FRM Profile

Subproject	**FRM-BDP-Deli-Percut**
River basin	Belawan Ular Padang
Main river	Deli-Percut River
District/Province	North Sumatra
Agency in charge	BWS Sumatera II (BWS SII)
Proposed work description	The infrastructure components to be constructed along the Deli-Percut 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 E 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 F 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) modification of existing and proposed infrastructure, ii) real time flow management, iii) floodways, and iv) detention basins. Nature-based solutions are recommended to replace hard engineering designs and introduced into new enhanced solutions. The main features of **BWS SII** proposals and **EWSIP** enhancements are described below. **BWS SII** proposals for **normalisation** and **flood control** include: i) Normalisation along 37 km of Deli River **(Subproject ID DP2a)**, 15 km of Babura River **(Subproject ID DP2b)**, 2 km of Bekala River, and 19 km of Kera River **(Subproject ID DP2c)** ii) Assessment of flood control needs in Percut River iii) Update flood control planning in Sikambing River and Putih River (require further surveys). In addition, Lau Simeme Dam which is currently under construction will have a positive effect in reducing flooding in Medan. **EWSIP** proposals for **detention basins** include: i) **Deli-Percut Floodway modification (Subproject ID DP3a)** to allow a defined discharge flow through the floodway; and use of **SCADA network (Subproject ID DP3h)** by automating the gate structures on the floodway to respond to flood events in real time ii) **Operation plan at Lau Simeme Dam (Subproject ID DP3b)**, if reservoir levels are maintained 2 m below the weir crest, an additional volume of 0.2 Mm3 can be stored iii) **Propose Namo Batang Dam (Subproject ID DP3c)** (surface area of approx. 80 ha, depth of 41 m, and storage volume of 3.1 Mm3) and **alternative Eastern Floodway** which will function better by **enlarging Belumai River (Subproject ID DP3i)** as a strategy for limited easement in the main rivers

<table>
<tr><td></td><td>iv) Detention basin in Marindal (Subproject ID DP3d) (surface area of approx. 32 ha, depth of 2 m, and temporary storage volume of 0.6 Mm3)
v) Deli transfer (1,200 m long floodway) will transfer flow during wet seasons from Deli River to the extended storage (from 25 ha to 145 ha) in Siombak Lake (Subproject ID DP3e) (extended conditions with surface area of approx. 120 ha, depth of 6 m, and storage volume of 7.2 Mm3)
vi) Potential detention basins in Sikambing River (Subproject ID DP3f) (surface area of approx. 35 ha, depth of 2 m, and temporary storage volume of 0.7 Mm3)
vii) S Sikambing and S Putih transfer (Subproject ID DP3g), the drain connection through the road could be upgraded and used to connect both rivers to improve conveyance along the S Sikambing
viii) Deli River enhancements (Subproject ID DP3j), where side slopes of channels around bends with 1:1 to be implemented by using gabions or vetiver grass and natural vegetative protection is proposed along the straight channel sections in a 3m x 3m box culvert with vetiver and local species grasses in between
ix) Kera River enhancements (Subproject ID DP3k), which consists of detention basins and compound channel in Kera River, to allow deeper and faster flowing sections and to keep sediments moving, also Sustainable Urban Drainage (SUDs) practices in Kera factory areas to minimise urban drainage runoff into the river network
x) Babura River enhancements (Subproject ID DP3l), to evaluate the potential to raise one segment of the banks along the river above flood levels.

NBS along the watershed include catchment management in mountain and hill zones should focus on improving poor agricultural practices to more sustainable cropping and cultivation practices.

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 BWS SII control center 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 North Sumatra Province year 2003-2018[1].</td></tr>
</table>

[1] http://perpustakaan.bappenas.go.id/lontar/opac/themes/bappenas4/templateDetail.jsp?id=13715&lokasi=lokal, last accessed in June 2019.

<table>
<tr><td>Potential Involuntary Resettlement impact</td><td>The subprojects are expected result in Land Acquisition (LA) as documented below. The Subproject DP3a, DP3b, DP3h, DP3i, DP3j, DP3k, and DP3l are not expected to result in LA. 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 Subprojects</th><th>Estimate for LA area (ha)</th></tr>
<tr><td></td><td>EWSIP Proposals</td><td></td></tr>
<tr><td>DP3.c</td><td>Namo Batang Dam</td><td>100</td></tr>
<tr><td>DP3.d</td><td>Percut detention basin & water park</td><td>84</td></tr>
<tr><td>DP3.e</td><td>Siombak Lake extension and Deli Floodway</td><td>120</td></tr>
<tr><td>DP3.f</td><td>Sikambing storage ponds</td><td>35</td></tr>
<tr><td>DP3.g</td><td>Sikambing transfer</td><td>1.2</td></tr>
<tr><td colspan="2">Total estimate for land acquisition</td><td>340.2</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>
<tr><td>Potential Indigenous People impact</td><td>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.</td></tr>
<tr><td>Potential Environment impact</td><td>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].

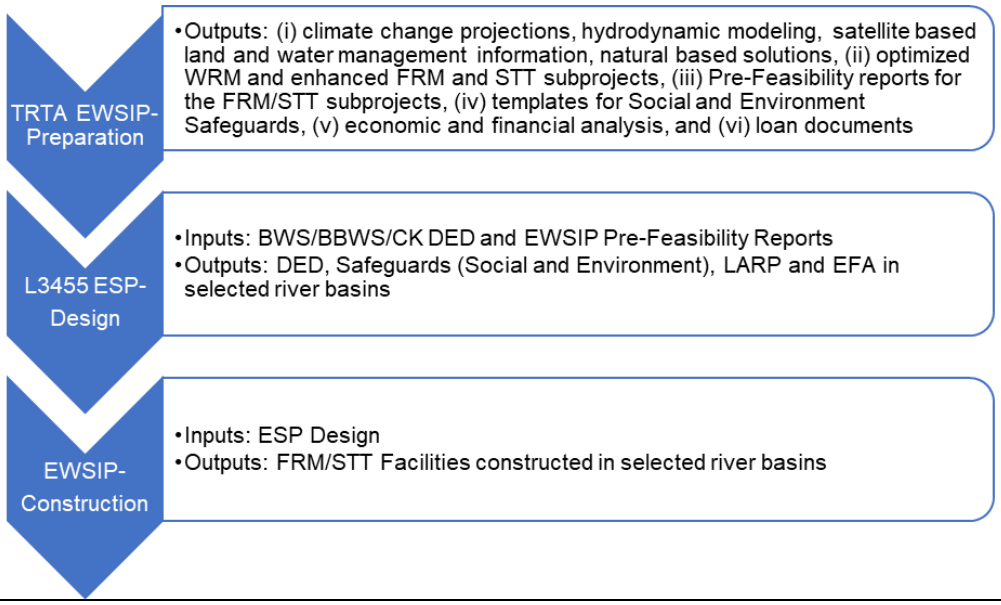
There are no documents on environmental impacts (i.e., IEE, AMDAL, etc.).

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.</td></tr>
<tr><td>Estimated cost and implementation period</td><td>The implementation period is 2020 – 2025.

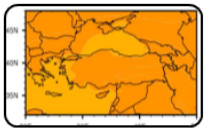
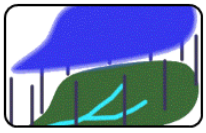
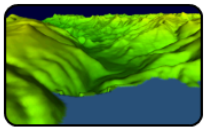
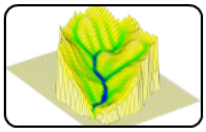
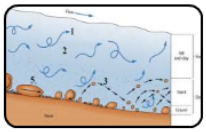
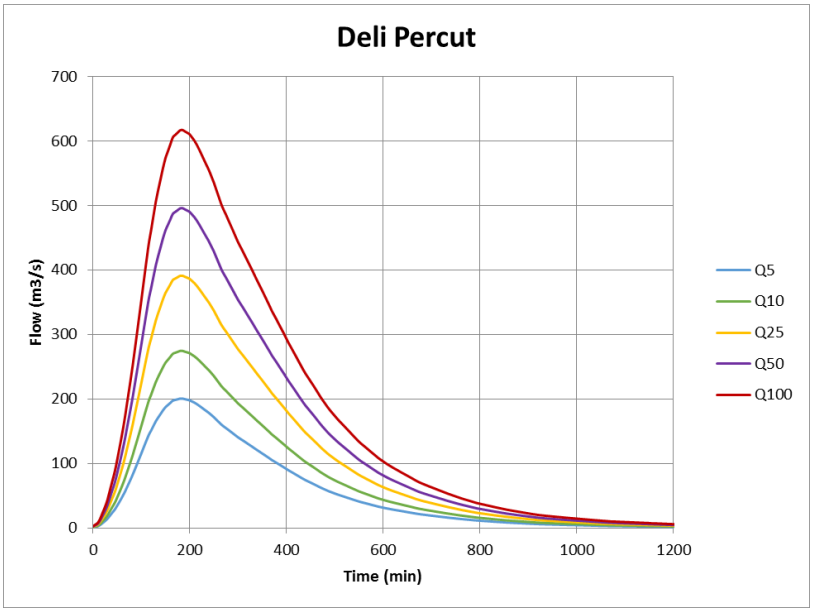
The project costs include i) RpM 737,242 for the infrastructure by the BWS SII and ii) RpM 847,688 for the proposals by EWSIP.
O&M costs are annual and to be calculated as 2% of infrastructure implementation costs through the lifecycle of proposed infrastructure over 30-years.</td></tr>
<tr><td>Readiness FS/DED/IEE-EIA/LARP/Bidding documents</td><td>DED is available for the infrastructure proposed along the Deli River and Percut 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).

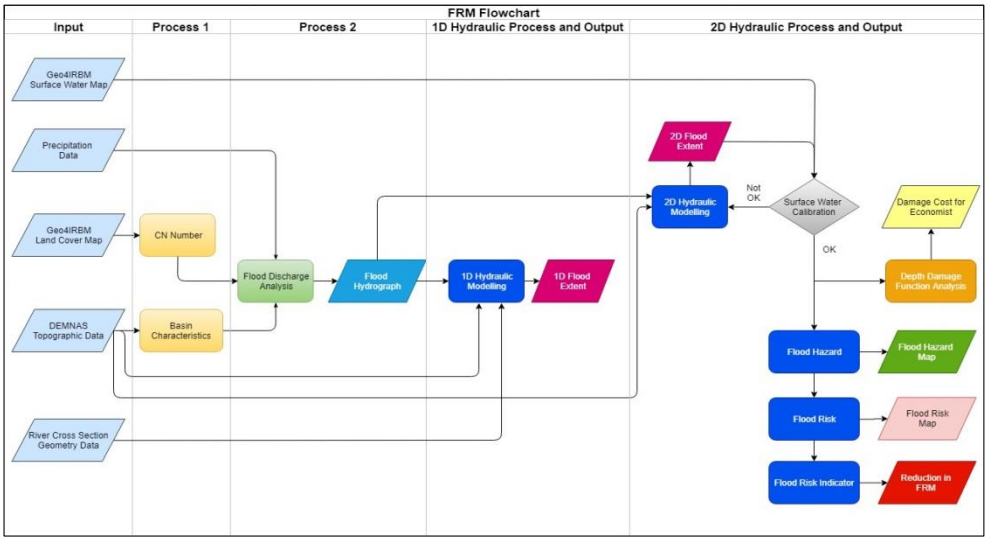
The documents that are available include: i) DED (Inventarisasi & Review Desain Sungai Deli, tahun 2008), ii) DED (SID Sungai Babura Kota Medan dan Kabupaten Deli Serdang, tahun 2012), and iii) DED (SID Sungai Kera Hilir, Kabupaten Deli Serang, tahun 2013).</td></tr>
</table>

[2] http://brwa.or.id/sig/, last accessed in June 2019.
[3] http://www.aman.or.id/peta/, last accessed 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.

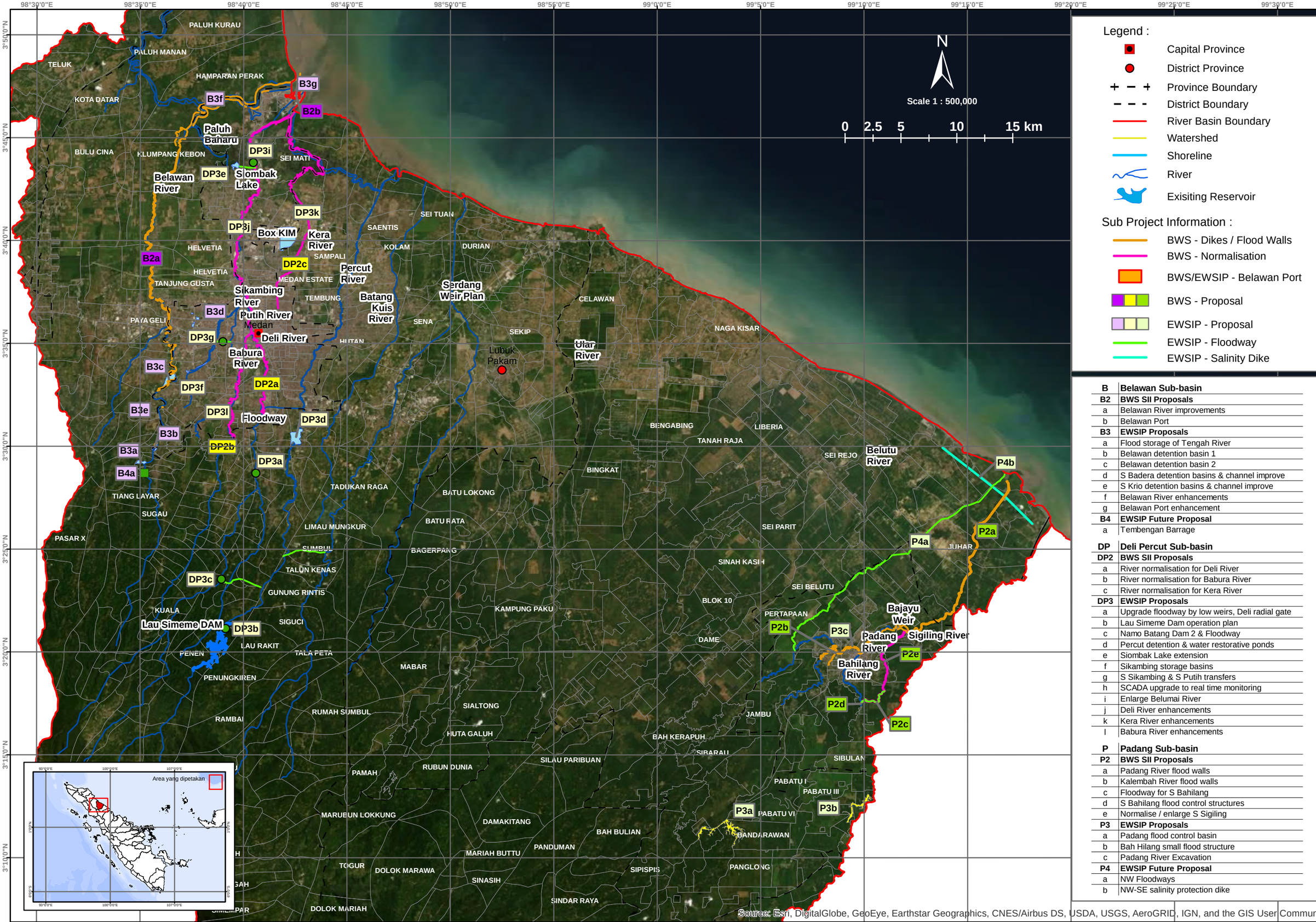
Linkages between EWSIP and ESP	The linkages between the TRTA, Engineering Services Project (ESP), and construction under EWSIP are schematized below: 

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 BWS 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. 
Flood Risk Maps - Outcomes	The outcomes shall be represented for i) agriculture areas and ii) people/buildings at the river basin scale, as shown below.  Risk to Agriculture Areas  Risk to People/Buildings 

EWSIP - FRM INDICATIVE MAP FOR BELAWAN-DELI-PERCUT-PADANG SYSTEM SUB PROJECT



Legend :

- Capital Province
- District Province
- Province Boundary
- District Boundary
- River Basin Boundary
- Watershed
- Shoreline
- River
- Exisiting Reservoir

Sub Project Information :

- BWS - Dikes / Flood Walls
- BWS - Normalisation
- BWS/EWSIP - Belawan Port
- BWS - Proposal
- EWSIP - Proposal
- EWSIP - Floodway
- EWSIP - Salinity Dike

B	**Belawan Sub-basin**
B2	**BWS SII Proposals**
a	Belawan River improvements
b	Belawan Port
B3	**EWSIP Proposals**
a	Flood storage of Tengah River
b	Belawan detention basin 1
c	Belawan detention basin 2
d	S Badera detention basins & channel improve
e	S Krio detention basins & channel improve
f	Belawan River enhancements
g	Belawan Port enhancement
B4	**EWSIP Future Proposal**
a	Tembengan Barrage
DP	**Deli Percut Sub-basin**
DP2	**BWS SII Proposals**
a	River normalisation for Deli River
b	River normalisation for Babura River
c	River normalisation for Kera River
DP3	**EWSIP Proposals**
a	Upgrade floodway by low weirs, Deli radial gate
b	Lau Simeme Dam operation plan
c	Namo Batang Dam 2 & Floodway
d	Percut detention & water restorative ponds
e	Siombak Lake extension
f	Sikambing storage basins
g	S Sikambing & S Putih transfers
h	SCADA upgrade to real time monitoring
i	Enlarge Belumai River
j	Deli River enhancements
k	Kera River enhancements
l	Babura River enhancements
P	**Padang Sub-basin**
P2	**BWS SII Proposals**
a	Padang River flood walls
b	Kalembah River flood walls
c	Floodway for S Bahilang
d	S Bahilang flood control structures
e	Normalise / enlarge S Sigiling
P3	**EWSIP Proposals**
a	Padang flood control basin
b	Bah Hilang small flood structure
c	Padang River Excavation
P4	**EWSIP Future Proposal**
a	NW Floodways
b	NW-SE salinity protection dike

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