

Republic of Indonesia

FY2017 Ex-Post Evaluation of Japanese ODA Loan

“Lower Solo River Improvement Project (Phase I)”

External Evaluator: Kenichi Inazawa, Octavia Japan Co., Ltd.

## 0. Summary

This project implemented river improvement work in the lower Solo River Basin on the island of Java, which is subject to frequent flooding, in order to contribute to the reduction of flood damages, improve productivity of agriculture in the surrounding area, and stimulate the economy. Relevance of this project is high because it conforms to the development plan for infrastructure needed to reduce flood damage and disaster risks through the *National Medium-term Development Plan* and the *Strategy Plan*, identifies development needs related to the development and improvement of flood control and levees through the construction of barrages and dams in the lower Solo River Basin, and maintains consistency with the assistance policy of the Japanese Government. As for efficiency, project outputs were implemented mostly as planned, but project costs exceeded the initial plan due to rising consulting service and management costs and land acquisition costs and construction costs incurred after the completion of the loan (since 2004). With regard to the project period, land acquisitions had yet to be completed by the executing agency even at the time of ex-post evaluation. Thus, efficiency of this project is low. As for quantitative effects, discharge capacity at the time of ex-post evaluation exceeded the target value, the water level observed at the Babat Barrage was below the levee height at the same place, and no flooding from the levee of the main Solo River or flood damage has occurred. Additionally, interviews with local residents and farmers as well as economic and agricultural production data indicate the project is supporting the stimulation of the local economy. Thus, the effectiveness and impacts of this project are high. There are no particular concerns regarding the structural aspects, technical aspects and financial aspects of the organizations and departments in charge of the project’s operation and maintenance. Thus, sustainability of the effects realized through this project is high.

In light of the above, this project is evaluated to be satisfactory.

## 1. Project Description



Project Location



Solo River and Babat Barrage

### 1.1 Background

The Solo River is the largest river on the island of Java. It has a drainage basin of around 16,000 km<sup>2</sup> and is about 600km of river flow path. Prior to the start of this project, development was progressing in the lower Solo River Basin following an increase in the local population, but flooding occurred on almost an annual basis. Flood damage grew worse with the concentration of economic assets resulting from urbanization and the extent of human and economic damages could no longer be ignored. Therefore, carrying out river improvement work in the lower Solo River Basin to reduce flood damages in the surrounding area was an urgent task.

### 1.2 Project Outline

The objective of this project is to mitigate flood damages due to habitual inundation in the lower Solo River Basin, on the island of Java, by implementing river improvement works (levee construction between the mouth of the Solo River and Babat Barrage) corresponding to a flood of 10 year probability of flood control; thereby contributing to improve agricultural productivity and economic activities in the surrounding area.

Loan Approved Amount/ Disbursed Amount	10,796 million yen / 10,781million yen
Exchange of Notes Date/ Loan Agreement Signing Date	December 1995 / December 1995
Terms and Conditions	Interest Rate: 2.1-2.3% Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: Bilateral Tied
Borrower / Executing Agency	Republic of Indonesia / Directorate General of Water Resources, Ministry of Public Works and Housing; (hereafter referred to as "DGWR")

Project Completion	February 2018 (Not completed yet)
Main Contractors (Over 1 billion yen)	PT. Adhi Karya (Indonesia), PT. Teguh Raksa Jaya (Indonesia)
Main Consultants (Over 100 million yen)	PT. Indah Karya (Indonesia) / PT. Wiratman & Associates (Indonesia) / PT. Bina Karya (Indonesia) / PT. Barunadri Engineering Consultant (Indonesia) / Nippon Koei (Japan) (JV)
Related Studies (Feasibility Studies, etc.)	Master Plan: Overseas Technical Cooperation Agency (OTCA), (Solo River Water Resources Development Plan, April 1974)
Related Projects	(Japanese Technical Cooperation) - Project on Capacity Development for RBOs in Practical Water Resources Management and Technology in the Republic of Indonesia (Phase I: 2008-2011), (Phase II: 2014-2018)  (ODA Loan Project) - Wonogiri Multi-purpose Dam Construction Project (Loan agreement was made in August 1977.) - Madiun River Urgent Flood Control Project (Loan agreement was made in February 1985.) - Upper Solo River Flood Control Project (Loan agreement was made in December 1985.) - Lower Solo River Flood Control Project Phase 2 (Loan agreement was made in March 2005.) - Countermeasure for Sediment in Wonogiri Multipurpose Project (Loan agreement was made in March 2009 for Phase I, in February 2014 for Phase 2.)

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa, Octavia Japan Co., Ltd.

### 2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: July 2017 - August 2018

Duration of the Field Study: 16-27 October 2017 and 16-25 February 2018

### 2.3 Constraints during the Evaluation Study

This ex-post evaluation was unable to obtain sufficient data because of unsatisfactory monitoring by the executing agencies with regard to the quantitative effects (river flow rate and flood probability) since project completion (2004). Many aspects of the evaluation were forced to rely on interviews with related parties.

In addition, the executing agency has constructed barrages and levees in other areas up to the time of the ex-post evaluation, in order to improve the reliability of flood control for the entire

Solo River, and “Lower Solo River Flood Control Project (Phase 2)” is in process. Taking this into account, the evaluation has judged the quantitative effects in the lower Solo River Basin (target area of this project) and it has been difficult to determine the effects and impacts attributed directly to this project.

Moreover, land acquisition has yet to be completed for certain areas of this project; thus, for all intents and purposes the project is incomplete. However, because a certain degree of effects are seen, the evaluation decision has been carried out based on an analysis of the outlook and trends of the realization of effects.

### **3. Result of the Evaluation (Overall Rating: B<sup>1</sup>).**

#### **3.1 Relevance (Rating: ③<sup>2</sup>)**

##### **3.1.1 Consistency with the Development Plan of Indonesia**

At the time of appraisal, the Government of Indonesia prepared the *Sixth Five Year Plan* (REPELITA VI, 1994 to 1999) as a national medium-term development plan. This plan placed particular emphasis on flood control projects in urban areas with large concentrations of people and assets and in agricultural areas with developed irrigation facilities. This project, which aimed to reduce flood damages in the vicinity around the Solo River, aligned with the country’s development plan.

At the time of ex-post evaluation, the Government of Indonesia formulated the *National Medium-term Development Plan* (RJPMN, 2015 to 2019 fiscal year), which sets forth seven priority areas for realizing an independent domestic economy (1. Improve food self-sufficiency, 2. Secure and improve water resources, 3. Improve energy self-sufficiency, 4. Protect natural resources and manage the environment and disasters, 5. Develop sea routes and the maritime economy, 6. Strengthen the financial sector, and 7. Strengthen national fiscal capacity). Among these, “4. Protect natural resources and manage the environment and disasters,” calls for reducing areas prone to flood damages through flood control and coastal protection from volcanic sediment and lava. In addition, DGWR prepared the *Strategy Plan* (RENSTRA, 2015 to 2019) that includes plans to develop necessary infrastructure facilities to improve and protect coastal and river dikes for disaster risk reduction, including climate change, through the management of flood prone areas, as one measure for managing the country’s water resources.

Based on the above, the Government of Indonesia has continued to place importance on flood

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<sup>1</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>2</sup> ③: High, ②: Fair, ①: Low

control and disaster countermeasures from the time of appraisal to the time of ex-post evaluation. Also, this project continues to maintain consistency with the importance placed on flood control projects in the *Sixth Five Year Plan* (REPELITA VI) at the time of the appraisal. Thus, the project is acknowledged as consistent with the policies and measures laid out in the national plan and sector plan at both before the start of the project and at the time of ex-post evaluation.

### 3.1.2 Consistency with the Development Needs of Indonesia

At the time of appraisal, flooding occurred in the Solo River vicinity on almost an annual basis. In particular, large-scale flooding occurred during the monsoon season, resulting in many deaths and injuries, victims, and damaged homes. The flood that occurred in March 1993 inundated an area of 64,000 hectares, causing 24 deaths and injuries, affecting some 300,000 people, and damaging about 60,000 homes. This flood also caused major damages to the area's agriculture and economy. Protecting areas prone to flooding from damages and reducing human loss and impacts on economic activities, mainly agriculture, was an urgent task.

At the time of ex-post evaluation, no flooding from the levees developed by this project or flood damages in surrounding areas had occurred. However, the Jabung Reservoir<sup>3</sup> located north of the Babat Barrage developed in this project had yet to be completed, which has resulted in flooding of nearby farmland during the monsoon season and flood damages in the surrounding area of the ponds and tributary rivers connecting to the main Solo River. Therefore, Balai Besar Wilayah Sungai, Bengawan Solo (hereafter referred to as "BBWS"), the Solo River office under DGWR, which is charged with the operation and maintenance of this project's facilities, continues to work on river improvements and flood control to implement flood control facility development in all areas of the river (constructing barrages and dams, developing and improving levees, and others).

In light of the above, the lower Solo River Basin has had strong needs for flood control facility development from the time of appraisal to the time of ex-post evaluation. Thus, the project is consistent with the development needs of the area both at the time of appraisal and at the time of ex-post evaluation.

### 3.1.3 Consistency with Japan's ODA Policy

In February 1994, the Ministry of Foreign Affairs of Japan formulated the *Country Assistance*

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<sup>3</sup> Phase 2 is currently under development as a continuation of this project.

*Program for the Republic of Indonesia*. Within this program there were five areas of focus: namely, (1) equal development country wide ensuring fairness; (2) raise educational levels and develop human resources for wide ranging areas from the perspective of securing competitiveness; (3) response to environmental issues caused by rapid development; (4) industrial restructuring for sound macroeconomic management and broader economic development; and (5) development of industrial base for the continued inflow of investment.

This project involved infrastructure assistance for reducing flood damages through river improvement work in the vicinity of the lower Solo River Basin and stimulating the economy in the process, and it maintains consistency with the five areas of focus in the *Country Assistance Program for the Republic of Indonesia* above. Therefore, it can be said that this project is consistent with the assistance policy of the Japanese government.

In light of the above, this project has been highly relevant to Indonesia's development plan and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

### 3.2 Efficiency (Rating: ①)

#### 3.2.1 Project Outputs

This project carried out river improvement work from the mouth of the Solo River to Babat to address 10-year probability of flood control. Figure 1 shows the specific developed places. Table 1 contains the details of the output plan (at the time of appraisal: 1995), changes after detailed design (1998), and actuals at the time of ex-post evaluation (2017).

Table 1: Planned and Actual Outputs of this Project

Outputs		Appraisal (1995)	After detailed design (1998)	Actuals at the time of ex-post evaluation (2017)
1) River improvement (Packages I-1 to I-5)	Levee	Approx. 126km	Approx. 138km	Approx. 131km *Note
	Low water dike construction	Approx. 4km	Approx. 2.6km	Approx. 2.6km
	High water dike construction	Approx. 3km	Approx. 2.7km	Approx. 2.7km
2) Discharge channel (Package F)	Small discharge channel at Sedayulawas	Length: 12.4km, Bottom width: 25m	As planned	As planned
3) Land acquisition	Land acquisition ([1] Levee)	Land acquisition and resettlement (approx. 3,000 homes)		Generally assumed to be as planned

			(There is no data on the number of homes for resettlement. Also, some households did not relocate even after compensation negotiations, so negotiations faced difficulties.)
	Land acquisition ([2] New river channel)	Land acquisition in the vicinity of the Karanggenen Shortcut	Almost as planned (There is no data on the number of homes for resettlement.)  *However, it was determined that the total land area acquired for (1) levees and (2) new river channel amounted to 41,300m <sup>2</sup>
4) Consulting services		Bid assistance, construction project management, and detailed design of Jabung Reservoir and Small discharge channel width expansion at Sedayulawas, etc.	As planned
<p>[Additional outputs]</p> <p>1) Development of Babat Barrage as well as dikes in the vicinity and access road (Packages B-1 and B-2)</p> <p>2) Development of bridge at the inlet of Jabung Reservoir and water gate at the outlet (Packages J-1 and J-3)</p> <p>3) Consulting services for (1) Development of Babat Barrage as well as dikes in the vicinity and access road</p>			

Source: JICA documents, interviews with BBWS, answer on questionnaire, field visits

\*Note: This 131km section includes work paid for by the Indonesia side after the end of the loan disbursement (2004).

1) As for river improvement work, the output plan was modified slightly based on the detailed design after the start of the project (1998). The plan after the detailed design consisted of levees of approximately 138km, low water levee construction of approximately 2.6km and high water levee construction of approximately 2.7km. As for actuals at the time of ex-post evaluation, low water levee construction and high water levee construction proceeded according to plan, but the levee was approximately 131km at the ex-post evaluation, indicating a difference (approximately 7km) with the extension at the time of the detailed design. The reason is because

land acquisition has not been completed at the time of ex-post evaluation. The application location is shown in Figure 1.

2) The small discharge channel at Sedayulawas was developed as planned.

3) At the time of the project appraisal, land acquisition and resettlement were deemed necessary for the levee and the vicinity of the Karanggenen Shortcut. It was assumed that affected households would be relocated to nearby land or inside the levee to avoid flood damage.

Table 2 contains changes in land acquisition results for the levee (based on length of levee) and remaining sections. The background and factors as to why land acquisition was not completed are described in detail in 3.4.2.2 Impacts – Resettlement and Land Acquisition.

Table 2: Changes and Remaining Section Regarding Land Acquisition's Record Based on the Extension of Levee

(Unit: km)

At the Time of Appraisal	After Detailed Design	At the Time of Loan Completion (2004)		At the Time of Ex-post Evaluation (2017)	
		Already acquired	Not acquired yet	Already acquired	Not acquired yet
Approx.126	Approx.138	Approx.112	Approx.26 *Note	Approx.131	Approx.7 *Note

Source: JICA documents, interview with BBWS

\*Note: Indicates the remaining sections that need to be acquired. At the end of the loan disbursement for this project (2004), Japan and Indonesia agreed that the approximately 26km of remaining sections yet to be completed would be borne by the Indonesia side.

#### 4) Consulting Services

Consulting services including bid assistance, construction project management, and detailed design of Jabung Reservoir and small discharge channel width expansion at Sedayulawas, were implemented as planned.

#### [Additional outputs]

Additional outputs were planned from 1998 to 1999 and implemented from 2000 to 2002. For Babat Barrage, it was determined that developing a barrage across the Solo River would be preferable for directing flood water to Jabung Reservoir. In addition, this barrage was developed to more efficiently manage flow rate control along the entire lower Solo River Basin. A dike and access road were also developed in the vicinity of Babat Barrage. The development of a bridge at the inlet of Jabung Reservoir and development of a water gate at the outlet was initially expected to take place through Phase 2 as the continuation of the project, but following the collapse in the value of the rupiah during the Asian Currency Crisis in the second half of the



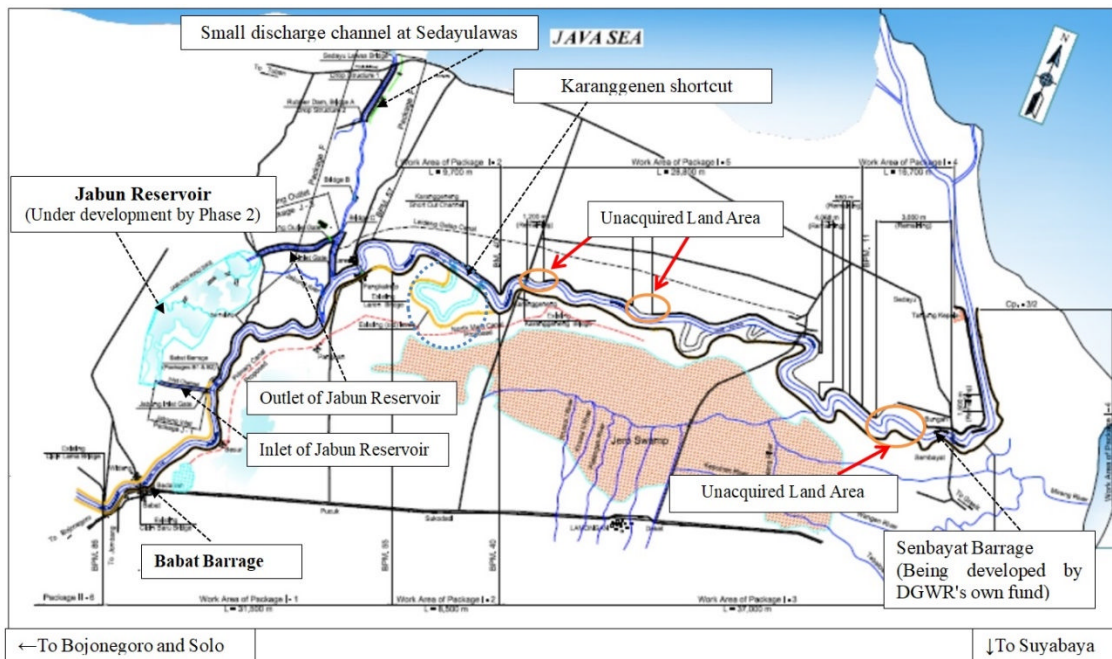
1990s, at the time Indonesia was able to convert most of its yen loans (yen capital account) to rupiah, making it possible to carry out more civil works projects than initially planned<sup>4</sup>; thus, this work was carried out before commencement of the Phase 2 project.



Photo 1: Dyke around Babat Barrage



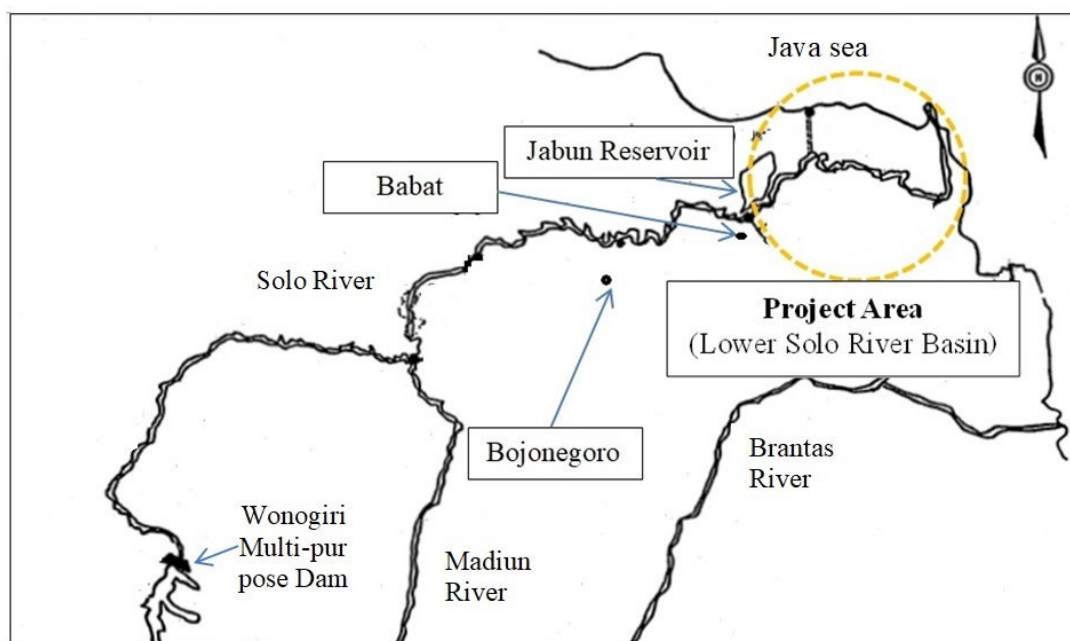
Photo 2: Water Gate Control Room of Babat Barrage



Source: BBWS

Figure 1: Location Map of Lower Solo River Basin and Project Site

<sup>4</sup> Most of the payments made to domestic vendors were denominated in rupiah. Therefore, it was possible to increase the amount of work.



Source: JICA document

Figure 2: The Entire Solo River (Upstream to Downstream)

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total project cost planned at the time of appraisal was 13,563 million yen (of which 10,796 million yen was covered by yen loans). The actual costs totaled 15,132 million (of which 10,781 million yen was covered by yen loans) at the time of ex-post evaluation, which marked a slight overrun from the initial plan (112% compared to the plan). The main reasons for this overrun were the additional civil works projects beyond the initial plan implemented due to additional outputs as well as an increase in consulting services and administrative costs borne by the Indonesia side due to the extension of the project period, and land acquisition costs and construction costs required<sup>5</sup> after the completion of the loan (since 2004), among others.

#### 3.2.2.2 Project Period

At the time of the appraisal, the project period was planned for the six year and one month period from December 1995 to December 2001 (73 months). The project period currently stands at December 1995 to February 2018 (267 months) because it is yet to be completed. This indicates the plan was exceeded by a large margin (366% versus the plan, and still not complete).

<sup>5</sup> Project costs could potentially increase in the future (portion borne by Indonesia) as the project is still not completed at the time of ex-post evaluation.

Table 3 shows the initial plan and actual periods of each project component. As noted above, the levee has not been completed due to land acquisitions not being completed, which was the main reason for this delay<sup>6</sup>. Therefore, the time of the ex-post evaluation is considered the nodal point in terms of the timing for judging the project period. In addition, civil works construction and consulting services were delayed slightly less than about three years compared to the initial plan. The reason for this is because of the budget allocations within the Government of Indonesia affected by the Asian Currency Crisis of the late 1990s and delays in procedures inside of DGWR.

Table 3: Planned and Actual Periods of This Project

	Planned (1995)	Actual
(The Whole Project)	December 1995 – December 2001 (73 months)	December 1995 – February 2018 (267 months)
<b>Each Project Component</b>		
1) Selection of Consultants	December 1995 – June 1996	December 1995 – February 1996
2) Selection of Contractors	July 1996 – December 1998	April 1996 – June 1997 <sup>7</sup> April 1996 – September 1996 <sup>8</sup>
3) Detailed Design	July 1996 – July 1997	April 1996 – June 1997
4) Civil Works	December 1997 – December 2001	July 1997 – April 2004 <sup>9</sup> October 1996 – August 2001 <sup>10</sup>
5) Land Acquisition	December 1995 – November 2000	December 1995 – February 2018 (Not yet completed at the time of ex-post evaluation)
6) Consulting Services	July 1996 – December 2001	March 1996 – August 2004
<b>Additional Works</b>		
1) Selection of Contractors	-	January 2000 – September 2000 <sup>11</sup> February 2001 – September 2001 <sup>12</sup>

<sup>6</sup> The completion of most civil works projects including additional outputs was April 2004. Afterwards, dike construction made progress along with progress in land acquisition, but information was not obtained from BBWS about the specific implementation period. In either case, parts of the levee were not completed at the time of ex-post evaluation due to incomplete land acquisitions; thus, it is difficult to say that the project has reached the project completion's timing assumed initially.

<sup>7</sup> Package I-1 ~ I-5

<sup>8</sup> Package F

<sup>9</sup> Package I-1 to I-5. Part of the construction work was carried out up to 2015 following progress with land acquisition, but information could not be obtained on the implementation period.

<sup>10</sup> Package F

<sup>11</sup> Package B-1 and B-2

<sup>12</sup> Package J-1 and J-2

2) Detailed Design	-	January 1999 – September 2002
3) Civil Works	-	October 2000 – April 2004 <sup>13</sup> August 2001 – December 2002 <sup>14</sup>

Source: Documents provided by JICA, answers on questionnaire

### 3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

#### Economic Internal Rate of Return (EIRR)

At the time of the project's appraisal, the economic internal rate of return (EIRR) was calculated to be 15.9%, based on the expected amount from reduction of flood damages (assets such as homes, businesses, and public facilities, and products such as rice, soy beans, maize and farmed fish) and expected amount of increased income (reduction of flood frequency, increased yield from increased planting, and increased yield from new development of non-arable land) as the benefits, construction costs, operation and maintenance costs, reserve funds, and consulting service costs as the costs, and 50 years as the project life. Attempts were made to collect data related to the benefits, but the executing agency and local governments in the vicinity did not accumulate this data from the time of the appraisal to the time of the ex-post evaluation. Basic data for analogical reasoning was also missing and could not be collected; thus, a re-calculation of EIRR was not possible.

#### Financial Internal Rate of Return (FIRR)

The FIRR was not calculated for this project at the time of the appraisal. Therefore, a re-calculation was not performed at the time of ex-post evaluation.

Based on above, the project cost exceeded the plan, and the project period significantly exceeded the plan. Therefore, efficiency of the project is low.

### 3.3 Effectiveness and Impacts<sup>15</sup> (Rating: ③)

#### 3.3.1 Effectiveness

##### 3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

##### 1) Operation Indicator

For this project, the discharge capacity and highest water level were assumed to be operation

<sup>13</sup> Package B-1 and B-2

<sup>14</sup> Package J-1 and J-2

<sup>15</sup> Sub-rating for Effectiveness is to be put with consideration of Impacts.

indicators. The discharge capacity can be found in Table 4. The values for both river channel and discharge channel exceed the target values. Since completing the main construction (since 2004), BBWS has not regularly calculated data on discharge capacity and amount of river flow, but this data was confirmed only at the time of ex-post evaluation (most recent several years). BBWS and Jasa Tirta I (East Java) Public Corporation (hereafter referred to as “Jasa Tirta 1”)<sup>16</sup>, a nation owned corporation affiliated with the Ministry of Public Works and Housing responsible for operating and maintaining the Babat Barrage, discharge channel, and the outlet for Jabung Reservoir, confirmed, through interviews of local residents and farmers appearing below, that at the time of heavy rains there has been no flooding from the developed levee or flood damage up to the ex-post evaluation. It can be surmised that the outcome of this project’s river improvement work has secured the integrity of the river (width of river and height of levee) and discharge capacity<sup>17</sup> in general.

Table 4: Actual Results Related to Discharge Capacity and Highest Water Mark

Indicator	Target (At the time of project completion: 2001)	Actual Results (At the time of ex-post evaluation: most recent several years)
Discharge capacity *Note 1 (Unit: m <sup>3</sup> /second)	River channel: 2,500 to 2,530 Discharge channel: 125 to 365	River channel: 2,960 to 3,500 *Note 3 (response to 10 to 50 year flood scale) Discharge channel: 400 to 640 *Note 4 (response to 10 to 50 year flood scale)
Highest water level *Note 2 (Unit: m)	7 to 8	6.36 to 8.20m (*See Table 5 for details)

Source: Interviews with BBWS and Jasa Tirta I, BBWS documents

Note 1: Discharge capacity indicates the designed flow rate without flooding. The actual river flow rate has not been observed.

Note 2: Observed at Babat Barrage at the time of ex-post evaluation.

Note 3: Discharge capacity between the mouth of the Solo River and Babat Barrage. Depending on the location, readings vary between 2,960 to 3,500m<sup>3</sup>/second.

Note 4: Discharge capacity of the small discharge channel section at Sedayulawas. Depending on the location, readings vary between 400 to 640m<sup>3</sup>/second.

The actual results of the highest water level were observed around the vicinity of the Babat Barrage developed as part of the project. Table 5 shows the highest water level and date which

<sup>16</sup> The relationship with BBWS in terms of operation and maintenance is explained in 3.5.1 Institutional Aspects of Sustainability, Operation and Maintenance.

<sup>17</sup> However, at the time of ex-post evaluation about 17 years after the completion of the project’s main work and about 13 years after the completion of work on additional outputs, BBWS developed barrages and levees along the Solo River upstream and mid-stream (including the Phase 2 intended as a continuation of the project [river improvement project in the vicinity of Bojonegoro]) and Sembayat Barrage downstream (see Figure 1), furthermore developed using its own funds flood control facilities throughout the entire Solo River Basin. Since the discharge capacity and the reliability of flood control have improved for the entire Solo River, this is one factor behind why the actuals in Table 4 exceed the targets. In other words, there is room for discussion about identifying discharge capacity quantitatively focused on the project’s outputs or limited to the project.

was recorded for each year. According to BBWS and Jasa Tirta 1, the highest water level recorded since the year of completion of this project (2004) was 8.2 meters on February 28, 2009. Table 6 shows the warning levels for Babat Barrage. Although the above record of 8.2 meters exceeds the “red” level (8.0 meters) (and although 8.0 meters was recorded on December 1 and 2, 2016, December 30 and 31, 2007, and January 1, 2008), this level is below the levee height (9.20 – 9.5 meters), and there was no flooding from the developed levee in either case. Also, through interviews with residents at 3.3.1.2 Qualitative Effects, it was confirmed that flood damage has not occurred around the levee of the target area, so it is judged that flood damage has been alleviated. Therefore, it can be said that the initially envisioned purpose of the project (reduce flood damage) has been achieved<sup>18</sup>.

Table 5: (Actual) Highest Water Level and Date Which Was Recorded for Each Year

Year	Highest water level	Recorded Date
2005	6.70m	April 7
2006	6.70m	January 6, 7, and May 4
2007	8.00m	December 30, 31
2008	8.00m	January 1
2009	8.20m	February 28
2010	6.99m	May 18
2011	7.04m	May 4
2012	7.00m	January 18
2013	7.85m	December 20
2014	6.36m	December 22
2015	6.99m	February 13
2016	8.00m	December 1, 2
2017	7.35m	February 5

Source: Jasa Tirata I, BBWS

<sup>18</sup> As stated in 3.2.1 Project Effectiveness and Outputs, it cannot be denied that parts of the river may be flooded at the time of high water levels, as for the area around the undeveloped levee (approximately 7km) due to lack of land acquisition.. In interviews with BBWS and Jasa Tirta I, representatives commented that “We don’t know the detailed extent of damages at high water levels in the areas where the levee hasn’t been developed. To date, we have not received complaints, reports or requests for countermeasures from residents or community leaders. It is believed that damages to commercial or residential land are nearly non-existent. If there were damages, they would likely be limited.” Although the reliability of flood control hasn’t improved only in the areas in question, there was no mention of flood damaged areas in interviews with local residents as explained in “(Reference) Flood Damage in the Lower Solo River Basin” and “3.3.2 Qualitative Effects” below. In either case, it is desirable that BBWS should strive to resolve the land acquisition issues in the areas in question to every extent possible, but flood damage in areas where the levee has yet to be developed is presumed to be limited.

(Reference) Table 6: Warning Levels for Babat Barrage

Classification		Height
Level of highest levee		9.20-9.50m <sup>19</sup>
Water level	Red	8.00m
	Yellow	7.50m
	Green	7.00m

Source: Jasa Tirata I, BBWS

**(Reference) [Warning Levels for the Solo River Basin (Types)]**

**Red:** Monitoring of weather, water level and structures such as dikes is performed continuously and reported every 15 minutes to one hour to related institutions (BBWS, surrounding local governments, National Board of Disaster Management (BPBD)). BBWS will discuss flood warning alerts with the governments of East Java and Central Java.

**Yellow:** Monitoring of weather, water level and structures such as dikes is performed every hour and reported every three hours to related institutions (same as above). BBWS commences discussions about flood warning alerts and evacuation orders with the regional branches of the National Board of Disaster Management (BPBD) and surrounding local governments (Tuban, Gresik, Lamongan).

**Green:** Monitoring of weather, water level and structures such as dikes is performed every two hours and reported every six hours to related institutions (same as above). Materials are prepared for flood countermeasures.

2) Effect Indicator

This project set reliability of flood controls (decline in flood probability) for the lower Solo River Basin as the effect indicator. According to BBWS, prior to the start of this project floods occurred frequently whenever heavy rains struck in the monsoon season and there were extensive damages incurred in the river's lower basin vicinity. In other words, it is presumed that overflowing occurred every year or once every several years resulting in flooding of the surrounding area. Table 7 shows the target and actual figures of the reliability of flood controls (decline in flood probability) for the lower Solo River Basin. BBWS' opinion is that it has now more able to control the flow rate for the entire Solo River Basin because of the combination of completing development of Sembayat Barrage as well as barrages and levels in the upstream and mid-stream areas of the Solo River using its own funds. In addition, BBWS has shown the opinion, "It is impossible to determine the flood probability specialized in this project which has been over 16 years since most of the levees have already been completed. However, concerning only the lower Solo River Basin, the situation close to the 1/10 to 1/50 (corresponding to the flood scale once every 10 to 50 years) has already been achieved in places other than the

<sup>19</sup> This range is used because of differences in depth in the surrounding area.

unresolved land acquisition site<sup>20</sup>.” Although it cannot deny that the quantitative basis required for accurate judgment is somewhat lacking, once the Jabung Reservoir in Phase 2 of the project and levee are completed in areas where land acquisition has yet to be resolved in Phase 1, it is presumed that response to 1/10 flood scale will be guaranteed and it will be closer to realizing responses to 1/50.

Table 7: Ensuring Reliability of Flood Control Surrounding the Lower Solo River Basin

	Target (At the time of project completion)	Actual (2017)
Ensuring reliability of flood control (decline in flood probability)	1/10 (Response to flood scale of once every 10 years)	1/10 – 1/50 (Response to flood scale of once every 10 – 50 years)

Source: Interview with BBWS

#### (Reference) Flood Damage in the Lower Solo River Basin

For reference, Table 8 explains flood damages that occurred in the lower Solo River Basin (since 2011, only for the Lamongan area<sup>21</sup>). As for flood damage, data since 2011 only was obtained from the National Board of Disaster Management (BPBD). However, with regard to the content of Table 8, it was confirmed by interviews with BBWS that, instead of flood damages caused by the flooding of the main Solo River, damages from flooding from the nearby irrigation canal, streams, lakes, wetlands, and undeveloped Jabung Reservoir (Phase 2) did occur during heavy rains, farmers in the lower Solo River Basin vicinity, and employees of surrounding local governments<sup>22</sup>. Backing these views, Table 5 and 6 above as well as their explanations serve as evidence. In other words, the content of Table 8 is handled as reference only because it is not related to the levees developed by this project. Meanwhile, in interviews farmers commented, “there is continuing risk that our fields will flood during heavy rain as long as work is not completed on the Jabung Reservoir (Phase 2) and connecting channels (inlet and outlet).” That is to say, in the surrounding areas damages continue to occur due to factors beyond this project, although these are not flood damages due to the flooding from the levees developed by this project<sup>23</sup>.

<sup>20</sup> It was confirmed through this evaluation survey that BBWS has not carried out estimates of the flood probability on a regular basis. Information about the situation of flood damages in areas around sections of the levee not yet developed due to the lack of resolution of land acquisition is as already discussed.

<sup>21</sup> The Lamongan area occupies a majority of the lower Solo River Basin.

<sup>22</sup> BBWS has a plan for a project to connect wetlands and small rivers to the channel and then control water volume and flows as well as draw and discharge accumulated water using pump facilities.

<sup>23</sup> See Footnote 18 for an explanation of flood damages concerning parts where land acquisition has yet to be completed (approximately 7km).



(Reference) Table 8: Flood Damages that Occurred in the Lower Solo River Basin

Year	Flooded Households	Damage to Farmland (rice field) (ha)	Amount of Total Damage (1 million Rp.)
2011	2,106	0	9,657
2012	1,361	146	8,138
2013	2,462	305	1,250
2015	1,361	146	7,384
2016	246	91	955.5
2017	3,346	0	6,343.58

Source: Lamongan Branch Office, National Board of Disaster Management (BPBD)

Note: Lamongan Branch, the National Board of Disaster Management (BPBD) was established in 2011.

As a result, no data exists prior to 2010. The Indonesian National Board of Disaster Management was established in 2008. Furthermore, enough flood damage data has not been retained by BBWS.



Photo 3: Constructed Levee (Tuban District)



Photo 4: Jabung Reservoir Inlet (Developed as additional output)

### 3.3.1.2 Qualitative Effect (Other Effects)

#### Reduction of Flood Damages through Project Implementation

Interviews<sup>24</sup> of residents and farmers in the vicinity of the lower Solo River Basin were interviewed for this ex-post evaluation. Comments included, “Floods occurred frequently before the start of the project. In particular, in the flood of March 1994 the water level reached about two meters above ground level, causing extensive damages. Many needed to rebuild homes or make major renovations due to the damages, but now there is no need. I don’t really feel that transportation has been affected by floods or access has improved with the development of the levee, but I do feel safe knowing I can go out with two wheel drive motorcycle or bicycle when the Solo River rises. I can go about my life with more peace of mind because there are no longer any floods like the one in March 1994.” Also, comments were received from local governments

<sup>24</sup> In this evaluation survey, group interviews were held involving residents and farmers living in the village communities under the Tuban and Lamongan local governments in the lower Solo River Basin (Banjar, Tegalorejo, and Shimojo under Tuban’s administration and Kedung under Lamongan’s administration: all four villages close to the main Solo River). Key informant interviews were separately held for community leaders. There were 18 total participants in the interviews, consisting of 16 men and 2 women.

(Tuban and Lamongan) that included, “Although we cannot explain quantitative data for flood probability, we do not believe there has been any flood damages in the vicinity thanks to the project. If this project wasn’t implemented, there would still be a lot of human and property damages caused by heavy rain.” Furthermore, BBWS executives commented, “Without the discharge channel at Sedayulawas, residential and agricultural land would have been flooded after prolonged rains or heavy rains. During floods 20 years ago (before the start of the project), flood water levels remained the same for at least more than five hours. This discharge channel plays a vital role in discharging water appropriately.”

In light of the above, it is believed that this project has been contributing to the reduction of flood damages in the vicinity of the lower Solo River Basin.



Photo 5: Interview of Project Beneficiaries



Photo 6: A tributary River Located Away from the Solo River (Flooding occurs sometimes during heavy rains)

### 3.3.2 Impacts

#### 3.3.2.1 Intended Impacts

Contributions to Improving Productivity of Agriculture in the Lower Solo River Basin Area and Stimulating the Economy

##### 1) Quantitative Effects

Table 9 shows changes in the Gross Regional Domestic Product (hereafter referred to as “GRDP”) of the local governments in the lower Solo River Basin and production value of the agricultural sector. Data for this table is from before the start of this project (1991), the years after completion of the project from 2005 to 2010, and the most recent six months of data from 2015. Although a simple comparison is not possible<sup>25</sup> between the time prior to the start of the

<sup>25</sup> As one example, readers must keep in mind the massive change of the rupiah in Indonesia caused by the Asian Currency Crisis in the second half of the 1990s.

project (1995), the time of completion of the project (2004) and the time of ex-post evaluation many years later (2017), in the three local government around the Solo River Basin (Gresik, Lamongan, and Tuban), GRDP and production value of the agricultural sector tend to increasing since 2005. As explained above, with major reductions in flood damages in most of the area along the main Solo River, as noted below in 2) Qualitative Effects based on comments from farmers, farmers can now plant rice and corn during the monsoon season with peace of mind, securing stable income throughout the year. Taking this into consideration, it is believed that this project is underpinning the economic stimulation of the surrounding area.

Table 9: GRDP of Local Governments in the Lower Solo River Basin and the Production Value of Agriculture Sector

(Unit: 1 billion rupiah)

	1991	2005	2006	2007	2008	2009	2010	2015
<b>【Gross Regional Domestic Production (Nominal GRDP)】</b>								
a) Kab. Gresik	1,189.9	19,746	20,990	24,337	28,353	33,247	59,069	100,724
b) Kab. Lamongan	333.7	5,306	6,016	6,807	10,358	11,774	17,360	28,831
c) Kab. Tuban	279.1	7,689	8,995	10,325	12,160	16,978	28,018	47,691
<b>【Production Value of Agriculture Sector】</b>								
a) Kab. Gresik	121.1	1,925	2,183	2,409	2,688	3,173	3,581	8,274
b) Kab. Lamongan	157.7	2,179	2,368	2,643	2,980	4,749	5,293	11,520
c) Kab. Tuban	173.6	1,873	2,092	2,240	2,513	4,321	5,346	10,277

Source: Statistics Indonesia (BPS)

## 2) Qualitative Effects

Interviews<sup>26</sup> of residents and farmers were conducted about the environment surrounding farming in the lower Solo River Basin area. Comments including the following, “After completion of Babat Barrage, I have been able to secure a stable supply of irrigation water throughout the monsoon season and dry season (supplemental explanation: water intake barrages have been developed along the levee on the banks of the main Solo River and water is supplied to nearby farmland). In particular, prior to the development of the levee, water intake

<sup>26</sup> Implementation method and eligible persons are explained in 3.3.1.2 Project Effectiveness and Qualitative Effects (Reduction of Flood Damages through Project Implementation). 80 to 90% of the residents in villages under local governments in the vicinity of the project facilities work in agriculture.

during the dry season was inconsistent, resulting in inconsistent rice yields, but now my income has increased in dry season thanks to the rice crop. In the past, I only had one growing season, but now it's mainly two to three. I believe that the price of agricultural land is increasing<sup>27</sup>. Compared to 20 years ago, before the start of the project, there is little concern of flooding, so during the monsoon season I can plant rice and corn without worry. I now have stable and rising income. This means I have been able to afford to spend money and renovate my house to make it stronger (the house was made of bamboo, but now it is made of concrete blocks and bricks). I was also able to buy a two wheel drive motorcycle. My house flooded during the flood 20 years ago and it cost me a great deal to repair it, making it impossible to save money. Today, such flooding no longer happens. Children of the village were only able to attend the local junior high school in the past, but now some are able to attend vocational school or four-year university.”

In light of the interviews results above, this project has increased the production volume of crops in the lower Solo River Basin area, increased residents and farmers' incomes as well as their purchasing power, and in the process contributes to the stimulation of the local economy.

### 3.3.2.2 Other Positive and Negative Impacts

#### 1) Impact on the Natural Environment

This project is applied to "OECE Guidelines for Environmental Consideration" (October 1989). The environmental impact assessment (EIA) for this project involved the environmental impact study carried out from 1992 to 1994, and the project was officially approved after receiving approval of the Minister of Public Works.

During the project implementation, interviews with BBWS confirmed that there were no negative impacts on the ecosystem, issues related to air or water pollution and waste. As for loud noise, according to BBWS, some noises in a short time were made during the river improvement work, and there were no complaints from residents in the surrounding area. It was confirmed through interviews with BBWS and field visits that no negative environmental impacts (air pollution, water quality issues, loud noises/vibrations, and negative impacts on ecosystem, etc.) have occurred since project completion (2004).

According to BBWS and Operation and Maintenance Area 4 Bojonegoro Office (Area 4 Kantor Bojonegoro; hereafter referred to as “Bojonegoro Office”), under BBWS and in charge

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<sup>27</sup> According to the leader of Tegalrejo Village, under Tuban and situated in the middle of the lower Solo River Basin, comparing the time of project completion (2004) and the time of the ex-post evaluation (2017), land prices of residential, agricultural and commercial lands have risen at least between approximately 150 and 200%.

of operation and maintenance of the levees developed by this project, if negative environmental impacts were confirmed, there is a system in place for dealing with such impacts. BBWS and Bojonegoro Office will discuss and have the local government with jurisdiction in the lower Solo River Basin check the detail, and then a request letter will be sent to the DGWR head office in the name of the local government to request for instructions and decision. Later, the DGWR head office will then issue instructions to BBWS and Bojonegoro Office (appropriating a budget if necessary). In either case, this system has not functioned because there have been no negative environmental impacts up to the ex-post evaluation.

## 2) Resettlement and Land Acquisition

As noted in 3.2.1 Project Effectiveness and Outputs, land acquisition and resettlement was carried out according to plan for the new river channel (Karanggenen Shortcut vicinity). There were 201 landowners that negotiated and concluded agreements with BBWS and local governments, and the total area of land acquired was approximately 41,300m<sup>2</sup>, with total compensation paid of 97,815 million rupiah. According to BBWS, land acquisition procedures were carried out appropriately according to Indonesian law (land law). However, data is not available on the number of homes resettled and the number of people resettled through land acquisitions<sup>28</sup>.

As noted above, the land acquisitions and resettlement has generally been completed in most of the areas around the levee, but in some areas (areas along approximately 7km) land acquisitions have yet to be settled. The reason why settlements have yet to be reached is because some residents living along the Solo River since ancient times have continually lived there while braving the dangers of rising water levels during heavy rains. Figure 3 shows an archetypical example. These people will not resettle no matter how much compensation or land is offered for resettlement. Among them, some have built their own simple levees and have continued to live where they are with an overinflated sense of security in the effects of these homemade levees. BBWS and local governments have continually negotiated for land acquisitions during project implementation but have yet to acquire surrounding land for the remaining approximately 7km section<sup>29</sup>. According to BBWS, “BBWS and local governments

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<sup>28</sup> The reason why the number of resettled homes and resettlement residents is unknown is because BBWS and local governments negotiated only with landowners. In many cases, there were multiple homes and residents on land in the possession of landowners, and BBWS and local governments were unable to negotiate directly with them. For this reason, there are no records and monitoring has not been carried out after acquisition. Compensation for affected residents and measures to restore livelihoods were included in the compensation amount paid.

<sup>29</sup> As of the ex-post evaluation, BBWS is working on identifying the landowners of land for the remaining

worked diligently to seek the understanding of local residents about the project, through seminars and briefing sessions. BBWS feels like the coordination and negotiating capabilities of local governments and community leaders was not as expected. At the time, BBWS was not able to directly engage in coordination and negotiations with local residents. Our assumption was that local governments and community leaders would cooperate and coordinate. Yet, in many cases their high coordination capabilities and willingness was not as it seemed. Part of the reasons why land acquisitions were not completed by 2004 was somewhat because of this situation.” As indicated above, since there are residents who stubbornly refuse relocation, it is thought that the executing agency should have prepared for consultation with the residents widely ahead of time prior to the start of the project, identified the coordinating capabilities and influence of the local governments and community leaders at earlier stage, and taken the measures.

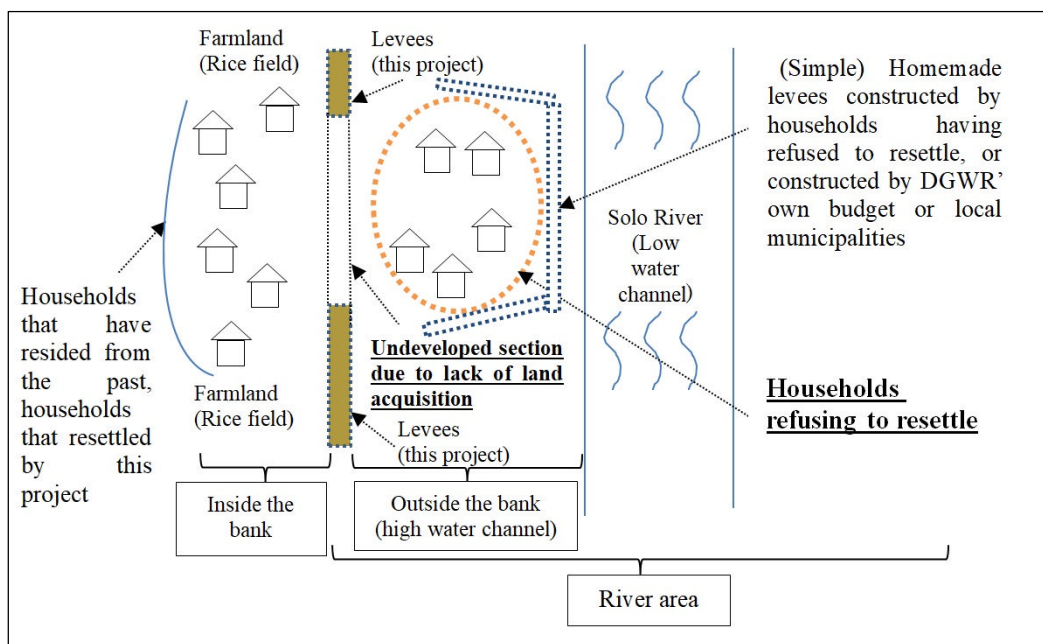


Figure 3: Explanation of Sections Where Land Acquisition Has Not been Completed (Example) (Low water channel indicates where everyday water flows and the high water channel indicates where floods occur at times of rising water levels.)

approximately 7km section and BBWS will be in a position to secure a budget with the necessary funds.



Photo 7: Lower Solo River Basin and Households Living Along the River that Refuse to Resettle (pictured at left)



Photo 8: Levee Developed Using BBWS' Own Budget and Undeveloped Area Due to Absence of Land Acquisition

#### [Summary of Effectiveness and Impact]

With regard to quantitative effects, discharge capacity at the time of ex-post evaluation (designed flow rate) had attained and exceeded the target for both the river channel and discharge channel. No flood damages caused by the flooding of the main Solo River have occurred during heavy rains from the levees developed. Water levels recorded at Babat Barrage are below the levee height at the same place, thus, it can be determined that the project purpose initially assumed (reduce flood damages) has been attained. In addition, according to interviews with residents and farmers and economic and agricultural production statistical data, it is presumed that farmers have seen an increase in crop yield and incomes of both residents and farmers have increased, which is believed to be stimulating the local economy as well. Thus, effectiveness and impacts of this project are high.

### 3.4 Sustainability (Rating: ③)

#### 3.4.1 Institutional / Organizational Aspects of Operation and Maintenance

At the time of ex-post evaluation, the executing agency of this project is DGWR, which is responsible for flood control, water resource development, planning of irrigation projects, as well as project implementation, operation and maintenance in Indonesia. In the Solo River Basin, BBWS, an organization under DGWR, is responsible for new water resource development, as well as flood control project planning, execution, management and maintenance.

Bojonegoro Office<sup>30</sup>, a department of BBWS, is responsible for the operation and maintenance of levees developed by this project. The operation and maintenance work mainly involves inspections, patrols and repairs related to the levees and river channel, digging of river channel when necessary, and water resource management. Jasa Tirta 1<sup>31</sup>, a nation owned corporation affiliated with the Ministry of Public Works and Housing is responsible for the operation and maintenance of Babat Barrage, discharge channel, and the outlet for Jabung Reservoir developed by this project. Jasa Tirta 1 carries out daily maintenance mainly in the form of cleaning around the barrage, weed removal along the access road, inspecting, replacing, greasing of cables/wires and barrages for opening/closing water gates, and painting of structures and guardrails, etc. It also observes water levels of the Solo River at Babat Barrage and reports to BBWS<sup>32</sup>.

At the time of ex-post evaluation, BBWS has employed a workforce of approximately 1,300 (of these, around 330 are responsible for flood control projects), while the number of employees at Bojonegoro Office under BBWS is 30, and at Jasa Tirta I is 12. At the time of field visits, through interviews with frontline workers of the Bojonegoro Office and Jasa Tirta I, it was observed that the workforce of each organization is sufficient. It was confirmed that the staff are allocated to each department without shortage or overage and right person is assigned for the right job<sup>33</sup>.

Figure 4 contains a diagram (outline) of the organizations in charge of the operation and maintenance for this project. Supervision and work reports are carried out among the DGWR head office, BBWS and Bojonegoro Office.

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<sup>30</sup> Bojonegoro City is located in the upper basin of the project's target area; therefore, Bojonegoro Office established a project office in Babat City (hereafter referred to as "Babat Office"), closer to the project's target area, and carries out work from there.

<sup>31</sup> Jasa Tirta I is a nation owned organization specializing in operation and maintenance. DGWR has concluded an agreement on facility operation and maintenance (MOU) with Jasa Tirta 1 in order to achieve more efficient operation and maintenance after the project output's warranty period.

<sup>32</sup> It was confirmed through field visits that Jasa Tirta I has the necessary equipment for maintenance (water level observation room, equipment, heavy machinery, and vehicles, etc.).

<sup>33</sup> As for the working conditions of employees, Bojonegoro Office has a daytime shift on weekdays (Monday to Friday). However, Jasa Tirta I uses a three-shift system 24 hours a day, 365 days a year because it monitors daily flow rate and water levels at the Babat Barrage.



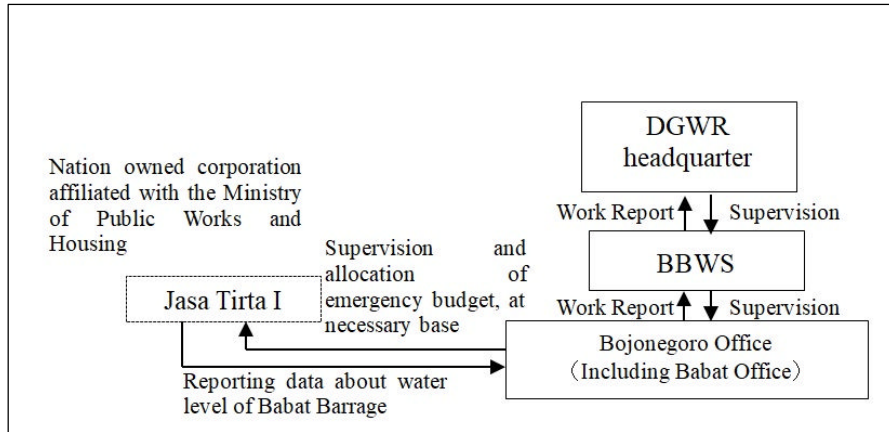


Figure 4: Organization Relationship Diagram for the Operation and Maintenance of this Project (Schematic)

In light of the above, it is judged that no particular institutional issues were observed with regard to the project's operation and maintenance.

### 3.4.2 Technical Aspects of Operation and Maintenance

At the Bojonegoro Office, employees are required to undergo training two times per year. This training is carried out at facilities such as research or university institutes in Indonesia and covers inspections of river barrages and levees, opening and closing of water gates, water level observation methodology, barrage's maintenance, and how to use discharge pumps. Employees who receive training share what they learned with colleagues and this knowledge is put to good use in daily maintenance work. On-the-job-training is also carried out for new employees in a timely manner. One of the requirements for new employees is that they must have graduated from a specialty school (vocational college or four-year university). After being hired, new employees undergo performance valuations on a regular basis within the organization and their capabilities and experience has been confirmed. Jasa Tirta I also provides training to employees on a regular basis. This training covers operation of machinery and electrical work, fire fighting, and accident prevention, etc. As with the Bojonegoro Office, training is conducted at facilities of research and university institutions in Indonesia. The hiring requirement and on-the-job-training is the same, too. Through field visits and interviews at both organizations, it was confirmed that highly experienced employees are assigned based on the right person for the right job. In addition, it was confirmed that a manual on maintenance for project facilities has been created by both organizations and this manual is being used in a timely manner.

Based on the above, no technical issues were observed with regard to the project's operation

and maintenance.

### 3.4.3 Financial Aspects of Operation and Maintenance

Table 10 shows the operation and maintenance budget of Bojonegoro Office for the most current four years.

Table 10: Operation and Maintenance Budget of Bojonegoro Office

(Unit: million Rp.)

2014	2015	2016	2017
Approx. 8,000	Approx. 8,000	Approx. 12,000	Approx. 14,000

Source: BBWS

Bojonegoro Office and BBWS commented that, “Every year sufficient budget funds are appropriated for maintenance work. There has never been a budget shortfall that has affected maintenance work.” The budget has increased since 2016. One reason cited for this increase is that the central government is more strongly aware of the importance and need for DGWR’s operations in terms of water supply, irrigation and flood control. When looking only at this project’s facilities, the budget for maintenance has been allocated in just the right amount, with attention given to increasing frontline workers and appropriate flow rate management (including water level observation and management of various data). Interviews at the office also confirmed that there are no funding issues<sup>34</sup>.

Based on the above, taking into account that no insufficient maintenance has occurred due to a shortfall in the budget, no particular financial issues were observed with regard to the project’s operation and maintenance.

### 3.4.4 Status of Operation and Maintenance

At the time of ex-post evaluation, there were no particular problems with the levees and discharge channel developed by this project, the facilities including Babat Barrage, and maintenance situation. Both the Bojonegoro Office and Jasa Tirta I prepare a maintenance plan every year, and inspections and maintenance of each facility are carried out after identifying necessary areas of emphasis. This was confirmed through interviews at both organizations and

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<sup>34</sup> Although specific monetary data could not be obtained on the budget for operation and maintenance of the project’s facilities handled by Jasa Tirta I, interviews with senior management revealed that although monetary amounts are not large, every year the budget is appropriated in the right amount needed. Also, according to Jasa Tirta I, separate from this project, it carries out a water supply project at a water treatment plant fed by the Solo River, which provides ample fee income.

field visits.

There are no problems with the purchase or storage of spare parts at the Bojonegoro Office and Jasa Tirta I. Every year the necessary budget is appropriated. However, Jasa Tirta I keeps purchases and storage of spare parts to a minimum because relatively major maintenance work has not been required. If major repairs or replacement is needed, Jasa Tirta I can address the situation internally or request assistance from the Bojonegoro Office.

In light of the above, no major problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore sustainability of the project effects is high.

#### **4. Conclusion, Lessons Learned and Recommendations**

##### 4.1 Conclusion

This project implemented river improvement work in the lower Solo River Basin on the island of Java, which is subject to frequent flooding, in order to contribute to the reduction of flood damages, improve productivity of agriculture in the surrounding area, and stimulate the economy. Relevance of this project is high because it provides a development plan for infrastructure needed to reduce flood damage and disaster risks through the *National Medium-term Development Plan* and the *Strategy Plan*, identifies development needs related to the development and improvement of flood control and levees through the construction of barrages and dams in the lower Solo River Basin, and maintains consistency with the assistance policy of the Japanese Government. As for efficiency, project outputs were implemented mostly as planned, but project costs exceeded the initial plan due to rising consulting service and management costs and land acquisition costs and construction costs incurred after the completion of the loan (since 2004). The project period had a low efficiency because land acquisitions had yet to be completed by the executing agency even at the time of ex-post evaluation. As for quantitative effects, discharge capacity at the time of ex-post evaluation exceeded the target value, the water level observed at the Babat Barrage was below the levee height at the same place, and no flooding from the levee of the main Solo River or flood damage has occurred. Additionally, interviews with local residents and farmers as well as economic and agricultural production data indicate the project is supporting the stimulation of the local economy. Thus, the effectiveness and impacts of this project are high. There are no particular concerns regarding the structural aspects, technical aspects and financial aspects of the

organizations and departments in charge of the project's operation and maintenance. Thus, sustainability of the effects realized through this project is high.

In light of the above, this project is evaluated to be satisfactory.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

- At the time of ex-post evaluation, BBWS observes the water level of the Solo River on a daily basis, but it was observed that BBWS does not fully share data on river water level and flood damages with Jasa Tirta I. This data is useful for the analysis of effects of flood control projects; thus, it is desirable that a system be developed for sharing this data among related parties to every extent possible. Also, it is desirable to properly store and manage the past data.
- At the time of ex-post evaluation, land acquisitions had yet to be completed in some areas (approximately 7km) of the lower Solo River Basin. It is desirable that BBWS cooperate with DGWR and address this situation in a prompt manner.

### 4.2.2 Recommendations to JICA

- None.

## 4.3 Lessons Learned

### Importance of coordination related to land acquisition and resettlement at an early stage

- Although the task of land acquisition and resettlement is not an easy in the lower Solo River Basin as some residents obstinately refuse resettlement and land provision, the possibility cannot be refuted that progress could have been made that BBWS should have prepared for consultation with the residents widely ahead of time prior to the start of the project, identified the coordinating capabilities and influence of the local governments and community leaders at earlier stage, closely tied up and taken all measures (example: BBWS continues to make proposals or lobby, so as to have local governments and community leaders repeatedly engage residents in discussions patiently). In addition, as a possible measure to be taken during the project implementation, there may have been room for BBWS and local governments to carry out awareness raising activities to encourage residents continually living along the Solo River outside the levee (high water channel) or provide some form of useful incentive outside of money, or review such measures proactively. Therefore, if difficulty in land acquisition could be foreseen at an early stage after the start of the project, a persistent stance is needed in which

negotiations should be carried out after coordination to every extent possible with relevant institutions, and based on predictions of outcomes, and in which difficult situations are addressed to every extent possible.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs	<p>1. River improvement</p> <ul style="list-style-type: none"> <li>• Levee (approx.126km)</li> <li>• Low water dike construction (approx. 4km)</li> <li>• High water dike construction (approx. 3km)</li> </ul> <p>2. Discharge Channel</p> <ul style="list-style-type: none"> <li>• Small discharge channel at Sedayulawas (length: 12.4 km, bottom width: 25 m)</li> </ul> <p>3. Land Acquisition</p> <ul style="list-style-type: none"> <li>• Levee (land acquisition and resettlement: approx.3,000 homes)</li> <li>• Part of new river channel (land acquisition in the vicinity of the Karangenen Shortcut)</li> </ul> <p>4. Consulting Services</p> <ul style="list-style-type: none"> <li>• Bid assistance, construction project management, and detailed design of Jabung Reservoir and Small discharge channel width expansion at Sedayulawas, etc.</li> </ul>	<p>1. River improvement</p> <ul style="list-style-type: none"> <li>• Approx. 131km (Note: this 131 km includes construction by the Indonesian side to be borne after the end of loan disbursement (2004))</li> <li>• Approx. 2.6km</li> <li>• Approx. 2.7km</li> </ul> <p>2. Discharge Channel</p> <ul style="list-style-type: none"> <li>• As planned</li> </ul> <p>3. Land Acquisition</p> <ul style="list-style-type: none"> <li>• Estimated almost as planned</li> <li>• Estimated almost as planned</li> </ul> <p>4. Consulting Services</p> <ul style="list-style-type: none"> <li>• As planned</li> </ul> <p>[Additional Output]</p> <p>1) Development of Babat Barrage as well as dikes in the vicinity and access road</p> <p>2) Development of bridge at the inlet of Jabung Reservoir and water gate at the outlet</p> <p>3) Consulting services for 1) Development of Babat Barrage as well as dikes in the vicinity and access road</p>
2. Project Period	December 1995 – December 2001 (73 months)	December 1995 – February 2018 (267 months, not completed yet)
3. Project Cost Amount Paid in Foreign Currency	7,238million yen	2,032million yen
Amount Paid in Local Currency	6,325million yen (140,541million Rp.)	13,100million yen (871,726million Rp.)
Total	13,563million yen	15,132million yen
ODA Loan Portion	10,796million yen	10,781million yen

Exchange Rate	<p>1 Rp.=0.045 yen  1USD=98.3 yen  (As of April, 1995)</p>	<p>1Rp.=0.015349 yen  1USD=117.04 yen  (Average between 1995 and 2004)  1Rp.=0.008713 yen  1USD=104.18 yen  (Average between 2012 and 2017)  based on rates issued by the IMF's  International Financial Statistics Data</p>
4. Final Disbursement	August 30, 2004	