Abstract: City of Makassar with a total population of approximately 1.3 million people has a fairly rapid process of urbanization, seen from the rampant development in the suburbs. Coefficient changes the basic building the greater the likely impact of the lack of green open spaces and groundwater catchment area. Gradually the surface condition of ground water will decrease and the external impact on other areas surrounding the lower. With the condition of the catchment area that is increasingly critical, then a chance of rain water into the bowels of the earth the less. Meanwhile, the use of ground water through pumping is increasingly rising. As a result, soil water deficit, which is characterized by deepening the groundwater. Diminishing rain just a little while, then quickly dropped the groundwater. The condition of the decline in the groundwater if allowed to continue, it will result in the difficulty of obtaining ground water for agricultural irrigation purposes and other living things. In this regard, it is necessary to conserve water in an effort to increase ground water through construction of water wells recharge. The basic principle of water conservation is to prevent or minimize water lost as runoff and store it as much as possible into the body of the earth. On this principle, the excessive rainfall during the rainy season are not allowed to flow into the sea but it's useless divulging accommodated in a container which allows water to seep back into the ground (groundwater recharge).

Keywords: Urbanization, green open space, soil water deficit

**PREFACE**

Water is something that is essential for life. Without water, the microorganisms that decompose organic material did not exist, so there will never be the recycling of materials and energy, and thus, without water there will never be the complexity of the ecosystem.

Current water resources, has been degraded to the level of use within and has caused serious social conflict. Therefore, it needs the extra effort and non-conventional approach to obtain alternative water resource.

The basic principle of conservation are prevent or minimize water is lost as surface runoff and store it as much as possible into the body of the earth. On the basis of this principle, the excessive rainfall during the rainy season, are not allowed to flow into the sea but it's useless in the capacity of a container which allows water to seep back into the ground (groundwater recharge).

In line with the trend over the preservation of the environment is getting stronger, until in the management of urban drainage on the thought and effort to change the concept and principles of management of urban drainage is a long way quickly drain water out of the drainage area on a new concept which allows water to seep into the ground.

The purpose of this paper is to determine the amount of rainwater that can be absorbed in the ground water fills Telkomas residential. Wells is essentially a drainage system where rainwater falling on the roof in the capacity of a water catchment system. Unlike conventional systems in this way is do not waste the rain water into the rivers which then continues into the sea.
**HYDROLOGICAL CYCLE**

The water contained in the earth having continuous circulation. This circulation begins with the evaporation of all the earth's surface caused by the heat that comes from the sun. It consists of evaporation of ground water evaporation, the surface of trees and surface water (water body). Evaporation of surface water that occurs is known as evaporation, while the evaporation that occurs from the surface of trees known as transpiration.

The result is evaporation, then the next will form clouds and then clouds condense which in turn can produce rain, snow and hail stones. Before the rain came to the earth's surface, some evaporates into the air and some came to the surface of the earth. Not all the rain that falls to the earth's surface reaches the soil surface.

Rain water that falls to the ground some of it will go into the ground (infiltration). Depending on the geological structure, a horizontal flow can occur due to flow between (inter flow, subsurface flow). Part of this water also reaches the river and the sea. Another part of the infiltrated water can be determined as the percolation of water that reaches the aquifer (aquifer, ground water storage). This water then flows as well as ground water flow reaches of the river or the sea. The other part will flow on the surface next to the water runoff (overland flow) which can then be run off, which is beyond the river and the sea. The flow of runoff before it reaches the river, flowing and restrained at ground level in the basin and to a certain amount of water is lost due to water infiltration process, called a lift basin.

Circulation of water, both on land and at sea, will take place continuously. Water circulation is known as the Hydrological Cycle (Figure 2.1)

Human water needs in their everyday lives, comes from the water in this circulation process. So, if the circulation of water that occurs unevenly will cause flooding and if less, it raises drought.

Hydrological circulation is presented in Figure 2.1 can be clearly seen in the form of a diagram. It is presented in Figure 2.2.

![Figure 2.2 Diagram siklus hidrologi](image)

**Figure 2.2 (Hydrological Cycle Diagram)**

Rain water is always present in the atmosphere, even in these days of cloudless. When the moist air moves upward and then to cool until through the dew point, the water vapor in it mengkondensir to form beads of water will fall as rain, when it suffered a massive cooling process. Rain happens to be snow, ice cubes, and so forth.

Rainfall intensity is the average amount of rain during the time of concentration for a certain period so that the amount of re-use within the rain intensity is strongly influenced by the calculated concentration and the return period rainfall; rainfall intensity can be calculated using the formula of Dr. Mononobe, namely:

\[
I = \frac{R}{24} \left( \frac{24}{t} \right)^{2/3} \quad \ldots \ldots \ldots \ldots (2.1)
\]

**Where:**
- \(I\) = rainfall intensity (mm / h)
- \(R\) = maximum rainfall
- \(t\) = length of time of concentration (hours)
Infiltration is the process of entry of rainwater into the surface layer down to the surface of the soil and groundwater. Infiltration velocity varying according to the intensity of rainfall is called the rate of infiltration. The maximum infiltration rate that occurs in a particular condition is called infiltration capacity.

THE OCCURRENCE OF INFILTRATION PROCESS

Rain to the earth's surface, it will first wet the plants and bare soil surface. When the surface layer was completely wet, then the next rain water will penetrate into the surface layer if the surface layer is not waterproof.

The rain may move into the soil by gravity and capillary force in a flow that is called infiltration. Water moving vertically either by way of evapotranspiration to the surface and in a way that decreased percolation due porous (cavities can be filled with air or liquid), the land has the capacity to save the water. This water is called soil moisture. Part of the soil moisture can be removed from the soil by natural means (by osmosis, gravity, or capillary); the call is in permanent storage.

Harvester storage capacity of a soil is measured by soil water content at permanent wilting point of vegetation. This wilting point (the lowest water content in which plants can extract water from the soil pore space of the gravitational force) is determined for a soil when the plant is at the top of the atmospheric wet and too hot. Percolation of water through the plant roots reach into a transition zone where the capillarity and osmosis is not so important.

At this zone, the water being held as a deposit on the membrane of individual soil particles by surface forces. In the capillary zone some downward percolation of water into the groundwater and some of the water held against gravity by capillary action.

Percolation of water jetting is a process in a land use within the lower layer or the under surface of the soil saturation.

Ground water is water that moves in the soil contained in the spaces between grains of soil that form and in the cracks of the rocks of.

Permeability is the ability of fluid to flow through a porous medium. However, porous or porosity alone is not sufficient, because the inter-connectivity is important. When the inter-connectivity between the pores of the surface top to bottom so it will have permeability properties. Materials such as clay and silt deposits in the nature have a very large porosity values but hardly permeable (impermeable to water), mainly due to the cavity size is very small, although other factors also influence it.

Soil permeability coefficient (K) for various types of soil are in a certain range as shown in table 2.1 below:

Table 1. Prices K for the ground manifold

<table>
<thead>
<tr>
<th>JENIS TANAH</th>
<th>KOEFISIEN PERMEABILITAS (cm/detik)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerikil bersih</td>
<td>1.0</td>
</tr>
<tr>
<td>Pasir kasar bersih</td>
<td>1.0 - 10^{-2}</td>
</tr>
<tr>
<td>Pasir campuran lempung</td>
<td>10^{-2} - 5x10^{-2}</td>
</tr>
<tr>
<td>Pasir halus</td>
<td>5x10^{-2} - 10^{-3}</td>
</tr>
<tr>
<td>Pasir kelanauan</td>
<td>2x10^{-3} - 10^{-4}</td>
</tr>
<tr>
<td>Lanau</td>
<td>5x10^{4} - 10^{-5}</td>
</tr>
<tr>
<td>lempung</td>
<td>10^{-6} - 10^{-9}</td>
</tr>
</tbody>
</table>

Source: Mekanika Tanah (Soil Mechanics)

K value can reach infinity, for example, the value of K for gravel can reach 10 times the value of K for the clay is not slotted.

Wells is essentially a drainage system where rainwater falling on the roof housed in a water catchment system.

Overview of Location

Makassar city has a strategic position because it is located at the intersection of the traffic lane in the direction of North and South Sulawesi province, from the western region to region of eastern Indonesia and northern regions to South Indonesia. In other words, the Makassar city is at coordinates 119° east longitude and 5.8° south latitude with altitudes varying between 1-25 meters above sea level. Makassar is a flat coastal area with a slope of 0.5 degrees to the west, flanked by two estuaries namely Tallo River which empties into the northern part of the city and Jeneberang River which empties into the South of the city. The total area of the city of Makassar totaling approximately 175.77 km² of land and includes 11 islands in the Strait of Makassar in the area plus waters of approximately 100 km².
Soil types that exist in Makassar city area consists of soil and soil inceptisol ultisol. Inceptisol soil types found in almost all areas of the city of Makassar including Tamalanrea. This soil is formed from a variety of parent materials, namely alluvium (fluvial and marine), sandstone, clay, and limestone. The spread of this land, especially in the plains between the hills, the river levee, back swamp rivers, alluvial plains, and the vast plains that have structural relief, flat landform structural / tectonic and plains / volcanic hills. Sometimes in a state of stagnant for a long time interval at a depth of 40-50 cm. Dominance of land use is residential area to the percentage of approximately 30% and the remainder is used separately for industrial, agricultural, trade / services, fisheries, education and land conversion. On Telkomas residential until now have been built more than 1200 housing units with a variety of types, namely type 70, type 54 and type 45 with the details of Table 3.1

Table 2 details. Breakdown of Number of Housing Units Houses In Telkomas residential.

<table>
<thead>
<tr>
<th>Tipe Rumah</th>
<th>Luas Lahan (m²)</th>
<th>Luas Atap (m²)</th>
<th>Jumlah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tipe 70</td>
<td>216</td>
<td>110</td>
<td>316</td>
</tr>
<tr>
<td>Tipe 54</td>
<td>180</td>
<td>99</td>
<td>466</td>
</tr>
<tr>
<td>Tipe 45</td>
<td>160</td>
<td>78</td>
<td>487</td>
</tr>
</tbody>
</table>

Rainfall data obtained from the Meteorology and Geophysics Makassar is the rainfall data at two different stations namely Hasanuddin Station and Station Panakkukang. Both stations measuring rainfall is close to the research station.

Table 3. Annual maximum daily rainfall

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Stasiun Hasanuddin (mm)</th>
<th>Stasiun Panakkukang (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>197</td>
<td>376</td>
</tr>
<tr>
<td>2001</td>
<td>270</td>
<td>200</td>
</tr>
<tr>
<td>2002</td>
<td>148</td>
<td>245</td>
</tr>
<tr>
<td>2003</td>
<td>716</td>
<td>210</td>
</tr>
<tr>
<td>2004</td>
<td>110</td>
<td>128</td>
</tr>
<tr>
<td>2005</td>
<td>94</td>
<td>144</td>
</tr>
<tr>
<td>2006</td>
<td>189</td>
<td>206</td>
</tr>
<tr>
<td>2007</td>
<td>217</td>
<td>218</td>
</tr>
<tr>
<td>2008</td>
<td>138</td>
<td>424</td>
</tr>
<tr>
<td>2009</td>
<td>235</td>
<td>399</td>
</tr>
</tbody>
</table>

Sumber: Badan Meteorologi dan Geofisika Makassar

For analysis of rainfall frequency analysis method used Gumbel Method. This method is based on the distribution of the extreme prices that followed the theory of Fisher and Tipper with anggapan that the distribution of hydrological variables is infinite, then it must use the largest prices (maximum).

\[ X_t = \bar{X} + K S_x \]

\[ K = \frac{Y_t - Y_n}{S_n} \]

\[ S_x = \sqrt{\frac{\sum X^2 - \bar{X}^2 n}{n-1}} \]

Where:

- \( X_t \): Quantities are expected to occur in year \( t \)
- \( \bar{X} \): Average price observations
- \( t \): Reset Period.
- \( K \): The frequency factor
- \( Y_t \): Reduced Variate
- \( Y_n \): Reduced Mean
- \( S_n \): Reduced Deviation Standard
- \( S_x \): Standard Deviation
Table 4. The relationship between return period (t) varies with the price reduction (Yi).

Source: set of modules (module c) training separately the road drainage system planning 2000 (Kumpulan Modul (Modul c) pelatihan perencanaan sistem drainase untuk jalan 2000)

Table 5. Reduced Mean (Yn) are used in the calculation method of Gumbel.

Source: set of modules (module c) training separately the road drainage system planning 2000 (Kumpulan Modul (Modul c) pelatihan perencanaan sistem drainase untuk jalan 2000)

Table 6. Reduced Standard (Sn) are used in the calculation method of Gumbel.

Source: set of modules (module c) training separately the road drainage system planning 2000 (Kumpulan Modul (Modul c) pelatihan perencanaan sistem drainase untuk jalan 2000)

Soil Permeability Coefficient

Soil permeability coefficient values obtained by direct field research conducted in three different places.

To get the value of the coefficient of permeability experiments conducted as follows:

Make a hole in the ground with the dimensions: Height 70cm, length 30 cm and 30 cm wide. then carried soil saturation, where the hole filled with water with a depth ≥ 30 cm, kept constant for 4 hours, after the water-saturated soil test run to the procedure as follows:

For hole filled with water up to 15cm, then the observed decrease if:

a. As high as 15 cm of water discharged in t ≤ 1 hour
b. As high as 15 cm of water discharged in 1 ≤ t ≤ 4 hours
• The hole filled with water just once as high as 15 cm, wait for 10 minutes.
• Completion of water as high as 15 cm performed 6 times, only the last run, observe the decrease of water in the hole let x cm for t minutes exactly, then the large percolation factor (T):

T = \frac{t}{X} \quad \text{(menit/cm)} \quad \ldots (2)

b. As high as 15 cm of water discharged in 1 ≤ t ≤ 4 hours

Run the following test procedures

• a hole filled with water as high as 15 cm wait for 30 minutes.
• The same is done as much as 8 times, the observed decrease in water in the hole, let Y cm for t minutes exactly the percolation factor (T):

T = \frac{t}{Y} \quad \text{(menit/cm)} \quad \ldots (3)

c. As high as 15 cm of water discharged in t ≥ 4 hours

Run the following test procedures

• The hole filled with water just once as high as 15 cm
• Observing the decline of water in the hole, let z cm for t minutes exactly the percolation factor (T):
T (min/cm) = 0.6 / K with K in m/h. This is considered to meet the requirements given the way in determining the infiltration factor by measuring the permeability of the soil by Kovacs (1981) are the same.

**Analysis of Calculation**

For the analysis of the calculations in this study can be seen in Figure 1 below:

**Figure 1. Flow chart of calculation capacity wells**

<table>
<thead>
<tr>
<th>No</th>
<th>year</th>
<th>X</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>197</td>
<td>38809</td>
</tr>
<tr>
<td>2</td>
<td>2001</td>
<td>270</td>
<td>72900</td>
</tr>
<tr>
<td>3</td>
<td>2002</td>
<td>148</td>
<td>21904</td>
</tr>
<tr>
<td>4</td>
<td>2003</td>
<td>716</td>
<td>512656</td>
</tr>
<tr>
<td>5</td>
<td>2004</td>
<td>110</td>
<td>12100</td>
</tr>
<tr>
<td>6</td>
<td>2005</td>
<td>94</td>
<td>8836</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2006</td>
<td>189</td>
<td>35721</td>
</tr>
<tr>
<td>8</td>
<td>2007</td>
<td>217</td>
<td>47089</td>
</tr>
<tr>
<td>9</td>
<td>2008</td>
<td>138</td>
<td>19044</td>
</tr>
<tr>
<td>10</td>
<td>2009</td>
<td>235</td>
<td>55225</td>
</tr>
<tr>
<td>sum</td>
<td>2314</td>
<td>824284</td>
<td></td>
</tr>
</tbody>
</table>

Source: of the data processing

\[
\overline{X} = \frac{2314}{10} = 231.4 \text{ mm}
\]

\[
S_x = \sqrt{\frac{\sum X^2 - \overline{X} \sum X}{n - 1}}
\]

\[
S_x = \sqrt{\frac{824284 - (231.4 \times 2314)}{10 - 1}}
\]

\[
S_x = 179.1413
\]

For \( n = 10 \) \( \rightarrow \) \( Y_n = 0.4952 \)

\( S_n = 0.950 \)

\( T = 2 \text{ Years} \) \( Y_t = 0.3665 \)

\[
K = \frac{Y_t - Y_n}{S_n}
\]

\[
K = \frac{0.3665 - 0.4952}{0.950} = -0.1355
\]

\[
X_{tr} = X + K \cdot S_x
\]

\[
X_x = 231.4 + (-0.1355 \times 179.1413)
\]

\[
= 207.126 \text{ mm}
\]
Table 8. Analysis of Rainfall Stations Panakkukang with Gumbel method.

<table>
<thead>
<tr>
<th>No</th>
<th>Y</th>
<th>X</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>376</td>
<td>141376</td>
</tr>
<tr>
<td>2</td>
<td>2001</td>
<td>200</td>
<td>40000</td>
</tr>
<tr>
<td>3</td>
<td>2002</td>
<td>245</td>
<td>60025</td>
</tr>
<tr>
<td>4</td>
<td>2003</td>
<td>210</td>
<td>44100</td>
</tr>
<tr>
<td>5</td>
<td>2004</td>
<td>128</td>
<td>16384</td>
</tr>
<tr>
<td>6</td>
<td>2005</td>
<td>144</td>
<td>20736</td>
</tr>
<tr>
<td>7</td>
<td>2006</td>
<td>206</td>
<td>42436</td>
</tr>
<tr>
<td>8</td>
<td>2007</td>
<td>218</td>
<td>47524</td>
</tr>
<tr>
<td>9</td>
<td>2008</td>
<td>424</td>
<td>179776</td>
</tr>
<tr>
<td>10</td>
<td>2009</td>
<td>399</td>
<td>159201</td>
</tr>
</tbody>
</table>

sum 2550 751558

Source: Results of Data Processing

\[ \bar{X} = \frac{\sum X}{n} = 255 \text{ mm} \]

\[ S_x = \sqrt{\frac{\sum X^2 - \bar{X} \sum X}{n-1}} \]

\[ S_x = \sqrt{\frac{751558 - (255 \times 2550)}{10 - 1}} \]

\[ S_x = 106,0964 \]

For \( n = 10 \) \( \Rightarrow Y_n = 0.4952 \)

\[ \text{Sn} = 0.950 \]

\[ T = 2 \text{ Years} \quad Y_t = 0.3665 \]

\[ K = \frac{Y_t - Y_n}{\text{Sn}} \]

\[ K = \frac{0.3665 - 0.4952}{0.950} = -0.1355 \]

\[ X_{tr} = X + K \cdot S_x \]

\[ X_2 = 255 + (-0.1355 \times 106,0964) \]

\[ = 240,624 \text{ mm} \]

Table 9. Rainfall average of two stations with the Gumbel method

<table>
<thead>
<tr>
<th>Periode Ulang (Tahun)</th>
<th>Stasiun Mandai (mm)</th>
<th>Stasiun Panakkukang (mm)</th>
<th>Rata-rata (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>207,126</td>
<td>240,624</td>
<td>223,875</td>
</tr>
</tbody>
</table>

Source: Results of Data Processing

**ANALYSIS OF RAINFALL INTENSITY**

Analysis of rainfall intensity using the formula Mononobe. In this case, the time taken by the duration of the dominant concentration of rain in Makassar. According to rainfall data processing of Meteorological and Geophysics stations in Mandai, the duration of the dominant rainfall ranges from 20-60 minutes.

\[ I = \frac{R}{24} \left( \frac{24}{t} \right)^{2/3} \quad ...............(5) \]

For \( t = 60 \) minute = 1 hour

\[ I_2 = \frac{223,875}{24} \left[ \frac{24}{1} \right]^{2/3} = 77,61 \text{ mm/hours} \]

**DEBIT ANALYSIS IN ACCORDANCE WITH WIDE ROOF RAIN**

The method used to estimate the magnitude of rainfall discharge (Q) goes into the well m³/second infiltration is "rational method" which is a function of roof runoff coefficient (C), rainfall intensity (I) mm / h and the roof area (A) ha.
\[
Q = 0.00278 \times C \times I \times A \quad \text{...(6)}
\]

\[
Q = 0.00278 \times C \times I \times A
\]

- For Type 70 with roof 110 m²
  \[
  Q = 0.00278 \times 0.95 \times 77.61 \times 110 \times 10^{-4}
  = 0.0022 \text{ m}^3/\text{sec}
  \]

- For Type 54 with roof 99 m²
  \[
  Q = 0.00278 \times 0.95 \times 77.61 \times 99 \times 10^{-4}
  = 0.0020 \text{ m}^3/\text{sec}
  \]

- For Type 45 with roof 78 m²
  \[
  Q = 0.00278 \times 0.95 \times 77.61 \times 78 \times 10^{-4}
  = 0.0015 \text{ m}^3/\text{sec}
  \]

**Table 10. Debit masing – masing tipe rumah sesuai dengan luas atap**

<table>
<thead>
<tr>
<th>Tipe rumah</th>
<th>Luas Atap (m²)</th>
<th>Debit (m³/det)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>110</td>
<td>0.0022</td>
</tr>
<tr>
<td>54</td>
<td>99</td>
<td>0.0020</td>
</tr>
<tr>
<td>45</td>
<td>78</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

*Sumber: Hasil Pengolahan Data*

**High Water in the Home Absorption Well**

Theoretically, the volume and efficiency of recharge wells can be calculated based on the balance of water use within the well and into the water that seeped into the ground and separately determine the water level in wells used by Sunjoto approach:

\[
H = \frac{Q}{FK} \left[1 - \exp\left(-\frac{FKT}{\pi R^2}\right)\right] \quad \text{...(7)}
\]

Where:

\[
H = \text{Height of water level in the well (m)}
\]

\[
Q = \text{Debit incoming water (m}^3/\text{second)}
\]

\[
F = \text{a geometric factor (m)}
\]

\[
K = \text{coefficient of permeability (m / sec)}
\]

Jetting T = Time (the duration of the dominant rain) (seconds)

R = radius of well (m)

Geometric factor depending on various circumstances and in general can be expressed in the equation

\[
Q_o = F.K.H \quad \text{...........(8)}
\]

Effective depth of wells is calculated from the ground water level when the well is below the water table and is measured from the bottom of the well when the water table under the bottom of the well. Bottom of the well should be on the ground with high permeability layer.

- Type 70 with roof 110 and debit 0.0022 m³/sec
  \[
  H = \frac{0.0022}{3.14 \times 0.00003} \left[1 - \exp\left(-3.14 \times 0.00003 \times 3600 / 3.14 \times 0.5^2\right)\right] = 8.19 \text{ m}
  \]

- Type 54 with roof 99 and debit 0.0020 m³/sec
  \[
  H = \frac{0.0020}{3.14 \times 0.00003} \left[1 - \exp\left(-3.14 \times 0.00003 \times 3600 / 3.14 \times 0.5^2\right)\right] = 7.44 \text{ m}
  \]

- Type 45 with roof 78 and debit 0.0015 m³/sec
  \[
  H = \frac{0.0015}{3.14 \times 0.00003} \left[1 - \exp\left(-3.14 \times 0.00003 \times 3600 / 3.14 \times 0.5^2\right)\right] = 5.58 \text{ m}
  \]

**Table 11. High Water in the Well Resapan face on each type of housing based on roof area and discharge**

<table>
<thead>
<tr>
<th>Tipe Rumah</th>
<th>Luas Atap (m²)</th>
<th>Debit (m³/det)</th>
<th>Diameter (m)</th>
<th>Tinggi (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>110</td>
<td>0.0022</td>
<td>1</td>
<td>8.19</td>
</tr>
<tr>
<td>54</td>
<td>99</td>
<td>0.0020</td>
<td>1</td>
<td>7.44</td>
</tr>
<tr>
<td>45</td>
<td>78</td>
<td>0.0015</td>
<td>1</td>
<td>5.58</td>
</tr>
</tbody>
</table>

*Source: Results of Data Processing*
THE WELL ABSORPTION CAPACITY

Analysis of the capacity of wells is based on the calculation of volume, where the maximum effective depth of the wells with ground water level is approximately 2 meters. Capacity wells without a space surveillance can be seen in the table below.

Table 13. Capacity wells without a space surveillance.

<table>
<thead>
<tr>
<th>Tipe Rumah</th>
<th>Luas Atap (m²)</th>
<th>Diameter (m)</th>
<th>Kedalaman (m)</th>
<th>Kapasitas (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>110</td>
<td>1</td>
<td>2</td>
<td>1.57</td>
</tr>
<tr>
<td>54</td>
<td>99</td>
<td>1</td>
<td>2</td>
<td>1.57</td>
</tr>
<tr>
<td>45</td>
<td>78</td>
<td>1</td>
<td>2</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Source: Results of Data Processing

Based on the analysis of the capacity of wells, the volume of rainwater that can be absorbed for Telkomas residential are as follows:

- Type 70 with an area of roof 110 m² and 1.57 m³ capacity
  Infiltration volume = the number of housing units x capacity
  = 316 x 1.57
  = 496.12 m³

- Type 54 with an area of roof 99 m² and 1.57 m³ capacity
  Infiltration volume = the number of housing units x capacity
  = 466 x 1.57
  = 731.62 m³

- Type 45 with an area of roof 78 m² and 1.57 m³ capacity
  Infiltration volume = the number of housing units x capacity
  = 487 x 1.57
  = 764.59 m³

Table 14. The volume of water absorbed in Telkomas Residential

<table>
<thead>
<tr>
<th>Tipe</th>
<th>Unit</th>
<th>Kapasitas Sumur (m³)</th>
<th>Volume Resapan (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>316</td>
<td>1.57</td>
<td>496.12</td>
</tr>
<tr>
<td>54</td>
<td>466</td>
<td>1.57</td>
<td>731.62</td>
</tr>
</tbody>
</table>

Source: Results of Data Processing

THE WELL ABSORPTION CONSTRUCTION

For the construction of wells, construction of the wall can be planned from brick materials neatly organized and given the cavity so that ore can quickly soak into the soil or may be made of iron rods with a diameter of 100 cm. At the top of the cover is made of reinforced concrete 10 cm thick reinforced concrete, the upper part backfilled with compacted soil 15 cm thick.

Construction of wells equipped with inlet pipe 100 mm diameter PVC and PVC peluap pipe diameter 100 mm, which are directed to a drainage channel. Peluap pipe installed at a depth of 25 cm from the soil surface and the edges are given a wire sieve. At the bottom layer of rock fill construction in an empty 50 cm thick, which serves as a medium for retaining wall and the well, is not eroded as a media filter rain before it absorbed into the ground.

Conclusions and Suggestion

Conclusion

From the analysis and discussion of the obtained conclusions are as follows:

1. To make the Telkomas Residential wells needed into approximately 2 meters with a capacity of 1.57 m³ wells.
2. If every home with a consciously make one wells, then the Telkomas Residential within one day of rain can absorb as much water as 1992.33 m³.

Suggestion

The role of government is expected in the manufacture of socializing wells as one of the businesses in the response to water shortages and the reduction of surface runoff.

Bibliography

G. Dja'tmiko Soedarmo, S. J. Edy Purnomo, 1993  
Mekanika Tanah, Kanisius, Malang.

Joyce Martha W, Wanny Adidarma Dipl. H,  
Mengenal Dasar-Dasar Hidrologi, Nova, Bandung.
