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Priority Handling of Teurebeh Irrigation Assets, Aceh Besar District, Aceh Province

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Abstract – Teurebeh Irrigation scheme is one of the promising irrigation areas in Aceh Besar District, Aceh Province. It is also one of the buffers in the agricultural sector, covering 750 hectares of agricultural area. However, the construction has shrunk over time, and the evaluation at the end of 2020 classified it as "Poor Performance and Requiring Attention." This study aims to determine the handling priority for the irrigation networks at the Teurebeh Irrigation scheme. Data on irrigation network inventory was used as input. The determination of handling priority was conducted using the Mann-Whitney method. The ranking for determining the priority of irrigation assets is based on the condition and function of the irrigation assets. ArcGIS and Google Earth software were used to determine the condition and handling of all assets. The results show that the handling priority levels are between the primary and secondary channels. The priority for handling irrigation structure in the secondary channel is for two tapping structures, and one divider structure are ranked 1 to 3. They must be fixed immediately as severe to moderately damaged conditions are not functioning correctly. Furthermore, the priority for handling irrigation structure in the primary channel is for two bridges, and one divider structure are within priority 1 to 3. The Mann-Whitney test on the proposed hypothesis comparing the urgency level between the two channels is insignificant, indicating no significant difference between the handling of primary and secondary channels, as both have similar conditions and functions. The results are expected to contribute to decision-making at the Irrigation Department in designing proposals for renovating irrigation networks.

Keywords: The handling priority, Teurebeh Irrigation scheme, inventory, Mann–Whitney, statistic test

Introduction

Irrigation is natural engineering utilizing water from available sources and delivering it to previously lack-of or no-water irrigated land. Irrigated land contributes greatly to agricultural produce; thus, it requires more efficient handling of irrigation networks (Azmeri *et al.*, 2019). More importantly, water resources for irrigation support economic development (Krebs *et al.*, 1999; Tilman, Cassman, Matson, Naylor & Polasky, 2002; Van Dam *et al.*, 2006; Singh, 2010). Proper management and efficiency in using irrigation water is one way to sustain water resources (Fasakhodi, Nouri, & Amini, 2010) because agricultural irrigation need is the greatest and the most important in achieving food security (Faures, Svendsen & Turral, 2007).

Irrigation schemes contribute to the delivery of water for agriculture. Teurebeh irrigation scheme is a potential irrigation area in Teurebeh Village, Jantho District, Aceh Besar District (Permen No.14/PRT/M/2015), with an area of 750 ha. It is under the authority of Aceh Besar District. It is one of the buffers in the agricultural sector. However, this irrigated area has shrunk compared to its initial construction. The Planting Index (PI) Planning of Teurebeh Irrigation Area is 200. However, the agricultural data showed that the area planted with rice using irrigation was ± 880 Ha (in 2017) and ± 550 Ha (in 2018), indicating a significant reduction of ± 330 Ha (Department of Agriculture Aceh Besar, 2019). The reduction in the area of irrigated areas is the difference between the area stated in Permen PUPR 14/PRT/M/2015 concerning Criteria and Determination of the Status of Irrigation Areas and the current area. However, there is no detailed information regarding changes in land use. The inventory of previous research (Ar-Rahman, Azmeri & Refika, 2020) reported that the shrinkage of the land area is due to several factors: land conversion and the reduced water discharge either due to faults or leaks

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in the channel, decreasing the water reaching the rice fields, and illegal water tapping. Based on the field survey, the water discharge at the intake was reduced from 0.937 m3/second to 0.740 m3/second, or 21.025% in the dry season.

The issue of fulfilling irrigation water is closely related to the drainage efficiency index. Knowledge of the system's efficiency is paramount to study. It is helpful to determine a system's feasibility before installation and evaluate the post-construction performance, which is part of the Irrigation Asset Management (IAM). Every system has an inherent performance capacity. Many efficiency terms describe system performance (Azmeri, Winardi, & Jemi, 2020; Yanita, Azmeri, & Fatimah, 2020).

Management of Irrigation Assets is stated in the Permen PUPR No.23/PRT/M/2015. Article 2, paragraph 2 states that irrigation managers must be able to carry out effective, efficient, and sustainable management of irrigation assets. Inventory can identify important information on the condition of the irrigation network, the first step in the Irrigation Asset Management (IAM) framework. The complete stages of IAM include inventory, management planning, management implementation, evaluation of the implementation of irrigation asset management, and updating the results of the irrigation asset inventory. The product of the inventory activity is irrigation asset data in each irrigation area, stored in a database located at the irrigation area management office in accordance with their authority (Aditya, 2016; Nugraha, Wahyuni & Prayogo, 2019; Yahdita, Siswanto & Fauzi, 2020).

Based on the Permen PUPR No.23/PRT/M/2015 and the Participatory Irrigation Sector Project (PISP, 2008), the priority of managing irrigation assets is determined by priority ranking, according to the weight of the condition and function of irrigation assets. This priority ranking compares the handling scores of each building in the irrigation scheme to determine their level of urgency (Kusuma, Rispiningtati & Sayekti, 2012; Yanti & Panggabean, 2014; Yayan, 2013). An asset management information system is an application developed to determine asset priority levels. The Mann-Whitney (U Test) is a non-parametric statistical test for testing two unequal groups, and the treatment priorities will be compared (Davis, 1993). This study aims to determine the priority of handling irrigation assets in the Teurebeh irrigation scheme based on the ranking of the condition and function of irrigation assets using The Mann-Whitney (U Test). This study tested two variables: primary and secondary channel handling. This study requires irrigation network inventory data as input in analyzing the performance of irrigation assets. The use of Mann-Whitney (U Test) because the data sources are 2 different groups, where the research objects are different from one another. The Mann-Whitney (U Test) is also used if it is clearly known that there are differences in the Median, the form and distribution of the data are the same, but it is not certain whether the difference in the Median is significant or not (Uysal O.K. and Atis E. 2010). This independent variable from one another means that the data comes from different or unpaired groups. Some experts state that the Mann-Whitney (U Test) does not only test the difference in medians, but also tests the Mann-Whitney (U Test). Because in various cases, it was found that the Median of the two groups could be the same, but the resulting P value was small, namely <0.05, which means there was a difference. The reason is because the means of the two groups are significantly different. It can be concluded that this test not only tests the difference in the Median but also the difference in the mean (Arora *et al.*, 2022)

Materials and Methods

Study Location

Teurebeh Irrigation Area is a technical Irrigation Area located ± 5 Km from Jantho, Aceh Besar District. Geographically, it is located at 05°16'31.0" N and 95°34'00.6" E and is at an altitude of ± 86 meters above sea level. Teurebeh Irrigation Area is a free intake without a crest but only intake and drain gates (Figure 1).

Data collection and data analysis methods

This research required primary data from a site survey in the Teurebeh Irrigation Area. Data collection was conducted from May to July 2020 through direct observation of the irrigation areas by measuring irrigation assets' physical condition and function. Irrigation assets assessed in this study are limited to irrigation buildings, not including the channels. Irrigation channels were examined to assess the efficiency of the carrier channel.

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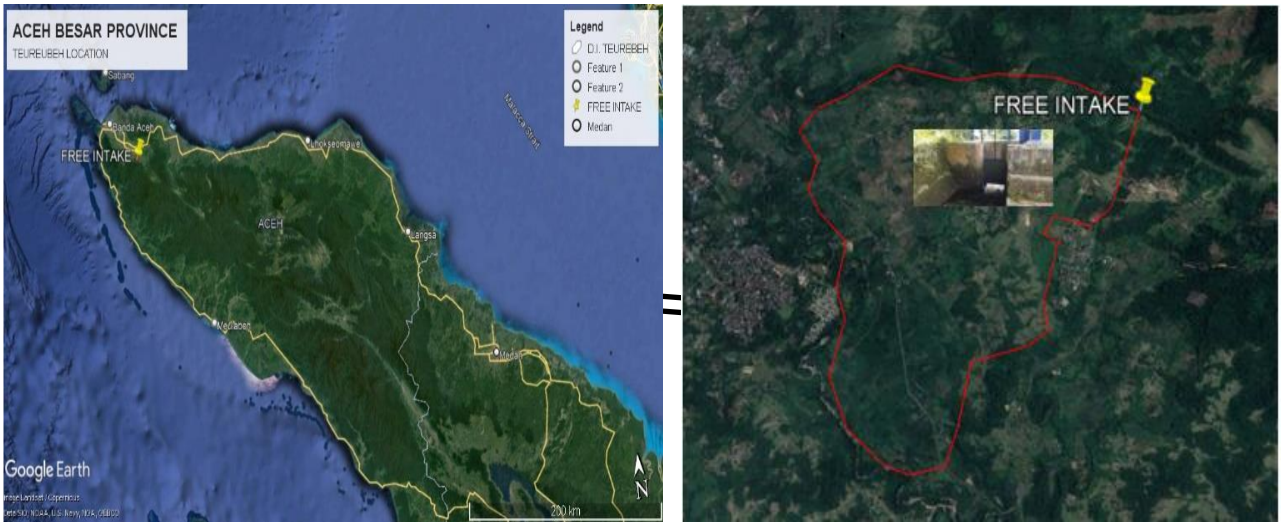

Figure 1. Study Location–Teurebeh Irrigation Area

Efficiency calculation in primary and secondary channels was done by comparing the discharge at the end and the channel's beginning. The efficiency assessment of the irrigation channel was undertaken by measuring the discharge flow rate upstream and downstream using hydrometry. Hydrometry was done by measuring the channel cross-section using a measuring tub and a meter and the flow velocity using a current meter. The results were then compared with the water transportation efficiency for the primary, secondary, and tertiary design channels, as presented in Table 1. The efficiency of the carrier channel at Teurebeh Irrigation Area based on the survey is presented in Table 2.

Table 1. Design Efficiency for primary, secondary, and tertiary channels in Indonesia

No	Channel Type	Design Efficiency (%)
1	Primary	75 – 90
2	Secondary	85 – 90
3	Tertiary	75 – 80

Source: KP01, 1986

The performance assessment of the Teurebeh Irrigation Area, including six indicators (physical infrastructure, crop productivity, supporting facilities, personnel organization, documentation, and water user associations conditions), shows a total value of 59.16%. It can be concluded that the performance of the Teurebeh Irrigation Area is "poor and needs attention" (Ministerial Regulation of Public Works and Housing or Permen PUPR No.12/PRT/M/2015).

The irrigation network scheme in Teurebeh is derived from data from the Irrigation Department of Aceh Besar District (Figure 2). However, the Aceh Besar District Irrigation Department does not have complete data for the boundaries of the Teurebeh irrigation area and irrigation structure. The boundary of the irrigation area (Figure 3) and the scheme of the Teurebeh irrigation structure (Figure 4) were obtained from the previous studies, which are part of this study. The nomenclature of naming for tapping and tapping structures can be seen in Figure 4. The irrigation building inventory reported that some of the tapping structures on this irrigation are illegal tapping, which did not exist in the initial planning of the irrigation area. Hence, the nomenclature is being adjusted. Irrigation area boundaries are presented using a GIS application. This data is used as a reference for asset inventory survey activities.

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Table 2. The Summary of Carrier Channel Efficiency

No	Channel	Channel Name	H (m)	B (m)	B1 (m)	A1 (m²)	V1 (m/d)	Q1 (m³/d)	H (m)	B (m)	B1 (m)	A2 (m²)	V2 (m/d)	Q2 (m3/d)	Eff	Mean
	RIVER		0.50	16.00	25.00	10.25	0.45	4.61								
1	Primary Channel	BDT.0 - BDT.1	0.33	1.80	2.40	0.69	1.07	0.74	0.25	1.50	1.80	0.41	0.76	0.31	0.42	0.70
2		BDT.1 - BDT.2	0.32	1.20	1.45	0.42	0.54	0.23	0.29	0.80	1.00	0.26	0.72	0.19	0.82	
3		BDT.2 - BDT.3	0.29	0.80	1.00	0.26	0.67	0.17	0.26	0.80	1.00	0.23	0.63	0.15	0.84	
4	Secondary Channel	BDT.3 - BDT.4	0.25	0.60	0.80	0.18	0.60	0.11	0.22	0.60	0.80	0.15	0.55	0.08	0.81	0.82
5		BDT.4 - BDT.5	0.22	0.60	0.80	0.15	0.55	0.08	0.20	0.60	0.80	0.14	0.50	0.07	0.83	
6		BDT.5 - BDT.6	0.25	0.50	0.50	0.13	0.53	0.07	0.23	0.50	0.50	0.12	0.54	0.06	0.94	
7		BDT.6 - BDT.7	0.23	0.50	0.50	0.12	0.53	0.06	0.20	0.50	0.50	0.10	0.51	0.05	0.84	
8		BDT.7 - BDT.8	0.20	0.50	0.50	0.10	0.50	0.05	0.17	0.50	0.50	0.09	0.40	0.03	0.68	

Source: Ar-rahman, Azmeri & Refika, 2020

where: H = water level in channel; B = width at the bottom of channel; B_1 and B_2 = width at the top of channel at upstream and downstream; A_1 and A_2 = channel area at upstream and downstream; v_1 and v_2 = water velocity at upstream and downstream; Q_1 and Q_2 = water discharge at upstream and downstream; Eff = channel efficiency.

Table 3. Summary of Teurebeh Irrigation Performance Assessment

Component	Available (%)	Max (%)	Min (%)	Optimum (%)
Physical Infrastructure	28.81	45.00	25	35
Crop Productivity	12.85	15.00	10	12.5
Supporting facilities	1.68	10.00	5	7,5
Personnel Organization	9.75	15.00	7.5	10
Documentation	0.70	5.00	2.5	5
Water user associations	5.38	10.00	5	7.5
Total	59.16	100	55	77.5

Source: Ar-rahman, Azmeri & Refika, 2020

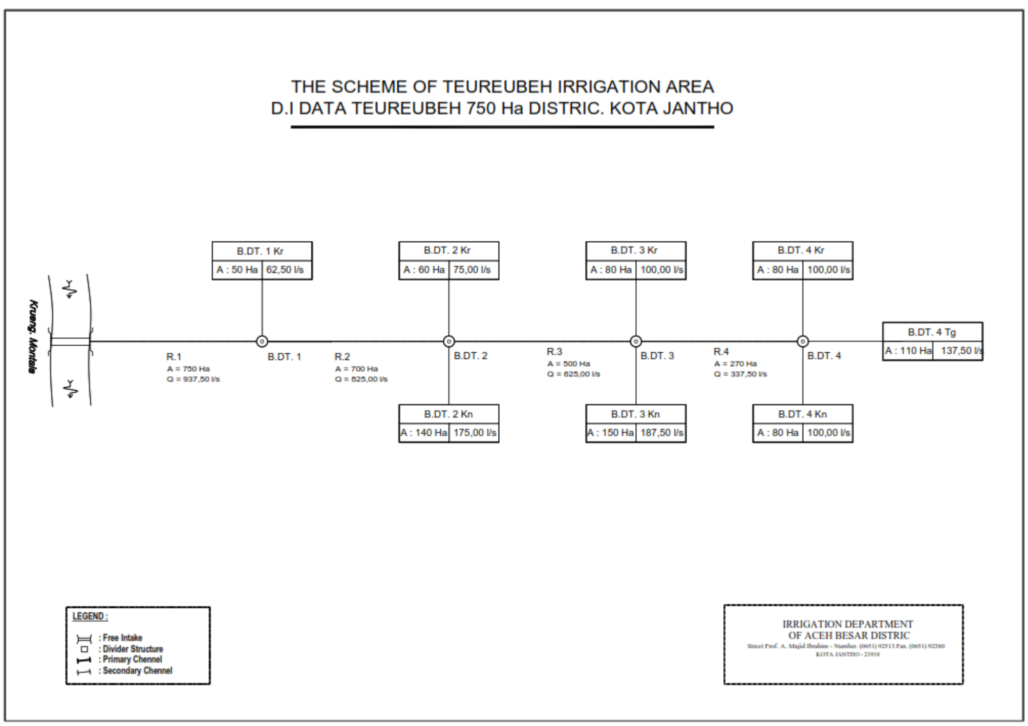

Figure 2. The Scheme of the Teurebeh Irrigation Area
(Source: Irrigation Department of Aceh Besar District, 2020)

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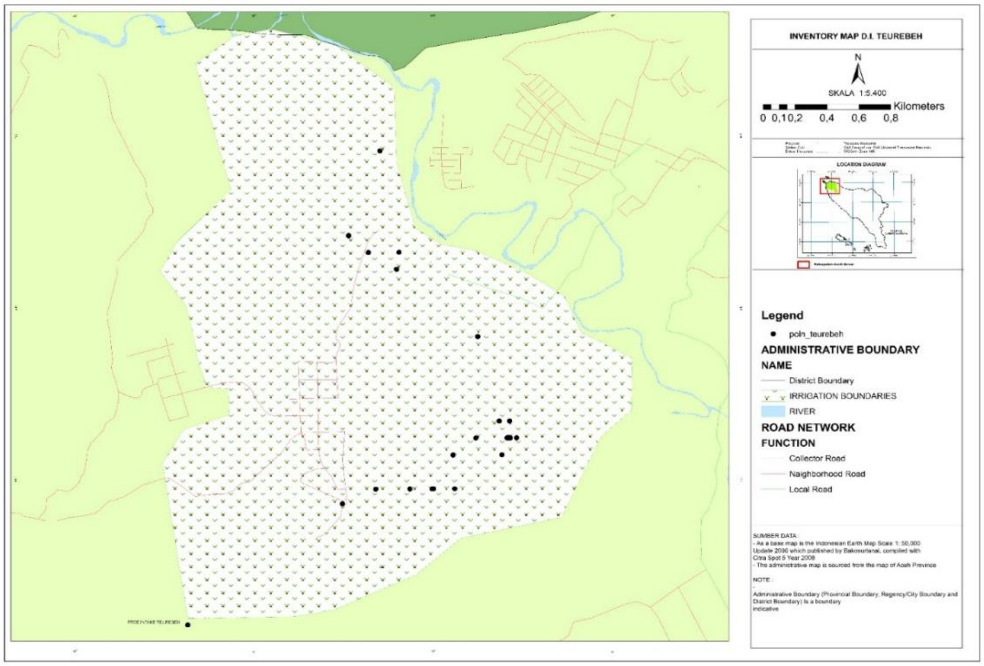

Figure 3. Map of Conditions and Functions of the Irrigation Structures
Source: Ar-rahman, Azmeri & Refika, 2020

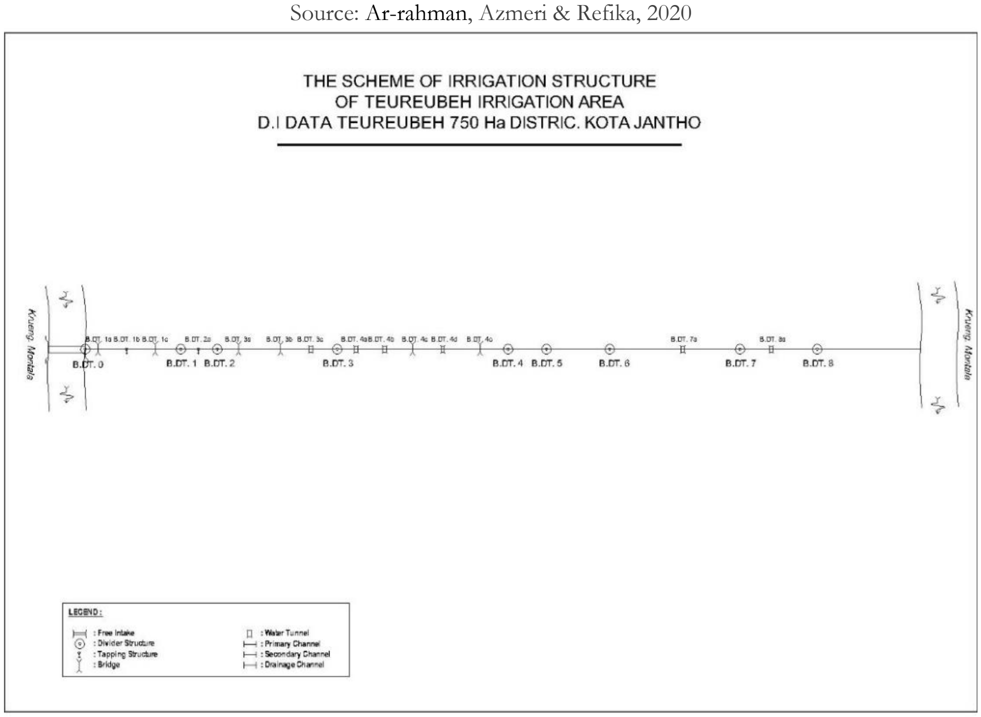

Figure 4. The Scheme of Irrigation Structure of Teurebeh Irrigation Area
(Source: Ar-rahman, Azmeri & Refika, 2020)

Asset condition and function criteria

The physical condition of irrigation assets is generally influenced by the age of the assets and other factors, including surveys, investigations, designs, building materials selection, construction implementation, operation, maintenance, and natural disasters. Quantitative numbers (%) are used as an indicator to determine the category of condition and function of assets based on the level of damage, as shown in Table 4 and Table 5.

Table 4. Quantitative Indicators of Asset Function

Damage Rate	Performance Rate	Function Category
0% - 20%	80% - 100%	Good
20% - 40%	60% - 80%	Fair
40% - 80%	20% - 60%	Poor
80% - 100%	0% - 20%	Not Functioning

Source: Participatory Irrigation Sector Project (PISP, 2008)

Table 5. Quantitative Indicators of Asset Condition

Damage Rate	Performance Rate	Condition Category
<10%	>90%	Excellent
10% - 20%	80% - 90%	Minor Damage
21% - 40%	60% - 80%	Moderate Damage
>40%	<60%	Major Damage

Source: Participatory Irrigation Sector Project (PISP, 2008) and Permen PUPR 23/PRT/M/2015

The consideration of the urgency level is provided below.
a) Very urgent, i.e., if the proposed maintenance needs to be implemented within the next one or two years.
b) Urgent, i.e., if the proposed maintenance needs to be implemented within the next three years.
c) Less urgent, i.e., if the proposed maintenance can be carried out within four years.
d) Long-term, i.e., if the proposed maintenance can be implemented within five years.

The Permen PUPR No.23/PRT/M/2015 stipulates that the priority of irrigation assets in irrigation asset management is determined by the priority ranking of assets according to the weight of the condition and function of irrigation assets using the following equation:

$$P = (K \text{ x } 0{,}35 + F^{1{,}5} \text{x } 0{,}65) \text{x } \left(\frac{A_D}{A_{DI}}\right)^{-0{,}5} \quad (1)$$

where: P = priority; K = Condition Score; F = Function Score; A_D= Area of Damage; dan A_{Di}= The Area of Irrigation Area

This priority is determined by comparing the handling scores of each construction in the Teurebeh Irrigation Area to obtain their level of urgency. Priority is calculated using MS Office Excel. An asset management information system is an application developed to determine asset priority levels. The resulting information system is user-friendly software with several GIS data, photos of assets, the condition of irrigation networks, asset functions, and nomenclature. This study's asset management information system employs the ArcGIS 10.3 application. It can map the condition of the Teurebeh Irrigation Area visually, equipped with photos of assets, building conditions, and networks covering each asset's physical condition and function, as well as information on the level of damage and the value of each asset in the structure.

Statistical analysis is done to compare two or more of the variables. Statistical analysis plays a role in decision-making for the hypothesis of the tested variables. Hypothesis testing is conducted, and it is concluded that the differences between the variables tested are significantly different. In this study, two variables were analyzed, namely the primary and secondary channels, so the Mann-Whitney test (U test) is more appropriate. The Mann-Whitney test is a ranking test for two groups of equal or unequal size (Siegel, 1956). This study compares treatment priority between primary and secondary channels in the Teurebeh Irrigation Area.

The Mann-Whitney test (U test) can be calculated using equations (2) and (3), provided that the number of samples (n) ≤ 20. Equation (2) is used to determine U using n1, and equation (3) is used to determine U using n2. The smallest between n1 and n2 are taken and compared to the U table.

$$U = n1\ n2 + \frac{n1(n1+1)}{2} - R1 \quad (2)$$

$$U = n1\ n2 + \frac{n2(n2+1)}{2} - R2 \quad (3)$$

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The null hypothesis is a population with the same mean. The alternative hypothesis is a population with unequal means. The hypothesis used is as follows: H_0:µ1 = µ2 is rejected if U < Uα, and H0 : µ1≠µ2 is accepted if U≥Uα.

Where: n_1 = number of elements in the smaller samples; n_2 = number of elements in the larger samples; R_1 = number of rankings in fewer samples; and R_2 = the number of ranks in the larger sample.

If n_1 and n_2 are greater than 20, the normal curve approach is used using the following equation.

$$E\,(U) = \frac{n1\;n2}{2} \tag{4}$$

$$\sigma U = \sqrt{\frac{n1\;n2\;(n1+n2+1)}{12}} \tag{5}$$

$$Z = \frac{U-E\,(U)}{\sigma U} \tag{6}$$

where: U = Mann-Whitney (U Test); n = number of observations in the group; R = number of ranks; E(U) = mean; U = standard deviation; and Z = standard value

For the above conditions, the following hypothesis is used: H_0 is rejected: $Z > \frac{Zu}{2}$ or $Z < \frac{Zu}{2}$, and H_0 is accepted if $-\frac{Zu}{2} \leq Z \leq \frac{Zu}{2}$.

Result

Irrigation and irrigation structure schemes serve as guidelines in describing the condition and function schemes of irrigation assets in Teurebeh. The scheme used a GIS application based on the performance index assessment. The data displayed are the latest structure image along with their coordinates, conditions, function, the latest nomenclature of the inventory results; and the boundaries of the Teurebeh Irrigation Area (see Figure 5 for more details).

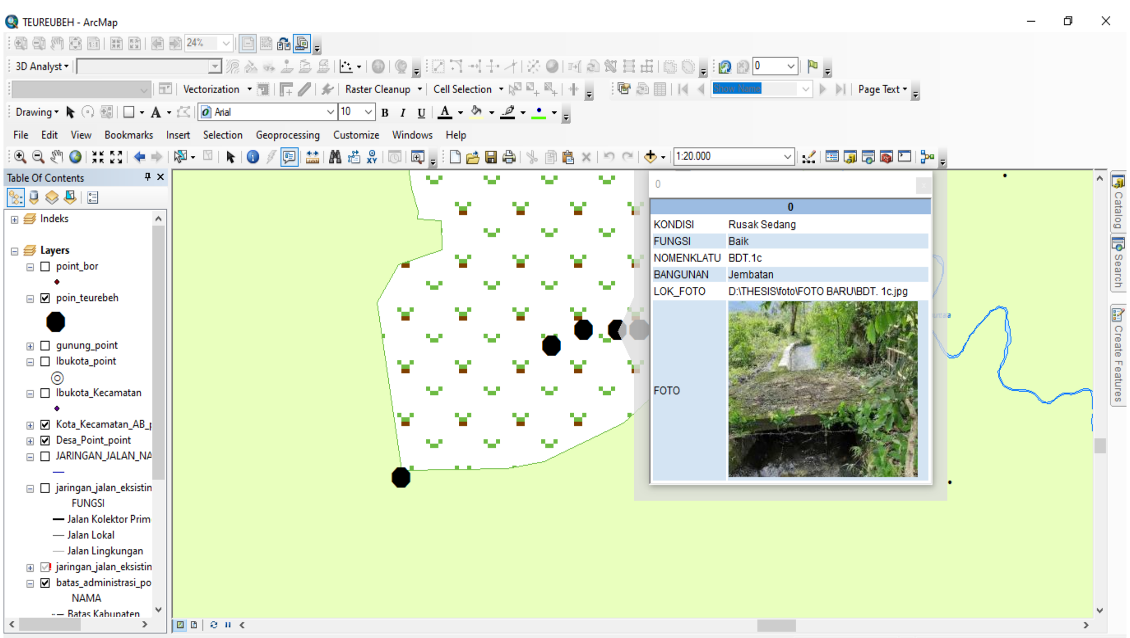

Figure 5. Map Display of the Irrigation Structure Conditions and Functions

Table 6. Teurebeh Irrigation Performance Ranking Based on Asset Conditions and Functions

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Nomenclature	Type	Area (ha)	Condition	Function	Condition Performance	Function Performance	Score	Rank
BDT.1a	Bridge	50	Moderate Damage	Good	74.71	90.00	3,151.60	7
BDT.1b	Tapping	50	Minor Damage	Good	87.50	90.00	6, 547.26	21
BDT.1c	Bridge	50	Moderate Damage	Good	70.00	90.00	3,345.63	8
BDT.1	Divider Structure	50	Moderate Damage	Fair	73.33	80.00	2,313.51	4
BDT.2a	Tapping	200	Moderate Damage	Fair	70.00	77.00	1,3115.05	22
BDT.2	Divider Structure	200	Moderate Damage	Fair	78.84	80.00	3,751.33	10
BDT.3a	Bridge	230	Minor Damage	Good	84.60	95.00	4,282.87	11
BDT.3b	Bridge	230	Minor Damage	Good	82.22	95.00	4,508.59	12
BDT.3c	Culvert	230	Minor Damage	Good	85.63	93.00	5,196.35	18
BDT.3	Divider Structure	230	Minor Damage	Good	89.33	95.00	4,958.41	16
BDT.4a	Culvert	160	Minor Damage	Good	84.58	95.00	5,155.92	17
BDT.4b	Culvert	160	Moderate Damage	Good	70.00	92.00	4,883.31	15
BDT.4c	Bridge	160	Minor Damage	Good	83.33	95.00	4,608.40	13
BDT.4d	Culvert	160	Excellent	Good	92.00	98.00	5,928.24	19
BDT.4e	Bridge	160	Minor Damage	Good	87.00	95.00	4,617.77	14
BDT.4	Tapping Structure	160	Major Damage	Not Functioning	50.00	0.00	247.49	3
BDT.5	Divider Structure	110	Moderate Damage	Fair	66.57	78.00	2,640.88	6
BDT. 6	Divider Structure	110	Major Damage	Not Functioning	53.70	0.00	189.70	2
BDT.7a	Culvert	110	Moderate Damage	Fair	72.22	80.00	3,833.48	11
BDT.7	Tapping Structure	110	Major Damage	Poor	50.00	50.00	2,367.81	5
BDT.8a	Culvert	110	Moderate Damage	Fair	78.89	75.00	3,516.24	9
BDT.8	Tapping Structure	110	Major Damage	Not Functioning	50.00	0.00	167.55	1
BDT.1 s/d BDT.3 Structure on Primary Channel								
BDT.4 s/d BDT.8 Structure on Secondary Channel								

After ranking the assets of the Teurebeh Irrigation Area, the urgency level of the primary and secondary channels was tested using the Mann-Whitney method to determine the priority level of handling (Table 7). The summary of the test is provided in Table 8.

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Table 7. The Summary of the Priority Ranking of Irrigation Assets in the Teurebeh Irrigation Area

No.	Data				Ranking	
	Structure	Primary	Structure	Secondary	Primary	Secondary
1	BDT.1a	3,151.60	BDT.4a	5,155.92	2.0	11.0
2	BDT.1b	6,547.26	BDT.4b	4,883.31	9.0	10.0
3	BDT.1c	3,345.63	BDT.4c	4,608.40	3.0	8.0
4	BDT.1	2,313.51	BDT.4d	5,928.24	1.0	12.0
5	BDT.2a	13,115.05	BDT.4e	4,617.77	10.0	9.0
6	BDT.2	3,751.33	BDT.4	247.49	4.0	3,0
7	BDT.3a	4,282.87	BDT.5	2,640.88	5.0	5,0
8	BDT.3b	4,508.59	BDT. 6	189.70	6.0	2.0
9	BDT.3c	5,196.35	BDT.7a	3,833.48	8.0	7.0
10	BDT.3	4,958.41	BDT.7	2,367.81	7.0	4.0
11			BDT.8a	3,516.24		6.0
12			BDT.8	167.55		1.0
MEAN		5,117.06		3,179.73	5.5	6.5

Based on the handling, priority levels are between the primary and secondary channels. The priority for handling irrigation structure in the secondary channel is for two tapping structures (BDT.8 and BDT.4) and one divider structure (BDT.6) are ranked 1 to 3. They must be fixed immediately as the conditions are severe to moderately damaged and not functioning poorly. Furthermore, the priority for handling irrigation structure in the primary channel is for two bridges (BDT.1a and BDT.1c), and one divider structure (BDT.1) are within priority 1 to 3. Overall, the assets require handling. If it is in good condition, handling means maintenance. For moderately damaged structures, replacement is needed, and for majorly damaged or not functioning structures, rebuilding or major repairs such as rehabilitation must be carried out as described in the research of Yanti & Panggabean (2014). Damage to irrigation network facilities and infrastructure can reduce the performance of irrigation water management systems. The decrease in the performance of the irrigation system affects the availability of water needed by rice plants in paddy fields in one unit area (Yahdita, Siswanto, Fauzi, 2020).

Table 8. The Summary of the Mann-Whitney Test

Parameter	Primary	Secondary
COUNT	10	12
RANK SUM	5.50	6.50
U	169.5	191.5
A	0.05	
Tails	2	
U	169.50	
U-crit	24	
Sig.	No	

The Sig "NO" means not significant, or H_0 is rejected; "YES" means significant, or H_0 is accepted. When H_0 is rejected, it means there is no significant difference between the two groups, the primary and secondary channels. Likewise, if H_0 is accepted, it indicates a significant difference between the two groups.

Discussion

From the results of the Mann-Whitney test, it can be concluded that there is no significant difference between the primary and the secondary channels because their condition and function are similar, indicating the priority of handling for the two channels is equal when all the findings are evaluated together, both the analysis based on the data obtained from the primary and the secondary channels, as well as the analysis based on the survey data reveal that the Man-White has been successful in assessing the priority of handling (Uysal and Atis, 2010).

The distribution efficiency in the Teurebeh primary channel is 70%. Thus, the water loss along the Teurebeh primary channel is 20% of the design efficiency for the primary channel (90%) (KP01, 1986). The field observations identified that the leading cause of the reduced efficiency of the primary channel was due to a moderate damage assessment with fair function in the divider structure (BDT.1), which was located at the beginning of the primary channel. In addition, the low-efficiency value was also caused by the broken and leaking channel drains and many illegal taps along the channel using stones or wood. This condition is in accordance with the results of research from Azmeri et al. (2019) and Azmeri et al. (2020).

Using the exact measurement and analysis method, the Teurebeh secondary channel efficiency is 82%, indicating 8% water loss along the secondary. The field observations identified that the main cause of the reduced efficiency of the secondary channel was that the tapping structure (BDT.4) and the divider structure (BDT.6 and BDT.8) were the major damage and non-functioning condition. On the other hand, the problems in the secondary channel were due to a large number of wild plants, leaks or cracks, and water withdrawal for fish cultivation, causing a shortage of irrigation water at a certain time. The problems throughout the research area are the main reason for the sub-optimal flow rate to reach the irrigated land.

The priority scale in handling irrigation networks must be determined robustly (Yanti, 2014). Therefore, scientific studies are necessary following the Minister of Public Works Regulation concerning Guidelines for the Operation and Maintenance of existing irrigation networks. The results of this study are expected to be the basis for decision-making at the Department of Public Works and Irrigation of Aceh Besar in designing and proposing a program for handling the irrigation networks in the Teurebeh Irrigation Area. The priority scale should be determined while reviewing the interests of the people using irrigation water and increasing agricultural production in the area (Kusuma et al. 2012).

Conclusion

The Mann-Whitney test on the proposed hypothesis comparing the urgency level between the two channels is insignificant, indicating no significant difference between the handling of primary and secondary channels, as both have similar conditions and functions. The priority for handling irrigation structure in the secondary channel is for two tapping structures (BDT.8 and BDT.4) and one divider structure (BDT.6) are ranked 1 to 3. The field observations identified that the main cause of the reduced efficiency of the secondary channel was that the tapping structure and the divider structure were the major damage and non-functioning condition. They must be fixed immediately as the conditions are severe to moderately damaged and not functioning poorly. Furthermore, the priority for handling irrigation structure in the primary channel is for two bridges (BDT.1a and BDT.1c), and one divider structure (BDT.1) is within priority 1 to 3. The field observations identified that the leading cause of the reduced efficiency of the primary channel was due to a moderate damage assessment with fair function in the divider structure (BDT.1), which was located at the beginning of the primary channel. The results of this study are expected to assist the Irrigation Department in decision-making and designing proposals for programs for repairing irrigation networks.

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