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Study On Effectiveness Recharge Wells For Water Conservation Land And Reduction Of Flood (Case Study Recharge Wells in East Jakarta and South Jakarta)

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ABSTRACT

Background: Land cover high growth and consumption patterns Jakarta residents has caused degradation of ground water in Jakarta. Water resource conservation programs as sustainable development becomes a necessity conducted local government of Jakarta. One program is the conservation of water resources development recharge wells. Recharge wells that have been constructed, up to now not been evaluated for their effectiveness both of debit entries, the volume of water absorption and maximum bin volume. **Objectives:** The purpose of this study was to evaluate the recharge wells development program based on technical standards SNI 03-2453-2002, Governor Regulation No. 20 of 2013 and the concept of environmentally friendly recharge wells. This research was conducted in East Jakarta and South Jakarta, both locations is the region with the best infiltration value other than Jakarta. **Methode:** The population in this study is all recharge wells that were built in East Jakarta and South Jakarta until year 2013 as many as 4.660 wells (data of DPE, 2013). Determination of samples is using Slovin formula with 10% error estimation, obtained 100 recharge wells as total sample The research method uses a quantitative approach with a qualitative and quantitative analysis. In the form of data collection instruments, visual field observations, measurements and dimensions of the inlet void volume recharge wells and literature studies. **Results:** The results showed a debit entries recharge wells is less than 50% capacity of accommodating wells. Type of shallow rechage wells constructed recharge wells in the halls of a type most effectively than other types. Recharge wells inlet conditions at the time this study was conducted mostly in not maintained conditions. Inlet conditions mostly covered with sediment or dirt, causing clogging at the inlet **Suggestion:** Local government should be more active in socialize the recharge wells development program to the public, it is expected to each building has its own recharge wells. Create storage as a pretreatment for deep recharge wells and perform self-monitoring of water recharge quality.Installing Automatic Water Level Recorder (AWLR) on recharge wells to monitor recharge capacity, for pilot project, AWLR will be installed indisde a building for easier supervision.Make a budget for recharge wells maintenance program, particularly recharge wells on the road / pavement.

INTRODUCTION

The rapid development pace of Jakarta and the increased population growth led to the acceleration of land cover growth in Jakarta. Areas that were still a natural open area, has quickly turned into a residential area, trade,

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services and industry which cover the soil and caused it watertight. Land cover in Jakarta will increase a runoff because the amount of water that enters the soil is smaller.

Meanwhile, because urban land area is relatively small, response from rain to be water dischargeoccurs very rapid and led urband area flow's characteristic to become rapid with high discharge. Such characters need to be muted, in order to not burden the city drainage conditions. Based on the data from Jakarta Regional Environmental Standards (SLHD) in 2012, the number of puddles locations in Jakarta are 62 (sixty-two) points withan area of 5 (five) hectares.Based on the review of Department of Industry and Energy (2012) states that the groundwater fromcentral to southern Jakarta are mostly in critical prone condition.

With the conditions that have been presented in the previous section, it is necessary to heldgroundwater conservation activities in order to avoid clean water deficit. Moreover, there must be a paradigm change regarding runoff, from immediately flow as much water as posible to the sea into ground absorption.On top of that, inJakarta Detailed Urban Planning (RDTR) in 2030, zero runoff program has been included. Zerro runoff program as groundwater conservation activities that can be done, is the manufacture of artificial infiltration which can increase groundwater reserves. Some forms of artificial infiltration are recharge well and biopori hole.

Based on recharge wells assessment needs in Jakarta by Jakarta Mining Agency (2007) which states that in order to maintain water balance in Jakarta in 2010, it takes about 247.118 pieces of recharge wells to insert 90.148.795 m^3 of water. The number of recharge wells that had been built is 37.840 pieces then the number of recharge wells to be built is 209.278 pieces. To achieve it, the government establishedan recharge wells development policy for 5.000 wells per year by DPE in accordance with Jakarta Mining Agency's study result in 2007.

The decrease trends of groundwater quantity in Jakarta based on DPE assessment (a) (2012), shows a decrease in the amount of water that fills the groundwater reserves in Jakarta even thoughrecharge wells development policy on a large scale was started in 2008 and strengthened in 2013. This indicates suboptimal infiltration function of recharge wells. Thus, this study will try to assess the level of recharge wells effectiveness which had been built by the Jakarta Government in East Jakarta and South Jakarta. Research questions that will be answered in this study are (1) how is the effectiveness level of discharge input that goes into the wells, (2) how is the effectiveness level of absorption volume that permeate into the ground, (3) how is the effectiveness level of recharge wells maximum capacity. The purpose of this study is (1) to analyze the effectiveness of the recharge wells to absorb rainwater and reduce the flood discharge (2) to analyze the factors that influence the effectiveness of recharge wells.

MATERIALS AND METHODS

This research generally uses quantitative approach with qualitative and quantitative analysis methods. This approach was chosen because the research presents facts research includes analysis based on literature review. This research will use mathematical models, theories or hypotheses related to the hydrological cycle, environmental geology and regulations related to water resources and recharge well.This research was held for 5 (five) months from December 2014 until April 2015. The research location is in East Jakarta and South Jakarta. The population in this study is all recharge wells that were built in East Jakarta and South Jakarta until year 2013 as many as 4.660 wells (data of DPE, 2013). Determination of samples is using Slovin formula with 10% error estimation, obtained 100 recharge wells as total sample. Determination of recharge wells locationwere using cluster method, followed by simple random sampling method. Data collected through two ways, secondary data through literature study and primary data based on field observations. The primary data obtained through; (1) recharge well condition visual observation, including inlet, cover, and body, (2) measure the dimensions of the inlet surface, recharge wells surface, recharge wells depth, absorption area in road / pavement and parks.

RESULTS AND DISCUSSION

1). Actual Condition of Recharge Wells:

Visual observation of recharge wells is very important to do, based on 4 months' observations that have been doneto 100 recharge well samples, more than 50% recharge wells conditions in South Jakarta and East Jakarta are untreated and shallowing. Apart from that, recharge wells placement and inlet positions are not correspond to groundwater flow or ground countours. This condition is certainly not in accordance with SNI 03-2453-2012 provisions on Rainwater Recharge Wells Planning Procedures Technique for Yard, which requires rainwater recharge wells placed on relatively flat land; has difference height between 0.03 or (3%).

2). Recharge Wells Debit Entries Evaluation:

Calculation of recharge wells debit entries using the concept of water balance, where rainfall in one area will flow as recharge wells debit entries and city drainage inflow (Saleh, 2011). Thus the greater effective inlet

surface area, the greater recharge wells debit entries become and the city drainage inflow will be smaller. To evaluate the effectiveness of recharge wells in terms of recharge wellsdebit entries, researchers conducted initial debit entries calculation and on research debit entries calculation for each sample in accordance with formula 1

Picture 5 shows the magnitude of initial debit entries and on research debit entries of recharge wells in various locations. From Picture 5, it is shown that the greatest recharge well debit entries are shallow recharge well located in a building with 0.00077 m^3 / sec. While, the smallest one is the deep recharge well or infiltration which located in road with 0.00017 m^3 / sec.Indonesian National Standard (SNI) 03-2453-2002 mentioned that rainwater recharge wells should be placed on relatively flat land; has difference height between 0,02 or (2%). Barid et al. (2007) states that the one which affects the amount of water that can be permeated into the wells is the design of recharge wells such as slope channels, reservoirs and the surface area of recharge wells. Standard design of deep recharge well published on evaluation report in Oklahoma, set the standard inlet slope of 3% (Osborn et al., 2007). The installation of inlet that does not follow the standard slope of 2% -3% led debit entries into the recharge wells small. This can be proofed by debit entries on recharge wells on the street only at 0.00017 m^3 / sec from potential debit entries of 0.0004 m^3 / sec.Under these conditions, the amount of debit entries into recharge wells is highly depends on the effective surface area recharge wells inlet. Recharge wells inlet conditions at the time this study was conducted mostly in not maintained conditions. Inlet conditions mostly covered with sediment or dirt, causing clogging at the inlet. As has been shown in previous picture of existing conditions, inlet conditions are not optimal in absorb water into recharge wells. Bhattacharya (2010) states that periodic maintenance is very important because recharge wells infiltration capacity reduced very fast.

3). Recharge Wells Maximum Capacity Evaluation:

Absorbtion well maximum capacity defined as the ability to accept debit entriesso there willbe no runoff. Maximum capacity is the total void volume and recharge volume of recharge wells (Arafat, 2008). SNI No. 03-2453-2002 on Rainwater Recharge Wells Planning Procedures Technique for Yard stated that recharge wells should be in an area with MAT of 1.5 meters. This means, the void volume of surface area with 1 meter diameter is equal to 1,5m^3. Then, by using formula 4, calculated all maximum capacity for each recharge wells.

For maximum recharge wells with the largest reservoirs are shallow recharge wells in park with 2.318 m^3 while the smallest is drilling recharge wells on the road with 0.455 m^3.

With condition of recent recharge well maximum capacity ranges between 81% and 24% of the initial conditions, it can be sure that the recharge well will not be optimum to absorb water during the rainfall peak.The reducing of maximum capacity due to shallowing of the recharge wells. Maintenance holds a central role in keeping the recharge wells to still have a maximum capacity (Osborn et al., 1997; Anwar 2005 and Bhattacharya, 2010). This was proofed in recharge in Jakarta, where the existing recharge wells are shallowing due to the lack of maintenance in the form of digging the sediment inside the recharge wells. As a result of the shallowing, the maximum capacity of recharge wells experienced a decreased pattern ranging from 81% to 24%.

Conclusions:

Based on field observations and the results of the calculation of recharge wells capacity shown in the previous section, the authors conclude that the condition of recharge wells that exist today have not been effective in terms of recharge wells capacity

Suggestion:

1. Local government should be more active in socialize the recharge wells development program to the public, it is expected to each building has its own recharge wells. Because recharge wells in buildings are more effective than the recharge wells on the street or sidewalk.
2. Create storage as a pretreatment for deep recharge wells and perform self-monitoring of water recharge quality.
3. Installing Automatic Water Level Recorder (AWLR) on recharge wells to monitor recharge capacity, for pilot project, AWLR will be installed indisde a building for easier supervision.
4. Make a budget for recharge wells maintenance program, particularly recharge wells on the road / pavement.

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