Abstract

The focus of this study is to identify and describe of a seawater intrusion in confined aquifer modelling in Semarang with a descriptive quantitative analytical method. The results showed potentially experiencing seawater intrusion which increased of 0.575 km^2/years. Seawater intrusion models divide to 3 models are the western route have a maximum error is 27.9%, then the middle route have the maximum error is 41.1% and the eastern route have the maximum error is 40%. In 2035, the seawater intrusion on western route is predicted about 3.0 km from the coastline, 4 km for middle route, and about 3.25 km for eastern route. This is one of the information that from right now, the management of a groundwater in the confined aquifer in Semarang is necessary to supervise and better and more optimal controlling

Peer-review under responsibility of scientific committee of the ICTCRED 2014

Keywords: Coastal Areas; Groundwater; Chloride; Seawater Intrusions

1. Introduction

The rapid pace of development in the city of Semarang in line with the high population growth is expected to require cleanwater to rise sharply. According to Bachtiar [1], the population of Indonesia in 2013 amounted to 250 millions peoples and about 60% of them live in coastal areas, these conditions resulted in marine environments burdens heavier, especially to meet the needs of clean water. According to Hadi [2], in environmental management, at first the human relationship with the environment running in a spirit of harmony that humans become an integral

* Corresponding author. Tel.: 081575161357; fax: 024-8453635.
*E-mail address:*edymaryamah@gmail.com

Peer-review under responsibility of scientific committee of the ICTCRED 2014
doi:10.1016/j.proenv.2015.01.017

part of nature, so that its behavior in tune and in harmony with the rhythms of nature and nature conservation in these conditions can be maintained. However, when the number of people more and more in line with advances in technology and increased demand, then the man is no longer a part of nature, human nature to want to handcuff antrophocentrism properties. This attitude fruitful in the destruction of nature that is often referred to as environmental disasters such as pollution that occurs in groundwater.

Purwanto [3] asserts that the use of Natural Resources was massive and uncontrolled and ignore the environmental equilibrium will result in a variety of negative effects will be felt in a relatively quick time in both the acute and the condition of chronic conditions in the long term. Environmental damage in coastal areas according to Ding and Peng [4] triggered by ecological conditions of coastal areas that have the ability to meet the economic needs of human beings through some important activities such as industry, fisheries and services. According to Kjellen and McGranahan [5], the socio-cultural aspects of the population such as the number of people, lifestyle, culture and social organization needs can be met through economic aspects such as industrial activities, household, agriculture, transportation and services will have an impact on the quality and quantity Resources the water.

Susanto [6], predicted that in 2030, the city of Semarang will experience a water crisis, it is because the need for freshwater of industry in 2010 about to 90% of water taken from the ground at 3.17 x 106 m^3, then the need for freshwater for residents amounted to 263,267 m^3, assuming the need for freshwater for hotel guests alike with fresh water needs population of 150 liters per person per day and assuming the hotel charged 75%. If the freshwater needs of the 90% wear groundwater, the groundwater needs to hotels of 236,940 m^3, the total ammount of groundwater use in the city of Semarang is predicted at 4.04 x 106 m^3. In general, groundwater flow conditions are very complex. Groundwater contamination due to sea water intrusion by Riley and Skirrow [7] can be identified from the dissolved contaminants such as chloride (Cl), because the content of salt (NaCl) in sea water made p 39.3% of Sodium (Na) and 60.7% of Chloride (Cl). An understanding of groundwater contamination due to seawater intrusion needs to be improved, so as to get information and better knowledge about the intrusion of sea water to the groundwater in the aquifer Depressed in this study will be developed in a model. Zhou et al. [8] argue that the development model of seawater intrusion can help Water Resource management efforts primarily groundwater in aquifers Depressed by describing the research area more accurately in a relatively fast with an inexpensive cost. According to Zhang [9], A model of seawater intrusion can be done by using the equation of mass transport of contaminants by advection-diffusion equation approach in the form of one-dimensional differential equation parsiil. Previous researchers such as Kumar, et., al [10], have examined the intrusion of sea water to ground water in shallow wells using the advection-diffusion equation in one dimension, New Delhi, Mohammadi and Manteghian [11] have examined the intrusion of seawater to river water by using advection-diffusion equation in one dimension Australia, and in Sweden, Gong and Nordstrom [12] also investigated the intrusion of seawater to river water by using the advection-diffusion equation 1 dimensions. The originality of this research is the modeling of seawater intrusion to the advection-diffusion equation approach one-dimensional and using indicator Chloride concentrations in ground water contained in the confined aquifer in Semarang.

The purpose of this study is to describe the condition of the sea water intrusion in groundwater or confined aquifer in Semarang, and then the seawater intrusion condition models into the advection equation in one dimensional diffusion, and predict the level of sea water intrusion of groundwater in the confined aquifer in Semarang.

2. Methods

According to Sibanda [13] to answer the above problems, then this type of research is a quantitative with descriptive quantitative analytical approach. The study population was groundwater in Well Drilling In Semarang coastal area covers the majority of Semarang District of West, North Semarang, Semarang, Central, South Semarang, Gajahmungkur, East Semarang, Genuk, Gayamsari, and Pedurungan with a sample of 33 Well Drilling In the located on the 3 lines of research, namely the Western Line located in the District of West Semarang, Central Line, located in the District of North Semarang, Central District of Semarang, Semarang District of the South, and the District of Gajahmungkur, and East Line, located in the district of East Semarang, District Genuk , Gayamsari District, and District Pedurungan. Data collection techniques used observation and literature. Analysis using quantitative descriptive analytic techniques using GIS computer program to illustrate the condition of seawater intrusion on groundwater in aquifers Depressed, followed by the drafting of seawater intrusion models using the advection-diffusion equation approach one-dimensional finite difference numerical methods with a grid step forward for distance x by 0.1 units and the grid for time t of 0.08 units. Then, using the chosen model, the prediction is done