SECONDARY CHANNEL STUDY OF WAY METEN IRRIGATION AREA, WAY APU SUB-DISTRICT, BURU DISTRICT, MALUKU PROVINCE

[1]Rudi Serang, [2]Edison Hukom, [3]Willem Gaspersz, [4]Delvia R. Apalem

Construction Project Management
Ambon State Polytechnic
Indonesia.

Abstract- **Performance is a description of the level of achievement of the implementation of a program of activities or policies in realizing the objectives. The purpose of this study is to determine the physical condition of the secondary channel, obtain the performance of the secondary irrigation channel building function and obtain the amount of maintenance implementation costs for the Way Way Meten irrigation secondary channel in Way Apu District, Buru Regency. Based on the results of research and analysis of calculations there is damage to the walls and floor of the channel Left Section Section (BA.Ki) 4 with Left Section Section (BA.Ki) 6, and the results of the Assessment of the performance index of the physical infrastructure of the carrier channel using the Regulation of the Minister of PUPR Number 12 / PRT / 2015 concerning Exploitation and Maintenance of Irrigation Networks, obtaining an assessment result of 59.80% in section Ba.Ki.4 and obtaining an assessment result of 57.05% in section Ba.Ki.6 with the predicate Physical Infrastructure of Carrier Channels (Secondary Channels) DI. Way Way Meten is a bad condition, so heavy repairs or replacements are needed on secondary channels that are damaged. budget needs Way meten irrigation secondary channel with a length of 1,033 m which is damaged with a budget cost of Rp. 2,486,731,000.00, - (Two Billion Four Hundred Eighty Six Million Seven Hundred Thirty One Thousand Rupiah).**

Index Terms: **Breakdown, Performance, Repair.**

I. INTRODUCTION

Irrigation is a means of utilizing water resources that has a function as a provider, regulator and distributor of water to support agricultural land, especially in the dry season. Irrigation is organized with the aim of realizing comprehensive, integrated, and environmentally sound water benefits. One of the problems that commonly occur in the irrigation sector is the problem of water distribution, this problem can be caused by water discharge factors that do not meet the irrigation of irrigation areas which can be caused by small upstream discharge or caused by technical factors in the field such as the physical infrastructure of irrigation problems that can hamper the performance of the irrigation itself.

According to Moeheriono (2012), performance is a description of the level of achievement of the implementation of an activity program or policy in realizing the goals, objectives, vision, and mission of the organization as outlined in an organization's strategic planning. Irrigation networks according to the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 12/PRT/M/2015 are channels, buildings, and their appurtenant buildings which are a single unit required for the provision, distribution, provision, use, and disposal of irrigation water. Way Metan Irrigation Network is an irrigation network of Buru Regency so that management is in the Maluku Irrigation Service. With a total area of Irrigation Area served of 2220 Ha. Irrigation building

Way Meten Irrigation Network with an efficient and effective irrigation management system greatly affects the maximum agricultural production in the context of national food security. In maintaining optimal irrigation water, of course, good maintenance effort management is needed, maintenance efforts and assessment of the irrigation area must always be improved and supervised in its operation. Currently, the Secondary channel of Way Meten irrigation that has been built is inadequate in its service, and also the way apu dam construction program, it is necessary to rehabilitate the Way Meten Irrigation Area. Problems with the physical infrastructure, of course, can cause the irrigation function to be ineffective and efficient and not as expected due to a decrease in the quality of the physical infrastructure. Please note, irrigation physical infrastructure certainly has a very vital role in the irrigation sector itself. So by analyzing the maintenance of the physical infrastructure of this Irrigation Area, the condition and function of each existing physical infrastructure can be known so that maintenance can be carried out to maintain the function of the water network in an Irrigation Area to remain optimal. Based on the above, the author took research on the Study of Secondary Irrigation Channel Way Meten Way Apu District Buru Regency.

II. METHODS

Research Location

The location of this research is in the Secondary Channel of Way Meten Irrigation Area in the Working Area of Way Apu District Administration of Buru Regency, Maluku Province.

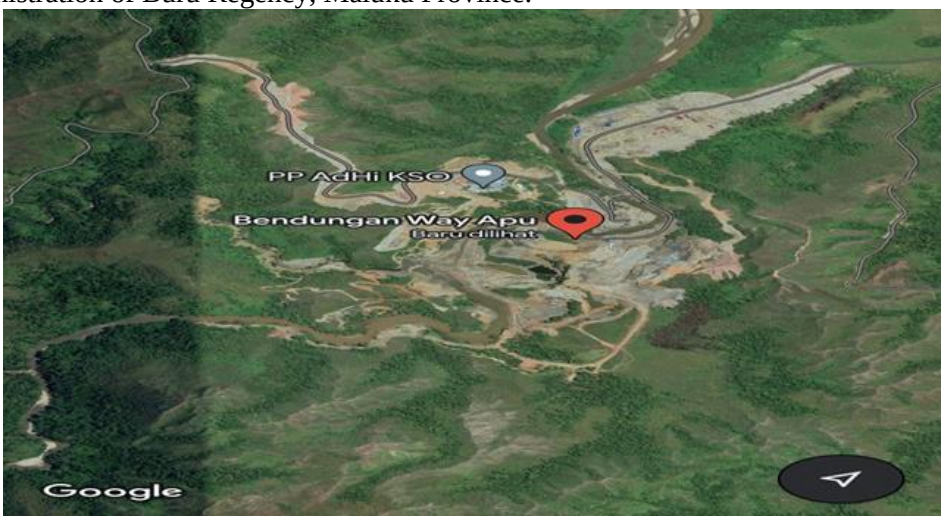


Figure 1 Secondary Channel Network of Way Meten Irrigation in Way Apu Sub-district

Data type

The types of data used in this study are:

a. Primary Data

Data Primary data is data obtained through surveys in the field, in the Way Meten Secondary Irrigation Canal Area consisting of :

1. Channel Condition
2. Discharge Measurement Data

b. Secondary Data

Secondary data is obtained by coordinating with related parties, namely from the Maluku River Basin Center. Secondary data consists of:

1. Technical data.
2. Schematic of the building up to the secondary network.Data Collection Technique.

Data collection technique

a. Field survey to assess all physical infrastructure and functionality of the Way Meten Irrigation Secondary Canal.

b. Secondary data collection obtained through coordination with the Maluku River Basin Center.

c. Literature study by conducting a study of books, literature, notes and reports that have to do with the analysis of the performance of Irrigation Areas.

Data source

Data sources from this research were obtained by coordinating with related parties, namely from the Maluku River Basin. Where the data needed is technical data, network schemes, and as built drawings, where the data is supporting data or references in the field when collecting data.

Metode analisis

The method that will be used for this assessment is quantitative. The types of data used are primary data and secondary data. The following are the research steps taken:

a. After ensuring that the formulation of the problem is clear enough, and the literature study is deemed to have met the needs of the research, primary and secondary data collection is then carried out.

b. Primary data collection consists of: Technical Data of Irrigation Area, Irrigation Area Network Scheme, Irrigation Area Building Scheme, and As Built Drawing of Irrigation Area. Primary data is needed for supporting data during primary data collection in the field.

c. Primary data collection is done by conducting field surveys to assess the condition and function of each existing physical infrastructure. Data collection is done by recording the condition and function of physical infrastructure in the field.

d. Recapitulating the primary data that has been obtained and processing the data before the data obtained is ready to be analyzed.

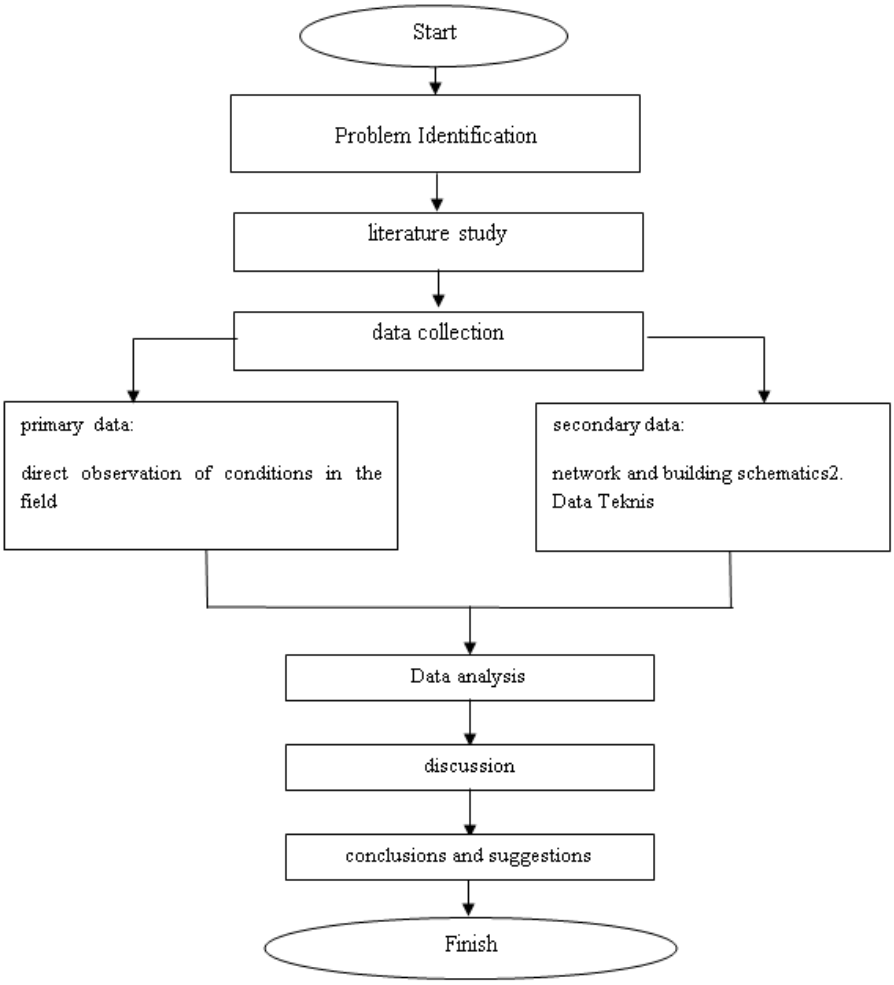
e. Analyzing the data and determining the recommendation value for the physical infrastructure that has been studied.

f. Calculating Volume and Cost, consisting of:
Inventory of Irrigation Network
Recapitulation of Performance Value Index Assessment
Final Performance Value Index Assessment

Table 1 Carrier Channel Irrigation Network Performance Index Assessment Form

Description		**Weight value standard**	**BP**	**SECONDARY CHANNEL CONDITION**							
				Very good (90 - 100)%		Good (80 < 90)%		Medium (60 < 80)%		Ugly (< 60)%	
				Bobot	%	Bobot	%	Bobot	%	Bobot	%
	1	2	3	12		13		14		15	
2	Carrier Channel	10	10								
2,1	channel capacity is sufficient to carry the maximum demand / plan discharge (primary & secondary)										
2,2	Embankment height sufficient to avoid overflow at all times during operation										
2,3	Implementation of channel repair & or maintenance has been completed										

Diagram alir



Gambar 1 Diagram Alir Penelitian

III. ANALYSIS AND DISCUSSION

Physical Condition of Way Meten Channel

For the condition and function of the Way Meten irrigation network is generally good, but there are several things that reduce the performance of the channel such as overgrown channels, several points of the channel experiencing damage / cracks and faults. The table below shows the results of the inventory carried out by the author, on the Way Meten Secondary channel, Way Apu District

Table 2 Inventory Results of Way Meten Secondary Channel

No	Building / Section	Conditions	Documentation
1	Carrier Channel		
	Way Meten Secondary Channel		
	- Left Section (BA.Ki) 1	a. The condition of the Couple is generally good	
	- Left Section (BA.Ki) 2	b. The condition of the Couple is generally good	

-	Left Section (BA.Ki) 3	c. The condition of the Couple is generally good	
-	Left Section (BA.Ki) 5	d. The condition of the Couple is generally good	
-	Left Section (BA.Ki) 7	e. The condition of the Couple is generally good	
	Left Section (BA.Ki) 4	f. Some spots There is damage to the channel walls and floor	
	Left Section (BA.Ki) 4		
	Left Section (BA.Ki) 4		
	Left Section (BA.Ki) 4		
	Left Section (BA.Ki) 6	g. There are cracks, longitudinal fractures on the floor and walls, growls (large holes), dry moss on the wall surface	
	Left Section (BA.Ki) 6		

		Left Section (BA.Ki) 6		
		Left Section (BA.Ki) 6		
		Left Section (BA.Ki) 6		
		Left Section (BA.Ki) 6		

Calculation of Way Meten Secondary Channel Discharge

a. Calculation to determine the discharge in the Way Meten Irrigation Area in the secondary channel on the left Section (BA.Ki) 4.

known:

Irrigated Area (A) = 652,40 Ha
Discharge Plan (Qr) = 1,287 m3/detik
Channel Length (L) = 511,55 m
Upstream Water Level (h1) = 0,80 m
Downstream Water Level (h2) = 0,80 m
Channel Bottom Width (b) = 1,6 m
Channel wall slope (m) = 1.00

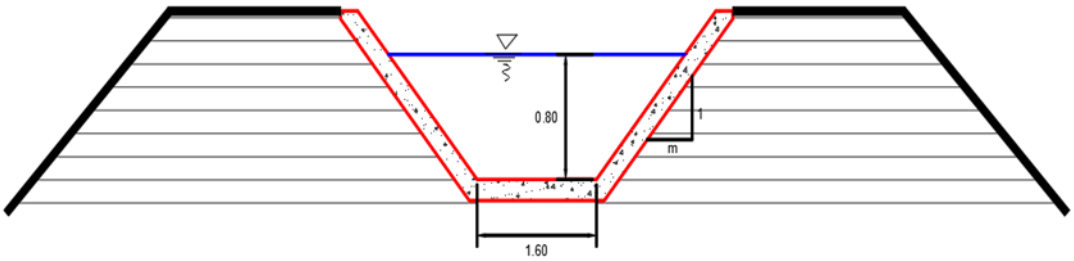


Figure 3 Upstream Secondary Channel

A (Wet Cross-Sectional Area)

$A_{upstream}$ =(b+ m.h)h
$A_{upstream}$ =(1,6+ 1.0,8)0,8
$A_{upstream}$ =1,92 m^2

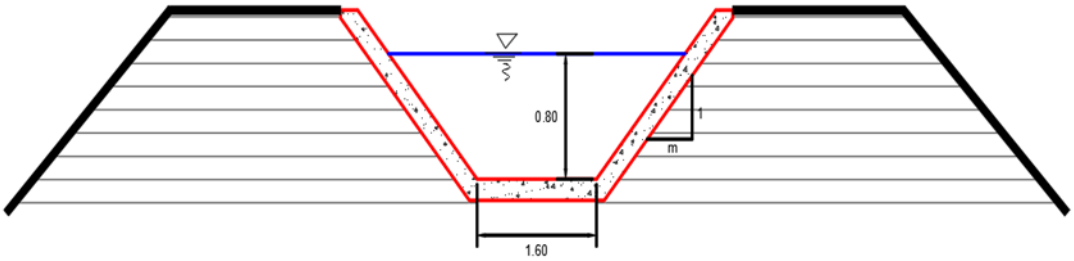


Figure 4 Downstream Secondary Channel

$A_{downstream} = (b + m.h)h$
$A_{downstream} = (1{,}6 + 1.0{,}8)0{,}8$
$A_{downstream} = 1{,}92\ m^2$
$$A = \frac{(A_{upstream} + A_{downstream})}{2}$$
$$A = \frac{(1{,}92\ m^2 + 1{,}92\ m^2)}{2}$$
$A = 1{,}92\ m^2$
V (Flow Velocity in the Channel) by doing 3 trials
$$V_1 = \frac{distance}{time}$$
$$V_1 = \frac{10\ m}{26{,}2\ sec}$$
$V_1 = 0{,}381\ m/sec$
$$V_2 = \frac{distance}{time}$$
$$V_2 = \frac{10\ m}{26{,}9\ det}$$
$V_2 = 0{,}371\ m/sec$
$$V_3 = \frac{distance}{time}$$
$$V_3 = \frac{10\ m}{26{,}5\ sec}$$
$V_3 = 0{,}377\ m/sec$
$$V\ average = \frac{(V_1 + V_2 + V_3)}{3}$$
$$V\ average = \frac{(0{,}381\ m/sec\ + 0{,}371\ m/sec + 0{,}377\ m/sec)}{3}$$
$V\ average = 0{,}376\ m/sec$
So the Discharge (Q) flowing in the Secondary Channel is :
$Q = A\ x\ V$
$Q = 1{,}92\ m^2\ x\ 0{,}376\ m/sec$
$Q = 0{,}721\ m^3/sec$
From the results of the above calculations, the Q obtained is 0.721 m3/sec and the plan Q is 1.287 m3/sec. The current Q does not meet the plan Q.

b. Calculation to determine the discharge in the Way Meten Irrigation Area in the secondary channel on the left section (BA.Ki) 6.
known :
Irrigated Area (A) = 567,60 Ha
Discharge Plan (Qr) = 1,119 m3/dt
Channel Length (L) = 1.522,17 m
Upstream Water Level (h1) = 0,35 m
Downstream Water Level (h2) = 0,35 m
Channel Bottom Width (b) = 1,60 m
Channel wall slope (m) = 1

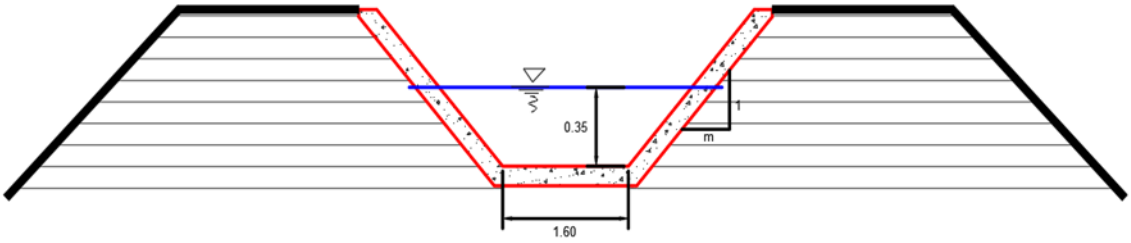


Figure 5 Upstream Secondary Channel

A (Wet Cross-Sectional Area)

$A_{upstream}$=(b+ m.h)h

$A_{upstream}$=(1,60+ 1.0,35)0,35

$A_{upstream}$=0,68 m^2

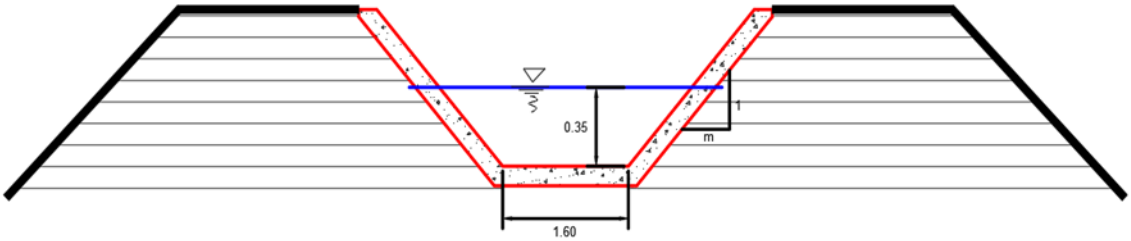


Figure 6 Downstream Secondary Channel

A (Wet Cross-Sectional Area)

$A_{downstream} = (b + m.h)h$

$A_{downstream} = (1{,}60 + 1.0{,}35)0{,}35$

$A_{downstream} = 0{,}68\ m^2$

$$A = \frac{(A_{upstream} + A_{downstream})}{2}$$

$$A = \frac{(0{,}68\ m^2 + 0{,}68\ m^2)}{2}$$

$$A = 0{,}68\ m^2$$

V (Flow Velocity in the Channel) by conducting 3 experiments

$$V_1 = \frac{distance}{time}$$

$$V_1 = \frac{10\ m}{26{,}3\ sec}$$

$$V_1 = 0{,}38\ m/sec$$

$$V_2 = \frac{distance}{time}$$

$$V_2 = \frac{10\ m}{26{,}6\ sec}$$

$$V_2 = 0{,}375\ m/sec$$

$$V_3 = \frac{distance}{time}$$

$$V_3 = \frac{10\ m}{26{,}2\ sec}$$

$$V_3 = 0{,}381\ m/sec$$

$$V\ average = \frac{(V_1 + V_2 + V_3)}{3}$$

$$V\ average = \frac{(0{,}38\ m/sec + 0{,}375\ m/sec + 0{,}381\ m/sec)}{3}$$

$$V\ average = 0{,}378\ m/sec$$

So the Debit (Q) that flowing in the Secondary Channel is :

$$Q = A\ x\ V$$

$$Q = 0{,}68\ m^2\ x\ 0{,}378\ m/sec$$

$$Q = 0{,}257\ m^3/sec$$

From the results of the above calculations, the Q obtained is 0.257 m3/sec and the plan Q is 1.119 m3/sec. The current Q does not meet the plan Q.

Criteria and Weighting for Assessment of Secondary Channel Function and Condition

Assessment of the weight of the function and condition of the Secondary Channel is carried out based on the Regulation of the Minister of Public Works and Public Housing Number 12/PRT/M/2015. The assessment of the Way Meten Secondary Channel adjusts the conditions from observations in the field. Weighting is carried out on the Left Section Section (BA.Ki) 4 and Left Section Section Section (BA.Ki) 6 of the Way Meten secondary channel after comparing the weight obtained with the standard weight determined in the Index (IKSI) method.

a. Way Meten Secondary Channel Left Section (BA.Ki) 4

Table 3 Assessment Data and Weighting of Secondary Channel Way Meten Left Section (BA.Ki) 4

no	**Description**	**weight value standard (%)**	**NO/BP**	**excellent condition (90-100)%**	**kondisi baik (80-<90)%**	**Good condition (60-<80)%**	**poor condition (<60)%**	**Description**
1	Carrier Channel	10						
1.1	Capacity of each channel each channel is sufficient to carry the discharge to the maximum demand / plan (secondary)	5	1 (50)	profile of each channel meets the plan capacity	profile on some sections underwent minor changes resulting in a 20% reduction in capacity	The profile of some channels changed and the capacity was reduced by more than 40% of the planned capacity.	The profile of each section changes and the capacity is reduced by more than 40% of the planned capacity.	
			2 (40)	Along the channel section there are no illegal tapping and no leaks, the efficiency meets the requirements.	There is illegal tapping and relatively small leaks that have little effect on channel capacity, efficiency is between 8% - 90%. There is one illegal intake for every 200 m of channel length..	There are several illegal taps and leaks that affect the channel capacity. Efficiency between 60% - 70% there is one illegal take for every 100 m of channel length.	There are many illegal taps and leaks that affect the plan capacity in quantity. Efficiency below 60% there is one illegal take for every 50 m of channel length.	
			3 (10)	There is no sediment or erosion that affects the channel capacity of the planned channel	Sediment or erosion has little effect on channel capacity between 10% - 20% of planned	Erosion deposits affect channel capacity 20% - 40% of the planned channel	Sediment or erosion has a major effect on channel capacity >40%	

				capacity.	channel capacity	capacity		
1.2	Embankment height sufficient to avoid overflow at all times during operation	2	1 (90)	Embankment has good stability, safe height to prevent overtopping during operation and rainy season (remaining height): - Earthen channel >30cm - Masonry channel >20%	The embankment has good stability, the guard height is still safe enough for the maximum elevation during operation and rainy season, (remaining guard height): - Earthen channel 20-30 cm - Cross-section channel 15-20 cm	The embankment has poor stability, the guard height is still safe enough for the maximum water elevation during operation and rainy season (remaining guard height): - Earthen channel 10-20 cm - Masonry channel 10-15 cm	Unstable embankment, unsafe height for maximum water elevation during operation and rainy season, (remaining height): - Earthen channel <10 cm - Masonry channel <15 cm or overflowing	
			2 (10)	The slope/external embankment wall is intact and there are no weeds.	Slopes / outer and / or inner embankment walls have landslides and wild plants	Slopes/external and/or internal embankment walls have landslides >20 - 40% and wild plants	Slope/external embankment wall and/or landslide >40% and lots of wild plants	
1.3	Implementation of channel repair and/or maintenance has been completed	3	1 (100)	Channel repairs in poor and moderate condition have been completed this year reaching 90 - 100%.	Channel repairs in poor and moderate condition have been completed this year reaching 80% - <90%	Channel repairs in poor and moderate condition have been completed this year only 60 - <80%	Repair of channels in poor and moderate condition that can be completed this year has not reached < 60%	

no	Description	weight value standard (%)	NO/BP	excellent condition (90-100)%	kondisi baik (80-<90)%	Good condition (60-<80)%	poor condition (<60)%	Description
1	Carrier Channel	10						
1.1	Capacity of each channel each channel is sufficient to carry the	5	1 (50)				The profile of each section changes	Damaged condition, if the condition is <60% of the initial

	discharge to the maximum demand / plan (secondary)						and the capacity is reduced by more than 40% of the planned capacity.	condition of the building/channel and heavy repair or replacement is required.
			2 (40)			There are several illegal taps and leaks that affect the channel capacity. Efficiency between 60% - 70% there is one illegal take for every 100 m of channel length.		Moderate condition, if the condition is 60 - <80% of the initial condition of the building / channel and maintenance is required which is repair in nature
			3 (10)		Sediment or erosion has little effect on channel capacity between 10% - 20% of planned channel capacity			Good condition, if the condition is 80 - <90% of the initial condition of the building/channel; and periodic maintenance is required.
1.2	Embankment height sufficient to avoid overflow at all times during operation	2	1 (90)	Embankment has good stability, safe height to prevent overtopping during operation and rainy season (remaining height): - Earthen channel >30cm - Masonry channel >20%				Very good condition, if the condition is 90 - 100% of the initial condition of the building / channel and routine maintenance is required

			2 (10)		Slopes / outer and / or inner embankment walls have landslides and wild plants			Good condition, if the initial condition of the building/channel; and periodic maintenance is required.
1.3	Implementation of channel repair and/or maintenance has been completed	3	1 (100)				Repair of channels in poor and moderate condition that can be completed this year has not reached < 60%	Damaged condition, if the condition is <60% of the initial condition of the building / heavy repair or replacement

Based on the assessment of the weight of the function and condition of the secondary channel, the calculation of the average weight is obtained based on table 3 assessment data and the weight of the secondary channel way meten Left Section (BA.Ki) 4 as follows :

Calculation 1. = (Average condition 1 x 50) + (Average condition 2 x 40) +(Average condition 3 x 10)
Capacity Condition = (55% x 50) + (70% x 40) + (85% x 10)
= 27,5% + 28% + 8,5%
= 64% (Medium Condition)
Calculation 2. = (Average condition 1 x 90) + (Average condition 2x 10)
Embankment Height Condition = (95% x 90) + (85% x 10)
= 85,5% + 8,5%
= 94% (Excellent Condition)
Calculation 3. = (Average condition 1 x 100)
Improvement Implementation Condition = (30% x 100)
= 30% (Poor Condition)

b. Secondary Channel Way Meten Left Section (BA.Ki) 6

Table 4 Assessment Data and Weighting of Secondary Channel Way Meten Left Section (BA.Ki) 6

no	**Description**	**weight value standard (%)**	**NO/BP**	**excellent condition (90-100)%**	**kondisi baik (80-<90)%**	**Good condition (60-<80)%**	**poor condition (<60)%**	**Description**
1	Carrier Channel	10						
1.1	Capacity of each channel each channel is sufficient to carry the discharge to	5	1 (50)	profile of each channel meets the plan capacity	profile on some sections underwent minor changes resulting in a 20%	The profile of some channels changed and the capacity was reduced by more than 40% of the	The profile of each section changes and the capacity is reduced by more than 40% of the planned	

	the maximum demand / plan (secondary)				reduction in capacity	planned capacity.	capacity.	
			2 (40)	Along the channel section there are no illegal tapping and no leaks, the efficiency meets the requirements.	There is illegal tapping and relatively small leaks that have little effect on channel capacity, efficiency is between 8% - 90%. There is one illegal intake for every 200 m of channel length..	There are several illegal taps and leaks that affect the channel capacity. Efficiency between 60% - 70% there is one illegal take for every 100 m of channel length.	There are many illegal taps and leaks that affect the plan capacity in quantity. Efficiency below 60% there is one illegal take for every 50 m of channel length.	
			3 (10)	There is no sediment or erosion that affects the channel capacity of the planned channel capacity.	Sediment or erosion has little effect on channel capacity between 10% - 20% of planned channel capacity	Erosion deposits affect channel capacity 20% - 40% of the planned channel capacity	Sediment or erosion has a major effect on channel capacity >40%	
1.2	Embankment height sufficient to avoid overflow at all times during operation	2	1 (90)	Embankment has good stability, safe height to prevent overtopping during operation and rainy season (remaining height): - Earthen channel >30cm - Masonry channel >20%	The embankment has good stability, the guard height is still safe enough for the maximum elevation during operation and rainy season, (remaining guard height): - Earthen channel 20-30 cm - Cross-section channel 15-20 cm	The embankment has poor stability, the guard height is still safe enough for the maximum water elevation during operation and rainy season (remaining guard height): - Earthen channel 10-20 cm - Masonry channel 10-15 cm	Unstable embankment, unsafe height for maximum water elevation during operation and rainy season, (remaining height): - Earthen channel <10 cm - Masonry channel <15 cm or overflowing	

			2 (10)	The slope/external embankment wall is intact and there are no weeds.	Slopes / outer and / or inner embankment walls have landslides and wild plants	Slopes/external and/or internal embankment walls have landslides >20 - 40% and wild plants	Slope/external embankment wall and/or landslide >40% and lots of wild plants	
1.3	Implementation of channel repair and/or maintenance has been completed	3	1 (100)	Channel repairs in poor and moderate condition have been completed this year reaching 90 - 100%.	Channel repairs in poor and moderate condition have been completed this year reaching 80% - <90%	Channel repairs in poor and moderate condition have been completed this year only 60 - <80%	Repair of channels in poor and moderate condition that can be completed this year has not reached < 60%	

no	**Description**	**weight value standard (%)**	**NO/BP**	**excellent condition (90-100)%**	**kondisi baik (80-<90)%**	**Good condition (60-<80)%**	**poor condition (<60)%**	**Description**
1	Carrier Channel	10						
1.1	Capacity of each channel each channel is sufficient to carry the discharge to the maximum demand / plan (secondary)	5	1 (50)				The profile of each section changes and the capacity is reduced by more than 40% of the planned capacity.	Damaged condition, if the condition is <60% of the initial condition of the building/channel and heavy repair or replacement is required.
			2 (40)			There are several illegal taps and leaks that affect the channel capacity. Efficiency between 60% - 70% there is one illegal take for every 100		Moderate condition, if the condition is 60 - <80% of the initial condition of the building / channel and maintenance is required which is repair in nature

						m of channel length.		
			3 (10)			Erosion deposits affect channel capacity 20% - 40% of the planned channel capacity		Moderate condition, if the condition is 60 - <80% of the initial condition of the building / channel and maintenance is required which is repair in nature.
1.2	Embankment height sufficient to avoid overflow at all times during operation	2	1 (90)	Embankment has good stability, safe height to prevent overtopping during operation and rainy season (remaining height): - Earthen channel >30cm - Masonry channel >20%				Very good condition, if the condition is 90 - 100% of the initial condition of the building / channel and routine maintenance is required
			2 (10)		Slopes / outer and / or inner embankment walls have landslides and wild plants			Good condition, if the initial condition of the building/channel; and periodic maintenance is required.
1.3	Implementation of channel repair and/or maintenance has been completed	3	1 (100)				Repair of channels in poor and moderate condition that can be completed this year has not reached < 60%	Damaged condition, if the condition is <60% of the initial condition of the building / heavy repair or replacement

Based on the assessment of the weight of the function and condition of the secondary channel, the calculation of the average weight of table 4 assessment data and the weight of the secondary channel way meten Left Section (BA.Ki) 6 is obtained as follows :

Calculations 1. = (Average condition 1 x 50) + (Average condition 2 x 40) + (Average condition 3 x 10)
Capacity Condition = (55% x 50) + (70% x 40) + 70% x 10)
= 27,5% + 28% + 7%
= 62,5% (Medium Condition)
Calculations 2. = (Average condition 1 x 90) + (Average condition 2x 10)
Embankment Height Condition = (95% x 90) + (85% x 10)
= 85,5% + 8,5%
= 94% (Excellent Condition)
Calculations 3. = (Average condition 1 x 100)
Improvement Implementation Condition = (30% x 100)
= 30% (Poor Condition)

Performance of Way Meten Secondary Channel

a. Secondary Channel Performance Index Assessment Left Section (BA.Ki) 4

From the results of the Secondary network performance index assessment, a performance index value of 5.98% of the maximum 10% assessment weight has been determined in the IKSI method. The following table calculates the secondary channel performance index.

Table 6 Performance Index of Way Meten Secondary Channel

Description		weight final %	value section %	index value Existing %	index value Maximum 100%	Description
1		2	3	4	5	6
1	Carrier Channel	5,98	100		10,00	
1.1	the capacity of each channel is sufficient to carry the maximum required / planned discharge	3,20	50	64,00	5,00	
1.2	Embankment height sufficient to avoid overflow at all times during operation	1,88	20	94,00	2,00	
1.3	All sewer repairs have been completed.	0,9	30	30	3,00	

The Way Meten Secondary Channel Performance Index uses the following calculation:
Final Weight = Existing Condition Index x Section Value x Carrier channel Maximum Condition Index.

b. Secondary Channel Performance Index Assessment Left Section (BA.Ki) 6

From the results of the Secondary network performance index assessment, a performance index value of 5.91% of the maximum 10% assessment weight has been determined in the IKSI method. The following table calculates the secondary channel performance index

Table 7 Performance Index of Way Meten Secondary Channel

Description		weight final %	value section %	index value Existing %	index value Maximum 100%	Description
1		2	3	4	5	6
1	Carrier Channel	5,91	100		10,00	
1.1	the capacity of each channel is sufficient to carry the maximum required / planned discharge	3,13	50	62,50	5,00	
1.2	Embankment height sufficient to avoid overflow at all times during operation	1,88	20	94,00	2,00	
1.3	All sewer repairs have been completed.	0,9	30	30	3,00	

RAB calculation

a. Channel Volume Calculation

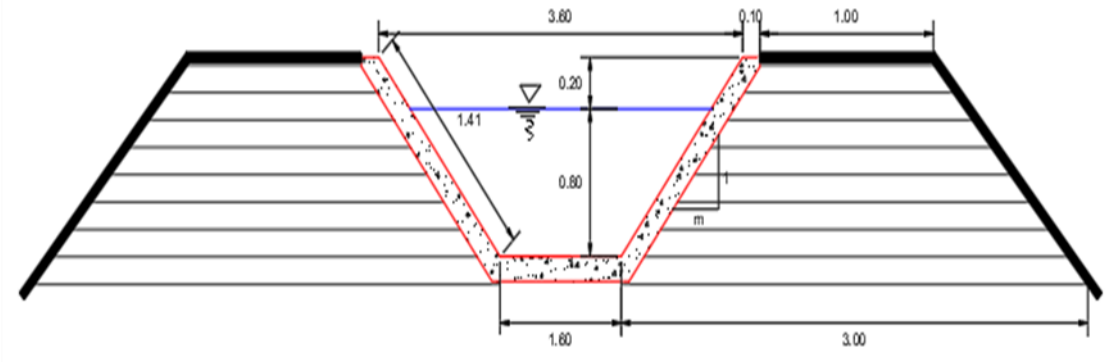


Figure 7 Secondary Channel

Concrete grade, f'c = 19,3 MPa (K225), slump (12±2) cm, w/c = 0,58

Left Wall Volume(m^3) = Wall Width (m) x Wall Thickness (m) x Long(m)

V. D. Ki (m^3) = 1,41 m x 0,10 m x 1.033 m

V. D. Ki (m^3) = 145,65 m^3

Right Wall Volume(m^3) = Wall Width (m) x Wall Thickness (m) x Long(m)

V. D. Ka (m^3) = 1,41 m x 0,10 m x 1.033 m

V. D. Ka (m^3) = 145,65 m^3

Channel Floor Volume (m^3) = Wall Width (m) x Wall Thickness (m) x Long(m)

V. L. Sa (m^3) = 1,60 m x 0,10 m x 1.033 m

V. L. Sa (m^3) = 165,28 m^3

Total Volumes (m^3) = Left Wall (m^3) + Right Wall (m^3) + Channel Floor(m^3)

Total Volumes (m^3) = 145,65 m^3 + 145,65 m^3 + 165,28 m^3

Total Volumes (m^3) = 456,58 m^3

Imported borrow area stockpiles

Left Backfill Volume (m^3) $= \frac{(Upper\ Width\ (m) + Lower\ Width\ (m))}{2}\ x\ Height\ (m)\ x\ Length\ (m)$

Left Backfill Volume (m^3) $= \frac{(1.00\ m + 3.00)}{2}\ x\ 1.00\ m\ x\ 1.033\ m$

Left Backfill Volume (m^3) $= 2.066\ m^3$

Right Backfill Volume(m^3) $= \frac{(Upper\ Width\ (m) + Lower\ Width\ (m))}{2}\ x\ Height\ (m)\ x\ Length\ (m)$

Right Backfill Volume (m^3) $= \frac{(1.00\ m + 3.00\ m)}{2}\ x\ 1.00\ m\ x\ 1.033\ m$

Right Backfill Volume(m^3) $= 2.066\ m^3$

$Total\ Volume\ of\ Backfill\ (m^3) = Right\ Backfill\ (m^3) + Left\ Backfill\ (m^3)$

$Total\ Volume\ of\ Backfill\ (m^3) = 2.066\ m^3 + 2.066\ m^3$

$Total\ Volume\ of\ Backfill\ (m^3) = 4.132\ m^3$

Striping

$Striping\ area\ (m^2) = Width\ (m) x\ Long(m)$

$Striping\ area\ (m^2) = 3\ m + 1.033\ m$

$Striping\ area\ (m^2) = 3.099\ m^2$

Excavation

Excavation Volume (m^3) $= Width\ x\ High\ (m)\ x\ Long\ (m)$

Excavation Volume (m^3) $= 1{,}60\ x\ 0{,}11\ m\ x\ 1.033\ m$

Excavation Volume (m^3) $= 181{,}8\ m^3$

b. Unit Price Analysis

Unit price analysis using the regulation of the minister of public works and public housing of the Republic of Indonesia Number 28/prt/m/2016 concerning Guidelines for analyzing the unit price of work in the field of public works and the price of wages and materials taken from the 2021 Basic Price of the Maluku Province Public Works Office..

Table 8 Unit price analysis to calculate 1¬ m3 quality, f'c = 19.3 MPa (K225), slump (12±2) cm, w/c = 0.58.

No	Description	Unit	Coefficient	Unit Price (Rp)	Amount (Rp)
I	MATERIALS				
1	Cement	kg	371,00	2.100,00	779.100,00
2	Gravel	kg	1.047,00	375,00	392.625,00
3	Concrete Sand	kg	698,00	350,00	244.300,00
4	Water	Liters	215,00	500,00	107.500,00
II	POWER				
1	Workers	Person/Day	1,3230	100.000,00	132.300,00
2	Stonemason	Person/Day	0,1890	125.000,00	23.625,00
3	Head Builder	Person/Day	0,0190	135.000,00	2.565,00
4	Foreman	Person/Day	0,1320	150.000,00	19.800,00
III	TOOLS				
1	Concrete Mixer	Day	0,2500	130.897,75	32.724,44
IV	Sub Total			Rp.	1.734.539,44
V	Indirect Costs (15%)			Rp.	260.180,92
VI	Total Price			Rp.	1.994.720,35

Table 9 Unit price analysis to calculate 1¬ m3 of imported borrow area embankment

No	Description	Unit	Coefficient	Unit Price (Rp)	Amount (Rp)
I	MATERIALS				
1	Borrow Area Urugan Land	m3	1,0000	150.000	150.000,00
II	POWER				
1	Foreman	Person/Day	0,0166	150.000	2.490,00
2	Workers	Person/Day	0,1660	100.000	16.600,00
III	TOOLS				
1	Excavator Operating Cost (Standard)	Hours	0,0277	612.828,35	16.954,92
2	Dump Truck Operating Cost	Hours	0,2176	358.721,92	78.057,89
3	Vibro Roller Operation Cost	Hours	0,0178	429.435,87	7.634,42
IV	Sub Total			Rp.	271.737,23
V	Indirect Costs (15%)			Rp.	40.760,58
VI	Total Price			Rp.	312.497,81

Table 10 Unit price analysis for calculating 1¬ m2 Striping

No	Description	Unit	Coefficient	Unit Price (Rp)	Amount (Rp)

I	MATERIALS				
II	POWER				
1	Workers	Person/Day	0,0600	100.000,00	6.000,00
2	Foreman	Person/Day	0,0060	150.000,00	900,00
III	TOOLS				
IV	Sub Total			Rp.	6.900,00
V	Indirect Costs (15%)			Rp.	1.035,00
VI	Total Price			Rp.	7.935,00

Table 11 Unit price analysis to calculate 1¬ m3 Earth Excavation

No	**Description**	**Unit**	**Coefficient**	**Unit Price (Rp)**	**Amount (Rp)**
I	MATERIALS				
II	POWER				
1	Workers	Person/Day	0,5630	100.000,00	56.300,00
2	Foreman	Person/Day	0,0563	150.000,00	8.445,00
III	TOOLS				
IV	Sub Total			Rp.	64.745,00
V	Indirect Costs (15%)			Rp.	9.711,75
VI	Total Price			Rp.	74.456,75

c. RAB Calculation

Based on the volume calculation with the unit price analysis, the cost budget plan for the work of the Way Meten Secondary Irrigation Canal in Way Apu District is obtained as follows:

ENGINEERING ESTIMATE					
Jobs	:	Way Meten Secondary Irrigation Canal			
Job Location	:	Way Apu Sub-district, Buru Regency			
No	**Work items**	**Unit**	**Volume**	**Unit price**	**Total price**
1	Concrete grade, f'c = 19,3 MPa (K225), slump (12±2) cm, w/c = 0,58	M3	456,58	1.994.720,35	910.749.417,40
2	Imported borrow area stockpiles	M3	4132	312.497,81	449.996.840,93
3	Striping	M2	3099	7.935,00	3.547.738,50
4	Excavation	M3	181,8	75.456,75	202.420.277,55
			A	Total Quantity	2.240.298.954,77
			B	Contingency (11%) x A	246.432.885,02
			C	Total A+B	2.486.731.839,79

		D	Rounded	2.486.731.000,00
Retrieved	Two Billion Four Hundred Eighty Six Million Seven Hundred Thirty One Thousand Rupiahs			

IV. CLOSING

Conclusion

In general, the physical condition of the channel and the function of the irrigation canal of the Way Meten irrigation area is generally still good to drain the flow of water to the rice fields in sections BA.Ki.1,2,3,5 And the assessment of the performance index of the physical infrastructure of the carrier channel using the Regulation of the Minister of PUPR Number 12 / PRT / 2015 concerning Exploitation and Maintenance of Irrigation Networks, obtained an assessment result of 59.80% in section Ba.Ki.4 and obtained an assessment result of 57.05% in section Ba.Ki.6 with the title Physical Infrastructure of Carrier Channels (Secondary Channels) DI. Way Meten is in poor condition and requires heavy repair or replacement of damaged secondary channels and budget requirements Way Meten irrigation secondary channels with a length of 1,033 m that are damaged, costing a budget of Rp. 2,486,731,000.00, - (Two Billion Four Hundred Eighty Six Million Seven Hundred Thirty One Thousand Rupiah).

REFERENCES:

1. Anonymous. 2010. "Irrigation Planning Standard Planning Criteria (KP 01-04)". Department of Public Works, Jakarta.
2. Mustapa Alihasmi Siregar1, Ivan Indrawan2, Performance Evaluation of Ujung Gurap Irrigation Network to Improve the Effectiveness and Efficiency of Irrigation Water Treatment.
3. Ministry of Public Works and Public Housing (2020). "Basic Irrigation Network Performance Module". Ministry of Public Works and Housing, Jakarta.
4. Ministry of Public Works and Housing (2016). "Basic Knowledge of PAI, IKSI and Aknop". Ministry of Public Works and Housing, Jakarta.
5. Ministry of Public Works and Housing (2015). "Regulation of the Minister of PUPR No. 12/PRT/M/2015: Exploitation and Maintenance of Irrigation Networks". Ministry of Public Works and Housing, Jakarta.
6. Ministry of Public Works and Housing (2012). "Regulation of the Minister of PUPR No. 13/PRT/M/2012: "Guidelines for Irrigation Asset Management". Ministry of Public Works and Housing, Jakarta.
7. Ministry of Public Works and Housing (2007). "Regulation of the Minister of PUPR No.32/PRT/M/2007: "Guidelines for Operation and Maintenance of Irrigation Networks". Ministry of Public Works and Housing, Jakarta.
8. Sudjarwadi, 1990. Theory and Practice of Irrigation. Yogyakarta. Gajah Mada University..
9. Rosany A. Nomleni1), Judi K. Nasjono2), Rosmiyati A. Bella2), "Calculation of Simulated Discharge with Measured Discharge at Das Manikin", Journal of Civil Engineering, Vol. VIII, No. 2, September 2019
10. Yulasni Astri1), Manyuk Fauzi2), Rinaldi2), "Performance Assessment of Irrigation Area Facilities and Infrastructure (DI) Muara Jalai Village, Kampar Regency", Jom Fak. Engineering, Volume 5 Edition 1 January to June 2018