

PROJECT DOCUMENT
OF
THE ASIAN INFRASTRUCTURE INVESTMENT BANK

Republic of Indonesia
Dam Operational Improvement and Safety Project Phase II

CURRENCY EQUIVALENTS
(Exchange Rate Effective February 27, 2017)

Currency Unit	=	Indonesian Rupiah (IDR)
US\$ 1	=	IDR 13,343

ABBREVIATIONS

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
AMDAL	Environmental Impact Analysis (<i>Analisis Mengenai Dampak Lingkungan</i>)
Balai PSDA	River Water Resources Management Unit (under the Provincial government)
BAPPENAS	National Development Planning Ministry (<i>Badan Perencanaan Pembangunan Nasional</i>)
BDSF	Basic Dam Safety Facility
BNPB	National Disaster Management Authority (<i>Badan Nasional Penanggulangan Bencana</i>)
CDMF	Central Dam Management Unit (in MPW)
CPIU	Central Project Implementation Unit
CPMU	Central Project Management Unit
CPF	Country Partnership Framework
DG	Directorate General
DGWR	Directorate General Water Resources, MPW
DOISP	Dam Operational Improvement and Safety Project
DSC	Dam Safety Commission
DSP	Dam Safety Project
DSU	Dam Safety Unit
EA	Environmental Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
FM	Financial Management
GDP	Gross Domestic Product
GoI	Government of Indonesia
GRS	Grievance Redress Service
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IDA	International Development Association
IDR	Indonesian Rupiah
ICOLD	International Commission on Large Dams
INACOLD	Indonesian Commission on Large Dams
IFR	Interim Financial Report
IPPF	Indigenous Peoples Planning Framework
LARAP	Land Acquisition and Resettlement Action Plan
LARPF	Land Acquisition and Resettlement Policy Framework

LG	Local Government
LKPP	<i>Lembaga Kebijakan Pengadaan Barang/Jasa Pemerintah</i> (Indonesia's National Procurement Policy Agency)
LPPI	<i>Lembaga Pembiayaan Pembangunan Indonesia</i> (Indonesian Development Financing Agency)
LPSE	<i>Layanan Pengadaan Secara Elektronik</i> (e-Procurement System)
MDG	Millennium Development Goal
MIS	Management Information System
MoF	Ministry of Finance
MoHA	Ministry of Home Affairs
MPWH	Ministry of Public Works and Housing
MTR	Mid-term Review
NCB	National Competitive Bidding
NPV	Net Present Value
OM	Operations Manual
PDAM	Local-level Public Water Utility (<i>Perusahaan Daerah Air Minum</i>)
PDMU	Provincial Dam Management Unit
PIP	Project Implementation Plan
PIU	Project Implementation Unit
PMF	Probable Maximum Flood
PMU	Project Management Unit
PPP	Public-Private Partnership
ROI	Return on Investment
RPJMD	District-level Medium-term Development Plan (<i>Rencana Pembangunan Jangka Menengah Daerah</i>)
RPJMN	National Medium-term Development Plan (<i>Rencana Pembangunan Jangka Menengah Nasional</i>)
SCD	Strategic Country Diagnostic
SNG	Subnational Government
TA	Technical Assistance
UKL	Environmental Management Measures (<i>Upaya Pengelolaan Lingkungan Hidup</i>)
UPL	Environmental Monitoring Measures (<i>Upaya Pemantauan Lingkungan Hidup</i>)
US\$	United States Dollar
USDRP	Urban Sector Development Reform Project
WA	Withdrawal Application

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1. PROJECT SUMMARY SHEET

Indonesia Dam Operational Improvement and Safety Project Phase II

Project No.	000010
Client Borrower(s) Implementing Agency	Republic of Indonesia Ministry of Public Works, Directorate General of Water Resources
Sector(s) Subsector(s)	Water Water Resource Management
Project Objectives/Brief Project Description	The Project Objectives are to increase the safety and functionality of existing dams in selected locations and strengthen the operation and management capacity for dam safety.
Project Implementation Period (Start Date and End Date)	Start Date: June 16, 2017 End Date: June 30, 2023
Expected Loan Closing Date	June 30, 2023
Project cost and Financing Plan	Project Total Cost: US\$300 million AIIB: US\$125 million World Bank: US\$125 million GoI: US\$50 million
AIIB Loan (Size and Terms)	US\$125 million with a final maturity of 15.5 year, including a grace period of 8 years, at the Bank's standard interest rate for sovereign-backed loans.
Co-financing (If any) (Co-financier(s), Size and Terms)	World Bank - US\$125 million, sovereign-backed loan with a final maturity of 15.5 years, including a grace period of 8 years
Environmental and Social Category	B
Project Risk (Low/Medium/High)	High
Conditions for Effectiveness and Disbursement (If any)	Cross-Effectiveness of IBRD Loan Agreement
Key Covenants	(i) The Borrower shall carry out the Project in accordance with the agreed detailed Project Management Manual (PMM). (ii) The Borrower shall ensure that all Sub-projects comply with all dam safety measures as documented in PMM and stipulated in Co-Financing Loan Agreement
Policy Assurance	The VP Policy and Strategy confirms an overall assurance that the Bank is in compliance with the policies applicable to the Project

President	Jin Liquan
Vice-President	D. J. Pandian
Director General, Operations	Supee Teravaninthorn
Manager, Operations	Ke Fang
Project Team Leader	Ghufran Shafi, Senior Investment Operations Specialist
Project Team Members	Chongwu Sun, Environment Specialist Consultant; Ian Nightingale, Procurement Advisor; Philip Daltrop, Senior Legal Consultant; Somnath Basu, Senior Social Development Specialist; Sylvester HSU, Senior Investment Operations Specialist; Yige Zhang, Project Assistant

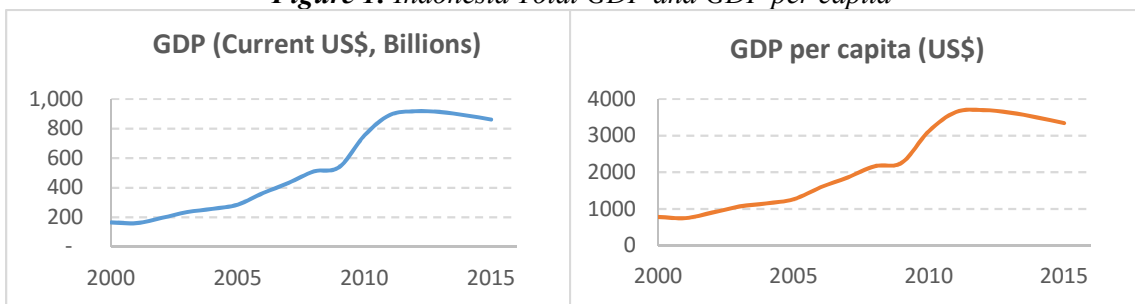
2. STRATEGIC CONTEXT

A. Country Context

1. Indonesia is the largest archipelago in the world, consisting of more than 17,000 islands that stretch over 5000 km of Southeast Asia and Oceania. Indonesia shares land borders with Papua New Guinea, Timor-Leste, and Malaysia, and maritime borders with Singapore, the Philippines, and Australia. The nation's total land area is around 190 million hectares. About 30% of the total land is agricultural while most of the rest is forest. Already the world's fourth most populous country, the population is estimated to increase to 288 million in 2050. Over half of the country's population lives in the Java–Bali region, while the rest is spread across Sumatra, Sulawesi, Kalimantan, Nusa Tenggara and Maluku, Papua, and about 6,000 other smaller inhabited islands. Economic activity is mostly focused in the Java–Bali region. The country's island geography makes transportation and service provision challenging in outlying provinces.

2. Indonesia, a member of G20 group, is the largest economy in Southeast Asia. Driven by political stability, an educated workforce and technological advancements, the economy has shown a steady growth with the gross national income per capita rising from US\$2,200 in year 2000 to US\$3,524 in 2014. This sustained economic growth has helped in lowering the poverty levels, accelerating infrastructure development and improving the performance of social sectors. Despite this, the economy is facing multiple challenges. Although the Gross Domestic Product, GDP, of the country has almost doubled since year 2000, agriculture sector still provides direct or indirect livelihood for a large segment of population. The gains from economic growth have not been distributed evenly with a large percentage of population still living very close to poverty line. Additionally, there are marked geographic disparities with the rural areas in the East of the country especially Papua which is still facing higher poverty rates.

Figure 1: Indonesia Total GDP and GDP per capita



Source: The World Bank¹

3. Indonesia has shown impressive economic growth since the Asian financial crisis of late 1990s. This has been in part because of prudent long and medium term development planning by the Government of Indonesia. The economic planning follows a 20-year development plan, spanning from 2005 to 2025. This long term planning is divided into four separate medium term plans called National Medium Term Development Plan,

¹ World Development Indicators. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed November 2016).

RPJMN, each with different development priorities. The current medium-term development plan – the third phase of the long-term plan – runs from 2015 to 2020, focusing, among others, on infrastructure development and social assistance programs related to education and health-care. Such shifts in public spending has been enabled by a reform of long-standing energy subsidies, allowing for more investments in programs that directly impact the poor and near-poor.

4. The economic growth has created a strong focus on infrastructure development in Indonesia but the current infrastructure investment is unable to meet the required demand. In fact, the total infrastructure investment in Indonesia lags behind its regional competitors. The total infrastructure investment today is only around 3-4 percent of the country's GDP. By comparison, the regional neighbors such as Thailand and Vietnam are investing around 7-8% of their respective GDPs in infrastructure sectors. This deficit in investment is not only affecting the creation of new infrastructure but has also constrained the rehabilitation, operations and upgrade of the existing infrastructure.

5. The country has also been characterized as highly vulnerable to natural disasters. It is geographically located in an active seismic zone resulting in frequent volcanic eruptions and earthquakes. According to the data from National Disaster Management Agency (BNPB), there have been 289 significant natural disasters per year over the last 30 years with an average death toll of 8000 people and an average annual reconstruction cost of US\$300-US\$500 million. This includes water based disasters with 14 reported dam failures with varying impacts. The Government stepped up its efforts post 2004 Indian Ocean tsunami to put in place a structured disaster management system in the country. This includes harmonization and coordination of the planning and management among the national, provincial and sub-provincial institutions involved in disaster risks management.

B. Sectoral and Institutional Context

6. The sustainability of natural resources including water resources is fundamental for Indonesia's inclusive and sustained economic growth. The growing population needs more fresh water for potable use and hygiene. Food security is linked to an adequate and timely availability of water for agriculture production. And since almost every industry needs water at some stage of its process cycle, the increased industrialization will entail an ever increasing water supply. Most large Indonesian cities and many of the rice (the staple food) growing areas depend on the large water reservoirs – dams and barrages – for water supply.

7. Indonesia has abundant aggregate water availability but the total water in terms of geographic and seasonal water distribution has been highly uneven. It is common for some parts of the country to be flooded in wet season due to incessant rainfall while other islands of archipelago face water shortages in dry season. The pronounced wet and dry periods lead to water shortages in not only the relatively dry rural zones of the country such as Sulawesi, and Nusa Tenggara islands but also in the densely populated islands of Java and Bali. Java in particular has nearly 60% of the population and less than 5% of the available water resource. More widespread shortages are predicted due to temperature increase and changes in rainfall patterns, as a result of a changing climate. Flooding is a growing annual occurrence throughout most of the country, imposing heavy economic losses, as much as

US\$430 million per year². From 2003 to 2013, average annual flood damages included: (i) 1.58 million affected persons; (ii) 350 deaths and 13,640 injured; (iii) 223,000 homes fully or partly damaged; and (iv) 168,000 hectares of crops inundated³. The floods sever vital transport arteries and often disrupt access to ports and airports, restricting the transfer of goods and services.

8. Although integrated water resources management (IWRM) in Indonesia has a strong legal and institutional framework, efforts to enhance water security have been inhibited by weak coordination and policy inconsistencies across government agencies. Development and management of natural resources is divided over many different sectors including the Ministry of Public Works and Housing, the Ministry of Mining, the Ministry of Environment and Forestry and the Ministry of Agriculture which more often than not lead to policy and investment inconsistencies. Improving water security in Indonesia is further constrained by: (i) administrative and fiscal decentralization affecting continuity in water resources planning and management; (ii) lack of an integrated water resources information and communications system for early warning of emergencies; (iii) bottlenecks to private participation which include complex regulations and financing from local governments which is not predictable; (iv) insufficient spatial planning; and (v) degraded watersheds and poor watershed management.

9. The aggregate water availability in Indonesia (estimated at 690 bcm/year) far exceeds the total demand (of 175 bcm/year). But total water is unevenly distributed. Kalimantan and Papua with only 13% of the country's population have about 70% of the available water resources. The country receives an average annual rainfall of 2,350 mm but different regions show strong annual variations. Likewise, there are high variations in surface water availability across different geographic areas with Kalimantan having the highest availability (34%) followed by Sumatera (22%), Sulawesi (8%), and Java (4%). The average yearly rainfall as well surface water data are shown in the Figure 2. to illustrate the strong variations across different regions.

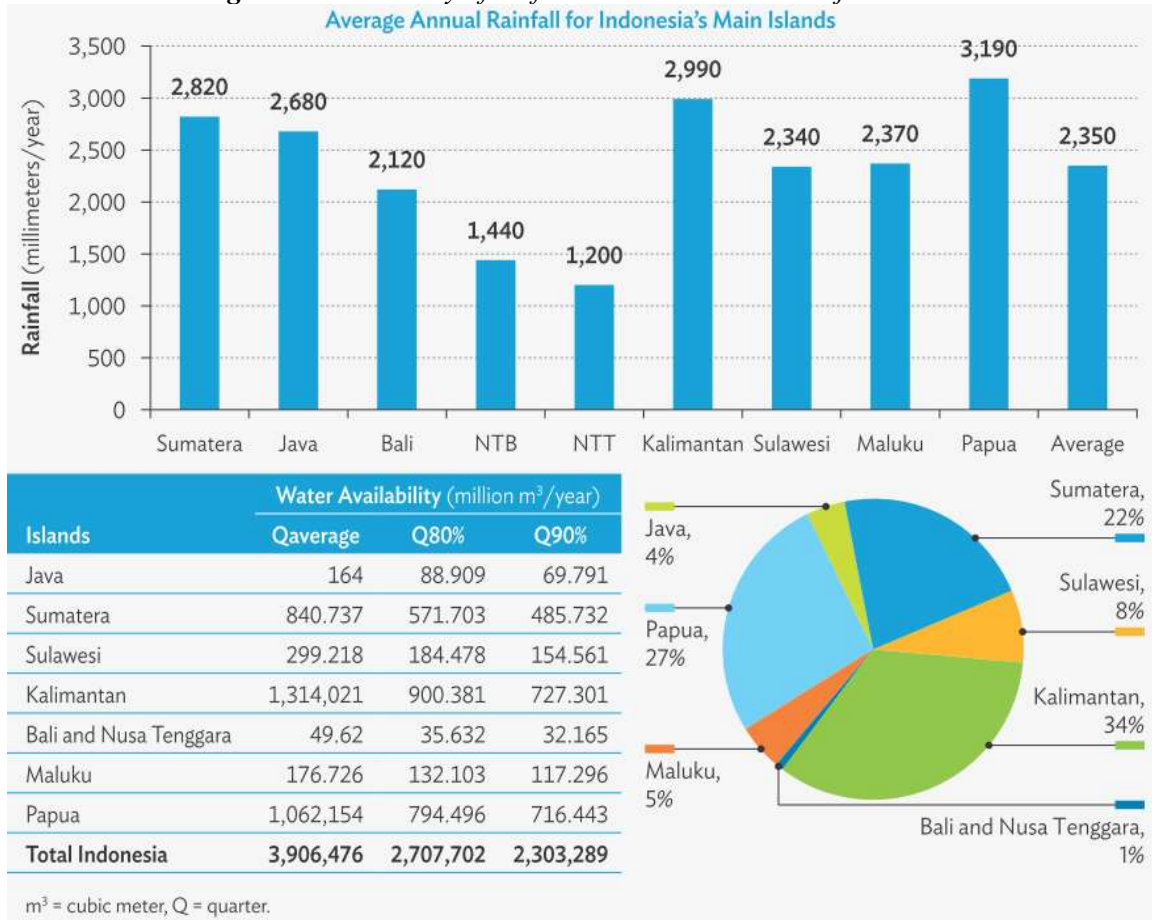
10. Indonesia has a long and successful history of dam construction. The country has a portfolio of over 2200 dams with 203 classified as large dams⁴. Despite having an impressive networks of reservoirs, the estimated storage capacity of 54 cu.m/capita is far below the target of 1,975 cu.m/capita stipulated in the 2005-2025 national long term development plan. The per capita storage capacity is also low when ranked alongside the storage capacities in other comparable economies: Brazil (3,386 cu.m /capita), China (2,486 cu.m / capita), India (2,000 cu.m / capita) and Thailand (1,277 cu.m / capita).

² Centre for Research on the Epidemiology of Disasters (CRED). EM-DAT: The OFDA/CRED International Disaster Database. www.emdat.be.

³ National Disaster Management Agency (BNPB). Indonesian Disaster Information and Data (DIBI). <http://dibi.bnpb.go.id/DesInventar/dashboard.jsp>

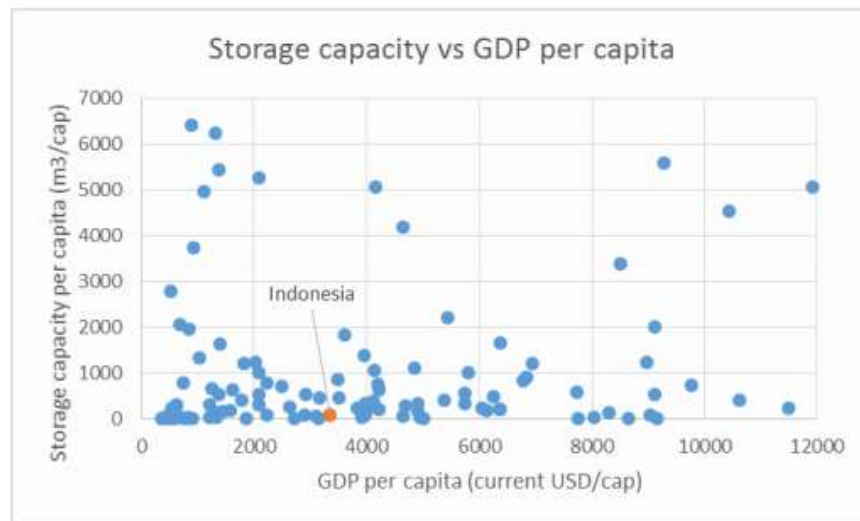
⁴ A large dam is defined as one which is: (a) more than 15 meters in height or (b) more than 10 meters in height and complies with at least one of the following conditions: (i) the crest is more than 500 meters in length (ii) the capacity of the reservoir is more than 1 million cubic meters, (iii) the maximum flood discharge is more than 2000 cubic meters per second, (iv) the dam is of unusual design.

Figure 2: Availability of surface and rain water in major Islands



Source: ADB, Country Water Assessment

Figure 3: Comparison of Storage capacity vs GDP per capita



Source: The World Bank

11. In addition to low storage capacity, the performance of most of the water resources including reservoirs is unsatisfactory. Deforestation and inappropriate agricultural

practices, which result in erosion and increased sediment loads in waterways ultimately reduce the lifetime of storage reservoirs, increase the rate of occurrence of floods and landslides, reduce the availability of water in the dry season, and raise water treatment costs. The water quality of the Indonesian rivers and lakes is far from good, due to a combination of untreated domestic sewage, solid waste disposal, and industrial effluents. This threatens both medium and long-term water security and socio-economic development. Associated problems are a lack of comprehensive urban planning and of pro-poor and pro-environment land use planning and management. Urbanization is causing increased water pollution, while increasingly severe seasonal water shortages intensify competition for water and exacerbate the impact of the overexploitation of groundwater, especially in urban areas. Lack of water storage with a unique geography is threatening the country's economic development, food security and disaster preparedness. Most of the river basins have low retention and are subject to high erosion contributing to lack of long term water availability, increased flood risks and catchment degradation. Rehabilitation and upgrade of existing water infrastructure including dams and ancillary structures are essential to increase water security, risk reduction and productive use of water resources.

12. Indonesia started introducing regulatory, institutional and administrative reforms in water resources and irrigation sector in 1990s through the assistance of other multilateral donors. River Basin Organizations (RBOs) were established and tasked with management of dams within river basins starting in the province of Java where river basin WRM agencies (Balai PSDA) were established in 1998. The Law 7/2004 on Water Resources set the stage for better governance through decentralization which allowed for establishing national River Basin Organizations and River Basin Organizations in other provinces. Under the Law, all river basins were required to have long term strategic plans (Pola) and sustainability focus water resources master plans (Rencana) outlining key actions for water resources in terms of conservation, quality, management and risks reduction. The Law was a framework law which meant that government regulations must further elaborate the general provisions. Given the complexities of the water resources environment involving different technologies, communities, levels of government, and a wide variety of stakeholders, the Government of Indonesia chose to issue separate regulations on the different aspects of WRM. The Law was suspended by the constitutional court in 2015. To fill the legal vacuum during the process of drafting a new water law, the constitutional court reinstated the old Water Law UU 11/1974.

13. The number of river basins in Indonesia based on the Regulation of Minister of Public Works Number 11A/PRT/M/2006 was 133. Based on the Decree of President of the Republic of Indonesia Number 12 of 2012 on Decision on River Basin, the number of river basins were revised to 131. Of these, 5 are international river basins (shared with Malaysia, Timor Leste or Papua Nugini), 29 basins are shared by two or more provinces, 29 river basins are considered to be of strategic national importance, 53 basins are shared by two or more districts and 15 basins are fully located within an individual district. Through the regulations of Ministry of Public Works, the river basins of strategic importance and the basins shared by provinces are managed by National RBOs (Bali Besar Wilayah Sungai-

BBWS). The other river basins are managed by Provincial Water Resources Services (Balai PSDA)⁵.

14. The World Bank has been helping the Government of Indonesia with institutional reforms which have led to a more cohesive and transparent framework for dam safety and management. The National Dam Safety Commission (DSC) is responsible for certification of dams during construction and special events during operation and reports to the Secretary General in the Ministry of Public Works. This Commission is supported by the Dam Safety Unit in carrying out inspections, evaluation of requests for licenses and certificates, provision of guidelines for operation, maintenance, safety procedures and equipment, and inspection. The DSU sits under the Secretary General and acts as a Secretariat to the Commission. The Directorate General of Water Resources is responsible for dam construction, operations & maintenance and management of water resources respectively through Center for Dam Construction, Directorate of Operations & Maintenance and decentralized river basin organizations. Oversight of the portfolio of existing dams under the responsibility of Ministry of Public Works is executed by the Central Dam Monitoring Unit (CDMU) which was established in the Directorate of Operations and Maintenance while the day to day management of individual dams is responsibility of the Dam Management Units (DMS) within the river basin organizations. The CDMU and the DMUs were established through the support of DOISP.

3. THE PROJECT

A. Rationale

15. The Project will increase the safety and functionality of existing dams in Indonesia and reduce spillway flood risks of downstream populations, through low cost but high effective investment in rehabilitation of existing dams, with a particular focus on improving their safety and operational management. The improvements in the dam structures, reservoir catchments and downstream irrigation networks will directly benefit the community, in particular the poor and women.

16. The project is well aligned with the Bank's primary mandate, i.e. to promote social and economic development in Asia through investment in infrastructure. By investing in the water infrastructure in Indonesia, the project will contribute to the twin goals enshrined in the Bank's Articles of Agreement, namely (i) fostering sustainable economic development: this will be done through rehabilitation and upgrade of the existing ageing water infrastructure including reservoirs, dams and irrigation networks, contributing to an inclusive and sustainable socio-economic growth in the country, and (ii) addressing development challenges through collaboration with other development institutions: the Bank will co-finance the project with World Bank, which has a long and established history of working in the Indonesia water resources management sector.

⁵ Source: I. Syafri. 2013. "The meaning of coordination in the arrangement of water resource management plan in Indonesia". 1st international conference on infrastructure development, UMS Surakarta

17. The proposed project represents a next phase of an ongoing project – DOISP, financed by IBRD – and shows a continued commitment to strengthening water resources institutions and asset management in Indonesia. The Government has a long-term programmatic approach to develop a portfolio management approach across its dam and reservoir sector. This is aimed at improving the aggregate levels of performance and safety of its reservoirs, starting to improve their financial sustainability, carry out the investigations, designs and actual works, and starting to address the erosion from the upper river catchments. World Bank supported the Government to invest in existing water infrastructure by preparation and implementation of a series of dam improvement projects. Dam Safety Project (DSP: 1994-2003) was the first in a series of projects envisaged at supporting the Governments efforts and was followed by the Dam Operational Improvement and Safety Project (DOISP: 2009-2016). The overall aims of DOISP were: (i) to increase the safety and the functionality of the 63 short-listed prioritized large dams/reservoirs, and (ii) develop and mainstream the regulatory and administrative arrangements for dam and reservoir management and safety that are more sustainable from a technical, environmental and financial perspective. It was recognized at the time that the rehabilitation and improvement of several dams would require more extensive surveys, investigations and designs under DOISP to allow implementation of the works under an envisaged second phase (DOISP-II). The longer-term time frame was also considered more feasible to realize the objectives of the institutional reforms. Both projects were rated in the satisfactory range by the World Bank and have included structural and non-structural interventions to improve safety and operational standards, enhancing sustainable catchment management practices, strengthening newly established dam safety institutions along with supporting adaptations to climate change, enabling more reliable supplies. The DOISP-II represents continued support for the series of activities that started in 2009.

18. The project will build on the WB's global experience with dam rehabilitation and safety projects in support of the Government's effort to enhance public sector performance. Global experience with dam safety and rehabilitation programs highlight the need for an appropriate balance of structural and non-structural interventions within an objective prioritization framework to ensure sound institutions, secure infrastructure and sustainable revenues. The additional financing draws on lessons learned from a number of related World Bank projects, including similar dam safety programs in Armenia, China, India, Indonesia and Sri Lanka as well as through reimbursable technical assistance in countries like Brazil. Drawing on this experience is helping to inform the appropriate mechanisms and innovations, such as the piloting of performance management contracts to stimulate private sector participation; conceptualizing market based mechanisms such as payments for environmental services to provide the incentives for improved watershed management and sediment management; and helping design a comprehensive asset management system to direct the flow of limited funds.

19. Building on the existing foundations of the Government's program, the projects have supported a combination of structural and non-structural measures to assist in the formulation and execution of a comprehensive program to address the systemic issues associated with dam safety. Coupling the funds required for the physical rehabilitation with the global experience will help increase the project's development impact and address the underlying systemic issues in ways that go beyond what can be realized by exclusive

reliance on the Government's own resources. Vertical integration of the basic elements of dam safety across different areas of Government is aimed at creating a virtuous cycle that will secure the structural integrity of the dam, implement the required operational and management measures, enhance the capacity and re-enforce the regulatory mechanisms to implement a portfolio approach that assures an organization level of safety with accompanying certification. The project also builds on the lessons learned from a number of related World Bank projects that advocate for an integrated, holistic approach to dam safety and operations within the context of the river basin and to ensure the adequacy of the supporting institutional environment.

B. Objective

20. The Project Objectives are to increase the safety and functionality of existing dams in selected locations and strengthen the operation and management capacity for dam safety.

21. The following key indicators will be used to ascertain the progress of the project:
- a) Direct Project Beneficiaries (number), of which female (%). This will include those beneficiaries directly reliant on the water from the dams under the project as well as those populations in downstream areas that would be at risk in the case of dam failure.
 - b) Dams returned to full operation with reduced risk of failure, measured using risk indices before and after rehabilitation (number). This will be based on the existing methodology developed and applied under DOISP.
 - c) Project dams where emergency response plans, including dam break analyses, have been prepared and disseminated to the population (number).
 - d) Selected/targeted institutional capacity for dam management strengthened, measured by development and application of needs based budgeting within a national asset management system.

C. Project Description and Components

22. The Dam Operational Improvement and Safety Project, DOISP, helped the Government of Indonesia to improve the aggregate levels of performance and safety of its reservoir sector, improve the financial sustainability of institutions involved in water governance, carry out the investigations, designs and physical works, and address the erosion in upper catchments. The proposed project, DOISP-II, will build upon the Government's experience in preparation and implementation of the DOISP to develop a portfolio management approach across its dam and reservoir sectors. This will be done by scaling up the activities of the original project which were structured around five components summarized below and detailed in Annex- 2.

23. **Component 1: Dam Operational Improvement and Safety Works and Studies.** DOISP-II will finance the physical rehabilitation of an estimated 140 major dams in the portfolio to restore dam performance and safety in accordance with acceptable international and national design standards. This includes 20 major dams prioritized and prepared under DOISP, along with priority investments from the remaining 120 major dams in the

portfolio that are to be prioritized based on the objective criteria for identification and assessment. Support would include: (i) specialized studies, including hydrological assessments to review flood flow data, estimate flood discharge frequency and review spillway capacity and downstream flooding risks; (ii) Surveys, Investigations and Designs (SIDs), supervision and quality control of rehabilitation works; (iii) rehabilitation and safety remedial works on existing dams and their associated structures, including civil and hydro-mechanical works; (iv) installation, rehabilitation or upgrading of Basic Dam Safety Facilities (BDSF) to improve safety monitoring, flood forecasting and preparedness systems; and (v) installation, rehabilitation or upgrading of instrumentation for operational hydro-meteorological monitoring. The project will not finance any new dam construction and is focused on the rehabilitation of existing dams and their associated structures, along with improved safety measures. These activities are not intended to exceed the original schemes, change their nature, or so alter or expand the scope and extent as to make them appear as new or different schemes.

24. **Component 2: Operations and Maintenance Improvement and Capacity Building.** The Project will finance improvements in the operational elements required for securing dam safety and improved utilization. This would include: (i) conducting strategic studies, including those for establishing asset management systems and needs based budgeting for operation and maintenance and piloting of performance-based contracts; (ii) Operation and Maintenance Plans; (iii) Instrumentation Plans and setting the service standards; (iv) preparing Emergency Preparedness Plans, including dam break analyses, downstream flood mapping and benchmarking; (v) conducting Community Participation Programs in reservoir maintenance, income-generating activities related to reservoir maintenance and related skills training with local communities; and (vi) human resource development and capacity building of dam safety institutions.

25. **Component 3: Reservoir Sedimentation Mitigation.** The Project will support the scale-up of a comprehensive Sedimentation Management Program. This will include: (i) studies and surveys related to reservoir sedimentation; (ii) Corrective Measures, such as (a) dredging; (b) flushing and diversion works; (c) check dams; etc. and, (iii) Preventative Measures, such as (a) community watershed management, including community participation programs; and (b) piloting of incentive mechanisms, such as Payment for Environmental Services.

26. **Component 4: Dam Safety Institutional Improvement.** The Project will support Government's institutional evolution and further innovations in building water resources institutions in Indonesia. The institutional activities include: (i) strengthening the capacity of the MPWH to manage its dam portfolio better and regulate large dams in the country, and (ii) improving the sustainability of the rehabilitation works and the reservoir life. This will include support for the following: (i) institutional assessments, benchmarking and enhanced coordination mechanism among line agencies; (ii) regulatory support and instruments, standards and guidelines, including national dam policy on registration, inspection, safety compliance and penalties; (iii) a National Dam Safety Management System; (iv) enhancing dam safety through improved surveillance and protection measures; and (v) supporting development of a dam technology center.

27. **Component 5: Project Management.** The Project will support continued implementation and the overall project management through: (i) the Project Management Unit (PMU) within Ministry to provide the necessary support services for timely and effective project implementation, including monitoring & evaluation, procurement, financial management, safeguard monitoring, etc.; (ii) Technical Assistance for the Dam Safety Unit to ensure oversight and effective implementation; (iii) Technical Assistance for the river basin organizations to ensure timely and effective implementation; (iv) Environmental and Social Service Provider/s; (v) an international Dam Safety Panel of Experts; (vi) a National Dam Safety Review Panel; (vii) the National Steering Committee for Water Resources; and, (viii) the incremental operating costs of the Central Project Management Unit's (CPMU) and the Project Implementation Units (PIUs) for activities related to project implementation.

D. Cost and Financing

28. The project cost of DOISP-II is estimated at US\$300 million and is jointly co-financed by the Bank, the World Bank, and the Government of Indonesia. The financing plan comprises of (i) a sovereign-backed loan of US\$125 million by the Bank, (ii) a sovereign-backed loan of US\$125 million by IBRD, and (iii) US\$50 million by the Government of Indonesia as counterpart funds. The World Bank will be the lead co-financier and will administer the Bank's loan on behalf of the Bank. Financial terms include an annuity loan with a 15.5 year term and a grace period of 8 years. Component-wise project investment plan is given below – the allocation tables for the two loans will however permit reallocation between the various components, depending on project needs (see the table 2 in paragraph 67).

Table 1: Project Cost and Financing Plan
(US\$ million)

	Cost	Financing		
		AIB	IBRD	GoI
Component 1	161.96	67.48	67.48	27.00
Component 2	23.08	9.62	9.62	3.84
Component 3	55.07	22.95	22.95	9.17
Component 4	24.82	10.34	10.34	4.14
Component 5	35.07	14.61	14.61	5.85
Total Cost	300.00	125.00	125.00	50.00

E. Implementation arrangement

29. **World Bank Supervision:** The WB will be the lead co-financier and will supervise the Project and administer the Bank's loan on behalf of the Bank, in accordance with the WB's applicable policies and procedures, and a Project Co-lenders' Agreement, to be signed in accordance with the existing Co-financing Framework Agreement between the Bank and the WB. The Bank has reviewed the WB's Procurement and Consultant Guidelines (2014) and the WB's sanctions policies and procedures including WB's Anti-

Corruption Guidelines. It has found them satisfactory for application to the project in accordance with the Bank's Procurement Policy⁶ and the Bank's Policy on Prohibited Practices⁷. In addition, the Bank also reviewed the WB's standard environmental and social safeguard policies that have been triggered for the Project. As detailed in Section 4.D, Environmental and Social, the Bank found them in accordance with the Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS1-Environmental and Social Assessment and Management, ESS2-Involuntary Resettlement)⁸. The Bank will accordingly rely on the WB's determination of compliance with the above WB policies and procedures applicable to the Project. Project monitoring and reporting, as well as financial management, will also be carried out in accordance with the WB's requirements. This approach will ensure that one set of policies will apply to the entire Project; it will also provide a single point of contact for the GoI and therefore facilitate a more efficient and seamless approach to Project implementation.

30. The institutional arrangements with responsibility for dam safety and operations includes a range of different stakeholders. Overall oversight will be provided by the National Steering Committee for Water Resources in the National Development Planning Agency (BAPPENAS). Drawing on the lessons from earlier projects technical assistance to support implementation and improve the quality of designs, supervision etc. will be provided through regional teams under the overall guidance of the central ministry. This on the ground presence is intended to provide a stronger framework for implementation. The organizations and agencies currently involved in dam safety, along with their brief responsibilities, include the following.

- (i) **Directorate General of Water Resources:** The roles and responsibilities of the Directorate General of Water Resources include formulation of policies in the field

⁶ Under the Procurement Policy, the Bank may agree on a common procedure framework with other co-financiers for a jointly-co-financed Project, if the Bank has determined that the co-financiers' procurement policies are consistent with the Bank's Core Procurement Principles and Procurement Standards (paragraph 5.11.3). In that case, the lead co-financier is normally responsible for overseeing the procurement process, applying its own procurement policy and internal review and clearance procedures, and determining whether the procurement has been conducted in accordance with its own policy. In all cases, the Bank's eligibility requirement will apply, permitting firms and individuals from all countries to offer goods, works and services for a Bank-financed contract.

⁷ Under the Bank's Policy on Prohibited Practices, the Bank may agree to the application of the prohibited practices or similar policy and investigations and sanctions processes of certain co-financiers for a Project (paragraph 12.6). As a precondition, the Bank must be satisfied that the co-financier's policy and processes are consistent with the Bank's Articles of Agreement and materially consistent with the Bank's Policy on Prohibited Practices. In that case, the Bank may agree that the co-financier will be responsible for the investigations and sanctions processes and the Bank may agree to give full force and effect to the co-financier's sanctions decisions with respect to investigations arising from the Project.

⁸ Under the ESP, the Bank may agree to the application, in a project, of the environmental and social policies and procedures of co-financiers. As a precondition, the Bank must be satisfied that these policies and procedures are consistent with the Bank's Articles of Agreement and materially consistent with the Bank's ESP and relevant ESSs, and that appropriate monitoring procedures are in place. In that case, the Bank may rely on the co-financier's determination of compliance with the co-financier's policies and procedures.

- of conservation and utilization of water resources; implementation of the policies; and preparation of standards and procedures for water resources management.
- (ii) **Dam Center (Pusat Bendungan):** The roles and responsibilities of the Dams Center include preparation and implementation of guidance, standards and procedures for dam and reservoirs; planning arrangements of these assets; and implementation of administrative affairs.
 - (iii) **Dam Safety Unit:** The tasks of Dam Safety Unit include implementing the provision of technical support assessment and preparation of technical advice and monitoring the behavior of the dam to the “dam safety commission”.
 - (iv) **Research Center for Water Resources (RCWR):** The roles and responsibilities of the RCWR Unit include preparation of technical policies and strategies; research and assessment in water fields; and monitoring, evaluation and learning in water resources management.
 - (v) **BBWS/BWS:** The River Region Bureau (*Balai Wilayah Sungai*) has the tasks of water resources management including planning, construction, operation and maintenance in the context of the conservation of water resources, water resources development, and utilization of water resources and control of water resources in the river basin.
 - (vi) **DINAS PSDA:** The main duties and functions of the Department of Water Resources Management in Central Java Province (PSDA Central Java Province) includes the duty to implement regional government affairs in the field of water resources based on the principle of local autonomy and duty of assistance.

31. The project will be implemented under the Ministry of Public Works by the Directorate General of Water Resources (DGWR) through the Directorate of Operation and Maintenance (DO&M), in accordance with the detailed Project Management Manual. A Central Project Management Unit (CPMU) would be established within the Central Dam Monitoring Unit (CDMU). The CDMU will be responsible for technical assurance, with the CPMU assisting with implementation oversight, project management, financial management and procurement, safeguards compliance, training and capacity building. The CDMU CPMU will be supported with Technical Assistance to support implementation. The Strategic Assistance will help re-enforce the capacity of the CDMU CPMU to ensure quality implementation.

32. The 16 regional Balai(Besar) WS Offices (River (Regional) Basin Organizations) under the MPWs that are responsible for dam operation and management will be responsible for implementation of the works. Project Implementation Units (PIU) will be established within each of the Dam Management Units (DMU) of the participating BBWS. These PIUs will be clustered based on the number and nature of the support, considering the amount of civil works, the number of studies, equipment and capacity required. This will be informed through a transparent, objective assessment based on the initial screening carried out during preparation and reviewed annually during implementation. Technical Assistance to support the PIUs will be provided across a number of clusters. This is proposed to capitalize on the economies of scale afforded by such clusters, maximize the economic efficiency, and ensure consistency in the approach and quality in support being

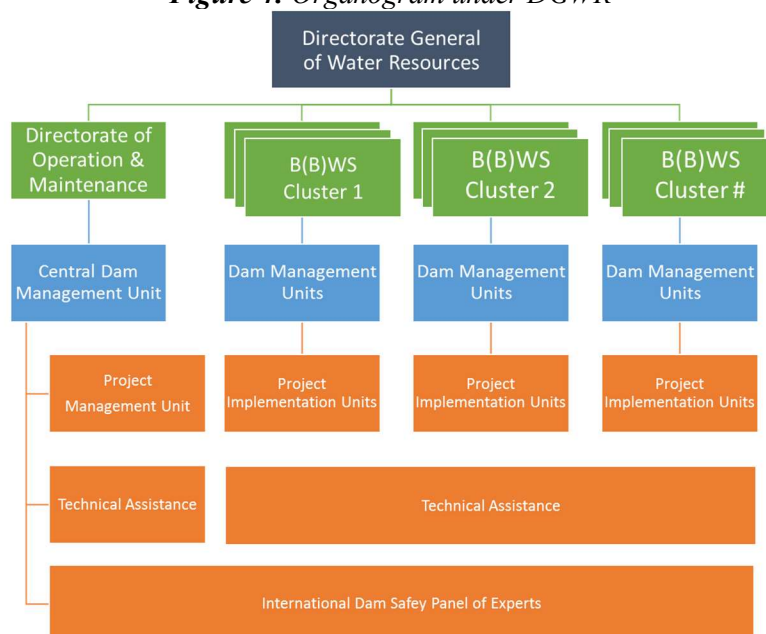
provided. The CDMU CPMU and the Technical Assistance will provide assistance and support during implementation.

33. The budget will be provided to the PIUs through the sectoral APBN budget. The RCWR, a semi-autonomous unit of MPW, will be assigned study, survey and technical review tasks, specifically those relating to hydrology and hydraulics. The training and institution strengthening will be implemented through the CDMU and include not only central government staff but also local government staff responsible for dam safety and management. This arrangement draws on the satisfactory performance of the other Bank-assisted projects with the same counterpart.

34. Overall policy oversight will be provided by the National Steering Committee for Water Resources (NSCWR) in Bappenas. The NSCWR was established 2004 and has been providing oversight for the other World Bank funded projects in the sector.

35. A National Dam Safety Review Panel and an International Dam Safety Panel of Experts would be established under the project to provide support during implementation. The independent Panel of Experts (PoE) would comprise several individual consultants, each with considerable experience in dam rehabilitation programs. The independent PoE would be expected to visit at least twice a year for a period of two weeks, at minimum, to review, assess and advise Government on the program. The International PoE is not envisaged under the Government’s own regulation and proved difficult to mobilize effectively under the parent project. Given the portfolio approach the PoE should be mobilized to address those highly specialized technical issues and projects with a high risk. This advocates for the development of a portfolio approach to properly assess and identify the risks within the portfolio so that the PoE can be deployed effectively. Aligning the International PoE with the National PoE can help facilitate the exchange of knowledge and experience and enhance the technical functioning and inputs of both panels.

Figure 4: Organogram under DGWR



36. **Procurement** of all co-financed contracts will be conducted in accordance with the World Bank’s “Guidelines: Procurement under IBRD Loans and IDA Credits” dated January 2011 (revised July 2014), and “Guidelines: Selection and Employment of Consultants by World Bank Borrowers” dated January 2011 (revised July 2014); which are fully aligned with the requirements of the Bank’s Procurement Policy.

37. The procurement under the project will include: (1) selection of consulting firms for Technical Assistance to support the CPMU in project implementation; (2) selection of consulting firms for Technical Assistance to support the PIU; (3) supply and installation of hydro-mechanical equipment; (4) work contracts for dam rehabilitation including design, construction, and supervision (procurement will be conducted by local and central government); (5) selection of individual consultants for the Panel of Experts; and (6) supply and installation for Basic Dam Safety Facilities. The Procurement Plan for the first 18 months was reviewed by both the Bank and the World Bank during Appraisal.

38. The existing CPMU under the DG of Water Resources is responsible for project implementation. Procurement under the proposed project will be carried out by the current Procurement Service Unit (ULP). According to the past experience and lessons learned from the DOISP project implementation, it is expected that several key issues and risk concerning procurement and contract management could be anticipated and mitigated during the project implementation as follows:

39. There is a possibility of delays in contract implementation, particularly procurement of goods which shall be imported. During the ongoing phase, the procurement of goods and services under several contracts required additional WB’s supervision and support. DOISP-II will require the Bank and the World Bank to engage extensively with CPMU for ensuring compliance with procurement procedures and implementation of procurement plan.

40. On strategically important and complex procurements, the Bank will work with World Bank for regular procurement supervision in the field every year including ex-post reviews of not less than 20% of the contracts.

4. PROJECT ASSESSMENT

A. Technical

41. The proposed project is intended to finance a scale up of activities which have recently been implemented through the ongoing DOISP. The project will not finance any new dam construction and is focused on the rehabilitation of existing dams and their associated structures, along with improved safety measures. This includes the rehabilitation of 20 major dams prioritized and prepared under DOISP, along with priority investments from the more than 100 remaining major dams in the portfolio that are to be prioritized based on the objective criteria for identification and assessment during implementation.

42. During its design, the DOISP was envisaged as the first in a series of projects under the proposed programmatic support. The overall aims of the program were: (i) to increase the safety and the functionality of the 63 short-listed prioritized large dams/reservoirs, and (ii) develop and mainstream the regulatory and administrative arrangements for dam and reservoir management and safety that are more sustainable from a technical, environmental and financial perspective.

43. It was recognized that the rehabilitation and improvement for a group of 29 dams would require more in-depth analysis and special studies, including extensive surveys, investigations and designs under DOISP to allow implementation of the works under an envisaged second phase (DOISP-II). As a result, the first phase of the project focused on the rehabilitation works for 34 dams to be completed. This also allowed sufficient time to realize the objectives of the institutional reforms.

44. In the interim six of these dams have been addressed by Government or removed from the prioritized list due to effectiveness and efficiency reason. The Special Studies for the remaining 23 major dams have been completed under DOISP. These have determined the root causes of their reduced safety and are used to inform the detailed design of risk-reducing remedial works, along with the necessary environmental and social safeguard requirements.

45. The 23 priority dams are distributed among nine river basin organizations, ranging in height from 7 to 129 meters with an average height of 39m and with an average storage capacity of 164 Mm³ ranging from high risk dams with a low capacity of only 0.13 Mm³ to larger reservoirs such as Juanda which has a storage capacity of 2,556 Mm³. Only six of the 23 priority dams identified have been built in the past 25 years, with the average age of over 50 years and the oldest constructed 100 years ago in 1916 with the Tempuran Dam in BBWS Pemali Juana. The Modern Equivalent Asset Value of these 23 dams is estimated at Rp 12 trillion (roughly US\$980m equivalent).

46. The recommendations of the special studies for three dams were implemented under the ongoing DOISP, leaving 20 dams to be included under DOISP-II. Detailed designs and safeguard requirements have been advanced for 6 of the 20 investments and the tender dossier are expected to be prepared in time to accelerate their implementation in early 2017. The total investment cost for these six phase 1 investments is estimated at US\$17 million. Five of the first six phase 1 sub-projects are focused on relatively smaller dams within the portfolio, ranging from 8 to 23m, with a focus on rehabilitation of the main wall and dikes, hydro-mechanical works and sediment removal. The sixth includes replacement of concrete arches in the spillway of the Ubrug Dam with two radial gates. The Ubrug Dam is one of three saddle dams within the Jatilihur system under the BBWS Citarum. At the time of construction, the four outlet bays were blocked with solid concrete arches with the intention that these would be breached through blasting with dynamite during a high flood event. The installation of the radial gates will improve operational capacity and allow for the BBWS to manage the system to balance the risk during flood events.

47. Further additional rehabilitation works and remedial measures would be carried out for prioritized dams in the portfolio of 120 major dams under the MPWH. These will be assessed as part of an update to inform the risk assessment based on the modified ICOLD method. This method has been developed, reviewed, assessed and applied under the DOISP to provide a portfolio approach to management of dam safety by the MPWH CDMU.

48. Institutional support would continue to build on the foundations provided under the DSP and the first phase of DOISP. This is increasingly important given the ambitious development program launched by the Government with the construction of 65 dams over the five-year period from 2014-19. This has important implications and presents a number of challenges on the institutional capacity. The support under the project will focus on a range of legal and institutional capacity building and enhancement measures within the Directorate of Operation and Maintenance under the Director General for Water Resources in the Ministry of Public Works and Housing, the Central Dam Monitoring Unit, the Dam Safety Units within the basin organizations, and the Research Center for Water Resources within the MPWH. This support would include formal training and certification, on-the-job training, mentoring and peer to peer exchanges, research and technology innovations, as well as the formulation of additional regulations to enhance the enabling environment for sustained dam safety and improved operations.

49. Sediment management and mitigation measures are to be scaled up based on the experience of the community participation program under the current DOISP. This will include corrective mitigation measures, such as dredging, sediment traps, check dams, stabilization works and reservoir flushing, along with preventative management measures, such as catchment interventions to address sediment at the sources. This will include a focus on participatory approaches, piloting of market based mechanisms such as payments for environmental services, all aimed at continuing to provide cost effective options to improve the operational efficiency and sustainability of reservoirs.

B. Economic and Financial

50. An economic and financial analysis has been carried out to assess the economic and financial impacts of the project. This includes specific assessments for individual investments; and examination of the gains derived from improved operations. The potential losses resulting from dam breaks on each of the dams to be prevented by the project have been estimated using baseline data survey on the basis of (i) flood damage to houses, livestock, farm areas and infrastructure and industrial/commercial facilities; and (ii) reduction in irrigated agriculture production and farm income as a result of floods or loss of irrigation water. Detailed methodology and analysis are given in Annex-3

51. The expected combined outcomes of these activities are improvements in the dam safety or reduction in the probabilities of dam failure, restoration of the operational performance of dams and reservoirs, and increased longevity of dam life. The achievement of these outcomes is expected to increase the safety of existing dams and their operational performance thereby: (i) avoiding loss of human life, (ii) avoiding irrigation benefit loss, (iii) avoiding hydropower benefit loss, (iv) avoiding household property losses, and (vi) avoiding emergency response costs.

52. The cost benefit analysis methodology adopted for this project follows the probabilistic approach to dealing with the effects of dam safety improvement interventions. Successful implementation of this approach requires proper risk evaluation and risk measurement. It requires precise estimates of annualized risk of dam failure and its consequences or associated hazards. The annualized risk to local economy, human life, and the environment is the interplay of the probability of dam failure and the expected consequences or hazards. These consequences should be of most concern to the decision makers and dam safety analysts, not the collapse of the dam per se. Thus, meaningful quantification of dam failure risk depends on credible estimates of the damages that would result from each significant failure scenario.

53. Dam safety is unique in that it represents an extreme situation characteristic of low probability event and high consequence or hazard. Thus, conventional rules of economic analysis are difficult to extrapolate and extend to such events. For instance, human life is generally accepted as the most important consequence and often dominates dam safety decisions. Unfortunately, the confidence with which life loss can be estimated is low. Application of cost benefit analysis is still relevant as there are insufficient financial resources to improve the safety of every dam without limit. It is particularly useful for setting priority or determining the order in which dam safety rehabilitation projects are implemented within a portfolio of dams eligible for intervention. The extremely low probabilities of dam failure mask the risks. However, when the failure actually happens due to neglect or lack of necessary measures, the consequences are usually very costly, as evidenced by the recent two dam failure events in Indonesia itself.

54. The overall results of the cost benefit analysis carried out for the 23 priority dams show very high economic returns with NPV of 522.9 million and IRR of 60.3% (see Appendix 3 for details). Despite the overall highly satisfactory returns to the project, further scrutiny of the analysis done for each of the other dam reveals mixed results. The IRR ranged from 0.5% to 145%, while B/C ratio ranged from 0.5 to 32.4. Three dams had negative NPV and IRR less than the cut-off value of 6% due to small irrigation area and low population residing downstream of these dams. Five dams recoded IRR higher than 80% due mainly to high density of human population residing downstream of the dam and availability of hydropower plant.

55. Financial Analysis is required to assess the financial capacity of central and provincial governments to cover the O&M requirements of dams and reservoirs. The results of the financial analysis carried out for the original project are valid for the present contexts because no changes and regulations have been effected with regard to O&M issues. For instance, no regulations exist to require collection of water fees from the main water users, viz. irrigators (representing about 99.7% of the users from the reservoir). Only a small portion of the bulk water is supplied to hydropower, and industrial and domestic users. The annual O&M expenditures for dam and irrigation facilities are fully financed

from the central and provincial government budgets in the ratio of 20:80. The PJT I and II⁹ collect fees for water supplied for hydropower, urban and industrial uses.

56. The actual O&M expenditures are often lower than the total needs, although budget allocations are generally increasing. The planned investments within the framework of DOISP-II may reduce the annual O&M requirements by comprehensively addressing the rehabilitation requirements and reducing the need for annual O&M. The incremental O&M budget need to be provided through firmly committing resources or allowing the users to share the burden partially or fully through making new regulations.

C. Fiduciary and Governance

57. The proposed implementation arrangements for the project will draw on the lessons learned from the previous World Bank projects in water resource sector in Indonesia. The PIUs will be clustered based on the number and nature of the support. The CPMU and the PIUs will be informed through a transparent, objective assessment based on the initial screening carried out during preparation and reviewed periodically. The budget will be provided to the PIUs through the sectoral annual (APBN) budget. The training and institutional strengthening will be implemented through the CDMU and include central as well as local government staff. The overall policy oversight will be provided by the National Steering Committee for Water Resources (NSCWR) in Bappenas.

58. The proposed financing will be implemented with a generally similar financial management arrangement with those of the original project. It includes budgeting, fund flow, accounting and reporting, and auditing. Some adjustment in the budgeting and disbursement mechanism will take effect due to the co-financing. CPMU would continue within Central Dam Monitoring Unit under Directorate of Operation and Maintenance (DO&M) with support from financial management consultants. Project Implementation Units (PIU) will be established within each of the Dam Management Units (DMU) of the participating BBWS.

59. The CPMU is experienced at handling financial management aspect of WB financed activities. The financial management performance of the original project is in general satisfactory. The latest Financial Management rating for the project is Moderately Satisfactory. The project's financial statements also received unqualified opinion with timely follow up of audit findings. Risk that remains substantial from the original project is continuous delay of budget effectiveness that delay the project implementation. Risk also still noted in the payment verification function as noted in some audit findings related to overpayment to consultant firms and contractors. The risk related to budget delays will be mitigated through separation of contracts financed by loan and counterpart fund, close coordination between CPMU, PIUs, and the planning bureau of the ministry, and having a financial management consultant that fully understands the budgeting processes. The strengthening of payment verification functions effort within the CPMU and PIUs will also be maintained during the implementation of the additional financing.

⁹ PJT I and II are state enterprises assigned to operate and maintain the river infrastructure in the large basins of the Brantas and B. Solo, and Citarum respectively.

60. DOISP-II is jointly co-financed by the Bank and the World Bank. Each loan will be governed by separate loan agreements but all contracts and activities will be jointly cofinanced on an equal 50:50 basis. The review and clearance of withdrawal applications will be made by the World Bank and an instruction issued to the Bank requesting disbursement to the project's special account.

61. The budgeting system follows the existing government procedures. The project budget will be included in the annual government budget and line ministry budget document (DIPA). Budget register will be made separately for activities financed using WB and the Bank fund and are detailed in DIPA on an equal 50-50 basis and strictly followed. Some activities that might be implemented by the provincial satker, if any, will be budgeted through *Tugas Perbantuan*¹⁰ Mechanism.

62. CPMU and PIUs will maintain separate accounting records for all payment orders (SPM) and remittance orders (SP2D) on a cash basis. All payment of contracts and activities that is financed by loan will be using an equal 50:50 basis for WB and the Bank. All financial transactions will be recorded in the government accounting system and included in government accountability reports. All PIUs will keep original remittance payment records (SP2Ds) and maintain files for audit purposes. The CPMU will prepare a set of consolidated financial reports (interim Financial Reports) that are suitable for project monitoring purposes. The CPMU will be responsible for submitting the reports to the Bank on a quarterly basis not later than 45 days after the end of each quarter. A financial statement for this project will also be prepared annually for audit purposes.

63. Fund Flow. One pooled Designated Account (DA) for funds from WB and the Bank denominated in US dollars will be opened by DG Treasury (MOF) in the Bank Indonesia (Central Bank) specifically for the project. Access to funds in the DA follows government's treasury system.

64. For payments at the CPMU and PIU level, in addition to the existing verification procedures, the PMU/PIU will assign staff within CPMU/PIU to conduct detailed verification of the contractors and consultants' invoices prior to issuance of payment requests. This control measurement can be further improved through the provision of verification guidelines, and through improving the accountability of the verification team, such as official appointment of the team.

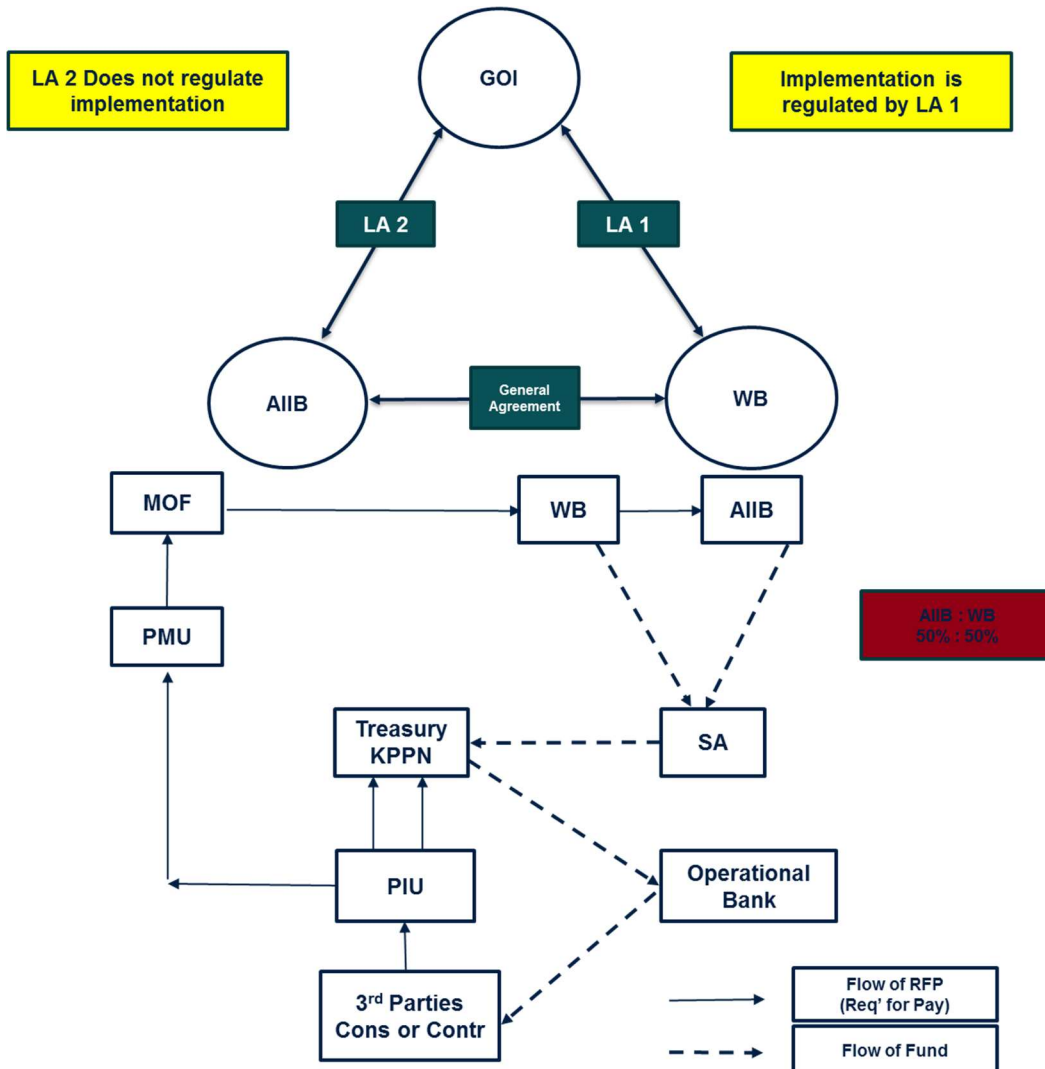
65. The applicable disbursement method will be (1) Advance, (2) Direct Payment, and (3) Reimbursement. One pooled Designated Account (DA) for funds from WB and the Bank denominated in US dollars will be opened by DG Treasury (MOF) in the Bank Indonesia (Central Bank). Advances from WB and the Bank will be deposit to this DA and will be solely used to finance eligible expenditures. The ceiling of the advance to DA will be variable, and the advance(s) will be made on the basis of the six month projected expenditures. The reporting of use of the DA funds will be based on the quarterly Interim Financial Report (IFR), which should be submitted to the World Bank and the Bank no

¹⁰ A task force assignment from the central government to a sub-national government for special tasks.

later than 45 days after the end of each quarter. Applications for an advance to the DA will be submitted together with the reporting on use of DA funds, which will consist of: (a) IFRs and a list of payments; (b) projected expenditures for six months; and (c) the DA reconciliation statement.

66. The Withdrawal Application (WA) will be submitted by the Borrower to the World Bank for review. The processing will cover the financing of both WB and the Bank. i.e. the same WA will be used for processing for both WB and AIIB parts and a separate WA for the AIIB part is not required. The CPMU will be responsible for reconciling the DAs and preparing applications for the withdrawal of reimbursements and advances, duly approved by the DG Treasury, before their submission to the Bank. Copies of DA bank statements will be provided to the PMU by DG Treasury, MOF. For each WA received by the Bank against advances or eligible expenditures, WB will pay its share of co-financing to the DA and simultaneously instruct the Bank to remit payment of their share of co-financing to the DA.

Figure 5: Project Funds Flow



67. The proceeds of the Bank loan would be disbursed against eligible expenditures (taxes inclusive) as in the table below. Parallel counterpart funds of US\$50 million will finance items such as minor rehabilitation works, studies, inspections, taxes, contingencies, and incremental operating expenses. Retroactive financing of up to US\$25 million will be available for payments made for eligible expenditures made not more than twelve months prior to the date of the legal agreement, provided that the relevant WB procurement guidelines are followed.

Table 2: Eligible Expenditures

Category	Amount of the Loan Allocated (expressed in US\$)	Percentage of Expenditures to be financed (inclusive of Taxes)
(1) Goods, works, non-consulting services, Training and Workshops, Incremental Operating Costs and consultants' services for the Project	125,000,000	100% of Bank Share of Total Lending
TOTAL AMOUNT	125,000,000	

D. Environmental and Social

68. The Bank has decided to use the WB's Environmental and Social Safeguard Policies (Safeguard Policies) since (i) they are consistent with the Bank's Articles of Agreement and materially consistent with the provisions of the Bank's Environmental and Social Policy and relevant Environmental and Social Standards; and (ii) the monitoring procedures that the WB has in place to ascertain compliance with its Safeguard Policies are appropriate for the Project. Under the WB's Safeguard Policies, the Project has been assigned Category B.

69. The WB carried out due diligence, including environmental and social impact studies of the Project, during the initial phase of DOISP. These studies are still relevant for the activities proposed under DOISP-II. An ESMF has been prepared for DOISP-II, which clarifies the principles, procedures and organizational arrangements for the environmental and social management of the Project's activities. Overall, the environmental and social impacts are expected to be positive as the works relate to physical rehabilitation of existing infrastructure. No new construction is planned and only limited land acquisition is anticipated to occur. The ESMF prepared for DOISP-II has been reviewed by the Bank and found adequate for the envisaged activities.

70. Six of the WB's safeguard policies have been applied to the DOISP-II: OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.09 Pest Management, OP/BP 4.10 Indigenous Peoples, OP/BP 4.12 Involuntary Resettlement and OP/BP 4.37 Safety of Dams. The ESMF provides guidance on (i) preparation of Environmental Management Plans (EMPs) for the sub-projects, and (ii) design and implementation of community participation in reservoir and watershed management. Any sub-project that

cannot be implemented according to the ESMF will not be funded under the project. The ESMF has been disclosed by the WB¹¹ as well as by the MPWH¹²

71. The ESMF includes a Land Acquisition and Resettlement Policy Framework (LARPF) and an Indigenous Peoples Policy Framework (IPPF) to address these issues if they occur during Project implementation. Although the focus is on rehabilitation and remedial work and no land acquisition is envisaged, the LARPF has been prepared to provide more flexibility during project implementation (in case land acquisition becomes inevitable). Similarly, the IPPF has been developed to better address the needs of Indigenous Peoples if they are found in the project site; the likelihood of Indigenous Peoples available in the project site is very low. The ESMF also has management framework for pest management and conservation of natural habitats though project activities do not suggest any negative impacts in these areas. OP/BP 4.11 has not been applied since most of the activities involve upgrading or repair of existing Dams and no excavations associated with the civil rehabilitation works. Also, OP/BP 7.50 on Projects on International Waterways has not been triggered as no activities are planned on international waterways. The project focusses on improving the safety of Dams which are identified as being at risk. The project is therefore designed to directly address the requirements of the Policy OP/BP 4.37. Each sub project will have a Dam Safety Report which will inform the specific risks and identify the specific works. World Bank will appoint an International Panel of Experts which will work with the National Dam Safety Commission of Indonesia to provide overall guidance during implementation.

72. The Project will only rehabilitate existing dams and their associated structures, along with improved safety measures. The physical rehabilitation of these dams and associated structures will be carried out in situ and mainly limited to improving operations. There will be no major alterations in the existing land use patterns; in situ rehabilitation works typically do not have any land acquisition and are normally implemented during the off-season. As such, there have not been any situations requiring extended draw down periods that have affected agricultural production. Should such impacts be identified during the screening process, assistance will be provided through a livelihoods support program, including preferential wage based employment opportunities associated with the construction and maintenance of the irrigation schemes, etc.

E. Risks and Mitigation Measures

73. The World Bank has analyzed the project risks utilizing its Systematic Operations Risk-Rating Tool (SORT) and proposed that the overall project risk is Substantial. The risk level for following individual categories has been proposed as Substantial: Sector Strategies and Policies, Technical Design of Project, Fiduciary, Environmental and Social, and Stakeholders. Based on the WB risk assessment and available information, the Bank is proposing a High risk for the project. Although the Project is of dispersed nature with activities planned across Indonesia, the physical works in a sub-project are localized and

¹¹ <http://documents.worldbank.org/curated/en/docsearch/projects/P161514>

¹² <http://sda.pu.go.id>

manageable. The project will be implemented on a rich experience of similar projects that the Government has been implementing in the sector with the assistance of World Bank.

74. The Sector Strategies and Policies risk is considered medium. While Indonesia has a comprehensive framework for dam safety management there is a complex legal framework and an evolving institutional context. The Water Law 7/2004 has been revoked and operations now continue under a recently issued Ministerial decree pending revision and resubmission of the Act.

75. Adequate financing for operation and maintenance remains a challenge under the current revenue framework and could present a significant risk to long-term sustainability. The Government has been exploring institutional models to optimize revenue mechanisms and develop sustainable revenue streams. These have been implemented in the more profitable river basins and the project will help develop institutional benchmarks to identify key constraints, along with asset management systems to assess the specific O&M requirements, guide budget decisions and strengthen institutions.

76. The Technical Design of Project or Program risk is considered substantial. The ongoing DOISP has provide an objective, internationally benchmarked framework for assessing risk and prioritizing specific interventions. The methodology has been developed, applied and refined during implementation and is broadly accepted. However, high or unseasonal flows during the rehabilitation works could negatively impact the schedule of works or cause downstream flooding. The PMF for each dam will be recalculated and the rule curve adjusted as needed. A number of measures would be taken to control the risks during rehabilitation of each dam and would be detailed in the contract documents. For example; operational measures such as lowering water levels prior to commencing civil works, phasing works during periods of low flood risk, ongoing monitoring before during and after work is completed and setting up a dam safety panel of independent experts.

77. The Institutional Capacity for Implementation and Sustainability risk is considered medium. The implementation arrangements involve a large number of different entities within different level of local, provincial and national Government. Both the Directorate for O&M and the B(B)WSs report directly to the Directorate General of Water Resources and a lack of appropriate incentives, coupled with an ambitious parallel program of new dam construction, may create delays in implementation within the basin organizations. The long period of underinvestment in dams and reservoir management has also led to a very limited capacity in both government and private sector in terms of knowledge, experience and management of dam operations and safety. An important part of resources need to be devoted to support capacity development of dam management units, consultants and contractors to ensure quality and quality control.

78. The Environment and Social risk is considered medium. The rehabilitation works are to be carried out in-situ and the experience of the ongoing DOSIP indicates that there are not expected to be any major social or environmental issues. However, the rehabilitation of existing dams may raise historical issues associated with the original construction and relating to the environmental and social context at the time. In accordance

with good practice, the identification process will include screening criteria to identify any historical issues, such as those associated with any original resettlement. The project documents will include provisions to ensure that if any such issues are identified, appropriate interventions will be incorporated to address them as required. The risks are considered to be manageable with the implementation of the best environmental management and its mitigation measures.

79. The Stakeholders risk is considered medium. There is considered public awareness through regular reporting in the popular media, with dam failures such as that of the Situ Gintung dam in 2009 receiving widespread local and international attention. A communications strategy is envisaged and public consultation will be carried out during preparation and implementation. Specific provisions will also be included to ensure corporate requirements relating to citizen engagement and gender are adequately addressed.

Annex 1: Results Framework and Monitoring

The World Bank has developed a Results Framework and Monitoring based on the project level Development Objective and project Indicators as shown below. The Bank will use this Result Framework to monitor the implementation of the project and report on the results.

Proposed Project Results Framework

PDO Indicators	Core	UOM	Progress To Date (Sept 26, 2016)	Target Values (CY)						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Notes
				2017	2018	2019	2020	2021	2022				
The Project Development Objective is to increase the safety and functionality of dams in selected locations and strengthen the operation and management capacity for dam safety.													
Overall risk reduction of all dams under project.	<input type="checkbox"/>	Percentage	4	4	6	9	12	15	20	Quarterly	TA team & CPIU / Secondary data	TA team & CPMU - DMU	The share of dams rehabilitated under the project that demonstrate reduction in all the risk categories under modified ICOLD method.
Number of dams with individual hazard reduced by > 20% of risk score.	<input type="checkbox"/>	Number	16	16					98	Quarterly	TA team & CPIU / Secondary data	TA team & CPMU - DMU	The share of dams rehabilitated under the project that demonstrate reduction in all the risk categories under modified ICOLD method

River Basin Organizations (Balai) with need based O&M budget and plan operationalized within a national dam asset management system.	<input type="checkbox"/>	Number	0	0	2	5	7	10	13	Quarterly	TA team & CPIU / field visit	TA team & CPMU - DMU	
Issuance of regulation on dam safety (incl. Government/PP, Minister and/or DG Decree on dam safety assurance)	<input type="checkbox"/>	Number	2	2	2	3	3	3	3	Quarterly	TA team & DSU / Secondary data	TA team & CPMU - DMU	
Beneficiaries													
Project beneficiaries	X	Number (million)	2.3	2.3	3.4	4.5	7.6	9.9	11.2	Quarterly	TA team & CPIU / field visit	TA team & CPMU - DMU	Only estimates those directly dependent on irrigation services. Population estimates at risk from failure will be determined through the EAPs during implementation.
Of which female (beneficiaries)	X	percentage	50	50	50	50	50	50	50	Quarterly	TA team & CPIU / field visit	TA team & CPMU - DMU	Female who get benefit from improved service and reduced risk of the dams

Intermediate Results Indicators	Core	UOM	Progress To Date (Sept 26, 2016)	Target Values (CY)						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Notes
				2017	2018	2019	2020	2021	2022				
Intermediate Result 1: DAM OPERATIONAL AND SAFETY IMPROVEMENT WORKS													
Number of dams rehabilitated	<input type="checkbox"/>	Number	35	20	60	90	105	120	140	Quarterly	Site Visit / Primary data	TA team & CPIU/ DSU/ Dam Safety Panel	
Number of dams with BDSF operational	<input type="checkbox"/>	Dams	10	15	25	65	95	124	140	Quarterly	Site Visit / Primary data	TA team & CPIU/CPMU/ DMU	
Number of dams where emergency action plans updated and disseminated	<input type="checkbox"/>	Dams	56	60	70	78	98	120	140	Quarterly	TA team & CPIU / Secondary data	CPIU/CPMU/ DMU	
Intermediate Result 2: O&M IMPROVEMENT AND CAPACITY BUILDING													
Dam operational staff receiving annual training	<input type="checkbox"/>	Percentage	0	50	90	90	90	90	90	Quarterly	TA team & CPIU/DSU / Secondary data	CPMU / DMU	
O&M Manuals (including related training) for Dams completed.	<input type="checkbox"/>	Number	51	70	85	100	110	125	140	Quarterly	TA team & CPIU/DSU / Secondary data	CPMU/DMU	
Community-Dam Management MOUs signed on Greenbelt Management	<input type="checkbox"/>	Number	03	08	10	15	20	25	30	Quarterly	Community /Primary data	Facilitators / TA team & CPIU	

Intermediate Results Indicators	Core	UOM	Progress To Date (Sept 26, 2016)	Target Values (CY)						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Notes
				2017	2018	2019	2020	2021	2022				
Intermediate Result 3: RESERVOIR SEDIMENTATION MITIGATION COMPONENT													
Land area under sustainable landscape management practices	<input type="checkbox"/>	Hectare	10	50	100	150	200	250	300	Quarterly	TA team & CPIU/DSU/ Secondary data	CPMU/DMU	The land area for which sustainable landscape management practices have been introduced
Communities joining catchment management activities (% of which female)**	<input type="checkbox"/>	Percentage	37	40	40	40	50	50	50	Quarterly	Community /PIUs/ /Primary data	Facilitators / TA team &CPIU	
Dams implementing at least 70% of catchment management activities	<input type="checkbox"/>	Number	0	5	10	10	10	10	60	Quarterly	Community /PIUs/ /Primary data	Facilitators / TA team &CPIU	
Intermediate Result 4: DAM SAFETY ASSURANCE INSTITUTIONAL IMPROVEMENT													
Dams providing real time data	<input type="checkbox"/>	Number	30	45	55	65	75	80	80	Quarterly	TA team & CPIU / Secondary data	CPMU/DMU	
Dam Technology Center established and operationalized	<input type="checkbox"/>	Number	0	0	0	0	1	1	1	Quarterly	RCWR / Secondary data	CPMU	
CDMU staff trained	<input type="checkbox"/>	Persons	5	5	5	5	5	5	5	Quarterly	CPMU / Secondary data	CPMU	
DSU staff trained	<input type="checkbox"/>	Persons	15	25	25	25	25	25	25	Quarterly	CPMU / Secondary data	CPMU	

Intermediate Results Indicators	Core	UOM	Progress To Date (Sept 26, 2016)	Target Values (CY)						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Notes
				2017	2018	2019	2020	2021	2022				
INACOLD certification of Dam Professional	<input type="checkbox"/>	Persons	40	40	80	100	120	160	200	Quarterly	/ Secondary data	CPMU	

** Citizen engagement indicators

*** Dam center, sub directorate of Dam O&M, DSU, Research center of WR (including river basin org surrounding in Indonesia)

Annex 2: Detailed Project Description

1. The proposed project represents the next phase in a continued commitment to strengthen water resources institutions and asset management in Indonesia. The DOISP was envisaged as the first stage of a longer-term programmatic approach by Government to develop a portfolio management approach across its dam and reservoir sector and builds on the foundations provided by the Dam Safety Project (DSP: 1994-2003). These projects were supported by World Bank. The overall aims of the program were to provide a platform to improve the aggregate levels of performance and safety of its reservoirs, starting to improve financial sustainability, carry out investigations, designs and actual works, and to start to address the issues associated with erosion from within the upper catchments. The specific objectives under DOISP were to: (i) to increase the safety and the functionality of the 63 short-listed prioritized large dams/reservoirs, and (ii) develop and mainstream the regulatory and administrative arrangements for dam and reservoir management and safety that are more sustainable from a technical, environmental and financial perspective. It was recognized at the time of appraisal for the first phase of DOISP that the rehabilitation and improvement of several dams would require more extensive surveys, investigations and designs under DOISP to allow implementation of the works under an envisaged second phase (DOISP-II). The longer-term time frame was also considered more feasible to realize the objectives of the institutional reforms.

2. The proposed financing represents the second phase of DOISP envisaged at the time of approval in 2009 and will upscale the portfolio approach developed under the first phase of DOISP to further enhance the institutional and regulatory arrangements for dam management and safety. The project is focused on core elements of the portfolio approach to dam safety, specifically: i) institutional, regulatory, human, and financial capacity for dam safety to ensure implementation and improve compliance; ii) physical rehabilitation to ensure structural integrity and enhance safety; iii) operational measures to ensure dam safety. Vertical integration of these three elements within each of the basin territories is aimed at creating a virtuous cycle that will secure the structural integrity of the dam, implement the required operational and management measures, enhance the capacity and re-enforce the regulatory mechanisms to implement a portfolio approach that assures an organization level of safety with accompanying certification.

3. The project builds on the lessons learned from a number of related World Bank projects that advocate for an integrated, holistic approach to dam safety and operations within the context of the river basin and to ensure the adequacy of the supporting institutional environment. These include similar dam safety programs in Armenia, China, India, Indonesia, Sri Lanka and Vietnam as well as through reimbursable technical assistance in countries like Brazil. Common to all approaches is the need to invest in long-term institutional support to provide a sustainable operating environment and a strong, national cadre of professionals and training institutions. This was demonstrated in Brazil where a strong focus on institutionalized training enhanced national capacity and established international professional networks through dedicated training exchange programs. Experiences from similar project support in India highlights the need for strong implementing agencies to ensure effective implementation. These arrangements are better served when embedded within centralized national apex institutions that can provide the necessary environment on regulatory, technical assistance support as well as overseeing

implementation. Performance in all instances was facilitated by ensuring a sound, transparent and objective framework for the identification, screening and prioritization of dams within a national framework. The long World Bank engagement on dam safety projects in Indonesia further highlights the importance of a *priori* agreement on these mechanisms and the use of internationally benchmarked assessment tools to set verifiable targets.

4. The project is to be jointly co-financed on an equal basis between the Bank and the World Bank. The joint co-financing will be implemented in accordance with the Co-Financing Framework Agreement signed between AIIB and IBRD/IDA on April 13, 2016. In accordance with the provisions of the agreement, all contracts will be jointly financed in agreed proportions. The current cost estimates for each of the components are shown below.

	Cost Estimate	GoI	AIIB	IBRD
Component 1	161.96	27.00	67.48	67.48
Component 2	23.08	3.84	9.62	9.62
Component 3	55.07	9.17	22.95	22.95
Component 4	24.82	4.14	10.34	10.34
Component 5	35.07	5.85	14.61	14.61
	300	50.00	125.00	125.00

Component 1: Dam Operational Improvement and Safety Works and Studies

	Cost Estimate		GoI		AIIB		IBRD	
	US\$	%	US\$	%	US\$	%	US\$	%
DOISP-II	161.96	100	27.00	17	67.48	42	67.48	42

5. The original objective was to restore dam performance and safety by providing for: (i) design and construction of *minor* and localized rehabilitation and remedial works on each of about 34 prioritized large dam/reservoir sites (“sub-projects”) to restore operational performance and/or safety (including spillway equipment repair and/or minor upgrading); (ii) four sub-projects for implementation in the first year; (iii) Surveys, Investigations and Designs (SID) - including social and environmental management plans - for *medium to major* works (sub-projects) to restore and/or improve operational performance and safety for approximately 22 dams/reservoirs to be implemented in the successor project, including the second-phase additional works on about 14 dams/reservoirs that were subject of first improvement in DOISP; (iv) Basic Dam Safety Facility (BDSF) repair and/or upgrading to improve safety monitoring, and preparedness systems for spillway emergency discharge for about 34 dams; (v) establishing a river inflow and sediment monitoring system to improve the operational hydrology for about 63 dams, and review flood flow data, estimated flood discharge frequency, and PMF or “Flood Envelope Curves” related to watershed area; and (vi) assessment of spillway capacity and downstream flooding risks for approximately 34 dams (including surveys, models and feasibility studies regarding downstream effects to determine the viability of any spillway modification or operational change, to be undertaken in the successor project).

6. DOISP-II will finance the physical rehabilitation of an estimated 140 dams to restore dam performance and safety in accordance with acceptable international and national design standards. This includes 20 major dams prioritized and prepared under DOISP, along with priority investments from the remaining 120 major dams in the portfolio that are to be prioritized based on the objective criteria for identification and assessment. Support would include: (i) specialized studies, including hydrological assessments to review flood flow data, estimate flood discharge frequency and review spillway capacity and downstream flooding risk; (ii) Surveys, Investigations and Designs (SIDs), supervision and quality control of rehabilitation works; (iii) rehabilitation and safety remedial works on existing dams and their associated structures, including civil and hydro-mechanical works; (iv) installation, rehabilitation or upgrading of Basic Dam Safety Facilities (BDSF) to improve safety monitoring, flood forecasting and preparedness systems; and (v) installation, rehabilitation or upgrading of instrumentation for operational hydro-meteorological monitoring. The project will not finance any new dam construction and is focused on the rehabilitation of existing dams and their associated structures, along with improved safety measures. These activities are not intended to exceed the original schemes, change their nature, or so alter or expand the scope and extent as to make them appear as new or different schemes.

7. Within the portfolio of proposed dams to be supported under the DOISP-II, the Dam Safety Assessment have been carried out for 20 major dams through Special Studies under the DOISP. These Special Studies include Dam Safety Assessments to: (a) inspect and evaluate the safety status of the dams, their appurtenances, and performance history; (b) review and evaluate the operation and maintenance procedures; and (c) provide a written report on the findings and recommendations. These findings are used to inform the detailed design of the remedial works and safety-related measures necessary to improve the overall performance to an acceptable standard of safety, along with the necessary environmental and social safeguard requirements. From these 20 dams, six sub-projects have been prepared through detailed designs and are ready for implementation in the first phase in 2017 with an estimated cost in excess of US\$17m. Two additional sites, the Gonggang and Pacal dams, have also been prioritized for early stage intervention. The six investments for the first phase include the following:

- a. Ubrug Dam in BBWS Citarum is one of three saddledams at Jatiluhur. The Special Study found that a fully control gate in the exiting auxiliary spillway is needed to reduce risk of overspill in the morning glory. At the time of construction, the four outlets in the auxiliary spillway were blocked with solid concrete arches. These would be breached through blasting with dynamite during a high flood event. To improve operational capacity, it is now proposed to complete the original design by replacing the concrete arches with two radial gates. This is estimated to cost US\$ 7m.
- b. Ketro Dam in BBWS Bengawan Solo is a 15m high, earthfill dam with a central clay core built in 1984. The Special Study found that piping in the downstream slope need permanent solution. The section of main dike in 0+180 also found to be unsafe with safety factor (SF) below minimum of 1.2 and 1.3 with and without earthquake. Based on the findings of the Special Study, the scope of work under the additional financing includes Rehabilitation of main dike, minor replacement of

- hydro-mechanical and dredging of sediment. The total cost is estimated at IDR 26 billion.
- c. Penjalin Dam in BBWS Pemali Juana is a 23m high, homogenous earthfill dam built in 1934. The Special Study found that the safety main dike to the earthquake is below minimum level, piping in the downstream slope is also observed. Based on the findings of the Special Study, the scope of work under the additional financing includes rehabilitation of the main dike, using diaphragm wall, minor replacement of hydro-mechanical and dredging of sediment. The total cost is estimated at IDR 19 billion.
 - d. Greneng Dam in BBWS Pemali Juana is a 13m high, homogenous earthfill dam built in 1918. The Special Study found similar case like in Penjalin dam. Based on the findings of the Special Study, the scope of work under the additional financing includes replacement of material along the dike, improved compaction and stability along with dredging of sediment. The total cost is estimated at IDR 26 billion.
 - e. Tempuran Dam in BBWS Pemali Juana is an 18m high, homogenous earthfill dam built in 1916. The Special Study found frequent piping in a spot where a big tree was removed. Sliding and crack in the crest level also happened. Based on the findings of the Special Study, the scope of work under the additional financing includes replacement of material along the dike, improved compaction and stability along with dredging of sediment. The total cost is estimated at IDR 22 billion.
 - f. Mrancang Dam in BWS Kalimantan III is a 08m high, homogenous earthfill dam built in 1995. The Special Study found that due to consolidation and crack the existing crest level is about 1.8 meter below design level. The existing spillway might not be enough to cope with flood, the dam is not safe. Based on the findings of the Special Study, the scope of work under the additional financing includes and levelling of undulating main dike, and repair spillway, minor replacement of hydro-mechanical and dredging of sediment. The total cost is estimated at IDR 49 billion.
8. Further additional rehabilitation works and remedial measures would be carried out for prioritized dams in the portfolio of 140 major dams under the Ministry. This framework provides a flexible mechanism that can respond to the changing risk profile of the portfolio during implementation and the availability of financing. It should be noted that the cost of the individual rehabilitation depends on the nature of the works required. From the 20 dams for which the special studies have been completed, the costs range from under US\$1 million to more than US\$15 million. The dams in the portfolio will be assessed during the first year of implementation as part of an update to inform the risk assessment based on the modified ICOLD method. This method has been developed, reviewed, assessed and applied under the DOISP to provide a portfolio approach to management of dam safety by the Ministry based on level of hazards and a rapid risk assessment.
9. The project will not finance any new dam construction and is focused on the rehabilitation of existing dams and their associated structures, along with improved safety measures. These activities are not intended to exceed the original schemes, change their nature, or so alter or expand the scope and extent as to make them appear as new or different schemes.

10. The quality of construction work on the dam will be achieved as planned if the system of quality control is done correctly, consistently and in line with guidelines related with quality control. The Ministry of Public Works and Housing has issued regulations to maintain the quality of construction work that is contain in the *Peraturan Menteri Pekerjaan Umum No.: 04/PRT/M/2009 tentang Sistem Manajemen Mutu (SMM) Departemen Pekerjaan Umum* (Quality System Management) as guidelines for contractor and consultant. The Government's dam development program means that there is a shortage of experienced consultants available within the country that could pose a risk to the quality of supervision and support during implementation. The quality of the designs and supervision was identified as one of the key issues under implementation of the parent project and is acknowledged as a substantial risk. The implementation arrangements have drawn on the lessons of the parent project and will include regional units within the technical assistance to provide support during implementation along with a pre-identified long list of potential expertise to be used thorough an on-call just-in-time basis during implementation.

11. **Basic Dam Safety Facilities (BDSF)** are considered an essential requirement to improve the basic safety at dams and appurtenant structures with the DGWR portfolio. Based on an assessment carried out during preparation and feedback from operation and maintenance staff, there is a recognized that there is a major lack or shortage of the following:

- (i) day to day access and mobility at sites
- (ii) communication facilities
- (iii) basic equipment need for surveillance and monitoring
- (iv) safety equipment for inspections and emergency repair works
- (v) standby power supply
- (vi) water borne transportation
- (vii) lighting etc.

12. DOISP-II will continue to extend the provision and installation of BDSFs. In general, the supply and/or installation of the elements list below are recommended as the minimum package of BDSF. The experience with procurement and installation of BDSF during the parent project points to a number of important lessons. The approach to be adopted under the additional financing will explore service contract provisions to sustain the provision of basic spares and maintenance measures, as well as sustained capacity building and support during the project period. This will be provided on a decreasing basis to correspond with increasing capacity to assume longer term sustainable operations.

13. Technological advances will be engaged to draw on digital systems where appropriate. This will build on existing platforms, such as those employed within BBWS Bengawan Solo that enables monitoring data at several dams to be sent real time using mobile phones from the dam location to the headquarters in BBWS Bengawan Solo.

INSTRUMENTATION	FACILITIES AND RELATED	SURVEY AND OTHER
V-Notch Weirs	CCTV Cameras	Monument Surveys
Water Level	Toe lead-away drains	Settlement Surveys
Seismographs	Stand by Generators	Dip Meters

Piezometers		Pressure Gauges
Inclinometers		Readout Units
Extensometers		

14. **Flood Forecasting and Preparedness System.** The operation of a flood forecasting / warning and preparedness for response system is the most effective method for reducing the risk of loss of life and economic losses. The additional financing will support a comprehensive program to enhance capacity with respect to flood forecasting including the following basic elements. This will include telemetry to facilitate real time data for each dam and a relay station to the office on site, the central dam safety unit within the basin organization and the central dam safety management unit.

RISK KNOWLEDGE	MONITORING AND WARNING	DISSEMINATION AND COMMUNICATION	RESPONSE CAPABILITY
- Hazard - Element of risk	- Rainfall - River Level - Water Reservoir - Dam Condition	- Radio - Telephone - Household Warning	- Evacuation Center - Search and Rescue

Component 2: Operations and Maintenance Improvement and Capacity Building

	Total		GoI		AIIB		IBRD	
	US\$	%	US\$	%	US\$	%	US\$	%
DOISP-II	23.08	100	3.84	17	9.62	42	9.62	42

15. The original objective was to support improved operations and maintenance and to strengthen capacity building of the dam agency through: (i) preparation of O&M Plans, Standard Operation Procedures (including rule curves and reservoir water balance) and manuals and undertaking needs based budgeting and O&M activities for about 34 dams and reservoirs, and for 29 dam sites to be rehabilitated under the successor project; (ii) preparation of dam and reservoir management plans and emergency spillway operation plans for about 34 dams; (iii) O&M staff training for dam safety monitoring, maintenance and operations, (iv) participatory programs on reservoir and dam management with local communities living near the reservoir, in approximately 20 reservoirs; and (v) provision of incremental operating costs for O&M of dams and reservoirs (borne by GOI).

16. DOISP-II will finance improvements in the operational elements required for securing dam safety and improved utilization. This would include: (i) conducting strategic studies, including those for establishing asset management systems and needs based budgeting for operation and maintenance and piloting of performance-based contracts; (ii) Operation and Maintenance Plans; (iii) Instrumentation Plans and setting the service standards; (iv) preparing Emergency Preparedness Plans, including dam break analyses, downstream flood mapping and benchmarking; (v) conducting Community Participation Programs in reservoir maintenance, income-generating activities related to reservoir

maintenance and related skills training with local communities; and (vi) human resource development and capacity building of dam safety institutions.

17. **Operation and Maintenance Plans, Instrumentation Plans, Standard Operating Procedures and Service Standards.** The existing project has developed a number of standard guidelines and plans that will be operationalized under the additional financing. Under the first phase parent project budget requirements have been derived based on the Modern Equivalent Asset Value (MEAV) which is based the 0.2 percent times the present value to build dam. Although there are requirements for the provision of O&M budgets, these are limited.

18. **Emergency Action Plans and Emergency Preparedness Plans, including dam break analyses, downstream flood mapping and benchmarking.** Recognizing the need to complement policies and procedures for dam design, construction, and operation and maintenance, Indonesia has made progress in developing emergency action plans. With the passage of Government Regulation No. 37 on Dams in 2010,¹³ the development of emergency action plans became mandatory for large dams. To date, the Directorate General of Water Resources (DGWR) of the Ministry of Public Works and Housing (MPWH) and the River Basin Organizations (RBOs) have developed emergency action plans for about 80 dams, of which 56 have been financed by DOISP. During preparation, the downstream communities that would be affected by dam failure and the provincial and local authorities responsible for early warning, evacuation, and post-flood assistance, are required to be consulted.

19. An emergency action plan is an operational tool to reduce the likelihood of dam failure and potential impacts caused by dam failure. With support of DOISP, DGWR has developed formal guidelines which provide a basic structure for the development of plans. Examples of items covered in the plans include, *inter alia*, preventive actions to be undertaken to avoid failure; a flowchart which lists all authorities to be involved in the notification process ranging from the dam operator to local emergency authorities; and inundation maps which delineate the area that would be flooded in the event of dam failure and identify evacuation zones. A review of a selected number of plans indicates that the level of detail and the quality of plans varies widely. Moreover, there appears to be limited experience with reinforcing and testing the effectiveness of the plans.

20. There is an opportunity to further improve the operationalization of emergency action plans. An effective emergency action plan is a living document to be revised and updated as new information about the reservoir and downstream area becomes available or the people involved in the notification process change. Continuous coordination between the RBOs, local government, and emergency management authorities, as well as simulation exercises to test the plans, would provide the necessary input to keep the emergency action plans up-to-date and benefit the execution in the event of dam failure. Another area which requires attention are the emergency actions plans for dams located in river basins with multiple dams. Currently, these plans do not take account for the failure of any of the other dams in the basin. Moving forward, it would be worth exploring how these plans can be updated to facilitate the execution of a collective response to cascade failures. Finally, it would be important to understand and evaluate how the operationalization of the

¹³ Since the 2004 Water Law was repealed in 2015, Government Regulation No.37 is temporarily replaced by Ministerial Regulation No.27 (clause 53-61).

emergency action plans compares across RBOs. In this context, a benchmarking exercise could provide insights into current practices and provide direction on how to continue to improve the operationalization of the plans.

21. DOISP-II is intended to build on the guidelines and experience under the existing project to improve the operationalization of the emergency preparedness plans. This will include the review of the Indonesian Hazard Classification Guidelines prepared under the original DSP and approved by the Indonesian Dam Safety Committee in 1999, along with the Emergency Action Plan (EAP) Guidelines prepared under the current DOISP. The proposed financing will support the development of Emergency Action Plans for all dams under the project where there is the potential for loss of life in the event of dam failure. Emergency Operation Plans will also be prepared for gated spillways (and controlled outlets).

Case Study I: Situ Gintung

22. The 10-meter high Situ Gintung dam was built in 1933 during the Dutch colonial era. It was located on a tributary of the Pesanggrahan near the village of Cirendue in the Banten province which has become part of suburban Jakarta. The dam was initially used for the irrigation of rice paddies, but these paddies were replaced over time by residential development and the size of the reservoir was reduced. A number of residential dwellings located downstream of the dam may have been illegal and in violation with Spatial Laws No.24/1992 and No.26/2007.

23. On March 27, 2009, the Situ Gintung dam failed. Heavy rains increased the water level of the reservoir causing overtopping and erosion of the dam surface. This resulted in a breach around 2 a.m. in the morning. The uncontrolled released of nearly 1 million cubic meters of water created a flash flood which inundated more than 400 residential dwellings, displaced 170 people, and claimed the lives of about 100 people. There had been no early warning system in place to provide timely warning to avoid the loss of life. One year prior to the event, there has been reports about the vulnerability of the dam, but no action was taken to reduce the risk of dam failure.

Case Study II: Way Ela

24. On July 13, 2012, a 5.6-magnitude earthquake hit central Maluku and triggered a landslide that blocked the flow of the Way Ela River. This event resulted in the creation of natural dam of 215 meters in height and 300 meters in width with a reservoir capacity of 19.8 million cubic meters. Recognizing the potential risk to the 4,777 residents of Negeri Lima village which was located 2.5 kilometers downstream of the dam, DGWR carried out a survey in the immediate aftermath of the event to assess the condition of the dam. The survey results indicated that demolishment of the dam would likely trigger additional landslides. In this context, the government decided to take action to protect the dam and to conduct preparedness activities with the community to maintain public safety in the event of dam failure.

25. Upstream preparedness efforts of the Maluku RBO focused primarily on the conservation of the natural dam and continuous on-site monitoring. Activities included the installment of water pumps; the construction of a toe drain to collect seepage; and the construction of an emergency spillway to provide controlled release from the dam. In addition, the RBO was involved in the monitoring of the dam, mostly the water level and

the amount of seepage discharge; the establishment of an early warning system; and the development of an emergency action plan. The early warning system consisted of various sensors to measure the water level, rainfall intensity, and the level of debris, and to provide an early alert of potential dam failure. In the event of dam failure, the system would automatically activate sirens to warn the downstream community. At the same time, downstream efforts focused on avoiding the loss of life in the event of dam failure. While the Maluku RBO took responsibility to conduct a community awareness campaign related to the emergency action plan, the provincial emergency authorities (BPBD) focused on the preparation of the evacuation routes and signs and the organization of different types of simulation exercises with the community to test the standard operating procedures and logistics.

26. During July 18 and 25, 2013, the efforts to reduce the water level of the reservoir failed and the condition of the dam became critical. Following the procedures of the emergency action plan, the head of the Maluku RBO notified the Governor of Maluku, the Regent of Maluku Tengah, and BPBD to start the evacuation. When the dam eventually collapsed within a period of 12 hours on July 25, 2013, nearly all residents of Negeri Lima had moved to the designated evacuation zones. In the end, the timely and effective public alert had saved almost 5,000 lives.

27. **Operation and Maintenance Budget Systems.** Sustained operations and maintenance is one of the key challenges associated with dam safety and the additional financing will support further development of instruments aimed at ensuring sufficient timely resources are made available to sustain the portfolio of dams within DGWR. The guidelines for preparation of O&M Manuals will be reviewed and updated to provide an integrated national framework for timely, accurate, and easier calculation of needs based budgets. These are based on the Guidelines for Needs Based Analysis of Operations and Maintenance (AKNOP - Analisa Kebutuhan Nyata Operasi Pemeliharaan).

28. **Asset Management System.** The O&M system will be linked to further development of asset management plans. To maximize the productivity of the infrastructure assets that have the conditions and optimal performance requires a sound management system for the owner or manager of the dam assets. Therefore, the dam manager must conduct an inventory of its assets and shall maintain the inventory and update asset data in accordance with the development of the situation as part of the asset management dam.

29. Asset Management is defined as the process of managing procurement, acquisition, operation, maintenance, rehabilitation, and elimination of the assets of an organization in order to provide a certain service levels are sustained in the long term cost effective manner. Asset management is an approach that can provide all of the information and analytical tools needed to manage existing assets more effectively and can meet the needs of today and the future. The goal of the asset management system is ensuring: i) the realization of administrative conduct asset dam; ii) creating efficiency and effectiveness of the use of assets dam; iii) security of the assets; and, iv) availability of data / information that is accurate on the number of assets for decision making Implementation of an asset management system for the portfolio of dams under DGWR will include the following activities:

- (i) Inventory of dam assets

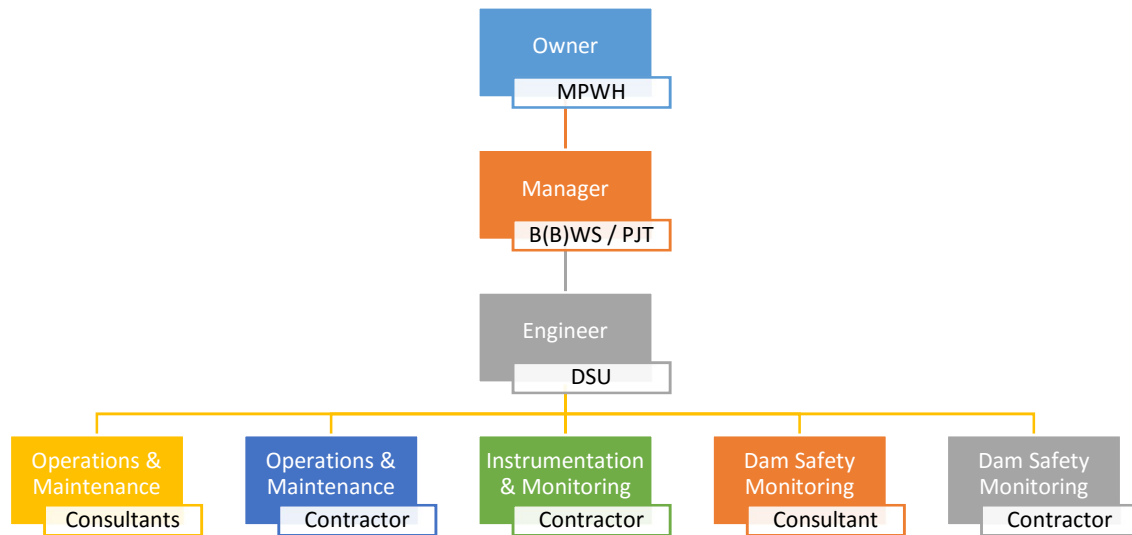
- (ii) Planning of the dam asset management
- (iii) Implementation of dam asset management
- (iv) Evaluation of the implementation of asset management
- (v) Update the inventory of dams

30. **Piloting Performance-Based and Service Management Contracts.** With an increasing portfolio of large dams, challenges with available capacity with growing maintenance needs in the face of a downsized or fixed maintenance work force and pressure on the operating budget expenditures the MPWH is exploring options for different contracting methods. These include Performance-Based Management Contracts (PBMC) and Service Management Contracts (SMC) that can provide incentives and/or disincentives to achieve desired outcomes or results and allow for innovation. Such contracts are often based on long-term, fixed ceiling or lump sum contracts with predictable payment schedules that improve budget predictability. Other benefits include but are not necessarily limited to the following:

- (i) Potential increases in the level of service
- (ii) Improved budget predictability and potential cost reductions
- (iii) Shift from an input-output focus to performance based outcomes
- (iv) Improved risk distribution among owners and contractors
- (v) Knowledge transfer and skills development through effective partnering
- (vi) Fostering innovation by focusing on outcomes and allowing flexibility in meeting performance specifications rather than method specifications
- (vii) Reduction in contract administration and management

31. There are a number of different potential entry points for PBMC/SMCs. All of these require strong government commitment and leadership to be successful. They can include simple instrumentation operation, monitoring and regular reporting; dam operations and maintenance measures; dam safety monitoring and reporting as well as rehabilitation works to meet standard requirements. Any such contract requires a clearly defined set of activities with corresponding outcome metrics framed within the national legal requirements relating to dam safety. PBM/SM Contracts rely on identifying performance measures, establishing desired performance standards or targets, and the levels of service to be achieved. These would be detailed in the Operation and Maintenance Plans, Instrumentation and Monitoring Plans, Emergency Action Plan and Standard Operating Procedures. Each would provide details on the appropriate Service Standards.

Schematic illustration of a framework for Performance Based Service Contracts



32. An Operation and Maintenance Contract may, for example, may be used to operate a dam in accordance with the Standing Operating Procedures and maintain the dam infrastructure in accordance with the Operation and Maintenance Manuals. This would typically include a requirement for the Contractor to prepare, in conjunction with the Owner, an Annual Report on Planned Maintenance each year during the period of the Contract. The Report would identify observations of deteriorating condition for each dam or performance of various components or scope for enhancements to improve efficiency, economy or safety of operations along with the staffing, technical expertise, and training required. Such report would covers all aspects including civil works, electrical and mechanical works such as painting, plant refurbishment, plant replacement, automation or upgrades and instrumentation and make recommendations for planned maintenance activities in the coming year. The report would include cost estimates together with proposed methods of implementing the work including details of any proposed sub-contracts and an indicative implementation plan for carrying out such work.

33. An Instrumentation and Monitoring Contract may, for example, be used to operate and maintain a dam instrumentation in accordance with the Instrumentation Plan and Standing Operating Procedures. This would typically include requirements for assessing the existing instrumentation network, upgrading as necessary, providing a sustained period of service to maintain the instrumentation, and provide regular monitoring reports on the dam behavior and related hydro-meteorological, structural, and seismic factors. Regular reporting, on a monthly and or annual basis, should confirm the status of the instrumentation and outline any remedial measures required to bring it in compliance with international best practice and national requirements, provide a short- and long-term summary of hydro-meteorological, structural, and seismic factors, forecast short- and long-term hydro-meteorological, structural, and seismic trends and identify any potential areas of concern requiring changes in operations or investment. The reports would include cost estimates together with proposed methods of implementing the work including details of

any proposed sub-contracts and an indicative implementation plan for carrying out such work.

34. A Dam Safety and Assurance Contract may, for example, be used to ensure the safety of a dam in accordance with national safety regulations, international best practice and the Standing Operating Procedures. This would typically include regular dam safety reviews, routine inspections and surveillance, along with specific inspections as required, to confirm the satisfactory behaviour of the dam and identify any deficiencies. The reports would include cost estimates together with proposed methods of implementing any required works, including details of any proposed sub-contracts, and an indicative implementation plan for carrying out such work.

35. There are a number of basic elements required to initiate PBM/SM Contracts. These include an effective contractor acquisition strategy, prequalification processes, clearly defined criteria for selecting a contractor, and clearly defined criteria for assessing contractor performance with payment linked indicators. Contractual provisions such as payment methods, including incentives and disincentives, need to be identified.

Component 3: Reservoir Sedimentation Mitigation

	Cost Estimate		GoI		AIIB		IBRD	
	US\$	%	US\$	%	US\$	%	US\$	%
DOISP-II	55.07	100	9.17	17	22.95	42	22.95	42

36. The original objective was to provide for measures to mitigate the risk of sedimentation of selected reservoirs and for sustained performance and safety through: (i) bathymetric surveys to determine the available total storage and water level-area-volume relations of approximately 30 of the 63 reservoirs known to be affected by accelerated sedimentation; (ii) feasibility studies, designs and any necessary safeguards plans for “within-reservoir” activities and interventions to be taken in the medium-term (e.g., dredging, hydro-suction, etc.) that can be funded in DOISP or the successor project; (iii) preparation for a sample study for decommissioning of a severely silted reservoir to be financed under the successor project; and (iv) piloting of institutional models and plans for treatment of upstream rivers and (sub-)catchments with construction of sediment retaining and river bank protection structures, mostly through community participation and incentive programs..

37. The proposed financing will support the scale-up of a comprehensive Sedimentation Management Program. This will include: (i) studies and surveys related to reservoir sedimentation; (ii) Corrective Measures, such as (a) dredging; (b) flushing and diversion works; (c) check dams; etc. and, (iii) Preventative Measures, such as (a) community watershed management, including community participation programs; and (b) piloting of incentive mechanisms, such as Payment for Environmental Services.

38. Catchment Conservation consists of structural and non-structural interventions. Structural interventions typically comprise of civil work, such as the construction of Check Dams, Sand Traps, Gully Plugs, etc. While the non-structural interventions to mitigate

sedimentation rates can be achieved through the participation of communities living in the catchment area. This can include results based financing mechanisms and other market based mechanisms to provide incentives for improved land care management and agricultural practices, along with replanting and revegetation of degraded areas through a range of different mechanisms.

39. These non-structural measures will require development of coordination mechanisms among various line agencies and Ministries at different levels of Government given the distribution of responsibilities relating to land and water management within the catchment areas. In the past, such efforts have been limited to the buffer zone around the reservoirs which are under the direct authority of the Ministry of Public Works and Housing.

40. Selective reservoir dredging, either on a large scale to support extensive reclaiming of reservoir storage, or on a relatively small scale in the vicinity of the outlet works to facilitate operation of the intake gates and spillway gates, is expensive and often not economically. Dredging should be accomplished using the most technically satisfactory, environmentally compatible, and economically feasible dredging and dredged material disposal procedures. Long- term objectives concern the management and operation of disposal areas to ensure their environmentally sustainable long-term use. To achieve these objectives, the following activities are carried out prior to any determination:

- (i) Analyze dredging location and quantities to be dredged, considering future needs.
- (ii) Determine the physical and chemical characteristics of the sediments.
- (iii) Evaluate potential disposal alternatives.
- (iv) Identify relevant social, environmental, and institutional factors.
- (v) Assess necessary actions for environmental and social effects mitigation
- (vi) Evaluate dredge plant requirements

Component 4: Dam Safety Institutional Improvement

	Cost Estimate		GoI		AIB		IBRD	
	US\$	%	US\$	%	US\$	%	US\$	%
DOISP-II	24.83	100	4.14	17	10.34	42	10.34	42

41. The objective of the original project was to further strengthen and consolidate the regulatory framework and national dam safety institution and strengthen MPWH’s capacity for portfolio management and regulation in order to sustain rehabilitation works and reservoir life. This was achieved through: (i) the preparation of the Government and Ministerial regulatory documents and Concept/Academic Papers, including the consultations; (ii) a public awareness campaign about dams and reservoirs, and dissemination to all public and private dam owners of the regulations and guidelines regarding dams and reservoirs; (iii) strengthening and development of the DSU better fulfill its regulatory roles for about 63 dams under MPW’s program, and of other public and mines

tailings dams through staff recruitment and training (with outsourcing of work to consultants and RCWR); (iv) provision of a fully furnished and equipped DSU office capable of housing about 30 engineers; (v) preparation of new or updated DSC Guidelines; (vi) establishing and supporting a National Dam Safety Panel to review site investigations and designs; (vii) establishing a dam engineer and technician training and certification system in cooperation with INACOLD; and (viii) incremental costs of the structural CDMU in DGWR to operate as the focal point for dam safety monitoring, review and archiving

42. The proposed financing represents a substantial increase over the parent project and will be used to continue to support Government's institutional evolution and further innovations in building water resources institutions in Indonesia. The institutional activities include: (i) strengthening the capacity of the MPWH to manage its dam portfolio better and regulate large dams in the country, and (ii) improving the sustainability of the rehabilitation works and the reservoir life. This will include support for the following: (i) institutional assessments, benchmarking and enhanced coordination mechanism among line agencies; (ii) regulatory support and instruments, standards and guidelines, including national dam policy on registration, inspection, safety compliance and penalties; (iii) a National Dam Safety Management System; (iv) enhancing dam safety through improved surveillance and protection measures; and (v) supporting development of a dam technology center.

43. There are a number of agencies under the Directorate General of Water Resources related to the dam safety. These include the Dam Centre, Directorate of O&M, Directorate of River and Coast, Research Center for Water Resources, and the Dam Safety Unit. The Dam Safety Units within the basin organizations are central to fulfilling the requirements for dam safety management and in the day-to-day operation and maintenance of dams and appurtenant structures. These organizations were established during the original Dam Safety Project. Coordination mechanisms among these agencies is important, along with enhanced capacity, to prevent or to mitigate the potential risks associated with dam safety. Enhancing coordination among these agencies requires appropriate platforms to ensure the highest standards relating to dam safety.

44. Strengthening the dam safety agencies can be achieved if the appropriate regulatory framework is in place and applied. The regulatory support for the tasks required for dam safety consist of instruments, standard and guidelines, including national dam policy registration, inspection, safety compliance and penalties. Although a variety of guidelines and standards have been developed under the earlier phases, there is a need to review, revise and update these considering new technologies and approaches.

45. The Directorate General of Water Resources, MPWH, have responsibility for performance all of the existing dam owned by government of Indonesia, in the implementation works have best coordination and communication with others institution related to the existing dam performance. To carry out the task of responsibilities, the Directorate General of Water Resources shall prepare various rules and regulations in accordance with the needs of existing dams that include instrumentation, standards, guidelines, including registration policy, inspection, security, and penalty or sanctions.

46. The Researched Center of Water Resources (RCWR - Pusat Penelitian dan Pengembangan Sumber Daya Air) was established in 1936 and is part of the MPWH. The RCWR has been assigned to implement applied research, development, science and

technology in the water resources field. It is proposed to support the establishment of a dedicated Dam Technology Center within RCWR. The current research focus is toward geological, hydrological, and environmental research and development. The current role of the RCWR in Water Resources Development based in the MPWH regulation, consists of:

- a. Implemented Research, Development, including applied Science and New Technology in the field of Water Resources
- b. Preparation of technical policies, plans and strategies for research, development and application of science and technology, as well as the investigation and assessment in the field of water resources.
- c. Implementation of research, development, implementation, and service of science and technology, as well as the investigation and assessment in the field of water resources.
- d. Preparation, formulation, and evaluation standards, guidelines, and manuals in the field of water resources.
- e. Monitoring, evaluation, and reporting tasks of research, development and application of science and technology, as well as the investigation and assessment in the field of water resources.

47. **Training and Career Development for Dam Safety.** To ensure the long-term effectiveness of dam safety rehabilitation works implemented under DOISP-II, it is essential that the CDMU, DMU and PDMU staff are given adequate training in the use of the dam safety assurance monitoring guidelines, evaluation of monitoring results and in the adoption of good O&M practices as set out in the O&M manuals of the Dam Safety Commission. The Dam Safety Training program will be divided into three types of training: i) Formal Training; ii) On Job Training; and, iii) Dissemination and Application of Guidelines. A National Master Trainer in the Technical Assistance Team will provide guidance and continuity in training. It may also be appropriate to second staff from the DGWR to various projects being developed under the Ministry and or by PLN for hydropower generation.

48. **Dissemination and Application of Dam Guidelines.** The objective of Dissemination and Application of Dam Guidelines is to improve Engineers who have background, often in charge of dam work especially in the field of dam design which includes design of new dams, rehabilitation and improvement of the function of the dam, the composing of the whole inspection (Inspeksi Besar), and preparation of dam Emergency Action Plan. A number of guidelines and standards were developed under DOISP1 and these will be reviewed, revised as needed and operationalized through enhanced dissemination etc. Additionally, the government policy that will be built almost 60 new dam unit for the next 5 year, automatically, the DSU coordination with Dam Safety Commission (DSC) as the “back bone” of new dam construction recommendation to the MPWH for Dam Construction Certification, more necessary to get technical assistance for DSU tasks. The Dissemination and Application of Dam Guidelines would include not only government employees but professionals / engineers working in the field of dam development and safety, such as Consultants and Contractors, Academics, Suppliers etc.

Component 5: Project Management

	Cost Estimate		GoI		AIIB		IBRD	
	US\$	%	US\$	%	US\$	%	US\$	%
DOISP-II	35.07	100	5.85	17	14.61	42	14.61	42

49. The original objective of this component was to provide for overall Project Management including provision of: (i) the principal Project Management TA Consultant; (ii) the incremental operating costs of the Central Project Management Unit's (CPMU) and Project Implementation Units (PIUs) activities for coordinating all project interventions; and (iii) all TA support to prepare for the successor project.

50. The proposed financing will support continued implementation and the overall project management through: (i) Technical Assistance for the Central Project Management Unit (CPMU) and Central Project Implementation Unit (CPIU) within Ministry to provide the necessary support services for timely and effective project implementation, including monitoring & evaluation, procurement, financial management, safeguard monitoring, etc.; (ii) Technical Assistance for the Dam Safety Unit to ensure oversight and effective implementation; (iii) Technical Assistance for the river basin organizations to ensure timely and effective implementation; (iv) Environmental and Social Service Provider/s; (v) an international Dam Safety Panel of Experts; (vi) a National Dam Safety Review Panel; and, (vii) the incremental operating costs of the Central Project Management Unit's (CPMU) and the Project Implementation Units (PIUs) for activities related to project implementation.

Annex 3: Economic and Financial Analysis

1. The proposed financing project maintains the five components of the original project and scales-up the original activities into additional dams already prioritized within the framework of the technical assistance activities conducted in the original project and those yet to be identified and prioritized during the implementation of the additional financing project. These components are:

- Component 1: Dam Operational Improvement and Safety Works and Studies
- Component 2: Operation and Maintenance Improvement and Capacity Building
- Component 3: Reservoir Sedimentation Mitigation
- Component 4: Dam Safety Institutional Improvement, and
- Component 4: Project Management

2. The expected combined outcomes of these activities are improvements in the dam safety or reduction in the probabilities of dam failure, restoration of the operational performance of dams and reservoirs, and increased longevity of dam life. The achievement of these outcomes is expected to increase the safety of existing dams and their operational performance thereby: (i) avoiding loss of human life, (ii) avoiding irrigation benefit loss, (iii) avoiding hydropower benefit loss, (iv) avoiding household property losses, and (vi) avoiding emergency response costs.

Methodology

3. The cost benefit analysis follows the probabilistic approach to dealing with the effects of dam safety improvement interventions. Successful implementation of this approach requires proper risk evaluation and risk measurement. It requires precise estimates of annualized risk of dam failure with and without the project and the associated consequences or hazards. The annualized risk to local economy, human life, and the environment is the interplay of the probability of dam failure and the expected consequences or hazards given the dam failure probability as depicted in the equation 1 below.

$$AR = PDF * EH \dots\dots\dots 1$$

Where,

AR is the annualized risk measured in monetary values

PDF is the probability of dam failure, and

EH is expected consequences or hazards given the dam failure event

4. The consequences could be direct or indirect. The direct consequences could be human life loss, loss of fishery or livestock, economic losses, loss of environmental amenities and expenditures for environmental restoration, onsite and downstream property damage etc. The indirect economic consequences refer to changes in business output and employment in linked economic sectors, which may represent a large portion of the economic consequences from a dam failure scenario. Development of dams often induce

huge multiplier effects in various sectors of the economy¹⁴. These direct and indirect consequences should be of most concern to the decision makers and dam safety analysts, not the collapse of the dam per se. Thus, meaningful quantification of dam failure risk depends on credible estimates of the damages that would result from each significant failure scenario.

5. Dam safety is unique in that it represents an extreme situation characteristic of low probability event and high consequence or hazard. Thus, conventional rules of economic analysis are difficult to extrapolate and extend to such events. For instance, human life is generally accepted as the most important consequence and often dominates dam safety decisions. Unfortunately, the confidence with which life loss can be estimated is low, which is a hindrance to credibility and value of dam safety risk assessment results. However, application of cost benefit analysis is still relevant as there are insufficient disposable financial resources to improve the safety of every dam without limit. The analysis is particularly useful for setting priority or determining the order in which dam safety rehabilitation projects should be approached within a portfolio of dams.

6. The extremely low probabilities of dam failure masks the risks. However, when the failure actually happens due to neglect or lack of necessary measures, the consequences are usually very costly, as evidenced by the recent two dam failure events in Indonesia itself (see Box).

The consequences of recent two dam failure events in Indonesia.

<p>The Situ Gintung dam tragedy of 2009</p> <p>Situ Gintung dam was built in 1933. There are different opinions regarding the cause for the collapse but failure to implement appropriate structural and non-structural dam safety measures is considered the major culprit. The losses associated with the failure this dam are the following:</p> <ul style="list-style-type: none"> • 100 people died • 190 people injured • 420 homes damaged • 1600 people displaced • About 10 Billion Rupiah worth of material lost
<p>The collapse of Wayela natural dam in 2013</p> <p>The Wayela natural dam was created in 2012 due to hill landslide that closed the flow of a river. Alarmed by Situ Gintung dam tragedy of 2009, the Indonesian government in cooperation with NGOs took some structural and non-structural dam safety measures, informed by results of solid technical analysis. Emergency disaster-risk management measures including early warning systems, awareness creation and capacity building of communities, and preparation of evacuation strategies were implemented. As a result, the consequences of the Wayela natural dam failure, particularly regarding human life loss, was significantly reduced in contrast to the case of the Situ Gintung situation. This is remarkable given the fact that the storage volume of Wayela natural dam is 41 times bigger than that of Situ Gintung dam. The losses encountered were:</p>

¹⁴ However, these effects are not considered in this analysis due to complexity of quantifying these consequences

- No death of human being recorded
- 3 people missed
- 3 people slightly injured
- 5233 people displaced
- 470 units of houses damaged
- 5 units of schools damaged
- 2 units of praying rooms damaged
- 1 bridge damaged
- 1 unit of KUD was damaged
- 1 unit of community health center damaged
- Two clean water facilities damaged
- 1 telecom tower damaged

7. On the top of the property and human life losses described above, the GOI and communities incur significant additional costs for post disaster rehabilitation and reconstruction operations.

8. The cost benefit analysis was done in two steps. First, the analysis was done for each of the priority dams identified for intervention. Secondly, analysis was done for cluster of priority dams to demonstrate the overall economic returns of the project.

9. Estimates of annualized dam failure probabilities and estimates of economic, property, and emergency response costs for with and without project scenarios were employed to determine the incremental benefit streams as shown in the equations 2 to 4 below.

$$\begin{aligned}
 IB &= AR_{WOP} - AR_{WP} \dots\dots\dots 2 \\
 AR_{WOP} &= PDF_{WOP} * EH \dots\dots\dots 3 \\
 AR_{WP} &= PDF_{WP} * EH \dots\dots\dots 4
 \end{aligned}$$

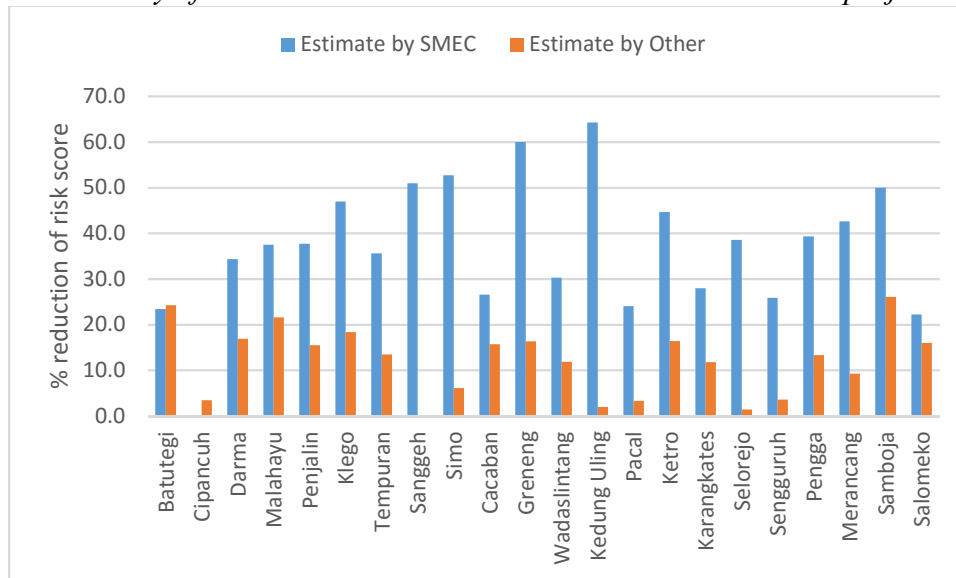
Where:

- IB= incremental benefit stream attributable to the project
- AR_{WOP}=Annualized risk without the project valued in monetary terms
- AR_{WP}=Annualized risk with project valued in monetary terms
- PDF_{WOP}= Probability of dam failure without the project
- PDF_{WP}=Probability of dam failure with project
- EH= Expected consequences or hazards valued in monetary terms

10. **Portfolio of Dams:** There are more than 146 dams eligible for consideration in this project. These dams are at different stages of readiness for implementation. Thus, the project shall follow a framework approach in which the dams are first studied, prioritized using risk assessment scores, and readied for implementation in batches during the course of project. Out of the 146 dams, 23 were already studied and prioritized for implementation. The cost benefit analysis was done for these dams to demonstrate the economic returns of the project.

11. **Dam Failure Probability Assumptions:** In the absence of a large number of historical data for portfolio of dams, it is difficult to estimate the probability of failure of any given dam. Therefore, it is a good practice to make an overall assessment of probability of dam failure reduction, and then carry out sensitivity analysis. Following the original project, the rate of dam failure has been assumed at 13% in a period of 20 years in the without project scenario. Existing historical records indicate that the failure risk of large dams in Indonesia is about 3.8% per year, which is very high. Thus, the 13% failure probability assumption in 20 years' period is conservative. International experience suggests that a comprehensive dam safety measures can reduce the probability of dam failure by, at least, one order of magnitude from the existing conditions for moderately intensive repairs and rehabilitations and up to two orders of magnitude for deep rehabilitation and replacement of large components of the structure and equipment. In this analysis, the rate of dam failure has been assumed to be reduced to 1.3% (i.e., 90% reduction) in the with project scenario. The risk score assessments for pre and post project implementation made by SMEC and other is provided in below figure. The results indicate that the percentage reduction in the dam risk assessment scores from initial pre-project condition to post-project implementation condition ranges between 2% and 65%.

Summary of Dam Risk Assessment score with and without the project



Source: DOISP project progress report

Benefits

12. There are two main categories of benefits that arise from improving dam safety. These are averted benefit losses and remediation costs. The potential averted benefit losses include irrigation water supply benefits, industrial and municipal water supply benefits, hydropower benefits, recreation or tourism benefits, fishing or aquaculture benefits, indirect economic benefits, averted loss of human life. The potential remediation cost benefits include property damage costs, environmental restoration costs, and emergency response costs. Due to paucity of data and/or difficulty in quantification and valuation (e.g., loss of human life, indirect economic benefits) only the following averted benefit loss and

remediation costs were considered in this analysis. These are: (i) irrigation benefits, (ii) hydropower benefits, (iii) avoided household property losses; (iv) avoided dam replacement or rehabilitation cost, and (v) avoided emergency response costs.

13. **Avoided irrigation benefit loss:** irrigation benefit loss is estimated based on data on net area irrigated at each of the 23 dam sites, representative crop budget¹⁵, and cropping intensity values¹⁶. The average gross margin per hectare is USD 350.5. The cropping intensity ranged from 0.8 to 2.9. It is assumed that only 30% of the total irrigation benefits from any given dam would be lost if dam failure occurs.

14. **Hydropower benefits:** Hydropower benefit loss was estimated using hydropower capacity at each dam site and energy price from hydropower plant, which ranges from 8 to 9 USD cents per KWh¹⁷. It was assumed that in the event of dam failure, only 30% of the hydropower benefits would be lost.

15. **Avoided household property loss:** Household property or infrastructure was estimated at USD2, 887.2 per unit. It was assumed that in the event of dam failure, only 10% of the household property value would be affected.

16. **Dam Replacement or rehabilitation cost:** the cost was estimated by using Modern Equivalent Asset Valuation (MEAV) method as a proxy for total value. MEAV is the notional total cost of replacing at the same location, the same type and size of structure at today's price. It is assumed that if dam failure happens only 30% of this value is required to reinstate the dam to its normal condition.

17. **Emergency Response Cost:** This cost was estimated based on the basic needs of affected people such as tent, food, water, etc. as indicated in the Evacuation Action Plan of Dam published by Ministry of Public Works and Housing. The population at risk at any given dam is assumed to be 30%.

18. The total potential avoidable benefit loss due to improvements in safety of the 23 dams is estimated to be about one billion US Dollar. The highest benefit is expected from the protection of household property and assets followed by averted dam replacement or rehabilitation expenditure. Avoided irrigation benefit loss constitutes only about 10% of the project benefits despite the fact that the primary function of the dam is agricultural water supply, reflecting the low dollar value of water use in agriculture.

¹⁵ Statistics Indonesia 2014

¹⁶ Statistics Indonesia 2013

¹⁷ Energy and Mineral resources Ministerial Decree no 03/2015. Normally lost energy benefit should be based on unit replacement cost

Potential averted benefit loss due to the project

No	Category	Avoided benefit loss (USD)	Proportion of total benefit loss (%)
1	Irrigation benefits	98,101,854	9.8
2	Hydropower benefits	30,723,561	3.0
3	Household property and assets	463,550,024	46.1
4	Dam replacement or rehabilitation expenditure	281,112,376	28.0
5	Emergency response cost	131,255,043	13.1
	Total	1,004,742,859	

Costs

19. The estimated total cost required to enhance the safety of the 23 priority dams is US Dollar 69.2 million. This sum is required to finance:

- Physical rehabilitation of the dams to restore their performance and safety in accordance with original design criteria
- Support improved maintenance and to strengthen capacity building of the dam agency or finance improvements in the operational elements required for securing dam safety and improved utilization
- Mitigate the risk of sedimentation of selected reservoirs, and
- Further strengthen and consolidate the regulatory framework and national dam safety institutions

Estimated costs of improving the safety of the 23 dams

No	Project components	Costs (USD)
1	Component 1	5,067,863
2	Component 2	50,453,350
3	Component 3	9,619,373
4	Component 4	4,088,889
	Total	69,229,476

Results of Economic Analysis

20. Assuming dam failure probability of 13% and reduction of this probability by 90% because of project interventions, the overall economic return of the project is very high. The NPV is USD522.9 million with IRR of 60.3%.

Summary Results of Economic Analysis

No	Name	NPV (USD)	B/C Ratio	ERR (%)
1	Cengklik	65,267,851	32.4	145.8%
2	Kedung Uling	13,004,782	7.3	37.6%
3	Ketro	8,536,729	4.3	25.2%
4	Plumbon	6,778,881	4.3	25.2%
5	Karangkates	83,813,995	28.9	127.7%

No	Name	NPV (USD)	B/C Ratio	ERR (%)
6	Sampean Baru	32,591,751	16.7	73.8%
7	Selorejo	14,266,426	7.9	40.0%
8	Wlingi	37,526,247	19.1	83.4%
9	Wonorejo	43,991,409	22.2	96.5%
10	Darma	10,458,716	5.0	28.3%
11	Malahayu	10,893,805	7.6	38.7%
12	Cipancuh	85,188	1.1	6.5%
13	Juanda	111,490,071	8.3	41.7%
14	Merancang	6,070,515	2.7	17.7%
15	Tiu Kulit	10,736,569	6.2	33.2%
16	Cacaban	11,472,444	7.4	38.1%
17	Greneng	-914,214	0.7	2.1%
18	Penjalin	12,138,266	5.6	31.1%
19	Sanggeh	-965,086	0.5	0.5%
20	Simo	1,274,715	1.7	11.7%
21	Tempuran	-466,598	0.8	4.2%
22	Salomeko	2,101,316	1.8	12.6%
23	Wadaslintang	48541813	21.2	92.2%
	Overall	522,918,622	9.7	60.3

21. Despite the overall highly satisfactory returns to the project, scrutiny of the analysis done for each of the 23 dams reveals mixed results. The IRR ranged from 0.5% to 145%, while the B/C ratio ranged from 0.5 to 32.4. Three dams, namely Greneng, Sanggeh, and Tempuran had negative NPV and IRR less than the cut-off value of 6%. The reasons behind unsatisfactory rate return for these dams are the relative small number of affected human population downstream of the dams and the small size of irrigated area served by the dams.

22. Five dams, namely Cengklik, Karangates, Wlingi, Wonorejo, and Wadaslintang recorded IRR higher than 80%. This is mainly due to high density of human population residing downstream of -the dam. These dams also generate hydropower in addition to supplying irrigation water.

Sensitivity Analysis

23. The economic viability to the project largely depends on the dam failure probability and reductions in dam failure probability (following project interventions) assumptions among other factors. Therefore, the sensitivity of returns to the project to these variables was analyzed and the results are depicted in table below. The results indicate that the returns to the project are quite robust. The project is viable under most of the plausible dam failure probabilities and failure probabilities reduction assumptions. Unfavorable result is recorded only for dam failure probability of 3.8% over 20 year's period and 25% reduction in this probability following project intervention. This assumption is too optimistic. Since 1960, Indonesia recorded 15 incidents of major dam structural failures. Based on this existing historical records, the failure risk of large dams in Indonesia was estimated 3.8%

per year, which is above international average and realistic figures for regulated and well maintained dam structures (about 0.5%)¹⁸.

Sensitivity of the viability of the project to some key variables

Indicators	Probability of dam failure	Dam failure probability reduction			
		90%	75%	50%	25%
NPV (Million USD)	13%	522.9	425.8	263.9	101.9
	10%	388.4	313.7	189.1	64.6
	5%	164.2	126.9	64.6	2.3
	3.8%	110.4	82.0	34.7	-12.6
IRR (%)	13%	60.3%	50.8%	35.6%	19.6%
	10%	47.3%	40.2%	28.5%	15.3%
	5%	26.0%	22.3%	15.3%	6.4%
	3.8%	20.5%	17.4%	11.5%	3.5%
B/C	13%	9.7	8.1	5.4	2.7
	10%	7.5	6.2	4.2	2.1
	5%	3.7	3.1	2.1	1.0
	3.8%	2.8	2.4	1.6	0.8

24. The sensitivity of the viability of the project (as indicated by IRR) for each of the 23 dams is summarized in below table. 30.4% the dams would have unfavorable IRR for the unlikely scenario of 3.8% dam failure probability over 20 years' period (which is very optimistic given the dam failure history of Indonesia) and only 25% reduction in failure probability following project intervention (which is considered pessimistic for a comprehensive dam safety program such as DOISP-II. Under this unlikely scenario, the project is economically viable for 69.6% of the dams.

25. The major conclusion of this finding is that if there is financial constraint cover all of the dams, the dams with economic returns (69.6%) need to be prioritized. However, this does not imply that the remaining 30.45% of the dams should not be considered. Interventions in these dams could as well make economic sense if all benefits of avoiding dam failure are identified, valued, and considered in the analysis.

Summary results of the sensitivity analysis for each of 23 dams

Probability of dam failure	IRR(%)	%Reduction in dam failure probability or number of dams			
		90%	75%	50%	25%
13%	<0%	0	0	0	3
	0%-10%	3	3	3	4
	10%-50%	9	10	13	13
	50%-90%	5	4	3	3
	>90%	6	6	4	0
10%	<0%	0	0	2	3
	0%-10%	3	3	3	4

¹⁸ DOISP1

Probability of dam failure	IRR(%)	%Reduction in dam failure probability or number of dams			
		90%	75%	50%	25%
	10%-50%	10	12	12	16
	50%-90%	4	2	6	0
	>90%	6	6	0	0
5%	<0%	2	3	3	7
	0%-10%	4	4	4	6
	10%-50%	11	11	16	10
	50%-90%	6	5	0	0
	>90%	0	0	0	0
3.8%	<0%	3	3	4	7
	0%-10%	4	4	7	9
	10%-50%	12	14	12	7
	50%-90%	4	2	0	0
	>90%	0	0	0	0

Financial Analysis

26. Financial analysis is required to assess the financial capacity of central and provincial governments to cover the O&M requirements of dams and reservoirs. Currently, expenditure review is under way to assess levels of efficacy of O&M. The expenditure review determines the Modern Equivalent Asset Value of portfolio of dams; assess budget allocations for O&M over the past 10 years. The expenditure review is expected to shade light on the fiscal impact of incremental O&M expenditures for dam owners, operators and water users. The results would enable the GOI to formulate policies and regulations that are needed to ensure the availability of adequate financial resources for maintaining and operating the dams and related infrastructure to ensure the sustainability of services for water users.

27. The results of the financial analysis done for the original project are valid for the present contexts because no changes and regulations have been effected with regard to O&M issues. For instance, still no regulations exist to require collection of water fees from the main water users, viz. **irrigators** (representing about 99.7% of the users from the reservoir). Only a small portion of the bulk water is supplied to hydropower, and industrial and domestic users. The annual O&M expenditures for dam and irrigation facilities are fully financed from the central and provincial government's budgets in the ratio of 20:80. The PJT I and II collect fees for water supplied for hydropower, urban and industrial uses.

28. The actual O&M expenditures are often lower than the total needs, although budget allocations is generally on increasing trend. The planned investments within the framework of DOISP-II would undoubtedly increase the O&M budget requirements for both the central and provincial governments. The incremental O&M budget need to be provided through firmly committing resources or allowing the users to share the burden partially or fully through making new regulations¹⁹.

¹⁹ Note that the 2004 Water Law specifically exempts individual small farmers from water charges.

Annex 4: Sovereign Credit Fact Sheet

Recent Economic Development

1. Indonesia is a low-middle-income country. Indonesian gross national income per capita rose from US\$560 in 2000 to US\$3,374 in 2015. According to IMF Article IV 2016 for Indonesia, despite the sharp fall in international oil prices, episodes of capital outflows, and turbulent global financial markets in 2015, the Indonesian economy performed well with a relatively stable growth at 4.7 per cent. This is largely due to sound monetary management and a prudent fiscal stance.

2. In 2016, growth is projected to increase moderately to 4.9 percent supported by domestic demand, which is driven by investment and public sector spending. Inflation has fallen sharply at end-2015, and it is expected to remain within the inflation target band (3-5 percent) in 2016. The current account deficit narrowed significantly in 2015 to around 2 percent of GDP on lower imports, but the deficit is projected to increase again in line with higher domestic demand. The fiscal deficit will remain below the 3 per cent of GDP, the statutory limit for the general government.

Economic Indicators

Selected Macroeconomic Economic indicators (2014-2018)

Economic Indicators	2014	2015*	2016*	2017*	2018*
National income and prices (change %)					
Real GDP	5.0	4.7	4.9	5.3	5.5
CPI inflation (change %, end of year)	8.4	3.4	4.5	4.4	4.4
Central government operations (% of GDP)					
Central government balance	-2.2	-2.8	-2.8	-2.8	-2.8
Total external debt (% of GDP)	33.1	36.6	36.6	36.0	35.1
Gross external financing requirement (US\$bn)	83.8	75.2	82.6	--	--
Nominal gross public debt	24.7	27.5	28.4	29.2	30.0
Public gross financing needs	4.4	4.5	4.6	4.7	4.5
Money and credit					
Broad money (M2, % annual change)	13.5	13.5	14.0	--	--
Net FDI inflows (% of GDP)	1.8	1.4	1.5	--	--
Gross reserves (months imports)	8.0	7.3	6.8	6.6	6.2
Current account balance (% of GDP)	-3.1	-2.0	-2.5	-2.5	-2.6
Exchange rate (Rupiah/US\$, end period)	12435	13788	--	--	--

Note: * denotes projected figures. Source: IMF Country Report No. 16/81, March 2016.

Economic Outlook and Risks

3. Looking ahead, Indonesia's medium term growth is projected to reach 6 percent by 2020, factoring in strong infrastructure investment and structural reforms that support productivity growth. The main external risks include (i) more volatile global financial conditions with poor market liquidity possibly amplifying volatility in the event of capital outflows, and (ii) a deeper-than-expected slowdown in EM trading partners that could further weaken external demand and commodity prices. The possible domestic risks will be the slow progress in investment-enabling structural reforms and public investment projects and continued declines in government revenue.

4. On debt look, Indonesia's external debt remains at a moderate level at 36.6 percent of GDP in 2015 and is projected to be sustainable over the medium-term. Growth in private external debt is expected to slow as global financial conditions tighten and borrowing costs rise. Public debt remains low while contingent liabilities arising from borrowing by state corporations pose some fiscal risk.²⁰

²⁰ International Monetary Fund (IMF), 2016. Country Report No. 16/81– 2015 Article IV Consultation— Press Release; Staff Report; and Statement by the Executive Director for Indonesia, March, 2016.