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Analysis of Irrigation Development Potential in Solo Vallei Werken Land

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Abstract:- ***The Solo Vallei Werken land is a very strategic state asset, the construction of the canal started in 1893 and then it was suspended so that the Solo Vallei land was abandoned.*** **For the management effort of Solo Vallei Warken, it is deemed very important to conduct an in-depth study, the results of which can be used as a reference, especially for the provision of irrigation water throughout the area.**

Analysis of dependable discharge, plant water needs and irrigation water needs are performed to ensure area that can be developed and the existing water availability. The analysis results are then followed by an economic feasibility analysis to determine the area development feasibility and economic benefits that will be obtained.

From the analysis of irrigation water needs, obtained the maximum amount of water needed in rice fields equal to 1,66 lt/sec/Ha. The 80% dependable discharge calculation was obtained at 228,37 m3/sec. Break Event Point (BEP) analysis shows B/C results > 1 break even in the third year. In 20, 25, and 30 years of the Solo Vallei development, obtained BCR = 3,323, 3,481, and 3,57 (feasible to be implemented). IRR analysis for 20, 25, and 30 benefit years yielded 51,177, 51,194, and 51,196. Identification results of the solo vallei warken acquisition stakes found that solo vallei warken acquisition stakes located in the southern part of Bengawan Solo, covering 62 thousand hectares area.

Keywords:- *Solo Vallei Warken; , Irrigation, Benefits.*

I. INTRODUCTION

In the areas of Bojonegoro, Tuban, Lamongan and Gresik around 1890 to 1930 there was a flood control development program and the construction of an irrigation network by the Dutch East Indies Government.. The development design is planned by making a new drain or channel parallel to the downstream of Bengawan Solo river starting from the western end of the Bojonegoro area until it empties into the Gresik area.

The program was followed up by purchasing community lands stretching from Ngluwak Subvillage, Luwihaji Village, Ngraho Subdistrict Bojonegoro to Gresik along 165 km, with a width of 150 m. The land purchased by the Dutch East Indies Government was named "Solo Vallei Werken".

The construction of the main canal began in 1893 to 1898 but was finally suspended for 32 years and stopped in 1930 because the budget that had been spent on land acquisition had exceeded the budget ceiling With the suspension of development, the land of Solo Vallei Werken was then used individually by local residents as agricultural and residential land.

Location of Solo Vallei Werken is located at 111°26'00"' to 112°41'00"' East Longitude and 6°49'00" to 7°25'00" South Latitude, starting from the Intake Structure at the upstream of the Karangnongko Barrage to the Gresik Regency along: 165 km, with a width of 150 m, and stretches east to the south of the Bengawan Solo river downstream to Kali Lamong along 130 km and a width of 150 m.

Solo Vallei Werken land is a very strategic state asset, if it is functioned optimally as a main channel and flood control, it can provide benefits to the community in various sectors, especially for regional areas (Bojonegoro, Tuban, Lamongan and Gresik Regencies). The main canal structure can be used as a flood control reservoir to reduce the flood issue in the downstream of Bengawan Solo River as well as a means of providing irrigation water, raw water and a solution to drought in the dry season.

For the management effort of Solo Vallei Warken, it is deemed very important to conduct an in-depth study, the results of which can be used as a reference, especially for the provision of irrigation water throughout the area. The results of this study are in line with the government's political commitment to implement the Sustainable Development Goals (SDGs), especially the number two goal, namely ending hunger, achieving food security and better nutrition and supporting sustainable agriculture.

The purpose of this study namely to determine the potential of Solo Vallei Werken for irrigation development and to determine the increase in food production and the economic benefits obtained in the development of the Solo Vallei Warken land.

II. LITERATURE REVIEW

A. Irrigation

Irrigation is an effort to provide water in the form of soil moisture as much as needed to grow and develop for plants (Najiyati:1987). Another definition of irrigation is artificially increasing the lack of soil water content, namely by providing water systematically to the cultivated soil.

B. Water Availability

The availability of water to meet irrigation water needs comes from the dependable discharge at the intake structure. Dependable discharge is the amount of available discharge to

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meet water needs with a calculated risk of failure. In the irrigation planning standard KP 01, the dependable discharge is the minimum river flow/discharge for a predetermined possibility that can be used for irrigation, with the probability of being fulfilled is set at 80% (the probability that the river discharge is lower than the dependable discharge is 20%) (Irrigation Planning Standard KP 01).

C. Irrigation Water Needs

Factors that influence the analysis of irrigation water needs for rice plant type among others: (Irrigation Planning Standards – KP 01, Director General of Water Resources, Ministry of Public Works).

1) *Land preparation.*
2) *Consumptive use / Water needs for plants.*
3) *Percolation and infiltration*
4) *Replacement of water layer.*
5) *Effective rainfall.*
6) *Irrigation Channel Efficiency (En)*

D. Economical Analysis

The economical analysis method used namely IRR (Interest Rate of Return), BCR (Benefit Cost Ratio), and BEP (Break Event Point) to determine the feasibility of the study.

Benefit Cost Ratio (BCR) is one of the analytical methods which is a comparison of the value of benefits (benefits) and the value of costs (cost) (Anna Mathofani, 2015). The project is considered feasible / profitable if the BCR value > 1 and is considered not feasible / detrimental if the BCR < 1.

Internal Rate of Return (IRR) is the discount rate that makes equal between the present value of cash receipts and the present value of the value or investment of discount rate which shows the net present value or equal to zero (Ni Putu Oki Wirastuti 2012).

BEP (Break Event Point) is the break-even point between revenues and expenses to be balanced. To reach the Break Event Point condition, the revenue must be equal to the total cost. (Wahyu Ramadhan, 2014).

III. METHODOLOGY

Based on the research objectives that have been determined, then the approach used in this study is a qualitative approach. The reason is that in carrying out actions on the object of research, then a detailed explanation of the irrigation development potential in the Solo Vallei Warken land is prioritized.

This research is included in the scope of water resources management, to determine the irrigation development potential in solo vallei werken land. So that with the development of Solo Vallei Warken as an irrigation area, it can provide benefits to the community by increasing agricultural production and contributing to an increase in income.

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IV. RESEARCH RESULTS

A. Dependable Discharge

The discharge data used to calculate the dependable discharge is the Napel AWLR discharge data. From the probability calculation, it is found that the dependable discharge is in the 5th order, namely in 2012.

TABLE I. NAPEL AWLR DISCHARGE DATA

NO.	TAHUN	Debit (m^3/dt)	TAHUN TERURUT	DEBIT TERURUT (m^3/dt)
1	2000	264,82	2019	176,62
2	2001	252,22	2005	200,92
3	2002	232,37	2014	203,74
4	2003	238,39	2004	216,87
5	2004	216,87	2012	228,37
6	2005	200,92	2018	229,51
7	2006	272,63	2002	232,37
8	2007	275,27	2003	238,39
9	2008	419,85	2020	238,70
10	2009	274,21	2001	252,22
11	2010	483,87	2000	264,82
12	2011	354,45	2006	272,63
13	2012	228,37	2009	274,21
14	2013	387,84	2007	275,27
15	2014	203,74	2015	285,55
16	2015	285,55	2017	334,99
17	2016	420,17	2011	354,45
18	2017	334,99	2013	387,84
19	2018	229,51	2008	419,85
20	2019	176,62	2016	420,17
21	2020	238,70	2010	483,87

B. Calculation of Irrigation Water Needs

Some of the assumptions used in the calculation of irrigation water needs in the study area are as follows:

1) *By natural rotation in tertiary plots, land preparation activities in all plots, namely taken 30 days, can be completed gradually.*
2) *Transplantation begins in the middle of the second month to half a month after land preparation (LP).*
3) *The cropping pattern in the irrigation area is defined as rice - rice - secondary crops with the type of secondary crops cultivation is corn.*

The calculation results of irrigation water needs obtained the results of 1,66 lt/sec/ha.

C. Economical Analysis

The budget plan for the implementation of the solo Vallei Warken development as an irrigation area which is an estimation price and its economic analysis can be seen in the table below.

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TABLE II. BUDGET PLAN

No	Uraian Pekerjaan	Jumlah Harga (Rp.)
I	PEKERJAAN PERSIAPAN	54,033,402,552.75
II	PEKERJAAN BANGUNAN	
2.1	Bangunan Intake	74,572,199,053.36
2.2	Bangunan Air	1,297,538,179,709.84
2.3	Saluran	1,806,638,013,641.35
	Biaya Langsung	**3,232,781,794,957.30**
	PPN (10 %)	**323,278,179,495.73**
	Total Biaya	**3,556,059,974,453.03**
	Dibulatkan	**3,556,059,974,000.00**

TABLE III. SOLO VALLEI WERKEN IRRIGATION RICE PLANTS BENEFITS

No	Luas Sawah Terairi (Ha)	Probabilitas Benefit (%)	Hasil Per/Ha (kg)	Harga *) (Rp)	Revenue
1	62,000	95	7,500	4,200	1,855,350,000,000
				Jumlah	**1,855,350,000,000**

TABLE IV. INDIRECT BENEFITS

No	Jenis Usaha	Nilai Usaha	Distribusi Usaha	Pertumbuhan Usaha *)	Probabilitas Benefit (%)	Keuntungan (Rp.)
1	Pertanian	1,855,350,000,000	3.57	0.122	60	44,590,071,834
					Jumlah	**44,590,071,834**

TABLE V. TOTAL BENEFIT

No	Benefit Type	Revenue
1	Direct benefits	Rp. 1.855.350.000.000
2	Indirect benefits	Rp. 44.590.071.834
		Rp. 1.899.940.071.834

Estimation of the operational and maintenance costs equal to 2,5% of construction costs = Rp. 88.901.499.361

TABLE VI. BREAK EVENT POINT (BEP)

No	Tahun	Investasi	Cost	Comulatif C	Benefit	Comulatif B	B / C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)=(7)/(5)
1	2022	PHASE 1	3,556,059,974,453	3,556,059,974,453		0	0.00
2	2023	O&P-->	88,901,499,361	3,644,961,473,814	1,899,940,071,834	1,899,940,071,834	0.52
3	2024	O&P-->	88,901,499,361	3,733,862,973,176	1,899,940,071,834	3,799,880,143,668	1.02
4	2025	O&P-->	88,901,499,361	3,822,764,472,537	1,899,940,071,834	5,699,820,215,502	1.49
5	2026	O&P-->	88,901,499,361	3,911,665,971,898	1,899,940,071,834	7,599,760,287,336	1.94
6	2027	O&P-->	88,901,499,361	4,000,567,471,260	1,899,940,071,834	9,499,700,359,170	2.37
7	2028	O&P-->	88,901,499,361	4,089,468,970,621	1,899,940,071,834	11,399,640,431,004	2.79
8	2029	O&P-->	88,901,499,361	4,178,370,469,982	1,899,940,071,834	13,299,580,502,838	3.18
9	2030	O&P-->	88,901,499,361	4,267,271,969,344	1,899,940,071,834	15,199,520,574,672	3.56
10	2031	O&P-->	88,901,499,361	4,356,173,468,705	1,899,940,071,834	17,099,460,646,506	3.93
11	2032	O&P-->	88,901,499,361	4,445,074,968,066	1,899,940,071,834	18,999,400,718,340	4.27
12	2033	O&P-->	88,901,499,361	4,533,976,467,428	1,899,940,071,834	20,899,340,790,174	4.61
13	2034	O&P-->	88,901,499,361	4,622,877,966,789	1,899,940,071,834	22,799,280,862,008	4.93
14	2035	O&P-->	88,901,499,361	4,711,779,466,150	1,899,940,071,834	24,699,220,933,842	5.24
15	2036	O&P-->	88,901,499,361	4,800,680,965,512	1,899,940,071,834	26,599,161,005,676	5.54
16	2037	O&P-->	88,901,499,361	4,889,582,464,873	1,899,940,071,834	28,499,101,077,510	5.83
17	2038	O&P-->	88,901,499,361	4,978,483,964,234	1,899,940,071,834	30,399,041,149,344	6.11
18	2039	O&P-->	88,901,499,361	5,067,385,463,596	1,899,940,071,834	32,298,981,221,178	6.37
19	2040	O&P-->	88,901,499,361	5,156,286,962,957	1,899,940,071,834	34,198,921,293,012	6.63
20	2041	O&P-->	88,901,499,361	5,245,188,462,318	1,899,940,071,834	36,098,861,364,846	6.88
21	2042	O&P-->	88,901,499,361	5,334,089,961,680	1,899,940,071,834	37,998,801,436,680	7.12
22	2043	O&P-->	88,901,499,361	5,422,991,461,041	1,899,940,071,834	39,898,741,508,514	7.36
23	2044	O&P-->	88,901,499,361	5,511,892,960,402	1,899,940,071,834	41,798,681,580,348	7.58
24	2045	O&P-->	88,901,499,361	5,600,794,459,764	1,899,940,071,834	43,698,621,652,182	7.80
25	2046	O&P-->	88,901,499,361	5,689,695,959,125	1,899,940,071,834	45,598,561,724,016	8.01

TABLE VII. BENEFIT COST RATION IN 20 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	30,627,497,116,819	0
2	2023	O&P-->	88,901,499,361	1,899,940,071,834	683,649,489,215	14,610,474,164,994
3	2024	O&P-->	88,901,499,361	1,899,940,071,834	610,401,329,656	13,045,066,218,745
4	2025	O&P-->	88,901,499,361	1,899,940,071,834	545,001,187,193	11,647,380,552,451
5	2026	O&P-->	88,901,499,361	1,899,940,071,834	486,608,202,851	10,399,446,921,851
6	2027	O&P-->	88,901,499,361	1,899,940,071,834	434,471,609,688	9,285,220,465,920
7	2028	O&P-->	88,901,499,361	1,899,940,071,834	387,921,080,079	8,290,375,416,000
8	2029	O&P-->	88,901,499,361	1,899,940,071,834	346,358,107,213	7,402,120,907,143
9	2030	O&P-->	88,901,499,361	1,899,940,071,834	309,248,310,012	6,609,036,524,235
10	2031	O&P-->	88,901,499,361	1,899,940,071,834	276,114,562,510	5,900,925,468,067
11	2032	O&P-->	88,901,499,361	1,899,940,071,834	246,530,859,384	5,268,683,453,631
12	2033	O&P-->	88,901,499,361	1,899,940,071,834	220,116,838,736	4,704,181,655,028
13	2034	O&P-->	88,901,499,361	1,899,940,071,834	196,532,891,729	4,200,162,191,989
14	2035	O&P-->	88,901,499,361	1,899,940,071,834	175,475,796,186	3,750,144,814,276
15	2036	O&P-->	88,901,499,361	1,899,940,071,834	156,674,818,023	3,348,343,584,175
16	2037	O&P-->	88,901,499,361	1,899,940,071,834	139,888,230,378	2,989,592,485,871
17	2038	O&P-->	88,901,499,361	1,899,940,071,834	124,900,205,695	2,669,279,005,242
18	2039	O&P-->	88,901,499,361	1,899,940,071,834	111,518,040,799	2,383,284,826,109
19	2040	O&P-->	88,901,499,361	1,899,940,071,834	99,569,679,285	2,127,932,880,454
20	2041	O&P-->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
					36,267,379,854,812	120,531,591,607,995
					B / C =	3.323

TABLE VIII. BENEFIT COST RATION IN 25 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	53,976,114,821,059	0
2	2023	O&P-->	88,901,499,361	1,899,940,071,834	1,204,823,991,541	25,748,647,632,286
3	2024	O&P-->	88,901,499,361	1,899,940,071,834	1,075,735,706,733	22,989,863,957,398
4	2025	O&P-->	88,901,499,361	1,899,940,071,834	960,478,309,583	20,526,664,247,677
5	2026	O&P-->	88,901,499,361	1,899,940,071,834	857,569,919,271	18,327,378,792,569
6	2027	O&P-->	88,901,499,361	1,899,940,071,834	765,687,427,920	16,363,731,064,793
7	2028	O&P-->	88,901,499,361	1,899,940,071,834	683,649,489,215	14,610,474,164,994
8	2029	O&P-->	88,901,499,361	1,899,940,071,834	610,401,329,656	13,045,066,218,745
9	2030	O&P-->	88,901,499,361	1,899,940,071,834	545,001,187,193	11,647,380,552,451
10	2031	O&P-->	88,901,499,361	1,899,940,071,834	486,608,202,851	10,399,446,921,851
11	2032	O&P-->	88,901,499,361	1,899,940,071,834	434,471,609,688	9,285,220,465,920
12	2033	O&P-->	88,901,499,361	1,899,940,071,834	387,921,080,079	8,290,375,416,000
13	2034	O&P-->	88,901,499,361	1,899,940,071,834	346,358,107,213	7,402,120,907,143
14	2035	O&P-->	88,901,499,361	1,899,940,071,834	309,248,310,012	6,609,036,524,235
15	2036	O&P-->	88,901,499,361	1,899,940,071,834	276,114,562,510	5,900,925,468,067
16	2037	O&P-->	88,901,499,361	1,899,940,071,834	246,530,859,384	5,268,683,453,631
17	2038	O&P-->	88,901,499,361	1,899,940,071,834	220,116,838,736	4,704,181,655,028
18	2039	O&P-->	88,901,499,361	1,899,940,071,834	196,532,891,729	4,200,162,191,989
19	2040	O&P-->	88,901,499,361	1,899,940,071,834	175,475,796,186	3,750,144,814,276
20	2041	O&P-->	88,901,499,361	1,899,940,071,834	156,674,818,023	3,348,343,584,175
21	2042	O&P-->	88,901,499,361	1,899,940,071,834	139,888,230,378	2,989,592,485,871
22	2043	O&P-->	88,901,499,361	1,899,940,071,834	124,900,205,695	2,669,279,005,242
23	2044	O&P-->	88,901,499,361	1,899,940,071,834	111,518,040,799	2,383,284,826,109
24	2045	O&P-->	88,901,499,361	1,899,940,071,834	99,569,679,285	2,127,932,880,454
25	2046	O&P-->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
					64,480,292,914,102	224,487,877,302,718
					B / C =	3.481

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TABLE IX. BENEFIT COST RATION IN 30 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	95,124,357,046,341	0
2	2023	O&P -->	88,901,499,361	1,899,940,071,834	2,123,311,541,213	45,377,915,008,406
3	2024	O&P -->	88,901,499,361	1,899,940,071,834	1,895,813,876,083	40,515,995,543,220
4	2025	O&P -->	88,901,499,361	1,899,940,071,834	1,692,690,960,788	36,174,996,020,732
5	2026	O&P -->	88,901,499,361	1,899,940,071,834	1,511,331,214,990	32,299,103,589,939
6	2027	O&P -->	88,901,499,361	1,899,940,071,834	1,349,402,870,526	28,838,485,348,160
7	2028	O&P -->	88,901,499,361	1,899,940,071,834	1,204,823,991,541	25,748,647,632,286
8	2029	O&P -->	88,901,499,361	1,899,940,071,834	1,075,735,706,733	22,989,863,957,398
9	2030	O&P -->	88,901,499,361	1,899,940,071,834	960,478,309,583	20,526,664,247,677
10	2031	O&P -->	88,901,499,361	1,899,940,071,834	857,569,919,271	18,327,378,792,569
11	2032	O&P -->	88,901,499,361	1,899,940,071,834	765,687,427,920	16,363,731,064,793
12	2033	O&P -->	88,901,499,361	1,899,940,071,834	683,649,489,215	14,610,474,164,994
13	2034	O&P -->	88,901,499,361	1,899,940,071,834	610,401,329,656	13,045,066,218,745
14	2035	O&P -->	88,901,499,361	1,899,940,071,834	545,001,187,193	11,647,380,552,451
15	2036	O&P -->	88,901,499,361	1,899,940,071,834	486,608,202,851	10,399,446,921,831
16	2037	O&P -->	88,901,499,361	1,899,940,071,834	434,471,609,688	9,285,220,465,920
17	2038	O&P -->	88,901,499,361	1,899,940,071,834	387,921,080,079	8,290,375,416,000
18	2039	O&P -->	88,901,499,361	1,899,940,071,834	346,358,107,213	7,402,120,907,143
19	2040	O&P -->	88,901,499,361	1,899,940,071,834	309,248,310,012	6,609,036,524,235
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23	2044	O&P -->	88,901,499,361	1,899,940,071,834	196,532,891,729	4,200,162,191,989
24	2045	O&P -->	88,901,499,361	1,899,940,071,834	175,475,796,186	3,750,144,814,276
25	2046	O&P -->	88,901,499,361	1,899,940,071,834	156,674,818,023	3,348,343,584,175
26	2047	O&P -->	88,901,499,361	1,899,940,071,834	139,888,230,378	2,989,592,485,871
27	2048	O&P -->	88,901,499,361	1,899,940,071,834	124,900,205,695	2,669,279,005,242
28	2049	O&P -->	88,901,499,361	1,899,940,071,834	111,518,040,799	2,383,284,826,109
29	2050	O&P -->	88,901,499,361	1,899,940,071,834	99,569,679,285	2,127,932,880,454
30	2051	O&P -->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
					114,201,085,602,984	407,694,372,813,176
					B / C =	3.570

TABLE X. INTERNAL RATE OF RETURN (IRR) IN 20 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	9,145,078,933,304,080	0
2	2023	O&P -->	88,901,499,361	1,899,940,071,834	151,231,510,192,461	3,232,013,052,680,020
3	2024	O&P -->	88,901,499,361	1,899,940,071,834	100,036,182,702,818	2,137,902,662,112,740
4	2025	O&P -->	88,901,499,361	1,899,940,071,834	66,171,645,294,133	1,414,173,680,047,080
5	2026	O&P -->	88,901,499,361	1,899,940,071,834	43,771,028,868,030	935,443,522,653,913
6	2027	O&P -->	88,901,499,361	1,899,940,071,834	28,953,533,793,058	618,774,480,406,131
7	2028	O&P -->	88,901,499,361	1,899,940,071,834	19,152,099,934,257	409,305,156,676,501
8	2029	O&P -->	88,901,499,361	1,899,940,071,834	12,668,675,765,571	270,745,993,228,448
9	2030	O&P -->	88,901,499,361	1,899,940,071,834	8,380,039,066,426	179,092,277,860,538
10	2031	O&P -->	88,901,499,361	1,899,940,071,834	5,543,204,045,499	118,465,442,855,928
11	2032	O&P -->	88,901,499,361	1,899,940,071,834	3,666,702,606,810	78,362,179,088,367
12	2033	O&P -->	88,901,499,361	1,899,940,071,834	2,425,439,853,275	51,834,787,963,822
13	2034	O&P -->	88,901,499,361	1,899,940,071,834	1,604,372,951,035	34,287,525,876,795
14	2035	O&P -->	88,901,499,361	1,899,940,071,834	1,061,255,987,254	22,680,413,616,670
15	2036	O&P -->	88,901,499,361	1,899,940,071,834	701,996,546,224	15,002,574,512,714
16	2037	O&P -->	88,901,499,361	1,899,940,071,834	464,354,648,482	9,923,859,670,888
17	2038	O&P -->	88,901,499,361	1,899,940,071,834	307,159,972,120	6,564,406,041,378
18	2039	O&P -->	88,901,499,361	1,899,940,071,834	203,179,291,478	4,342,204,354,470
19	2040	O&P -->	88,901,499,361	1,899,940,071,834	134,398,451,076	2,872,268,798,903
20	2041	O&P -->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
Usia Manfaat 20 Tahun Pengembangan Solo Vallei dengan IRR = 51.177 %					9,591,644,614,773,450	9,543,686,428,517,140
					B / C =	1.00

TABLE XI. INTERNAL RATE OF RETURN (IRR) IN 25 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	72,412,281,416,585,800	0
2	2023	O&P -->	88,901,499,361	1,899,940,071,834	1,197,338,942,508,800	25,588,682,449,482,300
3	2024	O&P -->	88,901,499,361	1,899,940,071,834	791,921,212,922,720	16,924,380,994,431,200
4	2025	O&P -->	88,901,499,361	1,899,940,071,834	523,777,507,948,533	11,193,808,065,482,200
5	2026	O&P -->	88,901,499,361	1,899,940,071,834	346,426,984,598,968	7,403,592,905,999,150
6	2027	O&P -->	88,901,499,361	1,899,940,071,834	229,127,165,327,088	4,896,743,992,824,560
7	2028	O&P -->	88,901,499,361	1,899,940,071,834	151,544,943,739,302	3,238,711,533,130,610
8	2029	O&P -->	88,901,499,361	1,899,940,071,834	100,231,982,271,345	2,142,087,152,239,050
9	2030	O&P -->	88,901,499,361	1,899,940,071,834	66,293,536,571,737	1,416,778,654,365,740
10	2031	O&P -->	88,901,499,361	1,899,940,071,834	43,846,613,541,880	937,058,864,933,801
11	2032	O&P -->	88,901,499,361	1,899,940,071,834	29,000,195,471,705	619,771,700,854,795
12	2033	O&P -->	88,901,499,361	1,899,940,071,834	19,180,759,229,987	409,917,642,908,786
13	2034	O&P -->	88,901,499,361	1,899,940,071,834	12,686,173,960,368	271,119,952,292,340
14	2035	O&P -->	88,901,499,361	1,899,940,071,834	8,390,648,556,868	179,319,016,399,002
15	2036	O&P -->	88,901,499,361	1,899,940,071,834	5,549,583,619,522	118,601,782,607,403
16	2037	O&P -->	88,901,499,361	1,899,940,071,834	3,670,500,336,337	78,443,341,482,281
17	2038	O&P -->	88,901,499,361	1,899,940,071,834	2,427,672,712,536	51,882,507,055,351
18	2039	O&P -->	88,901,499,361	1,899,940,071,834	1,605,665,238,836	34,315,143,739,211
19	2040	O&P -->	88,901,499,361	1,899,940,071,834	1,061,988,646,943	22,696,071,502,221
20	2041	O&P -->	88,901,499,361	1,899,940,071,834	702,400,387,675	15,011,205,127,063
21	2042	O&P -->	88,901,499,361	1,899,940,071,834	464,568,341,693	9,928,426,571,299
22	2043	O&P -->	88,901,499,361	1,899,940,071,834	307,265,980,899	6,566,671,586,145
23	2044	O&P -->	88,901,499,361	1,899,940,071,834	203,226,037,043	4,343,203,367,685
24	2045	O&P -->	88,901,499,361	1,899,940,071,834	134,413,910,747	2,872,599,192,089
25	2046	O&P -->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
Usia Manfaat 25 Tahun Pengembangan Solo Vallei dengan IRR = 51.194 %					75,948,264,269,946,700	75,568,528,817,646,200
					B / C =	1.00

TABLE XII. INTERNAL RATE OF RETURN (IRR) IN 30 YEARS

No	Tahun	Investasi	Cost	Benefit	FV Cost	FV Benefit
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1	2022	PHASE 1	3,556,059,974,453	0	572,318,556,479,559,000	0
2	2023	O&P -->	88,901,499,361	1,899,940,071,834	9,463,189,444,157,900	202,240,602,931,086,000
3	2024	O&P -->	88,901,499,361	1,899,940,071,834	6,258,888,756,420,740	133,760,551,159,479,000
4	2025	O&P -->	88,901,499,361	1,899,940,071,834	4,139,586,203,616,990	88,468,313,420,645,600
5	2026	O&P -->	88,901,499,361	1,899,940,071,834	2,737,893,994,296,800	58,512,337,244,798,500
6	2027	O&P -->	88,901,499,361	1,899,940,071,834	1,810,824,356,660,760	38,699,659,544,431,400
7	2028	O&P -->	88,901,499,361	1,899,940,071,834	1,197,666,840,829,620	25,595,690,060,869,000
8	2029	O&P -->	88,901,499,361	1,899,940,071,834	792,128,654,745,908	16,928,814,294,603,700
9	2030	O&P -->	88,901,499,361	1,899,940,071,834	523,908,472,939,699	11,196,601,956,800,200
10	2031	O&P -->	88,901,499,361	1,899,940,071,834	346,509,479,708,259	7,405,355,933,225,890
11	2032	O&P -->	88,901,499,361	1,899,940,071,834	229,178,999,251,474	4,897,851,750,857,090
12	2033	O&P -->	88,901,499,361	1,899,940,071,834	151,577,422,188,070	3,239,405,639,604,950
13	2034	O&P -->	88,901,499,361	1,899,940,071,834	100,252,270,025,708	2,142,520,727,800,300
14	2035	O&P -->	88,901,499,361	1,899,940,071,834	66,306,165,524,027	1,417,048,551,416,900
15	2036	O&P -->	88,901,499,361	1,899,940,071,834	43,854,444,247,220	937,226,217,239,149
16	2037	O&P -->	88,901,499,361	1,899,940,071,834	29,005,029,397,088	619,875,008,094,890
17	2038	O&P -->	88,901,499,361	1,899,940,071,834	19,183,728,006,751	409,981,089,509,570
18	2039	O&P -->	88,901,499,361	1,899,940,071,834	12,687,986,459,133	271,158,687,736,164
19	2040	O&P -->	88,901,499,361	1,899,940,071,834	8,391,747,439,835	179,342,500,949,869
20	2041	O&P -->	88,901,499,361	1,899,940,071,834	5,550,244,344,980	118,615,903,165,341
21	2042	O&P -->	88,901,499,361	1,899,940,071,834	3,670,893,638,046	78,451,746,848,687
22	2043	O&P -->	88,901,499,361	1,899,940,071,834	2,427,903,937,965	51,887,448,641,953
23	2044	O&P -->	88,901,499,361	1,899,940,071,834	1,605,799,054,185	34,318,003,546,359
24	2045	O&P -->	88,901,499,361	1,899,940,071,834	1,062,064,508,442	22,697,692,760,628
25	2046	O&P -->	88,901,499,361	1,899,940,071,834	702,442,199,822	15,012,098,706,730
26	2047	O&P -->	88,901,499,361	1,899,940,071,834	464,590,465,238	9,928,899,380,096
27	2048	O&P -->	88,901,499,361	1,899,940,071,834	307,276,955,236	6,566,906,121,919
28	2049	O&P -->	88,901,499,361	1,899,940,071,834	203,230,875,973	4,343,306,781,872
29	2050	O&P -->	88,901,499,361	1,899,940,071,834	134,415,510,974	2,872,633,391,010
30	2051	O&P -->	88,901,499,361	1,899,940,071,834	88,901,499,361	1,899,940,071,834
Usia Manfaat 30 Tahun Pengembangan Solo Vallei dengan IRR = 51.196 %					600,265,808,238,465,000	597,268,931,298,565,000
					B / C =	1.00

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D. Discussion

The results of the analysis for irrigation water needs obtained the maximum amount of water needs in the rice fields equal to 1,66 lt/sec/Ha. The identification results of the solo vallei warken acquisition stakes found that the solo vallei warken acquisition stakes were located in the Bojonegoro Regency and Lamongan Regency only, namely in the southern part of Bengawan Solo. Based on this, the development of irrigation in the Solo Vallei Warken land allows only the area in the southern part of Bengawan Solo covering an area of 62 thousand hectares, in accordance with the identified acquisition stakes.

The availability of irrigation water from the analysis of the dependable discharge per 10 days can be seen that the availability of water for irrigation development in the Solo Vallei Warken land can be met in the period from November the third week to the month of May the first week. In the period of the second week of May to the second week of November, the water availability from Bengawan Solo is less. Based on the results of the analysis, to meet the irrigation water needs in that period, an operational pattern can be carried out by functioning the field reservoir as storage in the rainy season, which then can be released for irrigation needs in the dry season, so that irrigation water needs can be met throughout the planting season period.

TABLE XIII. THE 10 DAILY DEPENDABLE DISCHARGE AT SOLO VALLEI WARKEN

Bulan	Periode	Jumlah Hari	Alfa	C	Q 80%
Jan	I	10	0.601	4.041	756.793
	II	10	0.601	5.275	987.954
	III	11	0.601	2.648	495.936
Feb	I	10	0.601	3.037	568.720
	II	10	0.601	2.538	475.308
	III	8	0.601	4.029	754.551
Mar	I	10	0.601	3.312	620.217
	II	10	0.601	2.065	386.732
	III	11	0.601	1.200	224.662
Apr	I	10	0.601	3.216	602.287
	II	10	0.601	1.152	215.829
	III	10	0.601	0.644	120.572
Mei	I	10	0.601	1.416	265.175
	II	10	0.601	0.390	73.077
	III	11	0.601	0.276	51.694
Juni	I	10	0.601	0.324	60.732
	II	10	0.601	0.294	55.123
	III	10	0.601	0.261	48.871
Juli	I	10	0.601	0.184	34.501
	II	10	0.601	0.155	28.947
	III	11	0.601	0.134	25.160
Agt	I	10	0.601	0.101	18.887
	II	10	0.601	0.082	15.378
	III	11	0.601	0.074	13.908
Spt	I	10	0.601	0.065	12.217
	II	10	0.601	0.061	11.449
	III	10	0.601	0.104	19.416
Okt	I	10	0.601	0.043	8.028
	II	10	0.601	0.107	20.011
	III	11	0.601	0.072	13.474
Nov	I	10	0.601	0.138	25.852
	II	10	0.601	0.502	93.964
	III	10	0.601	1.157	216.668
Des	I	10	0.601	1.249	233.979
	II	10	0.601	2.155	403.664
	III	11	0.601	1.695	317.511

Economical analysis parameters can be seen for Break Event Point (BEP) analysis showing B/C results > 1 break even in the third year. The calculation of the Benefit Cost of Ratio is based on the formulation of the comparison between the Total Future Value Benefit to the Total Future Value Cost, the comparison if B/C ratio > 1 means the project is feasible, if the opposite result is obtained or B/C < 1 then the project is not feasible to be implemented. Total Future Value is calculated with an investment interest rate of 12%. The results of the analysis are obtained:

In the 20 years of Solo Vallei development, obtained BCR = 3,323 (feasible to be implemented).

In the 25 years of Solo Vallei development, obtained BCR = 3.481 (feasible to be implemented).

In the 30 years of Solo Vallei development, obtained BCR = 3.570 (feasible to be implemented).

Analysis of the Internal Rate of Return (IRR) for several years of benefits obtained the following results:

The 20 years benefit life of Solo Vallei development with IRR = 51,177

The 25 years benefit life of Solo Vallei development with IRR = 51,194

The 30 years benefit life of Solo Vallei development with IRR = 51,196

V. CONCLUSION

The development of Solo Vallei Warken as an irrigation area according to the identified acquisition stakes covering an area of 62.000 Ha in the southern part of the Bengawan Solo is the most probable. Economical analysis in the development of Solo Vallei Warken as an irrigation area also shows the parameters that are feasible to be implemented. Obtained the total development benefit equal to Rp. 1.899.940.071.834.

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