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PLANNING OF THE CHECK DAM OF JACOBUS RED ROAD – AMBON CITY

(*Perencanaan Pemeriksaan Dam Jacobus Jalan Merah – kota ambon*)

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Abstract

Ambon city, which mostly consists of hilly areas, is an area that is very highly susceptible to the occurrence of debris mass movements, both in the form of debris flows and landslides (debris flows, erosions, and slope failures). In the city of Ambon, rivers are passed such as Way Ruhu, Way Batu Merah, Way Tantui, Way Tomu, Way Batu Gajah and Way Batu Hang. The purpose of this paper is to plan the check dam building for Way Batu Merah – Ambon City. The method used is Hydrological Analysis: hydrology as the basis for planning the Q25 Check Dam Building, which consists of rainfall analysis and the basis for calculating the planned discharge used in planning, using the Sabo Technical Center method. From the calculation results, it is obtained that the planned Q25 flood discharge of the Way Batu Merah River is 516.43 m / year with a return period of 25 years, the sediment volume can be accommodated 22,102 m / year and controlled by the Check Dam 56,050 m / year, then with a sediment discharge of 60,685 m³ / year . By comparing the amount of sediment that enters the Check Dam with the capacity of the Check Dam, it is dredged again for 3.5 years.

Keywords: *Sediment; Hydrological Analysis; Checkdam; Sediment Discharge*

Abstrak

Kota ambon yang sbagian besar terdiri dari daerah perbukitan, merupakan kawasan yang amat sangat rentang terhadap terjadinya gerakan massa debris, baik yang berupa aliran debris maupun tanah longsor (debris flows, landslides, and slope failures). Pada kota Ambon ini dilewati sungai – sungai seperti Way Ruhu, Way Batu Merah, Way Tantui, Way Tomu, Way Batu Gajah dan Way Batu Gantung. Tujuan dari penulisa ini yaitu untuk merencanakan bangunan check dam Way Batu Merah – Kota Ambon. Metode yang digunakan adalah Analisa Hidrologi : hidrologi sebagai dasar perencanaan Bangunan Check Dam Q25, yang terdiri dari analisa curah hujan dan dasar – dasar perhitungan debit rencana yang dipakai dalam perencanaan, menggunakan metode Sabo Teknikal Centre. Dari hasil perhitungan diperoleh debit banjir rencana Q25 Sungai Way Batu Merah sebesar 516.43 m³ / tahun dengan kala ulang 25 tahunan, volume sedimen dapat ditampung 22.102 m³ / tahun dan dikendalikan oleh Check Dam 56.050 m³ / tahun, maka dengan debit sedimen sebesar 60.685 m³ / tahun. Dengan membandingkan besar sedimen yang masuk ke dalam Check Dam dengan kapasitas tampung Check Dam, di keruk kembali selama 3.5 Tahun.

Kata-kata kunci: *Sedimen; Analisa Hidrologi; Cekdam; Debit Sedimen*

INTRODUCTION

The city of Ambon, which mostly consists of hilly areas, is an area that is very susceptible to the occurrence of debris mass movements, both in the form of debris flows and landslides (debris flows, erosions and slope failures). In Ambon city, rivers are passed such as Wai Ruhu, Wai Tantui, Wai Batu Merah, Wai Tomu, Wai Batu Gajah and Wai Batu Hang.

Every rainy season, these six rivers always cause flooding and inundate residential areas and damage other facilities such as bridges, roads and other water structures. Besides this, because of the condition of the soil and plants in the upstream area during the rainy season, erosion often occurs which causes silting of the downstream river channel.

Floods in rivers are caused by high and long rainfall and the capacity of river channels that are not able to accommodate and drain flood water so that river water overflows into the area around the river which causes flooding and causes considerable losses. Considering the potential for flood inundation areas is quite high, it is necessary to immediately handle the six rivers to avoid even greater losses that will arise later.

Wai Batu Merah or Order 2 river is an active river because this river flows active water and the water discharge increases during the rainy season.

In the downstream river, during the rainy season, floods often occur carrying quite a lot of sediment material, causing sedimentation problems in the Batu Merah Dalam Military Army dormitory housing complex, residential residents and the downstream part of the Way Batu Merah estuary where there are provincial roads and bridge markets that connect the city. Ambon with the route out of the city of Ambon.

Rainfall is taken from rain gauge stations in or around the planned Check Dam watershed. The rainfall data is still local data and the frequency is analyzed to become Extreeme Rainfall, which is expressed in mm / 24 hours. Extreme Rain is an estimate of the maximum rain that occurs on average once in the planned return period.

Soeyono Sudarsono (1977) Riverbed control dam (BPS) serves to accommodate, hold, control and divert a certain amount of sedimentation. The height of the BPS crest above the riverbed is determined based on the assumption that the design volume of sediment is permanently accommodated, the sedimentation volume is controlled (temporary) and the sediment volume that is allowed to flow downstream of the building. Errors in determining the effective height of BPS resulted in uncontrolled sediment supply to the downstream.

To calculate the average annual discharge used is the flow of air / planned flow of birthdays, while in the study area is an active river that flows water normally and the discharge increases when it rains with high rainfall only, so that the flood discharge at birthdays no because there is no flood recording device

Ray K. Linsley. JR (1989) calculates the average annual discharge of the planned annual return period using the DER WEDUWEN method as follows:

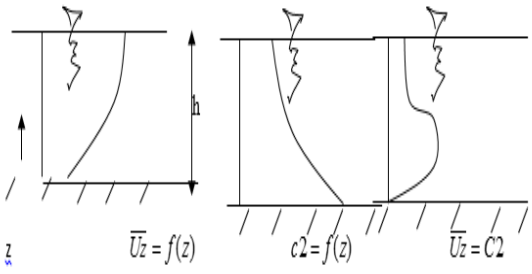

Figure 1 Distribution of speed, concentration and “suspended load” Integrated from the bottom to the water level, the intensity of the “suspended load” Sabo Technical Center (2009).

The result of desimentation is directly dependent on the production of sedimentation and the capacity of transport

by water. the cementitious material discussed earlier comes from erosion. So sedimentation results are also influenced by factors that determine the extent of erosion.
Several hydrologists have found the phenomenon of a relationship between the results of deposition and the size of the watershed (Wani Hadi Utomo, 1989). This means that deposit results can be recalled from the area of the watershed (Hudson, 1976). In addition, it is influenced by various factors as discussed above. However, Hudson (1976) argues that if the data obtained
If the relationship is large enough, we can draw an approximate estimate between the area of the flow area and the sedimentation rate as shown below:

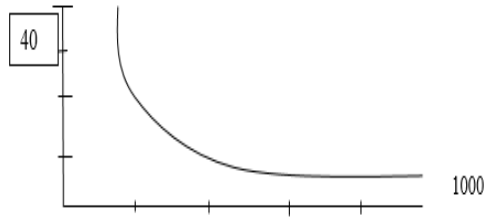

Figure 2 Relationship between watershed area and sediment level

The Department of the United States (USDA), has made a table of the relationship between the area of the watershed and the agricultural ratio of the United States (NPE (Sediment Delivery Ratio, SDR) as presented in the following table:

Large		SDR
Km^2	Ha	
0.05	5	0.58
0.10	10	0.52
0.50	50	0.39
1.00	100	0.35
5.00	500	0.25
10.00	1000	0.22
50.00	5000	0.153
100.00	10000	0.127
500.00	50000	0.079
1000.00	100000	0.059

Table 2.2 Relationship between Watershed Area and Sedimentation Release Ratio. The problems raised in this paper are as follows. How to plan a Check Dam building in Way Batu Merah – Ambon City.

RESEARCH METHOD

The research conducted by the author is located on the Way Batu Merah River, Batu Merah Village, Sirimau District, Ambon City. The data used in this writing are: Primary data: location of CHECK DAM placement, river width, type of land user. Secondary data: rainfall data, filter analysis data, watershed maps, slope maps, geological and land use maps.

Data source, The source of data obtained by the author is a topographic map, while the data collection techniques used are: Primary Data are data obtained from field observations as follows:
Rainfall data (BMG Pattimura Airport Ambon 2) Sieve Analysis Data (PT. INDRA KARYA 3) Sedimentation data (PT. INDRA KARYA), 4) Watershed Map (PT. Indah Karya), 5) Slope map (PT. Indah Karya), 6) Hydrological map (Department of Public Works), 7) Geological map (PT. Indah Karya), 8) Land use (Bapeda Kota Ambon)
The data analysis techniques used are: Start. Topography: The shape of the river channel. The size of the catchment area. Base point.
Planning: 1) DAM base point (basic point) a river channel used in calculating the amount of sediment that must be controlled in the target area, 2) Plan debit is used for planning basis, 3) Estimated amount of sediment: 4) Dimensions:
.

RESULTS AND DISCUSION

River Characteristics

Based on the topographic class, the Batu Merah watershed has slopes divided into 6 (six) slope classes, namely 0-3%' 3-8%' 8-15%' 30-45%' and > 45%). Slope conditions in the Way Batu Merah

watershed classified as flat to steep because it represents a slope of 0-3% to > 45%. In the upper watershed area, the topography is generally steep (15-30% slope) to the watershed boundary (transition boundary). In the upstream area of the watershed, the topography is generally steep (slope > 45%) to wavy (characterized by a slope of 15 – 30%) to the middle boundary of the watershed (transition boundary). In the Batu Merah watershed, the topography is generally wavy (characterized by a 15-30% slope) to choppy (characterized by a 15-30% slope) to wavy (characterized by a slope of 8-15%). While in the downstream area, the topography is generally sloping (characterized by 3 – 8%) to flat (characterized by a slope of 0-3%) especially in areas near the mouth of the river based on the topography, the wavy topography has the widest area in the area. Batu Merah watershed.

The Way Batu Merah watershed has a catchment area of about 7'2 km2 with a river length of 6'8 km. Way Batu Merah flows north - west down the mountain side towards Ambon Bay through hilly highlands and alluvial lowlands. This river has a stretch of about 1'5 km that passes through the residential and commercial areas of Ambon city, Way Batu Merah river has 4 main tributaries in the form of small tributaries.

In general, the watersheds in the city of Ambon such as Wai Tantui, Wai Ruhu, Wai Batu Merah, Wai Tomu, Wai Batu Gajah and Wai Batu Hang have the same characteristics, the upstream has a slope of 6%-10% 4-5km from the coastline with an altitude of 10-150m above sea level and from the foot of the mountains to the shoreline ranges from 1km to 1.5km with a slope of 0%-1% with an altitude of 0-10m above sea level.

Hydrological Data

The data collected is especially daily rainfall data and hourly rainfall, so for the calculation of the planned rainfall for a certain return period, a frequency analysis is carried out on the measured 24-hour rainfall data obtained from the Meteorology and Geophysics Agency office of the Laha observation station which is considered sufficient to represent. (Rainfall data can be seen in the appendix table).

From the data on the condition of watersheds on the island of Ambon such as Wai Ruhu, Wai Tantui, Wai Batu Merah, Wai Tomu, Wai Batu Gajah and Wai Batu Hang, in general they have a tropical climate with rainy months occurring in July and August. , as previously explained that the condition of the Way Batu Merah river is an active river that flows normal water during summer and during heavy rains floods occur due to the presence of ephemeral rivers.

Sediment Source

Soil erosion is the process of releasing and transferring soil grains from one place to another by erosional forces such as air, wind and so on or due to various natural causes, humans or a combination of nature and humans.

Field data shows that in the middle of the river there are land clearing and striping activities, so that the peeled soil surface is not protected by vegetation. This activity is part of the housing development of BTN Kebung Cengkeh. In the rainy season, the soil grains on the ground surface are easily removed by rainwater and enter the water body (river) and then carried by the air to the estuary (Ambon Bay).

Geology and Soil Mechanics

On this leitimur peninsula there are formations of sandstone, diabase, andesite, coral, loose rock and alluvium. This geological history begins with the deposition of sandstone, limestone which is an insert and a radioplant, on a geosynclinal path and then undergoes strong folding, after which the geological history of this area is dominated by a series of plutonic rock

intrusions (peridatite and granite) and volcanic rock extrusions (andesite).

These andesites then undergo denudation events, after which a subsidence occurs and dissolves to cover the rocks mentioned above, at approximately 500 m above sea level now. Then there was a gradual lifting of the island and coral limestone appeared in accordance with the surrounding conditions.

The upstream location of the Wai Batu Merah river is formed from loose material and coral limestone, both of these rock formations are located on andesite rocks, where the outcrop can be seen on the coast of Pandan Kasturi as a red rock headland.

In writing this soil mechanics work, the data we get is from the Maluku Water Resources Management and Flood Control project in the form of filter analysis data which only investigates the type of soil grain in the upstream, middle and downstream parts of the Wai Batu Merah river. To determine the type of aggregate that is washed away as sedimentary material.

In general, the land use in the Way Batu Merah Watershed (DAS) in most of the upstream areas is in the form of secondary dry land forest and grasslands, shrubs and a small part of buildings, namely for residential areas. In the middle area of the Way Batu Merah watershed, the largest land use is in the form of shrubs and residential areas, while in the downstream area generally buildings are for settlement of residents and service activities and a small part is still in the form of shrubs. The residential area of Ambon City has increased with urbanization especially downstream of Way Batu Merah, which has had a negative impact on land use change. The reduced flow capacity of the Way Batu Merah channel eventually causes overflow on both banks of the river when the flood flow exceeds the carrying capacity of the river flow.

Population

The population of the city of Ambon in its development in the past few decades has shown a fairly alarming increase. Based on the results of the 2005 Population Census, the population of Batu Merah Village was recorded as 3989 people, then in the 2006 Population Census it increased to 4185 people, then in the 2007 Population Census the population of Batu Merah Village grew to 8909 people, this does not include residents who do not live permanent (Homeless, Crew, Boat occupants). Then in the 2019 Population Census, it also increased to 10633 people, in the 2020 Population Census it increased to 13324 people. Furthermore, from the beginning of 2021 to the middle of 2021, there is another population increase in Batu Merah Village.

Land Use

Watersheds (DAS) such as Wai Tantui, Wai Batu Merah, Wai Tomu, Wai Batu Gajah and Wai Batu Hang have almost the same land use, namely in the upstream area it has not been utilized, as well as in some parts of the middle area, while in the downstream area. widely used for residential areas, worship infrastructure, sports and offices. In other words, the study area is a mixed crop field.

Rainfall Frequency Analysis

To calculate rainfall using the Haspers method, equation (2.1) is used as Haspers as follows:

Hasper Distribution Analysis Table

Maximum rain	Biggest order	Repeat Period	Standard Variable
R (mm)	M	$Tr = \frac{n+1}{m}$	U
R_1	1	10	1,26
R_2	2	5	0,73

Source: Calculation results

$\bar{R} = 875{,}67\ mm$

$$S = \frac{1}{2}\left(\frac{R_1 - \bar{R}}{U_1} + \frac{R_2 - \bar{R}}{U_2}\right)$$

$$S = \frac{1}{2}\left(\frac{1923 - 875{,}67}{1{,}26} + \frac{1468 - 875{,}67}{0{,}73}\right)$$

$= 821{,}313$

Haspers method rainfall table

Tahunan (T)	Rainfall (Rt)
10	2138,19 mm
15	2800,02 mm
20	3207,29 mm
25	3563,66 mm
50	4666,70 mm
100	5854,59 mm

Source: 2021 analysis results

Standard Variable (U)

T	U	T	U	T	U	T	U
1.00	-1,86	21.00	1,94	25.00	2,10	50.00	2,75
5.00	0,64	22.00	1.98	26.00	2,13	70.00	3,08
15.00	1,63	23.00	2,02	27.00	2,17	80.00	3.21
20.00	1,89	24.00	2,06	28.00	2,19	100.00	3.43

Source: Flood Calculation Method Ir. Oehadijono Plan, 1985.

Rainfall Recapitulation

NO	R	R−r	R−r2	R−r 3	R−r4
1	1923	1047	1096900.1289	7111117467	1203189892780.84
2	1468	592	350854.8289	3163575232	123099110962.45
3	1430	554	307281.7489	2924207000	94422073207.04
4	1252	376	141624.2689	1962515008	20057433541.46
5	960	84	7111.5489	884736000	50574127.76
6	914	38	1469.1889	763551944	2158516.02
7	847	-29	821.9689	607645423	675632.87
8	718	-158	24859.8289	370146232	618011092.94
9	534	-342	116738.3889	152273304	13627851442.97
10	498	-378	142634.6289	123505992	20344637361.44
Ammount	**10544**	**1787**	**2190296.5290**	**18063273602**	**1475412418666**

Source: analysis results, 2021

CLOSING

From the description of the application of the Sabo Dam in the Way Batu Merah River Basin as described in Chapter V, the following conclusions can be drawn: Rainfall in Ambon City is quite high, this can be seen in the calculation of the average max rainfall and the calculation of the flood discharge that quite high, for the Way Tantui watershed itself the annual average is 516.43 mm, with a watershed area of 6.42 km2. Erosion caused by the flow of the Way Batu Merah River which carries sediment to its drainage area which is a mixed rice field area, and the calculation of the amount of erosion calculated per year is obtained = 22,102 m/year. The amount of sediment discharge that is allowed to bind the river flow and does not disturb the stability of the river surface is (qs) = 56,050 m/year. Construction of Sabo Dam/Chek Dam is made of concrete construction with the main building peak height (H) = 9.00 m, and Sub Dam (p') = 3 m, with a storage volume of 60.685 m/year,

The highest rainfall in a year is in July and June, and the driest month is November. By comparing the carrying capacity with the amount of sediment that enters the Chek Dam, the sabo will be dredged in three years.

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