FRM Profile

Subproject	**FRM-CC- Cisanggarung**
River basin	Cimanuk-Cisanggarung
Main river	Cisanggarung River
District/Province	West Java
Agency in charge	BBWS Cimanuk-Cisanggarung (CC)
Proposed work description	The infrastructure components to be constructed along the Cisanggarung river system will allow i) reduction in flood water levels and ii) retention of flood volumes to reduce flood exposure to households and agriculture areas. The engineering consultant engaged under ADB Loan 3455 will prepare the detailed engineering design based on the agreed basic design and concept prepared under the TRTA. The L3455 will conduct detailed surveys (topography, geotechnical, bathymetry, social, and environmental) that might slightly impact on the design. No change on design that trigger category A for environment safeguards will be made. Flood Risk Management (FRM) plans shall be prepared and implemented at the river basin scale by reflecting national priorities/initiatives and international best practices (i.e., EU Flood Directive, WMO approaches and Prevention, Preparedness and Response to manmade and natural disasters (PPRD) East study). Some of the guiding principles are presented in Appendix D of the FRM technical pre-feasibility report to serve as the basis of developing Guidelines for FRM plans in Indonesia during development of detailed engineering design plans through L3455. Upstream Watershed Management practices will be described in further detail during the detailed engineering design stage (through L3455) in collaboration with the international project partner, International Fund for Agricultural Development (IFAD). In this context, site-specific actions will be evaluated and proposed, with the support of IFAD, to enhance stability and sediment yield characteristics in the upstream parts of the watershed. Some of the preliminary practices are described in Appendix E of the FRM technical pre-feasibility report to highlight joint functioning of various technologies as one system at the watershed scale. The FRM subprojects will include i) excavation of sediment in river channels, ii) raise in levee/bank elevations, which are proposed by the **BBWS CC**; and i) detention basins, ii) coastal protection, and iii nature-based solutions, which are proposed by the **EWSIP** in the context of enhanced structural and non-structural measures. The main features of BBWS proposals and EWSIP proposals are described below. The main features of **raised banks as proposed by BBWS CC** include: i) raising existing walls in the vicinity of Srigading **(Subproject ID B.a),** ii) raising existing walls in the vicinity of Desa Benda **(Subproject ID B.b),** iii) protecting lower reaches at Ciwarada with gravity walls on piles,**(Subproject ID B.c)** outside bend protection by gabions with riprap toe protection following channel normalization, iv) protecting lower reaches at Cijangkelok with gravity walls on piles, **(Subproject ID B.d)** outside bend protection by gabions with riprap toe protection following channel normalization, The main features of **detention basins as proposed by EWSIP (Subproject ID B.e)** include**:** Flood and raw-water supply storage is proposed based on a duckbill weir at Pasir Pucang that will also trap sediments (surface area of 186 ha, depth of 10 m, and temporary storage volume of 1.4M m3). During the wet season, levels would be kept low to absorb peak floods then allowed to fill towards the end of wet season for use in irrigation and raw-water supply in the dry season. The main features of **coastal protection as proposed by EWSIP (Subproject ID B.f)** include: a new diversion considered at Tawangsari on the tidal section of the Cisanggarung, 2km to the west as part of a plan to reclaim tidal eroded area of approximately 8 km2 as a brackish water lagoon with sediment, breakwaters and a

<table>
<tr><td></td><td>salinity protection dike to protect rice land and habitation from saline inundation.

The main features of nature-based solutions proposed by EWSIP (Subproject ID B.a, and B.b) include:
i) side slopes of proposed channels with 1:0.5 to be implemented by using gabions or reinforced soil design,
ii) natural vegetative protection is proposed along straight sections of the channel based on vetiver grasses in a 3m x 3m cell shape filled in with native vegetation,
iii) removal of housing to be considered within 10m of river banks.

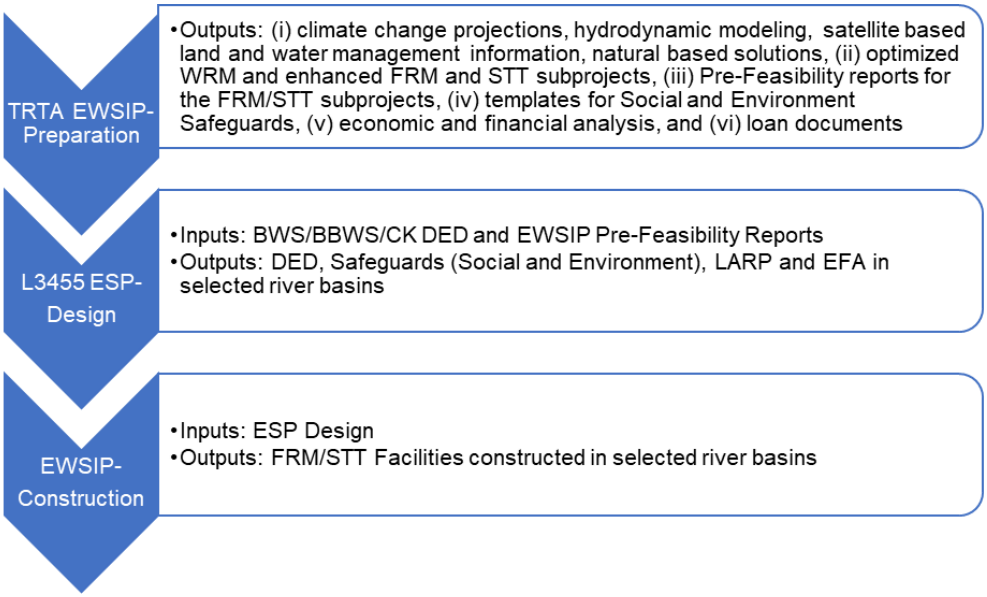
Nature-based solutions along the watershed include: improvement in poor agricultural practices such as cultivation of cassava and maize with downslope ridges.
A soft measure (as proposed by EWSIP) without implications for structural interventions include; upgrade in the flood warning system by placing greater intensity of water level sensors connected by SCADA to BBWS CC control centre for flood forecast and early warning.</td></tr>
<tr><td>EWSIP added value</td><td>EWSIP outputs are strategically linked to the BAPPENAS quick-win programs as defined below:

<table>
<tr><th>BAPPENAS Programs</th><th>EWSIP Outputs</th></tr>
<tr><td>Program 1: Smart Water Management</td><td>Output 1: Planning for water resources optimized</td></tr>
<tr><td>Program 2: Water for Food Security and Nutrition</td><td>Output 2: RWS infrastructure and services improved</td></tr>
<tr><td>Program 3: Multipurpose Storage for Water, Food, Flood, and Energy</td><td>Output 2: RWS infrastructure and services improved</td></tr>
<tr><td>Program 4: Disaster Resilience Infrastructure</td><td>Output 3: FRM enhanced</td></tr>
<tr><td>Program 5: North Java Integrated Coastal Development</td><td>Output 3: FRM enhanced</td></tr>
<tr><td>Program 6: Green Infrastructure</td><td>Output 1: Planning for water resources optimized</td></tr>
<tr><td>Program 7: Water Safety Plan</td><td>Output 1: Planning for water resources optimized</td></tr>
</table>
</td></tr>
<tr><td>Alignment with spatial plan</td><td>The subproject is consistent with the spatial plan of West Java Province year 2009-2029[1].</td></tr>
<tr><td>Potential Involuntary Resettlement impact</td><td>The subprojects are expected result in Land Acquisition (LA) as documented below. The final LA requirements for all subprojects shall follow detailed site-specific surveys to be implemented during the detailed engineering design stage through L3455.

<table>
<tr><th>ID</th><th>FRM Subproject</th><th>Estimate for LA area (ha)</th></tr>
<tr><td></td><td><u>BBWS CC Proposals</u></td><td></td></tr>
<tr><td>B.a</td><td>Cisanggarung- Srigading: Confluence</td><td>0.2</td></tr>
<tr><td>B.b</td><td>Cisanggarung Desa Benda wall protection</td><td>0.7</td></tr>
<tr><td>B.c</td><td>Cisanggarung- Ciarada enhancements</td><td>95.5</td></tr>
<tr><td>B.d</td><td>Cisanggarung- Cijangkelok enhancements</td><td>0.7</td></tr>
<tr><td colspan="2">Sub-total for BBWS CC</td><td>97.1</td></tr>
<tr><td></td><td><u>EWSIP Proposals</u></td><td></td></tr>
<tr><td>B.e</td><td>Pasir Pucang FR Reservoir and control barrage</td><td>186</td></tr>
<tr><td>B.f</td><td>Tawangsari river diversion & Crukcuk lagoon</td><td>14.6</td></tr>
<tr><td colspan="2">Sub-total for EWSIP</td><td>200.6</td></tr>
<tr><td colspan="2">Total estimate for land acquisition</td><td>297.7</td></tr>
</table>

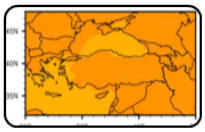
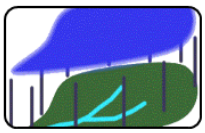
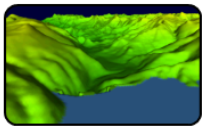
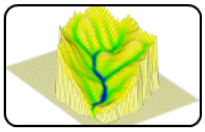
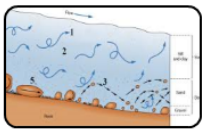
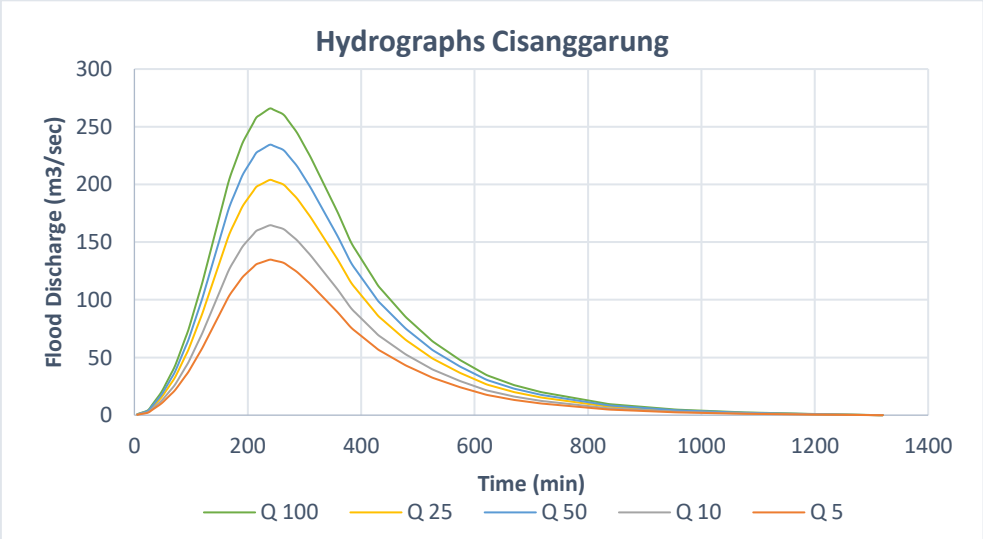
There are no documents on land acquisition, socio-economic conditions and resettlement needs along the project corridor (i.e, AMDAL, LARP, LARAP, IP&IR, etc.)</td></tr>
</table>

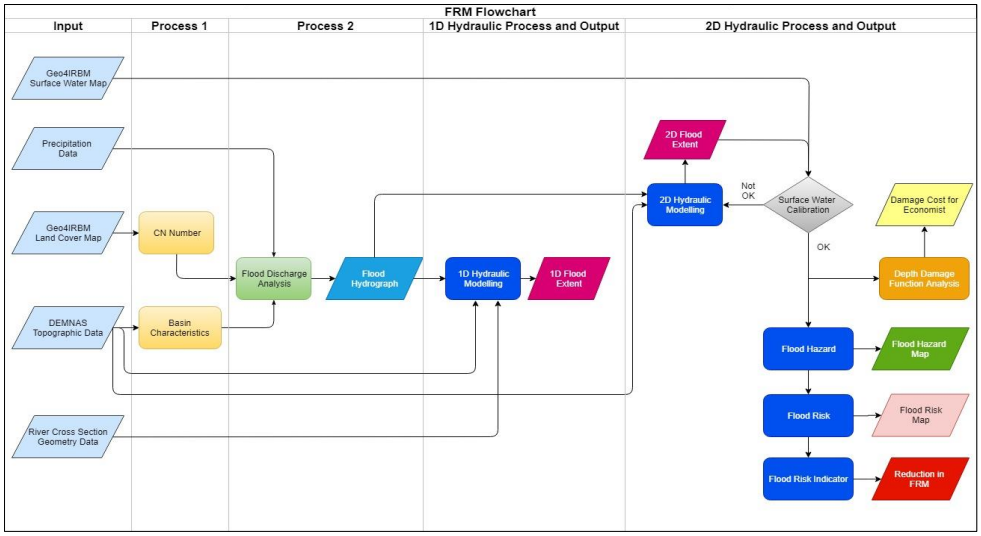
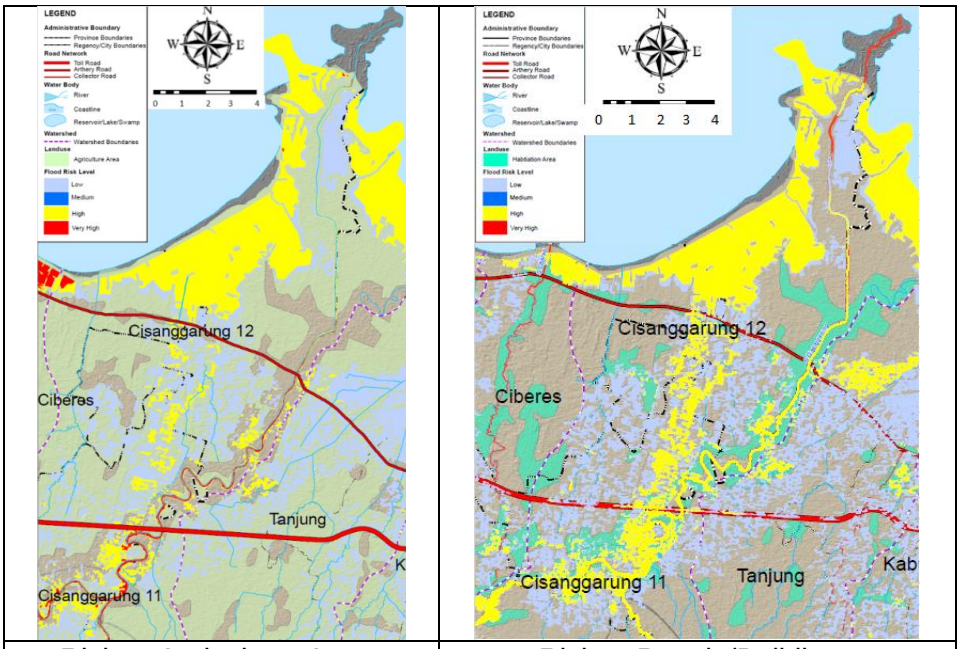
[1] http://bappeda.jabarprov.go.id/wp-content/uploads/2017/03/Perda-No-22-Tahun-2010-Tentang-RTRWP-Jawa-Barat-2009-2029.pdf, last accessed in July 2019.

Potential Indigenous people impact	The preliminary findings indicate that the proposed subproject doesn't cross any Indigenous People (IP) area. The final status on the potential for crossing areas with IP should be evaluated by i) reviewing the BRWA (Indigenous Territory Registration Agency) database[2], ii) reviewing the AMAN (Indigenous Peoples Alliance of the Archipelago) database[3], and iii) site-specific surveys.
Potential Environment impact	The subproject works are not expected to cross any protected area (forest/swamp), biodiversity sanctuary or protected forest as indicated in the Indicative Moratorium Maps 15th Revision, which are published as per the Forestry Ministerial Decree of the Republic of Indonesia Number: SK.8599/MENLHK-PKTL/IPSDH/PLA.1/12/ 2018 (Scale 1:250.000)[4]. There are no documents on environmental impacts (i.e., IEE, AMDAL, etc.). The potential to cross any protected area (forest/swamp), biodiversity sanctuary or protected forest should be evaluated through site-specific surveys by the Contractor during Detailed Engineering Design. No change on design that trigger category A for environment safeguards will be made.
Estimated cost and implementation period	Implementation period is 2020 – 2024. The project costs include i) RpM 1,683,515 for the infrastructure by the BBWS CC, ii) RpM 239,277 for the core enhancements by EWSIP, and iii) RpM 317,670 for climate resilience driven enhancements by EWSIP. O&M costs are annual and to be calculated as 2% of infrastructure implementation costs through the lifecycle of proposed infrastructure over 30-years.
Readiness FS/DED/IEE-EIA/LARP/Bidding documents	DED is available for the infrastructure proposed along the Belawan River by the BWS Sumatera II. Enhancement of the existing DED and Safeguards documentation will be proposed for preparation as part of ADB ESP packages (Loan 3455). The documents that are available include: i) Rencana Pengelolaan Sumber Daya Air Wilayah Sungai Cimanuk Cisanggarung (Water Resources Management Plan in Cimanuk Cisanggarung River Basin) by the DGWR-MPWH, 2017, Sejahtera (July 1998), and ii) Studi Pengendalian Banjir di DAS Cisanggarung - PT. Mitratama Asia Pasific (2016)
Linkages between EWSIP and ESP	The linkages between the TRTA, Engineering Services Project (ESP); and construction under EWSIP are schematized below: 

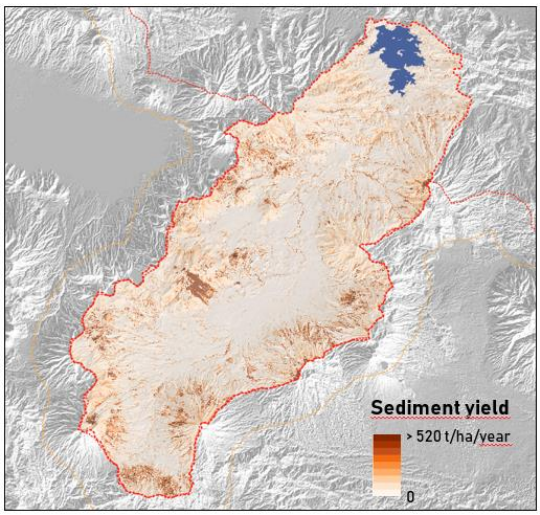
[2] http://brwa.or.id/sig/, last access in June 2019.
[3] http://www.aman.or.id/peta/, last access in June 2019.
[4] http://webgis.dephut.go.id:8080/kemenhut/index.php/en/map/pipib/61-pippib/330-indicative-moratorium-map-15th-revision, last accessed in July 2019.

FRM Numerical Modelling Processes

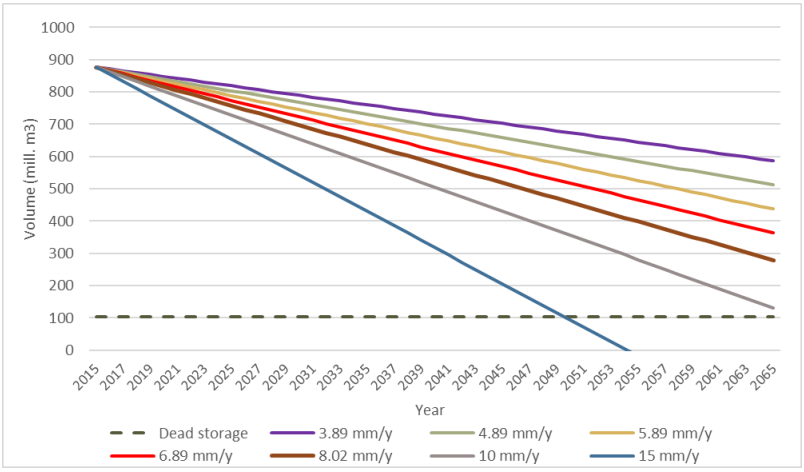
Numerical models in IFRM	ESP Consultant shall follow the numerical modelling processes in integrated flood risk modelling (IFRM) as highlighted below:  **Climate Change Modelling** - *Scope:* Climate change projections and anomalies - *Database:* Temperature, Precipitation and Evaporation (ADB)  **Hydrologic Modelling** - *Scope:* Evaluation of Rainfall to Runoff processes - *Database:* Hydromet. network (BBWS/PUSAIR), LULC (ESA)  **Hydraulic Modelling** - *Scope:* Evaluation of Runoff to River hydraulics (1D/2D) - *Database:* Flow gage network, DEM (BIG), Validatation (ESA)  **Erosion Modelling** - *Scope:* Sediment yield from the watershed - *Database:* RUSLE / MUSLE parameters  **Sediment Yield and Watershed Management** - *Scope:* Sediment yield along the watershed system - *Database:* Sediment characterization, FAO–WOCAT (World Overview of Conservation Approaches and Technologies)
Flood Hydrographs	ESP Consultant shall generate flood hydrographs (as depicted below) for existing/future conditions by using the Soil-Conservation-Service (SCS) Curve Number (CN) unit hydrograph approach. The existing/future land use and land cover data sets and climate change data sets (representing the changes in precipitation and temperature in 2030 and 2050) shall be used. 

Flood Hydraulics	The main objective of 1-dimensional hydraulic models is to i) identify existing level of flood protection (Scenario 1) along the river, ii) evaluate the proposed concepts by the BBWS DED (Scenario 2) and iii) evaluate the level of enhancement required for the flood protection services (Scenario 3). This evaluation was performed both in the context of existing hydrologic conditions (storm precipitation) and future conditions with climate change (Scenario 4). 2-dimensional hydraulic models shall be developed along the entire river basin by using the DEMNAS DEM available by the BIG. The hydraulic models shall be evaluated/validated through a combination of tools including i) BNPB database for disaster data for historical floods , ii) historical flood maps available with the BWS/BBWS, iii) Google Earth time series images to explore flood impacts, and iv) European Space Agency (ESA) satellite images of historical water extent.
Flood Risk Maps - Processes	ESP Consultant shall develop flood risk maps through the exposure, vulnerability and hazard processes and by using 1-dimensional and 2-dimensional hydraulic models. The flood risk maps for existing conditions shall be validated by using 
Flood Risk Maps - Outcomes	The outcomes shall be represented for i) building/people, and ii) agriculture at the river basin scale, as shown below.  Risk to Agriculture Areas | Risk to People/Buildings

Sediment Yield	The main findings of a recent European Space Agency study, in two river basins in Indonesia, indicate high level of sediment yield across the river basins. As an example, upstream of Jatigede reservoir, the high amount of sediment yield can lower the life-cycle of the reservoir by approximately 10 years. ESP Consultant shall evaluate the sediment yield upstream existing/proposed facilities.



Sediment yield potential upstream of Jatigede Reservoir



Potential impact of sediment yield on the life-cycle of reservoir

EWSIP - INDICATIVE MAP OF FRM CISANGGARUNG AND BABAKAN SUB-BASIN SUBPROJECT

Legend :

- Capital Province
- District Province
- National Boundary Line
- Province Boundary
- District Boundary
- Watershed Boundary
- River

Sub Project Information :

- Tawangsari river diversion and Crukcuk brackish lagoon
- BBWS river normalisation
- Flood Wall Plan
- Small habitation storage & drains
- Malahayu Dam spillway gates
- Detention Basin
- Raised Bank

	BBWS CC Cisanggarung Proposals
B.a	Cisanggarung- Srigading: Confluence
B.b	Cisanggarung Desa Benda wall protection
B.c	Cisanggarung- Ciarada enhancements
B.d	Cisanggarung- Cijangkelok enhancements
	EWSIP Cisanggarung Proposals
B.e	Pasir Pucang FR Reservoir and control barrage
B.f	Tawangsari river diversion & Crukcuk lagoon

	BBWS CC Babakan Proposals
C.a	River normalisation
C.b	Raised banks at Desa Ketanggungan and Desa Cikeusal Lor
	EWSIP Babakan Proposals
C.c	Cisadap flood and RWS storage
C.d	Small habitation storages & drains
C.e	Cikuwut detention basin
C.f	Malahayu Dam spillway gates

KOTA
CIREBON
KUNINGAN
BREBES
S. Cangah
S. Kalibangka
S. Cisanggarung
S. Cibeureum
S. Tanjung
S. Kamiyanan
S. Babakan
S. Kamal

B.a B.b B.c B.d B.e B.f C.a C.b C.c C.d C.e C.f

N

Scale 1:125,000

0 2.5 5 10 Kilometers

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

108°30'0"E 108°35'0"E 108°40'0"E 108°45'0"E 108°50'0"E 108°55'0"E

6°50'0"S 6°55'0"S 7°0'0"S