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Study Charge the Floods Evaluated From Morphometry and Mitigasi Arau Padang City

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Abstract : *High intensity rain and morphometri in Padang city cause at Arau. Morphometri geomorphologi that is related to wide of, river network, stream pattern and gradien of river. The form wide of DAS will be by stream pattern and level.This will influence to the number of rain. Make an index to closeness of stream depict closeness of river stream at one particular DAS. Speed of river stream influenced by storey, level steepness of river. Steepness storey, level is comparison of difference height of river downstream and upstream. Ever greater of steepness of river stream, excelsior speed of river stream that way on the contrary. High to lower speed of river stream influence occurence of floods, more than anything else if when influenced by debit big. By using rainfall from year 2005 to year 2015, and use Thiessen method got a rainfall. Use the DEM IFSAR, analysed sofware ARGIS, and with from earth map, the result got DAS in at condition of floods gristle and sedimentation. There are band evakuasi for resident which data in floods area.*

I. PRELIMINARY

Arau represent the especial river at DAS of Bar Arau, what source come from river of Lubuk Paraku, River Idas, and River of Gunung Sarik. Capture Area irrigate the DAS of Bar Arau part of upstream only about 3.090 hectare (30,90 Km2), covering conservation area, protected forest and farm own the society [17]. Referring to problem of floods that happened in Padang city that from year 2000, with high rain intensity will happened floods. Bar of Arau represent Eldest River which there are in Padang city, not yet can overcome floods [6]. Like known that high rain intensity will cause the happening of floods. Cause of high rainfall intensity have done many its research. That floods not merely caused by rainfall but also caused by DAS morphometry [3] what consist of wide of DAS, form DAS, river network, closeness of stream, stream pattern, and Gradient steepness of river. For that influence of morphometry to DAS Arau require to be done research.

II. STUDY LITERATURE

Parameter Crisis of Floods

According to [11], [13], [14], floods crisis parameters according to morphometry:

TABLE 1. Parameter floods and category

Parameter	Classification	Category	Score
Maximal Daily Rain (mm/day)	<20	Low	1
	21-40	Rather low	2
	41-75	Middle	3
	76-150	Rather high	4
	>150	High	5
Form of DAS	<0.2	Ellipse	1
	0.21-0.40	Rather ellipse	2
	0.41-0.60	Middle	3
	0.61-0.80	Roundish	4
	>0.80	Circular	5
Closeness of Drainage (km / km2)	<0.25	Seldom	1
	0.26-8.50	Rather seldom	2
	8.51-16.75	Middle	3
	16.76-25	Rather meeting	4
	>25	Meeting	5

	>25	Very steep	1
Bevel (%)	15-25	Steep	2
	8-15	Precipitous	3
	3-8	Sloping	4
	0-3	Level off	5
Usage of farm	Cover forest	Low	1
	Forest production/plantation	Rather low	2
	Lawn/bush	Middle	3
	Irrigated/non irrigated	Rather high	4
	Non irrigated/settlement	High	5
Gradient river	< 0.5	Low	1
	0.5-1.0	Rather low	2
	1.1-1.5	Middle	3
	1.6-2.0	Rather high	4
	>2.0	High	5
Form farm mountain Natural influence	Hilly	Low	1
	Rather hilly	Rather low	2
	Plain. terrace	Middle	3
	Plain terrace (bevel <2%)	Rather high	4
	Plain of alluvial	High	5
High of pond (cm) Natural influence	<23	Low	1
	24-47	Rather low	2
	48-71	Middle	3
	72-95	Rather high	4
	>96	High	5

III.   Congeniality

[1], DAS morphometry represent quantitative size measure characteristic of DAS which related to aspect of geomorphology area. This characteristic related to rainwater process which fall in DAS. The Parameter wide of DAS, form DAS, river network, closeness of stream, stream pattern, and Gradient steepness of river. Drainage basin (DAS) left outspread area beside and and right the than a river stream, where all watercourse which there are on the right and is left of river have estuary into mains river. All rain that happened in a basin drainage, all its water will fill river which there are in DAS. On that account, DAS areal also represent rain capture area or referred as area catchment. All water emitting a stream of to pass river pull away river capture area (DAS) with or without reckoning gone through road; street before reaching run off, [9]. Drainage basin (DAS) also can be defined as a area limited by natural topography, where all rainwater which fall in it will emit a stream of to a exit and river outlet at river, or represent set of hydrology depicting and using set of physic-biology and set of economic social activity for the planning of and management of natural resources. [16,18]. Morphometry Drainage basin (DAS)] term used to express situation of network groove river quantitatively. Such situation for the analysis of river stream [7] for example covering:

Area of DAS

DAS represent place gathering of rain / precipitation to a river system. Wide of stream area can be estimated [5] with measuring the area ap of topography. Border line between DAS is contour back / surface of earth able to dissociate and divide rainwater to each DAS. The border line determined pursuant to change of contour of map of topography while wide its DAS can be measured by means of planimeter, used map scale will influence correctness of calculation

Wide and Long of DAS

Long of DAS [7] is equal to distance level off from river estuary up at pate upstream as long as Mains River. While is wide of DAS is comparison between wide of DAS with mains river length.

Gradient River

Gradient of river [7] can be obtained with the following equation:
Gradient = Vertical Distance / Horizontal distance

$$Su = \frac{h85 - h10}{...}100 \qquad (1)$$

Closeness of drainage

Closeness of river [4] is an index number showing to the number of watercourse in a DAS. The Index obtained with the following equation:

$$Dd = L/A \qquad (2)$$

Form Drainage basin

Pattern River determine form a DAS. Form DAS have important meaning in its link with river stream, that is having an effect on to speed of stream. According to [7], to determine form of DAS can know by determining assess its R.

$$Rc = 4\pi A/P^2 \qquad (3)$$

Form of DAS influence rainwater concentration time emitting a stream of to go to outlet. Circular progressively form of DAS mean progressively shorten needed concentration time, so that floods fluctuation excelsior that happened. On the contrary ellipse progressively form of DAS, needed concentration time longer so that floods fluctuation progressively lower. Form of DAS quantitatively can be estimated by using long ratio value (' ratio' elongation / Re) and circularity ('ratio' circularity /Rc). Kinds of Drainage basin form: DAS in form of plumage, DAS in form of radial, DAS in form of is parallel.

River network

[14], River network can influence the level of river stream debit conducted by its river children. This parameter can be measured quantitatively from ramification ratio that is comparison between amounts of river path of ordo certain with river ordo one storey, level above him. This value indicate that ramification ratio excelsior mean the the river have many river children and fluctuation charge that happened ever greater also. River ordo is position ramification of river path in its sequence to river mains at one particular DAS. More and more amount of river order, progressively wide and long progressively also groove its river. River Ordo can be specified with method of Horton, Strahler, Shreve, and Scheidegger. But in general method of Strahler easier to be applied to be to be compared to the other method.

Daily rain maximum

Taken by rainfall data of year 2005 until year 2015

Sedimentation

Sedimentation is land, ground and parts of land, ground transported by water from an natural place of erosion at one particular drainage basin and enter into body irrigate. incoming sediment into body irrigate only just part from lan, ground which erosion from its place. Partly again from land, ground brought by a erosion.
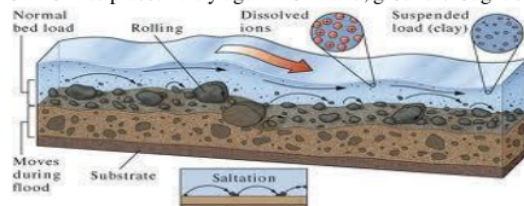
Sedimentation in the water

IV. Classification Floods

Of floods crisis parameter got by floods classification based on score of divided variable like table 2, According to [10], [11], [13], [14]:

TABLE 2. Classification floods

Classification	Score
Very gristle	40 – 29.4
Gristle	29.3 – 18.7
Not gristle	18.6 – 8

V.   RESEARCH METHODOLOGY

Research conducted by descriptive qualitative that is about characteristic of DAS based on morphology at Arau debit and sedimentation. As for method taken is method survey by collecting data. Data aggregate later will be analyzed [2]. Analyse the DAS relate at process use the DEM and operate for the data raster to depict the drainage basin and to get the fitur of like river, river network, and diffusion area. A big DAS can include cover all river system in DAS, possible there is small river stream, one to each, every watercourse in stream system.

Research by using rainfall data of year 2005 up to year 2015. Rainfall calculated by Thiessen and get floods debit by using logarithm method of Pearson III [8]. Analysis of DAS relate at process use DEM and data operation of raster [13] to depict drainage basin and to get feature like river, river network, diffusion area, hollow. A big DAS can include, cover entire all river system in DAS, possible there is small river stream, one to each, every watercourse in stream system required data

1. Image of DEM IFSAR with resolution 5 meter. IFSAR with Single Use August 2011
2. Software ARGIS

Population is corps set of having same characteristic or assumed is same. This characteristic can be seen in the form of certain size measure [16]. Population can in the form of farm, which farm on the surface of earth very immeasurable. For that in this research of farm population better limit in the form of inclination of bevel, closeness of drainage, rainfall, farm form, use of farm, river Gradient, ordo, form DAS, and is high of pond.

RESULT AND DISCUSSION

I.   **Pursuant to result of calculation of Order river class and length based on map of Image, hence obtained result of rivers order class length and amount region of DAS Bar of Arau:**

1. Wide of Bar of Arau 203,04 km2
2. Long of River of Arau 24,85 km
3. River Gradient:

$$Su = \frac{h85 - h10}{0.75Lb} \qquad (4)$$

Su   = Inclination of Especial Path River
h10   = Height of dot which lay in distance 0.10 Lb
h85   = Height of dot which lay in distance 0.85 Lb
Lb   = Long of Especial Path River
h85   = 160 m
h10   = 10 m
h85 - h10 = 160-10 = 150 m or 0.5 km
Su   = 0.15 / 24.85 = 0.006036217 or 0.6036217 % (> 0.5 % rather low) (Score 2)

4. Bifurcation Ratio (Rb)

$$Rb = \frac{N_u}{N_u + 1} \qquad (5)$$

Rb total =4.80 (ordo 5)

$$WRb = \frac{\sum \frac{Rb_u}{Rb_u +1}(N_u + N_u +1)}{N_u} \qquad (6)$$

WRb = 9.62

5. Circularity Ratio (Rc)

$$Rc = \frac{4\pi A}{P^2} \qquad (7)$$

A = 203.04 Km2
P = circle DAS = 98.19 km
Rc ...
Ac = πr^2
R = 15.63 km
Ac = 767.09 km
Rc = 0.26(Rather ellipse the including score 2)

6. Closeness Of drainage (Dd)
For total Length Mains river and watercourse of Batang Arau
324.26Km^2 Closeness of drainage
Dd = L / a = 324.26 / 203.04
Dd = 1.60
Closeness of drainage= 1.60 (closeness class category rather seldom, score 2)

7. Frequency river order ratio (F)
Grand total of Ordo river   = 263
Wide of DAS   = 203.04 Km^2
Grand total of ordo river/wide of DAS (F) = 1.29

8. Bevel
Of biggest bevel 25 - 45% broadly 83.27 km^2
(Score 1, and 0 - 3% broadly 55.21km^2 (score
5). Score bevel mean 3

9. Use of farm

TABLE 3. Use of farm

Use of farm	Area (Km^2)	SCORE
Forest	122.5	2
Garden	5.09	3
Farm	0.01	3
Empty farm	2.14	3
Settlement	50.58	5
Rice field	22.66	4
Coppice	3.7	3
Mean		3.28

10. Rainfall
Of Station record rainfall: Batu Busuk, Gunung Nago, Gunung Sarik, Ladang Padi and Simpang Alai
daily rainfall maximum is 210 mm, including score 5

11. Form farm
Farm form is form surface of earth representing floods determinant. Farm form which level off will be
more be big floods crisis compared to hilly farm have, precipitous bevel:

TABLE 4. Form farm Arau

Form farm	Area (km^2)	Calculation	Score
Plain of alluvial	55.58	55.58/203.02 x 5 = 0.82	0.82
Terrace (bevel < 3%)	26.08	26.08/203.02 x 3 = 0.51	0.51
Lava and fan	37.31	37.31/203.02 x 2 = 0.37	0.37
Mountain	33.09	33.09/203.02 x 1 = 0.16	0.16
Hilly	50.96	50.96/203.02 x 1 = 0.25	0.25
	Total		2.11

12. High of pond

R   = 128.88 mm
Wide area catchment (A)   = 203.04 km2
Inclination of River   = S = 0.067
Speed of stream (V)   = 5.41 km / hour
Concentration time (t)   = 4.59 hour
Rain intensity (I)   = 28.08 mm / hour
River Bar debit of Arau by using rational formula:

$$Q = 0.278CIA \qquad (8)$$

From analysis: debit of Arau Q = 317m^3 / second wide mean 54 m, Bar depth of water of Arau = 2.06 m Characteristic downstream in form of trapezium of A = (b + h) h x1/2
Angle inclination of river = 45^0.
P = circle wetly = b + 2hV^2
R=A/P
S = inclination of bar mean of Arau = 0.01
For the debit of Q = 317 m^3 / second, hence value of y = 0.85 meter, deepness of river mean = 2.06 meter, hence not happened floods middle area and Bar downstream of Arau. But low effect of depth of water him, speed of water Bar of Arau become to lower, so that happened sedimentation process (Score 4)

TABLE 5. Parameter of Morphometry floods

Parameter	Score	Total
Gradient = 0.6036217 % (low area)	2	
Rc = 0.26 (form of DAS) rather ellipse	2	
Closeness of drainage (Dd = 1.60) rather seldom	2	
Bevel (15%) precipitous	3	23.39
Usage of farm (middle)	3.28	Gristle floods
Rainfall (high)	5	Sedimentation
Form farm (rather low)	2.11	
High of pond (High)	4	

Table 6. Evacuasi in the Batang Arau

Area	Evacuasi location (above water sea)
Upstream: Parak Laweh Batung Taba Pegambiran	 17 metre 32 metre 23 metre
Middle: Andalas	17 metre
Downstream: Parak Rumbio Jati Baru Padang Pasir	 14 metre 7 metre 5 meter

II. Determination of floods Area

Using analysis of according by using program ARGIS, got the area of Pond from pate, upstream and down stream, can see the figure: Figure 1, 2 and 3 are area Upstream, Figure 4 is area middle and figure 5, 6, 7 are area down stream
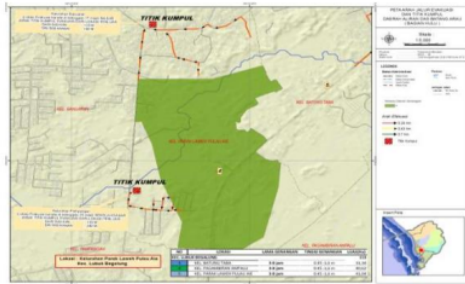

Fig. 1. Area of Pond and evakuasi of headwaters Parak Laweh

Fig. 2. Area of Pond and evakuasi of headwaters Batung Taba

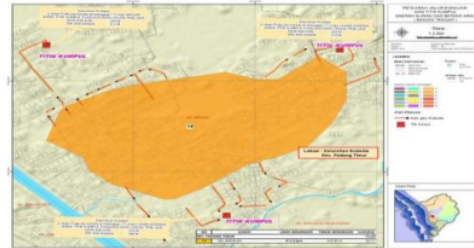Fig. 3. Area of Pond and evakuasi of headwaters Pegambiran
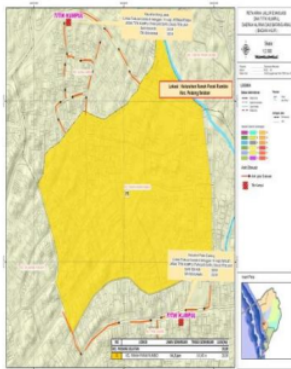

Fig.4. Area of Pond and evakuasi of middle Andalas

Fig. 5. Evakuasi of downstream Parak Rumbio

Fig 6. Evakuasi of downstream Jati Baru

Fig. 7. Evakuasi of downstream Padang Pasir

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