APPENDIX

1. Regulations on Spatial Planning (Appendix 6-1)
2. Coastal Characteristics of the Selected Area (Appendix 6-2)
3. Assessment of Current Coastal Conditions (Appendix 8)
4. Numerical Study on Coastal Facility Plan (Appendix 13)
5. Calculation Sheet for Economic Analysis (Appendix 16)
6. Socio-Environmental Study (Appendix 17)
7. Draft of Basic Policy for Coastal Management (Appendix 18)
8. Review Study of Existing Study on Sayung District (Appendix 21)

Appendix-6-1 Regulated Activity by Spatial Planning

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Red colored sentence: Descriptions related to coastal protection, Blue colored sentence: Descriptions related to mineral mining including sand mining.

Table 1 Regulated Activity by Marine Spatial Planning

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Sea port Zone	− Planting mangroves and nipa palm;Mangrove cultivation ; − Protection of biodiversity; − Environmental rescue and protection ; Anchor release ; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels ; − Transportation of cultivated fish by small fishing boats; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Development of Navigation Assistance Facilities (SBNP); − Determination of mooring ; − Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Construction of a container terminal; − Construction of a dry bulk terminal; CAIR bulk terminal ; Roro terminal; − Construction of a ship repair site; dead ships ; − Business of loading and unloading of goods: packaging , stacking and storage at the port; Independent tally business : activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; Jetty construction and operation ; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between regencies/inner cities, between provinces and international ports; Port water transportation services business ; − Sea transportation equipment rental service business ; − Management (TUKS) in regional feeder port DLKR/DLKP ; Province Ferry Ships ; − Determination of international shipping routes; − Loading and unloading activities by foreign ships; Ship pilotage service business ; − Construction and operation of special terminals; − Development of Infrastructure Facilities (Primary, Secondary and Water Beaches); − Repair or maintenance of ships/floating equipment only; − Activities to assist technical work on ships that are still afloat but is having a catastrophe; − Activities of transferring cargo and or fuel (cargo and fuel transferring); − Withdrawal (Towing); − Refloating ;	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Extreme tourism business (high risk); − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Research on conservation activities; − Education on conservation activities; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Use of poles to push the boat; − Extraction of non-fish marine resources for economic purposes; − Installation of deep water FADs; − Installation of shallow water FADs; − Unloading of fish; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fisheries research and development; - Activity of testing motorized fishing boats/fishing boats ; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Floating fish farming business (floating net); − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Genetically engineered fish farming; − Installation of floating net cages; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Development of TPI; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Construction and operation of cement grinding plants and cement packing plants; − Salt Mining Construction; − Salt industry; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Construction of fisherman refueling stations; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − Collection of coral reefs; − War training using ammunition by foreign ships;	tourist jetty business; − Entertainment and recreation business; − Domestic sea tourism business; − International tourism sea transportation business; − Scientific surveys and/or research; − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Dredging of waters by capital dredging; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of cables or poles and facilities at sea; − Construction of breakwaters; − Revetment construction, groin construction; − Determination of shipping lanes to and from fishing ports; − Ship trials; − Reclamation in Port waters area; − Aviation activities over the archipelagic channel; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Shipyard Industry Activities with Ship Graving Dock system; − Industrial development that is integrated with ports; − Ship/floating equipment construction activities only; − Production of main/auxiliary machines; − Activities of making other equipment specifically used in ships; − Other maritime equipment manufacturing activities − Fishing with vessel capacity ≤ 5GT; − Fishing with vessel capacity ≥ 5 - 10 GT; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; − Diving works activities;
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Fishing Port Zone	− Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Education on conservation activities; − Anchor release; − Use of poles to push the boat; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Unloading of fish; − Fisheries research and development; - Activity of testing motorized	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Fishing with vessel capacity ≥ 5 - 10 GT; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Extraction of non-fish marine resources for economic purposes; − Installation of deep water FADs; − Installation of shallow water FADs; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with	− Tourist jetty business; − Entertainment and recreation business; − Research on conservation activities; − Scientific surveys and/or research; − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Development of oil and gas

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
			fishing boats/fishing boats; − Dredging of waters by capital dredging; − Determination of mooring; − Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Construction of a ship repair site; − Placement of dead ships; − Development of TPI; − Determination of shipping lanes to and from fishing ports; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Jetty construction and operation; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Shipyard Industry Activities with Ship Graving Dock system; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Cargo and fuel transferring activities; − Construction of fisherman refueling stations;	one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Floating fish farming business (floating net); − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Transportation of cultivated fish by small fishing boats; − Genetically engineered fish farming; − Installation of floating net cages; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the Roro terminal; − Construction and operation of cement grinding plants and cement packing plants; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between inner districts/cities, between provinces and international ports; − Port water transportation services business; − Sea transportation equipment rental service business; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Flight activities over the archipelagic channel; − Determination of international shipping routes; − Loading and unloading activities by foreign ships; − Ship pilotage service business; − Salt Mining Construction; − Salt industry; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Production of main/supporting machines; − Other equipment manufacturing activities specifically used in ships; − Other maritime equipment manufacturing activities; − Diving works activities; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − Collection of coral reefs; − War training using ammunition by foreign ships	platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Construction of breakwaters; − Revetment construction, groin construction; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Construction and operation of special terminals; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Industrial development that is integrated with ports; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster; − Withdrawal (Towing); − Refloating; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Reclamation in Port waters area;
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Tourism Zone	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Research on conservation activities; − Education on conservation activities; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Transportation of cultivated fish by small fishing boats;	− Fishing with vessel capacity ≥ 5 - 10 GT; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Anchor release; − Extraction of non-fish marine resources for economic purposes; − Installation of deep water FADs; − Installation of shallow water FADs; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Unloading of fish; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; - Activity of testing motorized fishing boats/fishing boats; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Floating fish farming business (floating net); − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Genetically engineered fish farming; − Installation of floating net cages; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Dredging of waters by capital dredging; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Construction, transfer and/or demolition of buildings or installations; −	− Extreme tourism business (high risk); − Business of villas (cottages) above the sea; − Scientific surveys and/or research; − Fishing with vessel capacity ≤ 5GT; − Use of poles to push the boat; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fisheries research and development; − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Determination of mooring; − Construction of breakwaters; − Revetment construction, groin construction; − Jetty construction and operation; −

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the Roro terminal; − Construction of a ship repair site; − Placement of dead ships; − Development of TPI; − Determination of shipping lanes to and from fishing ports; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Construction and operation of cement grinding plants and cement packing plants; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Reclamation in Port waters area; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between inner districts/cities, between provinces and international ports; − Port water transportation services business; − Sea transportation equipment rental service business; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Aviation activities over the archipelagic channel; − Determination of international shipping routes; − Loading and unloading activities by foreign ships; − Ship pilotage service business; − Construction and operation of special terminals; − Salt Mining Construction; − Salt industry; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Shipyard Industry Activities with Ship Graving Dock system; − Industrial development that is integrated with ports; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Production of main/supporting machines; − Other equipment manufacturing activities specifically used in ships; − Other maritime equipment manufacturing activities; − Diving works activities; − Cargo and fuel transferring activities; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Construction of fisherman refueling stations; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − Collection of coral reefs; − War training using ammunition by foreign ships;	Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Activities to assist technical work on ships that are still afloat but are experiencing a disaster; − Withdrawal (Towing); − Refloating;
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Salt Zone	− Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Education on conservation activities; − Salt Mining Construction; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Salt industry; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan;	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Fishing with vessel capacity ≤ 5GT; − Fishing with vessel capacity ≥ 5 - 10 GT; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Unloading of fish; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; - Activity of testing motorized fishing boats/fishing boats; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Genetically engineered fish farming; − Installation of floating net cages; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Dredging of waters by capital dredging; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Determination of mooring; − Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the	− Research on conservation activities; − Scientific surveys and/or research; − Fisheries research and development; − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Construction of breakwaters; − Revetment construction, groin construction; − Jetty construction and operation; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Anchor release; − Use of poles to push the boat; − Extraction of non-fish marine resources for economic purposes; − Installation of deep water FADs; − Installation of shallow water FADs; − Transportation of cultivated fish by small fishing boats; − Floating fish farming business

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				Roro terminal; − Construction of a ship repair site; − Placement of dead ships; − Development of TPI; − Determination of shipping lanes to and from fishing ports; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Construction and operation of cement grinding plants and cement packing plants; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Reclamation in Port waters area; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between inner districts/cities, between provinces and international ports; − Port water transportation services business; − Sea transportation equipment rental service business; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Aviation activities over the archipelagic channel; − Determination of international shipping routes; − Loading and unloading activities by foreign ships; − Ship pilotage service business; − Construction and operation of special terminals; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Shipyard Industry Activities with Ship Graving Dock system; − Industrial development that is integrated with ports; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Production of main/auxiliary machines; − Activities of making other equipment specifically used in ships; − Other maritime equipment manufacturing activities; − Cargo and fuel transferring activities; − Withdrawal (Towing); − Refloating; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Construction of fisherman refueling stations; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − Collection of coral reefs; − War training using ammunition by foreign ships;	(floating net); − Diving works activities; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster;
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Capture Fisheries Zone	− Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Research on conservation activities; − Education on conservation activities; − Fishing with vessel capacity ≤ 5GT; − Fishing with vessel capacity ≥ 5 - 10 GT; − Anchor release; − Use of poles to push the boat; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; -	− Fishing with vessel capacity ≥ 30GT; − Extraction of non- fish marine resources for economic purposes; − Unloading of fish; − Fish farming for industrial purposes; − Cultivation of non-fish marine resources for economic purposes; − Genetically engineered fish farming; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Development of PLTU/PLTGU; − Determination of the place of transfer between ships; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the Roro terminal; − Construction of a ship repair site; − Placement of dead ships; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Construction and operation of cement grinding plants and cement packing plants; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Reclamation in Port waters area; − Port water transportation services business; − Sea transportation equipment rental service business; − Loading and unloading activities by foreign ships; − Salt Mining Construction; − Salt industry; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Shipyard Industry Activities with Ship Graving Dock system; − Other equipment manufacturing activities specifically used in ships; − Other maritime equipment manufacturing activities; − Collection of coral reefs;	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Scientific surveys and/or research; − Fishing with vessel capacity ≥10 - 30 GT; − Installation of deep water FADs; − Installation of shallow water FADs; − Fisheries research and development; − Sea fish cultivation business (grouper, snapper, baronang); − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Dredging of waters by capital dredging; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − OTEC energy exploration; − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
			Activity of testing motorized fishing boats/fishing boats; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Transportation of cultivated fish by small fishing boats; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Determination of shipping lanes to and from fishing ports; − Withdrawal (Towing); − Refloating;		cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Determination of mooring; − Construction of a harbor pool for the needs of berthing and ship movement; − Development of TPI; − Construction of breakwaters; − Revetment construction, groin construction; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Jetty construction and operation; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Determination of international shipping routes; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Ship pilotage service business; − Construction and operation of special terminals; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Industrial development that is integrated with ports; − Diving works activities; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster; − Cargo and fuel transferring activities; − Introduction of genetically engineered organisms into the environment; − Construction of fisherman refueling stations; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − War training using ammunition by foreign ships; − Floating fish farming business (floating net); − Installation of floating net cages; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − Aviation activities over the archipelagic channel; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between regencies/inner cities, between provinces and international ports; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Production of main/supporting machines; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Development of generation, transmission, distribution and sales of electricity;
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Energy Management Zone	− Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Education on conservation activities; − Use of poles to push the boat; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Dredging of waters by capital	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Fishing with vessel capacity ≥ 5 - 10 GT; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Installation of deep water FADs; − Installation	− Research on conservation activities; − Scientific surveys and/or research; − Anchor release; − Extraction of non-fish marine resources for economic purposes; Fishing with vessel capacity ≤ 5GT; − Fisheries research and development; − Exploration ; − Development of FPSO (Floating Production Storage and Offloading); −

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
			dredging; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Construction, transfer and/or demolition of buildings or installations; − Determination of mooring; − Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Construction and operation of special terminals; − Cargo and fuel transferring activities; − Withdrawal (Towing); − Refloating;	of shallow water FADs; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Unloading of fish; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fishing using fishing line: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; - Activity of testing motorized fishing boats/fishing boats; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Floating fish farming business (floating net); − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Transportation of cultivated fish by small fishing boats; − Genetically engineered fish farming; − Installation of floating net cages; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining;	Installation/deployment of Oil and Gas Pipelines; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Cable laying; − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Construction of breakwaters; − Revetment construction, groin construction; − Jetty construction and operation; − Loading and unloading activities by foreign ships; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Ship pilotage service business; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Repair or maintenance of ships/floating equipment only; − Diving works activities; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster; − Development of generation, transmission, distribution and sales of electricity; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Loading and unloading of goods: packaging, stacking and storage at the port
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Oil and Gas Mining Zone	− Planting mangroves and nipa palm; − Mangrove cultivation; − Protection of biodiversity; − Environmental rescue and protection; − Education on conservation activities; − Anchor release; − Extraction of non-fish marine resources for economic purposes; − Exploration ; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Dredging of waters by capital dredging; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Determination of mooring; − Determination of the place of transfer between ships; − Construction of a harbor pool for the needs of berthing and ship movement; − Jetty construction and operation; − Loading and unloading activities by foreign ships; − Construction and operation of special terminals; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Diving works activities; − Cargo and fuel transferring activities; − Withdrawal (Towing); − Refloating	− Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Fishing with vessel capacity ≤ 5GT; − Fishing with vessel capacity ≥ 5 - 10 GT; − Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Use of poles to push the boat; − Installation of deep water FADs; − Installation of shallow water FADs; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Unloading of fish; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, chart; boating or floating charter, ami bouke, step charter; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; - Activity of testing motorized fishing boats/fishing boats; − Sea fish cultivation business (grouper, snapper, baronang); − Fish farming for industrial purposes; − Floating fish farming business (floating net); − Cultivation of non-fish marine resources for economic purposes; − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Transportation of cultivated fish by small fishing boats; − Genetically engineered fish farming; − Installation of floating net cages; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Construction of Local Port Service	− Research on conservation activities; − Scientific surveys and/or research; − Fisheries research and development; − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of breakwaters; − Revetment construction, groin construction; − Hydrographic research or survey activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Ship pilotage service business; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster;

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				(LPS) telecommunication cables; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the Roro terminal; − Construction of a ship repair site; − Placement of dead ships; − Development of TPI; − Determination of shipping lanes to and from fishing ports; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Construction and operation of cement grinding plants and cement packing plants; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Reclamation in Port waters area; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between regencies/inner cities, between provinces and international ports; − Port water transportation services business; − Sea transportation equipment rental service business; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Flight activities over the archipelagic channel; − Determination of international shipping routes; − Salt Mining Construction; − Salt industry; − Shipyard Industry Activities with Ship Graving Dock system; − Industrial development that is integrated with ports; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Production of main/supporting machines; − Other equipment manufacturing activities specifically used in ships; − Other maritime equipment manufacturing activities; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Construction of fisherman refueling stations; − Military exercises; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products); − Collection of coral reefs; − War training using ammunition by foreign ships;	
West Java Province	PERDA 9 TAHUN 2022 - RTRWP 2022 2042	Conservation Areas - Parks	− Planting mangroves and nipa palm; − Mangrove cultivation; Biodiversity protection; − Environmental rescue and protection; − Research on conservation activities; − Education on conservation activities; − Scientific surveys and/or research ;	− Fishing with vessel capacity ≥10 - 30 GT; − Fishing with vessel capacity ≥ 30GT; − Extraction of non-fish marine resources for economic purposes; − Installation of deep water FADs; − Installation of shallow water FADs; − Unloading of fish; − Fishing using drag nets: beach drag nets, payang, pocket drag nets; − Fishing using drag nets: pocket shrimp drag nets, pocket fish drag nets; − Fishing using a rake: a rake with a ship, a rake without a boat; − Fishing using lift nets: anco, boating charter or floating charter, bouke ami, step netting; - Activity of testing motorized fishing boats/fishing boats; − Fish farming for industrial purposes; − Cultivation of non-fish marine resources for economic purposes; − Genetically engineered fish farming; − Installation of floating net cages; − Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals; − Dredging of waters by capital dredging; − Dredging of sea waters by capital dredging which cuts coral and/or rock material; − Exploitation (Production Operation) of metal minerals ; − Metal Mineral Processing and Refining; − Installation of energy generator turbine facilities; − Installation of Sea Current Power Plant (PLTAL); − Installation of heat engine facilities; − OTEC energy exploration; − Development of PLTU/PLTGU; − Determination of the place of transfer between ships; − Construction of a container terminal; − Construction of a dry bulk terminal; − Construction of CAIR bulk terminal; − Construction of the Roro terminal; − Construction of a ship repair site; − Ship trials; − Fishing boat repair and maintenance service business; − Logistics service business and supply of fishing vessels; − Construction of a fishing wharf; − Loading and unloading of goods: packaging, stacking and storage at the port; − Independent tally business: activities of cargodoring, receiving/delivery, stuffing, and stripping of containers for their own interests; − Construction and operation of cement grinding plants and cement packing plants; − Reclamation in Port waters area; − Business entity sea transportation business on cross ports between regencies/cities within the Province; − People's shipping sea transportation business or business entities at cross ports between inner districts/cities, between provinces and international ports; − Port water transportation services business; − Sea transportation equipment rental service business; − Management (TUKS) in regional feeder port DLKR/DLKP; − Operation of In-Province Ferry Ships; − Determination of international shipping routes; − Loading and unloading activities by foreign ships; - Anchoring activities except in force majeure by foreign ships; − Construction and operation of special terminals; − Salt Mining Construction; − Construction of Infrastructure Facilities (Primary, Secondary Channels and water beaches); − Salt industry; − B3 waste collection, utilization, processing, disposal and landfilling activities; − Activities of collecting, utilizing, processing, disposing of, and stockpiling non-B3 waste; − Shipyard Industry	− Seascape tourism; − Underwater tourism; − Historical tours; − Cultural tourism; − Water sports tourism; − Tourist jetty business; − Entertainment and recreation business; − Extreme tourism business (high risk); − Domestic sea tourism business; − International tourism sea transportation business; − Tour and travel service business; − Business of villas (cottages) above the sea; − Swimming tourism business; − Tirta Tourism Services (maritime); − Taking underwater photos/videos; − Anchor release; − Use of poles to push the boat; − Fishing with vessel capacity ≤ 5GT; − Fishing with vessel capacity ≥ 5 - 10 GT; − Transportation of caught fish by Indonesian-flagged Live Fish Carrier Vessels; − Fishing using circle nets: small pelagic purse seines with one boat, large pelagic purse seines with one boat, small pelagic purse seines with one boat, small pelagic purse seines with two boats, circle nets without wrinkles; − Catching fish using a tool that is dropped or spread: nets drop by ship, nets spread; − Fishing using gill nets: fixed gill nets, drift gill nets, circular gill nets, fixed gill nets, layered gill nets, combination gill nets; − Catching fish using traps: set nets, traps, winged traps, trawlers, togo, ambai, jermal, pengerih, sero; − Fishing using fishing rods: handline, tuna reel, fishing rod, squid, mechanical squid, kite fishing, pole line, mechanical line, bottom longline, tuna longline, troll line; − Catching fish using other fishing tools: spears, sledgehammers, arrows, trawlers, seser, pocongan; − Fisheries research and development; − Sea fish cultivation business (grouper, snapper, baronang); − Floating fish

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				Activities with Ship Graving Dock system; − Industrial development that is integrated with ports; − Ship/floating equipment construction activities only; − Repair or maintenance of ships/floating equipment only; − Production of main/auxiliary machines; − Activities of making other equipment specifically used in ships; − Other maritime equipment manufacturing activities; − Activities to assist technical work on ships that are still afloat but are experiencing a disaster; − Cargo and fuel transferring activities; − Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry; − Introduction of genetically engineered organisms into the environment; − Development of generation, transmission, distribution and sales of electricity; − Construction of fisherman refueling stations; − Military exercises; − Collection of coral reefs; − War training using ammunition by foreign ships;	farming business (floating net); − Transportation of cultivated fish by Indonesian-flagged Live Fish Carrier Vessels; − Transportation of cultivated fish by small fishing boats; − Determination of shipping lanes to and from fishing ports; − Exploration ; − Operation of Regional and Local Feeder Ports; − Dredging in the territorial waters of Regional and Local Feeder Ports; − Development of FPSO (Floating Production Storage and Offloading); − Installation/deployment of Oil and Gas Pipelines; − Development of oil and gas platforms/platforms; − Development of Floating Storage Offloading (FSO); − Development of Floating Facility for Oil and Gas: Mooring ; − Oil and Gas Exploitation (Production Operations); − Construction, transfer and/or demolition of buildings or installations; − Cable laying; − Construction of Local Port Service (LPS) telecommunication cables; − Planting and or laying of cables or poles and facilities at sea; − Development of Navigation Assistance Facilities (SBNP); − Determination of mooring; − Construction of a harbor pool for the needs of berthing and ship movement; − Placement of dead ships; − Development of TPI; − Construction of breakwaters; − Revetment construction, groin construction; − Jetty construction and operation; − Flight activities over the archipelagic channel; − Hydrographic research or survey activities by foreign ships; − Ship pilotage service business; − Diving works activities; − Withdrawal (Towing); − Refloating; − Collection of non-timber forest products in mangrove forests (honey; sap; leaves; fruit and seeds; tannins; fish; other non-timber forest products);
Central Java Province	Perda_No 13 Tahun 2018_RZWP3K	Tourism Area	a. provision of tourist attractions in accordance with the tourism master plan; and/or b. provision of tourism facilities and infrastructure.	a. removal and destruction of coral reefs; b. catching fish using explosives, toxic materials, and using fishing gear that is destructive to ecosystems in coastal areas and small islands; c. installation of fishing aids such as FADs; d. mining of metallic, non-metallic and rock minerals; e. other activities that reduce the value and/or function of the tourism zone; and/or f. other activities that do not support tourism	a. aquaculture; b. catching fish with fishing gear in accordance with statutory regulations; c. construction of public facilities; d. construction of coastal protection buildings; and/or e. research and education.
Central Java Province	Perda_No 13 Tahun 2018_RZWP3K	Port Area	a. construction of basic facilities, functional facilities, and supporting facilities in accordance with the port master plan and fishing port master plan and WKOPP; b. shipping lane activities, berths, places for loading and unloading between ships, port pools for the needs of berthing and ship maneuvering, scouting activities, ship repair places, and other activities in accordance with the provisions of the legislation; and/or c. the need for emergency situations, dead ships, sailing placements, ship piloting trials, ship facilities and construction, and maintenance of long-term port development and other activities in accordance with statutory provisions.	a. all types of fishing activities; b. all types of aquaculture activities; c. coral reef extraction; d. installation of fishing aids such as FADs; e. construction of buildings whose plans are not listed on the port master plan or WKOPP; f. mining of metallic, non-metallic and rock minerals; and/or g. other activities that value and/or reduce the function of the port zone.	a. dredging of harbor channel; b. laying/installing submarine cables/pipes; c. construction of public facilities; d. construction of coastal protection buildings; e. use or utilization of sea water; f. research and education; and/or g. tourism and recreation.
Central	Perda_No 13	Capture	a. fishing activities using equipment	a. fishing using explosives, toxic materials, electricity, and using fishing gear	a. research and education;

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
Java Province	Tahun 2018_RZWP3K	Fisheries Area	environmentally friendly; b. fishing activities that take into account the protection of habitats and fish populations; c. the size of fishing vessels, fishing gear (API) and fishing aids (ABPI) used in fishing activities in accordance with the regulations stipulated by the applicable laws and regulations; and/or d. installation of fish houses and fishing aids such as licensed FADs and artificial coral reefs.	destructive to ecosystems in coastal areas and islands small island; b. coral reef extraction; c. the use of fishing gear (API) that disturbs and destroys the sustainability of fish resources; d. the use of Fishing Aids (ABPI) which not in accordance with the applicable laws and regulations; and/or e. other activities that reduce the value and/or function of the capture fisheries zone.	b. construction of public facilities; c. construction of coastal protection buildings; d. tourism and recreation; e. mining in potential reserves of metal, non-metal and rock minerals that have been designated as mining business permit areas in accordance with the provisions of the law outside of 2 nautical miles from the coastline permanently in areas which, if technically, ecologically, socially, and/or culturally, do not cause environmental damage and/or environmental pollution and/or harm to the community surroundings; and/or f. all types of aquaculture activities in accordance with water and sediment quality standards to ensure food safety for all aquaculture products that do not interfere with fishing activities.
Central Java Province	Perda_No 13 Tahun 2018_RZWP3K	Mangrove Forest	a. rehabilitation of mangrove ecosystems; b. tourism and recreation; c. small-scale fishing (<=5 GT) with environmentally friendly fishing gear (API) in accordance with laws and regulations; and/or d. education and research.	a. fishing that uses explosives, toxic materials, as well as using fishing gear that is destroying the mangrove ecosystem; b. all activities that use destructive methods and methods and perform function transfers and cut down coastal vegetation for activities that damage ecosystems; c. campfire with campfire; d. mining of metallic, non-metallic and rock minerals; and/or e. other activities that reduce the value and/or function of the mangrove forest zone.	a. provision of tourism facilities and infrastructure; b. construction of public facilities; and/or c. construction of coastal protection structures.
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Aquaculture Zone	• Educational tourism business, tourist wharves, entertainment and recreation activities, tourism travel service business, spectacle tourism, marine nature tourism • Marine tourism services • Taking underwater photos/videos • Planting nipa palm, planting and cultivating mangroves • Protection of biodiversity • Environmental protection and rescue • Conservation research & education activities • Surveys and/or scientific research • Collection of non-timber forest products in mangrove forests • Marine fish farming business, fish farming for industrial purposes, floating fish farming business • Extraction of non-fish marine resources for economic purposes • Cultivation of non-fish marine resources for economic purposes • Transport of cultured fish and catches with Indonesian-flagged live fish carrier vessels • Transport of cultured fish by small fishing boats • Cultivation of genetically engineered fish • Installation of floating net cages • Fisheries research and development • Determination of shipping lanes and construction of fishing docks • Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry	• Surf tourism business • Domestic tourism sea transportation business • Tourism international sea transportation business • Collection of coral reefs • Fishing with a boat capacity of 10-30 GT and 30GT • Anchor release • Installation of deep & shallow water FADs • Unloading fish • Fishing using trawls, payang, cantrang, lampara nets, dogol, seine nets, Long bag set net, Squid Jigging, Long line, Pole & line, Bouke Ami, and its kind • Test activities for fishing boats/motorized fishing boats • Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals • Dredging the seabed with capital dredging • Dredging the seabed with capital dredging that cuts coral/rock material • Reclamation in regional and local feeder port waters • Activities for collecting, utilizing, processing, disposing, and landfilling B3 & non B3 waste	• Business of rowing tourism, diving tourism, fishing tourism, water sport tourism, extreme tourism, sea cottage business, snorkeling tour, swimming, sea restaurant • Fishing with vessel capacity < 10GT • Collecting antiquities and non-antiquities by motorized boat 5GT, 5 - 30 GT, and > 30 GT • Use of a pole to propel the boat • Transport of cultured and catching fish by foreign-flagged live fish carriers • Fishing using Gill Net, Prawe fishing gear, Bubu/Muroami, Floating chart, and its kind. • Exploration of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals • Construction of Floating Production Storage and Offloading, coal power plan, oil & gas platform, Floating Storage Offloading, oil & gas Floating Facility (Mooring) • Exploitation (Production Operation) and processing & refining of coal, metallic minerals, non-metallic minerals/rock minerals, radioactive minerals • Placement of tailings (material left behind after fractional separation) under the sea • Construction of LNG Regasification Terminal • Flaring • Destruction of oil and gas explosives • Installation of energy generator turbine facilities, Ocean Current Power Plant, & heat engine facilities • OTEC energy exploration • Construction, transfer and/or demolition of buildings or piping installations in waters • Embedding cables and pipes with diameters of 0-20 cm, 20-50 cm, 50-100 cm, and diameters above 100 cm • Development of Local Port Service (LPS) telecommunications cables • Planting/laying cables/poles and facilities at sea • Construction of shipping navigation

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
					aids • Determination of berths & places of transfer between ships • Construction of harbor ponds for the needs of berthing and ship movement, container terminals, dry & liquid bulk terminals, ro-ro terminals, ship repair sites • Placement of dead ships • Construction of a fish auction place • Construction of breakwaters, revetments and groins • Ship trials • Business of repair and maintenance of fishing vessels, logistics service business and supply of fishing vessels, loading and unloading of goods, independent tally business • Jetty construction and operation • Construction and operation of cement grinding plants and cement packing plants • Operation of regional and local feeder ports • Dredging in the territorial waters of regional and local feeder ports • Sea transportation business for people/business entities at cross ports between regencies/cities within the province of East Java, between provinces and international ports • Port water transportation services business • Marine transportation equipment rental service business • Management (TUKS) within DLKR/DLKP regional feeder ports. • Operation of ferry transport within the province • Flight activities over the archipelagic channel • Determination of international shipping routes • Loading and unloading activities by foreign ships • Hydrographic research or survey activities, anchoring activities except in force majeure conditions, war training using ammunition by foreign ships • Business of ship piloting services. • Construction and operation of special terminals • Transport and sale of salt, construction of salt mines, construction of salt industry facilities • Shipyard industry activities with a ship graving dock system • Industrial development that is integrated with ports • Ship/floating equipment building activities & repair/maintenance activities • Main/auxiliary machinery manufacturing activities • The activity of making other equipment specifically used in ships • Other maritime equipment manufacturing activities • Diving works within the framework of the maritime industry • Activities to assist technical work on ships that are still afloat but are experiencing a disaster • Cargo and fuel transferring • Towing • Refloating • Introduction of genetically modified organisms into the environment • Development of electricity generation, transmission, distribution and sales • Construction of fisherman's refueling station • Military training • Salt industry intake and output pipes
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Fishing Port Zone	• Protection of biodiversity • Environmental rescue and protection • Research and education on conservation activities • Scientific surveys and/or research • Anchor release	• Surfing tourism business, water sports, extreme tourism (high risk), domestic and international tourism sea transportation business, tourism travel services, seaside cottages, snorkeling & swimming tourism business, marine tourism services • Underwater photo/video capture • Collection of coral reefs and non-timber forest products in mangrove forests (honey, sap, leaves, fruit and other	• Educational tourism business, fishing tourism business, tourist wharf business, entertainment & recreation activity business, spectacle tourism business, seaside restaurant, aquatic natural tourism business • Planting nipa palm, planting and cultivating mangroves

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
			• Use of poles to propel the boat • Transport of cultured fish and caught fish using Indonesian-flagged live fish carriers • Transportation of cultivated fish by small fishing boats • Unloading of fish • Construction of shipping navigation aids • Determination of berths and transfers between ships • Development of harbor ponds and ship maneuvers • Construction of a ship repair place and a fish auction place • Construction of breakwaters, revetments and groins • Determination of shipping lanes to and from ports • Logistics service business and fishing vessel supplies • Construction of fishing wharf • Construction and operation of Jetty • Marine transportation equipment rental service business & ship pilotage service business • Activities to assist technical work on ships that are still afloat but are experiencing a disaster • Cargo and fuel transferring • Towing • Refloating • Construction of fishing fuel stations	non-timber forest products) • Floating aquaculture business (floating nets and pen systems ≥ 5 Ha with a total of 1000 units) • Taking and cultivating non-fish marine resources for economic purposes • Cultivation of genetically engineered fish • Installation of floating net cages & FADs in deep and shallow water • Fishing using trawls, payang, cantrang, lampara nets, dogol, gill nets, seine nets, long bag set nets, squid jigging, basic Prawe fishing lines, long lines, pole & line, Bubu/Muroami, Bouke Ami, Floating Bagan and its kind • Exploration and transportation of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals • Development of Floating Production Storage and Offloading, steam power plant, oil & gas platform, floating storage offloading, oil & gas floating facility (mooring) • Exploitation (Production Operation) of coal, metallic minerals, non-metallic minerals or rock minerals, radioactive minerals • Processing & refining of coal, metallic minerals, non-metallic minerals or rock minerals, radioactive minerals • Placement of tailings under the sea • Construction of LNG Regasification Terminal • Flaring • Destruction of oil and gas explosives • Installation of energy generator turbine facilities • Ocean Current Power Plant Installation • Installation of heat engine facilities • OTEC energy exploration • Construction of container terminals, dry & liquid bulk terminals, ro-ro terminals • Dead ship parking • Business of loading and unloading of goods: packaging, stacking and storage at the port • Independent tally business: cargodoring, receiving/delivery, stuffing, and stripping of containers for their own benefit. • Construction and operation of cement grinding plant & cement packing plant • Regional & local feeder port operations • Dredging & reclamation in regional and local feeder port areas • Sea transportation business for people or business entities in cross-ports between regencies/cities within the province of East Java, between provinces and international ports • Port water transportation services business • Management (TUKS) within DLKR/DLKP regional feeder ports • Operation of In-Province Ferry Ships • Determination of international shipping routes • Loading and unloading activities & anchoring by foreign ships except in force majeure conditions • War training using ammunition by foreign ships • Construction and operation of special terminals • Activities for the collection, utilization, processing, disposal, and landfilling of B3 and non-B3 waste • Introduction of genetically modified organisms into the environment • Development of electricity generation, transmission, distribution and sales	• Fishing with boat capacity < 10GT, 10-30 GT, and 30GT • Collection of antiquities (by motorized boats ≤ 5GT & 5 - 30 GT), antiquities and other than antiquities (by motorized boats 5 - 30 GT and > 30 GT) • Marine fish farming business (grouper, snapper, baronang) • Fish farming for industrial purposes • Transportation of cultivated fish & caught fish by foreign-flagged live fish carriers • Fisheries research and development • Activity of testing motorized fishing boats/fishing boats • Sea bed dredging with capital dredging • Sea bed dredging by capital dredging which cuts coral and/or rock material • Construction, transfer and/or demolition of buildings or piping installations in waters • Cable embedding • Planting Pipe diameter of 0-20 cm, 20-50 cm, 50-100 cm, and above 100 cm • Construction of Local Port Service telecommunication cables • Planting and or laying of cables or poles and facilities at sea • Ship trials • Fishing boat repair and maintenance service businesses: dock/slipway, workshops and net repair sites • Flight activities over the archipelagic channel • Hydrographic research or survey activities by foreign vessels • Transportation and sale of Salt • Salt Mining Construction • Construction of Infrastructure Facilities (Primary, Secondary Canals and water beaches) for Salt Industry • Shipyard Industry Activities with Ship Graving Dock system • Industrial development that is integrated with ports • Ship/floating equipment construction activities • Repair or maintenance of ships/floating equipment • Production of main/auxiliary machines • The activity of making other equipment specifically used in ships • Other maritime equipment manufacturing activities • Diving works within the framework of the maritime industry • Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry • Military training • Salt industry intake and output pipes
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Capture Fisheries Zone	• Educational tourism businesses, rowing tours, diving tours, fishing tours, surfing tours, water sports tours, tourist dock businesses, entertainment and recreational activities, extreme tourism (high risk), domestic & international tourism sea transportation businesses, travel service	• Collecting coral reefs • Fishing using trawls, payang, cantrang, lampara nets, dogol, seine nets and others • Transportation of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals • Reclamation in regional and local feeder port waters area • Activities for collecting, utilizing, processing, disposing of B3 and non-B3 waste	• Extraction of non-fish marine resources for economic purposes• Transportation of cultivated fish by Foreign-flagged Live Fish Carrier Vessels • Installation of floating net cages • Transport of fish caught by foreign-flagged live fish carriers • Unloading of fish• Exploration of metal

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
			businesses , cottages on the sea, snorkeling tours, spectacle tours, swimming, restaurants on the sea, aquatic nature tours, marine tourism services • Underwater photo/video capture • Nipah plantation, mangrove planting and cultivation • Protection of biodiversity; • Environmental rescue and protection • Research and education on conservation activities • Scientific surveys and/or research • Collection of non-timber forest products in mangrove forests (honey, sap, leaves, fruits and seeds, tannins, fish, other non-timber forest products) • Fishing with vessel capacity < 10GT, 10-30 GT, and ≥ 30GT • Retrieval of archaeological and non-archaeological goods by motorized boat 5GT, 5 - 30 GT, and > 30 GT • Anchor release • Use of poles to propel the boat • Marine fish farming business (grouper, snapper, baronang) • Fish farming for industrial purposes • Floating aquaculture business (floating nets and pen systems ≥ 5 Ha with a total of 1000 units) • Transportation of cultivated fish & catches by Indonesian-flagged live fish carriers • Transportation of cultivated fish by small fishing boats • Cultivation of genetically engineered fish • Installation of deep & shallow water FADs • Fishing using Gill Net, Long bag set net, Squid Jigging, Basic Prawe Fishing, Long line, Pole and line, Bubu/Muroami, Bouke Ami, floating chart • Fisheries research and development • Activity of testing motorized fishing boats/fishing boats • Determination of shipping lanes • Construction of fishing wharf • Cargo and fuel transferring • Towing and refloating • Marine biota cultivation activities for the benefit of the Biopharmacology/Marine Biotechnology industry	• Activities of making, repairing or maintaining ships/floating equipment • Production of main/auxiliary machines • Activities for the manufacture of other equipment specifically used on ships • Other maritime equipment manufacturing activities	minerals, non-metallic minerals, rocks, coal, radioactive minerals• Development of Floating Production Storage and Offloading• Seabed dredging with capital dredging• Seabed dredging with capital dredging which cuts coral and/or rock material• Construction of steam power plants, oil and gas platforms/platforms, floating storage offloading, oil and gas lloating facility (mooring)• Exploitation (production operations) of coal, metallic minerals, non-metallic minerals or rock minerals, radioactive minerals• Processing & refining of coal, metallic minerals, non-metallic minerals or rock minerals, radioactive minerals• Placement of tailings (material left after separation of fractions) under the sea• Construction of LNG Regasification Terminal• Flaring• Destruction of oil and gas explosives• Installation of energy generator turbine facilities, Sea Current Power Plant installation, installation of heat engine facilities• OTEC energy exploration• Construction, transfer and/or demolition of buildings or piping installations in waters• Cable laying & planting of pipes with diameters of 0-20 cm, 20-50 cm, 50-100 cm and diameters above 100 cm• Construction of Local Port Service telecommunications cables• Planting and or laying of cables or poles and facilities at sea• Development of Navigation Assistance Facilities• Determination of anchorage & place of transfer between ships• Development of harbor ponds, container terminals, dry & liquid bulk terminals, ro-ro terminals, ship repair sites• Parking dead ship• Construction of a fish auction place • Construction of breakwaters, revetments, groins• Ship trials• Fishing boat repair and maintenance service business, fishing boat logistics and supply services, loading and unloading of goods, independent tally business.• Construction and operation of Jetty• Construction and operation of cement grinding plants and cement packing plants• Operation of regional and local feeder ports• Dredging in the territorial waters of regional and local feeder ports• Sea transportation business for people or business entities in cross-ports between regencies/cities within the province of East Java, between provinces and international ports, water transportation services business, & marine transportation equipment rental service• Management (TUKS) within DLKR/DLKP regional feeder ports.• Operation of ferry transport within the province• Flight activities over the archipelagic channel• Determination of international shipping routes • Loading and unloading activities by foreign vessels• Hydrographic research or survey activities, anchoring activities except in force majeure circumstances, and war training using ammunition by foreign ships• Business of ship piloting services.• Construction and operation of special terminals

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
					• Transportation and sale of salt• Salt mining construction• Construction of salt industry infrastructure facilities• Shipbuilding industry activities with a ship graving dock system • Industrial development that is integrated with ports• Diving work activities within the framework of the maritime industry.• Activities to assist technical work on ships that are still afloat but are experiencing a disaster• Introduction of genetically modified organisms into the environment • Development of electricity generation, transmission, distribution and sales• Construction of fueling stations for fisherman• Military training• Salt industry intake and output pipes
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Oil Mining Zone	• Protection of biodiversity • Environmental rescue and protection • Conservation research and education activities • Scientific surveys and/or research • Flaring • Construction of Local Port Service telecommunications cables • Activities to assist technical work on ships that are afloat but are experiencing a disaster	• Educational tourism business, rowing, diving, fishing, surfing, water sports, jetty tourism, entertainment and recreation, extreme tourism, domestic & international tourism, tourism travel services, sea villas (cottages), snorkeling, spectacle tourism , swimming, restaurants above the sea, water nature tourism, marine tourism services• Taking underwater photos/videos• Planting of mangroves and palm trees• Mangrove cultivation• Collection of coral reefs• Collection of non-timber forest products in mangrove forests • Fish catching• Retrieval of antiquities and items other than antiquities• Anchor release• Use of poles to propel the boat• Fish farming business• Collection and cultivation of non-fish marine resources• Transportation of cultivated and caught fish• Cultivation of genetically engineered fish• Installation of floating net cages, deep & shallow water FADs• Unloading of fish• Fishing using trawls, payang, cantrang, lampara nets, dogol, gill nets, seine nets, long bag set nets, squid jigging, prawe fishing rods, long lines, pole and line, Bubu/Muroami, Bouke Ami, floating charts• Fisheries research and development • Activity of testing motorized fishing boats/fishing boats• Exploration, transportation, processing & refining of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals• Seabed dredging with capital dredging• Seabed dredging with capital dredging which cuts coral and/or rock material• Construction of a coal power plan• Placement of tailings under the sea• Destruction of oil and gas explosives • Installation of energy generator turbine facilities, Ocean Current Power Plant Installation, heat engine facilities• OTEC energy exploration• Determination of berths & places of transfer between ships • Development of harbor pools, container terminals, dry & liquid bulk terminals, ro-ro terminals, ship repair sites, dead ship placement, fish auction sites• Construction of breakwaters, revetments, groins• Determination of shipping lanes to and from fishing ports• Ship trials• Fishing boat repair and maintenance service business & fishing boat logistics and supply services• Construction of a fishing wharf • Business of loading and unloading of goods & independent tally business• Jetty construction and operation • Construction and operation of cement grinding plants and cement packing plants• Operation of Regional and Local Feeder Ports• Dredging & reclamation in the territorial waters of Regional and Local Feeder Ports • Sea transportation business & equipment rental services• Management (TUKS) within DLKR/DLKP regional feeder ports.• Flight activities over the archipelagic channel• Determination of international shipping routes • Loading and unloading activities by foreign vessels• Hydrographic research or survey activities by foreign ships• Activities anchoring foreign ships except in force majeure• War training using ammunition by foreign ships• Ship pilotage service business.• Construction and operation of special terminals• Transportation and sales, salt mining construction, construction of salt industry facilities• Collection, utilization, processing, disposal and landfilling of B3 & non-B3 waste• Shipyard Industry Activities with a Graving Dock system • Industrial development that is integrated with ports• Activities of making, repairing or maintaining ships/floating equipment• Production of main/auxiliary machines;• The activity of making other equipment specifically used in ships• Other maritime equipment manufacturing activities• Diving works within the framework of the maritime industry• Refloating• Marine biota cultivation activities for the benefit of the Biopharmacology / Marine Biotechnology industry• Introduction of genetically modified organisms into the environment• Development of electricity generation, transmission, distribution and sales• Construction of fishing refueling stations	• Construction of Floating Production Storage and Offloading, oil and gas platforms, Floating Storage Offloading and Mooring• Exploitation (production operations) of coal, metallic minerals, non-metallic minerals or rock minerals, radioactive minerals• Construction of LNG Regasification Terminal• Construction, transfer and/or demolition of buildings or piping installations in waters• Cable & pipe laying• Planting and or laying of cables or poles and facilities at sea• Development of Navigation Assistance Facilities• Cargo and fuel transferring• Towing• Military exercises• Salt industry intake and output pipes
East Java	Perda_No 1	Industrial	• Protection of biodiversity	• Educational tourism business, rowing, diving, fishing, surfing, tourist wharf, entertainment and recreation	• Water sport tourism business & spectacle tourism

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
Province	Tahun 2018_RZWP3K	Zone	• Environmental rescue and protection • Conservation research & education activities • Scientific surveys and/or research • Fish farming for industrial purposes • Fisheries research and development • Determination of anchorage • Business loading and unloading of goods • Construction and operation of cement grinding plants and cement packing plants • Transportation and sale of salt • Shipyard Industry Activities with a Graving Dock system • Industrial development that is integrated with ports • Repair or maintenance of ships/floating equipment • Production of main/auxiliary machines • The activity of making other equipment specifically used in ships • Other maritime equipment manufacturing activities • Diving works within the framework of the maritime industry • Activities to assist technical work on ships that are still afloat but have been in a disaster • Cargo and fuel transferring • Towing • Refloating	activities, extreme tourism, domestic & international tourism sea transportation, tourism travel service business, villas (cottages) over the sea, snorkeling, swimming, restaurants above the sea, aquatic natural tourism, marine tourism services• Nipa planting and mangrove cultivation• Collection of coral reefs• Collection of non-timber forest products in mangrove forests• Catching and cultivating fish• Retrieval of antiquities and other antiquities• Collection & cultivation of non-fish marine resources• Transportation of cultivated and caught fish• Cultivation of genetically engineered fish• Installation of floating net cages, deep & shallow water FADs• Unloading of fish• Fishing using trawls, payang, cantrang, lampara nets, dogol, gill nets, seine nets, long bag set nets, squid jigging, prawe lines, long lines, pole & line, Bubu/Muroami, Bouke Ami, and floating charts • Activity of testing fishing vessels• Exploration, transportation, exploitation, processing & refining of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals• Development of Floating Production Storage and Offloading • Seabed dredging with capital dredging• Development of coal power plans, oil and gas platforms, Floating Storage Offloading (FSO), Mooring Facility• Placement of tailings under the sea • Construction of LNG Regasification Terminal, flaring and destruction of oil and gas explosives• Installation of energy generator turbine facilities, Installation of Sea Current Power Generators, & heat engine facilities• OTEC energy exploration • Construction, transfer and/or dismantling of pipeline installations in waters• Determination of place of transfer between ships• Construction of harbor ponds, dry & liquid bulk terminals, ro-ro terminals, stationary ships dead, construction of fish auctions, & fishery piers• Construction of breakwaters, revetments, groins• Determination of shipping lanes & international shipping routes• Ship trials • Independent tally business, sea transportation business & sea transportation equipment rental services, ship pilotage service business.• Operation of Regional and Local Feeder Ports • Dredging & reclamation in the territorial waters of Regional and Local Feeder Ports• Management (TUKS) within DLKR/DLKP regional feeder ports.• Operation of ferry transport within the province• Flight activities over the archipelagic channel• Loading and unloading activities by foreign ships• Foreign ship berthing activities except in force majeure• War training using ammunition by foreign ships• Construction and operation of special terminals• Marine biota cultivation activities for the benefit of the marine biopharmacology/biotechnology industry • Introduction of genetically modified organisms into the environment• Development of electricity generation,transmission, distribution and sales• Military exercises	• Taking underwater photos/videos • Anchor release • Laying of cables, poles and pipes • Development of Local Port Service (LPS) telecommunications cables • Development of Navigation Assistance Facilities • Construction of container terminals, ship repair sites • Fishing boat repair and maintenance service business • Logistics service business and fishing boat supplies • Jetty construction and operation • Hydrographic research or survey activities by foreign vessels • Salt mining construction • Development of salt industry facilities • Activities for collecting, utilizing, processing, disposing of B3 and non-B3 waste • Ship/floating equipment building activities • Construction of fishing refueling stations • Salt industry intake and output pipes
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Oil and Gas Pipeline	• Educational tourism business, rowing, diving, fishing, surfing, water sports, entertainment and recreation, extreme tourism (high risk), snorkeling, spectacle tourism, swimming, marine tourism services • Taking underwater photos/videos • Protection of biodiversity • Environmental rescue and protection • Conservation research and education activities • Scientific surveys and/or research • Fishing with vessel capacity < 10GT • Use of poles to propel the boat • Fisheries research and development • Diving works within the framework of the maritime industry	• Collection of coral reefs • Fish farming for industrial purposes • Floating aquaculture business • Collection and cultivation of non-fish marine resources • Cultivation of genetically engineered fish • Installation of deep water FADs • Fishing using trawls, payang, cantrang, lampara nets, dogol, gill nets, seine nets, long bag set nets, and Bouke Ami • Activity of testing motorized fishing boats/fishing boats • Exploration, processing & refining of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals • Construction of a coal power plan & oil and gas platform • Placement of tailings under the sea • Construction of LNG Regasification Terminal • Flaring • Destruction of oil and gas explosives • Installation of energy generator turbine facilities • Construction of container terminals, dry & liquid bulk terminals, ro-ro terminals, ship repair sites, and fish auction sites • Construction of breakwaters, revetments, groins • Jetty construction and operation • Dredging and reclamation in the territorial waters of Regional and Local Feeder Ports	• Tourist jetty business, domestic & international tourism sea transportation business, tourism travel services, seaside villas (cottages), seaside restaurants, water nature tourism• Planting of mangroves and palm trees• Mangrove cultivation• Collection of non-timber forest products in mangrove forests • Catching fish with a vessel capacity of 10-30 GT and ≥ 30GT• Retrieval of antiquities by motorized boats ≤ 5GT, 5-30 GT, and > 30 GT• Collection of goods other than antiquities by motorized boat ≤ 5GT, 5-30 GT, and > 30 GT• Anchor release• Sea fish cultivation business• Transportation of cultivated and caught fish • Installation of floating net cages and shallow water FADs• Unloading of fish• Fishing using Squid Jigging, Prawe, long line, pole and line, Bubu/Muroami, floating chart• Transportation and exploitation (production operations) of metallic minerals, non-metallic minerals, rocks, coal, radioactive minerals • Development of Floating Production Storage and Offloading• Seabed dredging with capital dredging • Seabed dredging with capital dredging which cuts coral

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				• War training using ammunition by foreign ships • Activities for collecting, utilizing, processing, disposing of B3 and non-B3 waste	and/or rock material• Construction of Floating Storage Offloading, Mooring• Installation of Ocean Current Power Generation & heat engine facilities • OTEC energy exploration• Construction, transfer and/or demolition of buildings or piping installations in waters• Cable & pipe laying• Construction of Local Port Service telecommunications cables• Planting and or laying of cables or poles and facilities at sea• Development of Navigation Assistance Facilities• Determination of berths & places of transfer between ships• Development of harbor ponds• Placement of dead ships• Determination of shipping lanes to and from fishing ports• Ship trials• Fishing boat repair and maintenance service business• Logistics service business and fishing boat supplies• Construction of a fishing wharf• Business of loading and unloading of goods & independent tally business• Construction and operation of cement grinding plants and cement packing plants• Operation of Regional and Local Feeder Ports• Sea transportation & equipment rental business• Management (TUKS) within DLKR/DLKP regional feeder ports.• Operation of In-Province Ferry Ships• Flight activities over the archipelagic channel• Determination of international shipping routes• Loading and unloading activities by foreign vessels• Hydrographic research or survey activities by foreign vessels• Activities anchoring foreign ships except in force majeure• Ship pilotage service business• Construction and operation of special terminals • Salt mining transportation, sales, construction, construction of Salt Industry Infrastructure Facilities • Shipyard Industry Activities with a Graving Dock system• Industrial development that is integrated with ports• Activities of making, repairing/maintaining ships/floating equipment• Production of main/auxiliary machines• The activity of making other equipment specifically used in ships• Other maritime equipment manufacturing activities• Activities to assist technical work on ships that are afloat but are experiencing a disaster• Cargo and fuel transferring• Towing• Refloating• Marine biotacultivation activities for the benefit of the Biopharmacology / Marine Biotechnology industry• Introduction of genetically modified organisms into the environment• Development of electricitygeneration, transmission, distribution and sales• Construction of fishing refueling stations• Salt industry intake and output pipes
East Java Province	Perda_No 1 Tahun 2018_RZWP3K	Sea Channels	• Entertainment and recreation business activities • Protection of biodiversity • Environmental rescue and protection • Flight activities over the archipelagic channel • Foreign ship berthing activities except in force majeure • Refloating	• Educational tourism business, rowing tourism, diving, fishing, surfing, water sports, jetty tourism, extreme tourism, seaside cottages, snorkeling, viewing tours, swimming, seaside restaurants, water nature tourism, marine tourism • Taking underwater photos/videos • Planting nipa palm, planting and cultivating mangroves • Conservation research and education activities • Collection of coral reefs • Scientific surveys and/or research • Collection of non-timber forest products in mangrove forests • Fishing with vessel capacity < 10GT, 10-30 GT, and ≥ 30GT • Collection of antiquities and other than antiquities by motor boats ≤ 5GT, 5-30 GT, and > 30 GT • Anchor release • Use of poles to propel the boat • Fish farming • Taking and cultivating non-fish marine resources for economic purposes • Transportation of fish cultured & caught by live fish carriers with Indonesian and foreign	• Entertainment and recreation business activities • Protection of biodiversity • Environmental rescue and protection • Flight activities over the archipelagic channel • Activities in anchoring foreign ships except in force majeure • Refloating

Area	Law Reference	Zone	Allowed Activities	Not Allowed Activities	Allowed activities with permission
				flags • Transportation of cultivated fish by small fishing boats • Cultivation of genetically engineered fish • Installation of floating net cages, deep & shallow water FADs • Unloading fish • Fishing using trawls, payang, cantrang, lampara nets, dogol, gill nets, seine nets, long bag set nets, squid jigging, prawe fishing gear, long lines, pole & line, bubu/muroami, bouke ami, floating charts • Fisheries research and development • Activity of testing motorized fishing boats/fishing boats • Exploration and transportation of metal minerals, non-metallic minerals, rocks, coal, radioactive minerals • Development of floating production storage and offloading • Seabed dredging with capital dredging • Seabed dredging with capital dredging which cuts coral and/or rock material • Construction of a coal power plant • Construction of oil and gas platforms, floating storage offloading, mining floating facilities • Exploitation (production operations) and processing & refining of coal, metallic minerals, non-metallic minerals, radioactive minerals • Placement of tailings under the sea • Construction of LNG regasification terminal • Flaring, destruction of oil and gas explosives • Installation of energy generator turbine facilities, installation of ocean current power plants, installation of heat engine facilities • OTEC energy exploration • Construction, transfer/demolition of buildings/installation of piping in waters • Cable embedment diameter 0-20, 20-50, 50-100, and above 100 cm • Development of local port service telecommunications cables • Planting and or laying of cables or poles and facilities at sea • Determination of berthing places, loading and unloading places between ships • Construction of harbor pools, container terminals, dry & liquid bulk terminals, ro-ro terminals, ship repair sites, dead ship placement, construction of fish auction sites • Construction of breakwaters, revetments, groins • Ship trials • Service business for repair & maintenance, logistics services and supplies for fishing vessels • Construction of a fishing wharf • Cargo loading and unloading business, independent tally business • Jetty construction and operation • Dredging and reclamation in regional and local feeder harbor waters • Determination of international shipping routes • Activities of loading and unloading foreign ships, hydrographic research or surveys, & war training using ammunition by foreign ships • Salt mining construction & construction of salt industry facilities • Collection, utilization, processing, disposal and landfilling of B3 & non-B3 waste • Shipyard industry activities with a graving dock system • Ship/floating equipment manufacturing & repair/maintenance activities • Manufacturing activities of main/auxiliary engines & other equipment specifically used in ships • Activities for making maritime tools • Diving works within the framework of the maritime industry • Cargo and fuel transferring • Marine biota cultivation activities for the benefit of the marine biopharmacology/biotechnology industry • Introduction of genetically modified organisms into the environment • Development of electricity generation, transmission, distribution and sales • Construction of fishing refueling stations • Salt industry intake and output pipes • Military exercises	

Table 2 Regulated Activity by Land Spatial Plannning

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
Indramayu Regency	Regional Law 1 of 2012	Protected Forest	tourism without changing the natural landscape	other non-forestry development, except open pit mining	Activities that have the potential to reduce the forest and vegetation area
		Coastal Area	- green open space, defense and security, and transportation - customary interests and local wisdom - development of natural structures and artificial structures to prevent abrasion, accretion and seawater intrusion	- recreational activities, marine tourism, and ecotourism without constructing permanent buildings - community plantation forest	- solid waste, liquid waste, gas waste and B3 waste disposal - activities that can reduce the ecological and aesthetic functions of the area by changing and/or damaging the landscape, coastal functions and access to coastal areas
		River Area	- green open space - activities that can strengthen the protection function of river banks	- constructing buildings that support the function of river banks and/or buildings that are part of a network or transmission for the public interest - community plantation forest	activities that hinder the direction and intensity of water flow
		Plantation	- livestock cultivation activities, fisheries, settlements, and tourism activities - settlements for residents who work in the plantation sector - buildings that support plantation activities and regional infrastructure networks - conversion of the designated plantation area into other functions		- planting plantation crops that absorb water - change the type of plantation crops for large plantation areas that are not in accordance with permits
		Aquaculture	- regional infrastructure buildings and buildings that support fishing activities - freshwater aquaculture and floating nets - residential area	- permitted conditional on the use of fishery resources not exceeding the sustainable potential - capture fisheries and aquaculture activities with pay attention to environmental sustainability	- the development of fishery areas burdened with the tourism function undermines the tourism function - activities that cause water pollution and other environmental damage
		Industry	- development of residential area for employee housing - carry out operation/management in accordance with industrial designation areas with pay attention to environmental impacts - development of industrial activities supported by the availability of supporting facilities and infrastructure - construction and development of new industries in industrial areas - industrial activities that do not damage or conversion of protected areas	- industrial activities by having a waste and/or B3 waste treatment system - industrial activities in adjacent locations with integrated waste management - development of industrial designated areas along arterial or collector roads with frontage roads	- activities that have a damaging impact and reduce the quality of the environment
		Residential	- utilize water from surface water - provide education, health, trade and commerce facilities, open space facilities, parks and sports fields - household-scale industrial activities and other socio-economic facilities with environmental service scale	- residential development by providing building and environmental safety features - residential development by determining the type and terms of use of the building - residential development by providing drainage, infiltration wells, and rainwater collection - residential development by providing parking facilities - deep ground water and/or drilled wells utilization	- activities that disrupt the function of settlements and the continuity of social life of the community - developing settlements in river bends and intermittent river in landslides prone areas with a high level of vulnerability
		Defense and Security Area	- determination of the state defense and security area - provide supporting infrastructure for state defense and security areas	cultivation activities around the state defense and security area without disturbing the main function	-
Pemalang Regency	Regional Law 3 of 2011	River Area	- nature tourism as long as it does not disturb water quality - green open space - installation of billboards, counseling and warning boards, security signs, as well as shipping navigation aids - installation of electric cable networks, telephone cables, and drinking water pipes	- construction of buildings to support river management functions and recreational parks	- build a buildings in river area - carry out activities that damage and reduce the quality of the river

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
		Coastal Area	- aquaculture activities and their supporting activities - tourism activities, green open spaces and reforestation - construction of general, special and fishery ports along with supporting facilities - development of natural structures and artificial structures to prevent erosion - development of alternative energy from wind, sun, water/waves and non-fossil energy	-	carry out cultivation activities that damage the sustainability of coastal areas
		River Mouth (Estuary)	- carry out rehabilitation through a reforestation program with plants that have high conservation value and are suitable for the local environment - carry out outreach activities to the communities about the dangers of landuse change from protection function to cultivation activities	-	- cultivation activities extends following the flow of the river, especially around the river banks
		Mangrove Forested Coastal Area	mangrove planting	-	- reducing land conversion for neither cultivation areas nor settlements - Illegal mangrove logging - disposal of industrial waste which can be damaging to the northern coastal area
		Industry Designated Area	- develop supporting activities for industry - space utilization for buffer zones in the form of green belts and green open spaces - developing employee housing, local scale public facilities to support industrial activities	-	pollute water, air and soil beyond the permissible threshold
		Rural Residential Area	- trade in services - trade, creative industry and services with conditions that apply according to the scale of activity - carry out agricultural cultivation activities in yards, fisheries, stockbreeding and small/micro industries that process these cultivated products as long as they do not interfere with the comfort, health, safety, quality of life of the community and do not pollute the environment - development of public and social facilities	-	- damaging infrastructure, facilities and utilities that have been built - cultivation development other than mentioned in the allowed activities
		Urban Residential Area	- trade, creative industry and services with conditions that apply according to the scale of activity - development of public and social facilities	-	- damaging infrastructure, facilities and utilities that have been built - carry out livestock and industrial activities that can interfere the comfort, health, safety, quality of life of the community and pollute the environment
		Aquaculture Designated Area	activities that support fishing activities	-	- all cultivation activities that will disrupt the water quality of rivers and reservoirs for inland fisheries
		Paddy Field	activities that support agriculture	-	- cultivation activities that reduce the area of paddy fields - converting sustainable food agricultural land without a permit according to the conditions required - cultivation activities that reduce or damage land use and soil quality - construction of buildings in the irrigation canal area
		Horticultural Farming	- build detached house on condition that it is in accordance with a detailed spatial plan - space utilization for settlements of farmers	-	-
Pekalongan Regency	Regional Law 3 of 2020	River Area	- green open space	- nature tourism activities without disturbing river water quality - installation of billboards, counseling and warning boards, security signs - installation of electric cable networks, telephone cables, and drinking water pipes	- carry out activities that damage and reduce the quality of the river - carry out soil and rock mining activities

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
				- constructing buildings to support the functions of river management, water utilization, nature tourism, docks, energy facilities and other functions	
		Coastal Area	- carry out activities that able to protect/strengthen coastal areas from erosion, sea water intrusion and sea water infiltration	development of transportation infrastructure and facilities, fish auction market, water control buildings, tourism, energy facilities, shipping navigation aids, safety guard towers and/or other activities that located in beachside	activities that can damage the coastal ecosystem
		Mangrove Ecosystem	activities to protect mangrove ecosystems from destruction, disturbance, threats, pests and diseases	development of integrated mangrove ecosystem areas with education, research and tourism	activities that can damage the mangrove ecosystem
		Cultivation Area	comply with the general provisions of zoning regulations for production forest, agriculture, fishery, mining and energy, industry, tourism, settlement, defense and security areas		
		Industry Designated Area	- space utilization for warehousing, service industry, fueling stations and supporting activities - construction of energy generation facilities - development of infrastructure and supporting facilities for the industry	- developing housing and its supporting facilities - construction of facilities for public interest with considering the impact to industrial activities	- utilizing groundwater for the purposes of industrial activities and supporting activities from water catchment areas - contaminate water, air and soil beyond the required threshold
		Urban Residential Area	development of economic enterprises other than large and medium industries with consideration of environmental impacts	utilization of ground water for domestic use and its supporting activities from water catchment areas	carry out activities that have a significant impact on the health of the settlement environment
		Rural Residential Area	development of economic enterprises other than large and medium industries with consideration of environmental impacts	utilization of ground water for domestic use and its supporting activities from water catchment areas	carry out activities that have a significant impact on the health of the settlement environment
Pekalongan City	Regional Law 30 of 2011	Abrasion Prone Area	development of green open spaces, breakwaters, revetments, polders, retention ponds, pumping stations, embankments, drainage canals, overflow canals	marine business activities including: ports, fish auctions, safety guard towers and/or other activities that located in beachside as long as not damaging and/or polluting the coastal environment	activities and/or developments that threaten damage and/or reduce the quality of environmental sanitation
		Flood and Tidal Flood Prone Area	development of green open spaces, polders, retention ponds, pumping stations, embankments, drainage canals and other urban infrastructure	activities that not damaging the local drainage system and can adapt to flood problems, construction of open spaces that can increase rainwater infiltration into the soil	activities and/or developments that threaten damage and/or reduce the quality of environmental sanitation
		Industry Designated Area	industrial activities that not causing environmental damage and pollution	residential activities, as long as it is supporting industrial activities	-
		Tourism Designated Area	- tourism activities include: natural tourism or cultural tourism or artificial tourism, which is in accordance with the capacity of the environment and not damaging the preservation of nature reserves and cultural heritage - all supporting and supporting facilities including: recreation, sports, shows, lodging, meetings and trade services activities that support the main activities of the zone	residencial, as long as it is part and support of the main activities of the zone	-
		Capture Fisheries Designated Area	capture fisheries, aquaculture, processing and marketing of fishery products	utility network development activities, as long as the utility network is endeavored not to damage the existing fishery area	cultivation activities that reduces or damage the land use and soil quality
		Aquaculture Designated Area			
		Agriculture Designated Area	food crop agriculture, horticulture, and animal husbandry	urban utility/infrastructure network development activities, as long as the urban utility/infrastructure network does not damage the main activities in the area	conversion of land use without the permission from the authority
		Low Density Residential	residencial, religious activities, socio-cultural facilities that support settlements, government services, and others	small-scale service trading activities, small-scale offices, micro-industry, as long as they do not disturb the environment	-

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
		Area			
		Non-green Open Space Designated Area	- for non-green open space in water body: sports, tourism, fish farming, as long as it does not produce waste and garbage which will cause sedimentation in polders / retention ponds - for non-green open space in form of sport facility: sports, parking and the informal sector which will be further regulated by the authority - for non-green open space in form of parking facility: parking and other activities with the permission of the owner as long as it does not reduce the parking capacity	-	-
Rembang Regency	Regional Law 14 of 2011	Coastal Area	- wharf/dock, safety guard tower - activities to protect or strengthen the protection of the coastal border from erosion and infiltration of sea water into the soil - activities that support sea transportation facilities and infrastructure - restoration of damaged coastal protection functions - rehabilitation of degraded mangrove ecosystems - protection of mangrove ecosystems from destruction, disturbance, threats, pests and diseases - green open space	-	cultivation that can disrupt coastal functions, damage water quality, physical condition and sea bed
		River Area	- constructing buildings, except buildings for water management and/or water utilization	-	dumping industrial waste into the river
		Erosion Prone Area	- structural engineering with polder systems, wave breakwaters, sheet piles - non-structural engineering by rehabilitating mangrove forests in coastal areas	-	-
		Flood Prone Area	- preserve protected areas and upstream river areas - construction of infiltration wells in urban and rural urban areas, agricultural areas equipped with reservoirs, weirs, check dams, construction of new dams - create connected drains, and do not combine irrigation functions for drainage - green open space and construction of public facilities with low density	-	-
		Drought Prone Area			
		Nature Park	-	-	-
		Cultural Tourism Designated Area	research, education, and tourism	-	construction of buildings that are not in accordance with the function of the area
		Capture Fisheries Designated Area	-	-	-
		Aquaculture Area	-	-	-
		Residential Designated Area	-	-	-

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
Tuban Regency	Regional Law 17 of 2020	Coastal Area	- activities to protect or strengthen coastline protection from erosion and seawater intrusion, such as planting mangroves and other green open spaces - construction of natural or artificial structures to prevent abrasion such as breakwaters and other structures based on the vulnerability of the area - installation of foundations and spanning of electric cables, foundations of bridges/roads for public, buildings of weirs/dams and waterways, and water discharge controllers	- construction of buildings for recreation activities, which are limited to recreation buildings, guard towers, and sea transportation supporting infrastructure, with the following conditions: low intensity, using environmentally friendly building materials, not change the landscape, non-permanent design, consider physical-ecological conditions, the layout retains the characteristics of the landscape or its primary function - aquaculture activities with the following conditions: having minimum space utilization conflicts potential with the surrounding area, having a waste disposal system, having a feasibility study and/or environmental documents - port activities, marine and fisheries-based industries, construction of jetties with the following conditions: having minimum space utilization conflicts potential with the surrounding area, low intensity and does not have the potential to damage the coastal function, has a waste disposal system, has a feasibility study and/or environmental documents, not contradict the sea spatial plan (RZWP3K)	- construction of new buildings and/or infrastructure that has the potential to reduce area, disrupt protection functions, landscapes, beach preservation, and access to the coast - construction of new residential buildings
		River Area	- activities to protect or strengthen riverbanks, not to slow down the flow of water unless it is intentionally done to slow down the flow of water such as making check dams or cribs or dams or sluice gates or diverting river flow - installation of foundations and spanning of electric cables, foundations of bridges/roads for public, buildings of weirs/dams and waterways, and water discharge controllers - construction of green open spaces or activities that strengthen the protection function of riparian area with control, so not change the future function	- buildings that support river management and/or use of rivers and river nature tourism activities, with the following conditions: building materials that are environmentally friendly and do not change the landscape, non-permanent design and size, considering the physical-ecological conditions, the layout maintains the characteristics of the landscape and does not interfere with its main function - agricultural activities and inland fishery cultivation	construction of new buildings and/or infrastructure facilities that have the potential to reduce the area, disrupt the protection function, landscapes, preserve the function of rivers and impede the direction and intensity of water flow
		Aquaculture	- aquaculture research and development activities - fish breeding and cultivation - development of a market center for aquaculture products	- tourism activities with the following conditions: having an ecotourism concept, not reducing the function of green areas and water catchments, construction of supporting facilities is carried out with an environmentally friendly concept and low intensity - development of small and medium scale aquaculture processing industry with the following conditions: limiting the area, waste handling must be listed in environmental documents and required to have independent waste processing, must use environmentally friendly concepts	utilizing land for functions that negatively impact the ecological balance
		Industry Designated Area	- development of medium and large industrial activities, specifically development of various industries, basic chemical industry, basic metal and electronics machinery industry, and minapolitan industry - development of office for industrial management - warehouse development - green open space - development of bozem/reservoir/pond as a flood control facility, and not used for industrial waste disposal	- construction of housing in industrial areas with the following conditions: limiting the construction of residential houses based on needs, there must be green areas to reduce the negative impact of industry on existing settlements - development of trade and service activities with the following conditions: supporting industrial estates, not having a major environmental impact - supporting activities for environmental services in industrial areas such as health, education, religious activity, social and sports facilities in accordance with applicable technical standards - development of utility installations in the form of fire stations, garbage disposal sites, pump houses, substations, BTS, communal WWTP, with the following conditions: in accordance with	-

Area	Law Reference	Zone	Allowed Activities	Allowed Activities with Conditions	Prohibited Activities
				requirements and development standards as well as security requirements, waste disposal sites are integrated with the dominant waste sources, do not cause conflicts with around and there is a green area - activities that have the potential for high environmental health problems include B3 waste management activities with the following conditions: not causing a conflict with the allotment of space within the industrial area and its surroundings, complying with the provisions on the distance and intensity of the B3 waste management installation - oil and gas mining by complying with technical standards	
		Rural Residential Area	- medium and low density housing developments - green open space both environmental scale or village scale to complement and support the area - the development of blue open space in the form of a boezem/reservoir to maintain the quality of the local environment - protection of conservation of natural resources and preservation of local culture.	- trade and services with the following conditions: must provide loading, unloading areas, and parking lots in the area for local scale services; limited to existing buildings that already have permits, especially along the coastline, and unable to do new development; not causing environmental impacts and traffic disruption - raise, breed, and animal husbandary, with the following conditions: far from settlements, not located on productive land, does not cause waste that can interfere the community - small industry, small industrial centers, and warehouses - household scale industry with the condition - Environmental support activities such as health facilities, education, religion activities, social, and local scale sports, and the environment in accordance with applicable technical standards.	- mining activities
		Urban Residential Area	- high and moderate density housing developments - green open space both environmental scale or village scale to complement and support the area - development of graveyard as a support for housing while still consider the service range standard - the development of blue open space in the form of Boezem/Reservoir/Pond to support water catchment	- development of urban agriculture as tourism - supporting activities such as offices, health facilities, education, religious, social, and sports activities on a regional, local, and environmental service scale in accordance with applicable technical standards - construction of utility installations such as fire stations, garbage disposal sites, electrical substations, BTS, WWTP, pump houses, and other utility installations - trade and local,city, and regional scale service activity - small industrial activities, industrial centers, and warehouses - household scale industry	- mining activities
		Defense and Security Area	- military activities and supporting facilities - development of green open space as a buffer area	-	all activities other than allowed activities

Appendix-6-2
Coastal Characteristics of the Selected Areas

Appendix-6-2 Characteristics of the three selected areas

6.1 Wave characteristics

Wave data for 40 years from 1980 to 2021 offshore of the target coastal area was obtained from the wave estimation result of ERA5. Figure 1 shows the locations of three extracted wave estimation points, Indramayu, Pemalang and Rembang. The extracted estimated data has the following specifications.

- Period: January 1981 to December 2021 (41 years)
- Estimated time interval: 1 hour
- Wave parameters: maximum wave height, significant wave height, mean wave period, mean wave direction

Source：Edited by JICA Study Team based on Google Earth

Figure 1 Locations of Wave Estimation

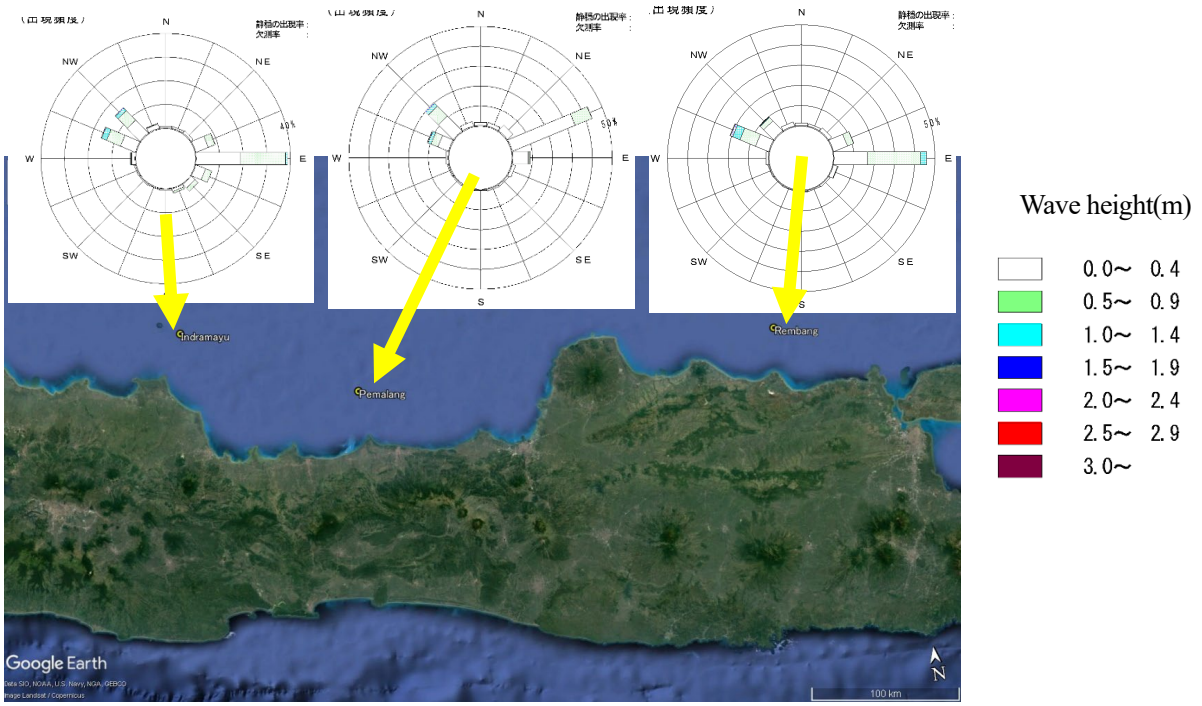
6.1.1 Wave Frequency Characteristics

From the wave direction frequencies at the three points (Figure 2 to Figure 5), it can be seen that there are waves from E and ENE directions and waves from NW and WNW directions. Waves from the E and ENE directions are dominant during the dry season from May to October, and waves from the NW and WNW directions are dominant during the rainy season from November to March. This corresponds to the wind direction that determines the direction of the waves in the dry and rainy seasons. In detail, the wave direction of Pemalang, which is located in the center, is slightly shifted in the N direction. This is thought to be due to the fact that Pemalang has protruding landforms to the east and west, and that waves coming from the east and west were blocked by those protruding landforms. Wave heights of 1 m or less are frequent at all points, but wave heights of 1 m or more tend to be slightly higher in the NW and WNW directions, that is, in the rainy season.

According to average value of annual maximum significant wave at 3 stations (Figure 6), the wave height tends to increase in the order Indramayu, Pemalang, and Rembang. Along with this, the period tends to become longer from west

to east. Regarding the wave direction, the characteristics of wave height depending on the wave direction described earlier, that is, the tendency for the wave height from the west direction to be high, and the wave direction of the maximum significant wave at any point is from the W direction, and a slightly northerly trend can be seen off the coast of Pemalang in the center. From the 40-year data of the three stations, the annual maximum significant wave height is about 1.5 to 3 m, and its period is about 6 s.

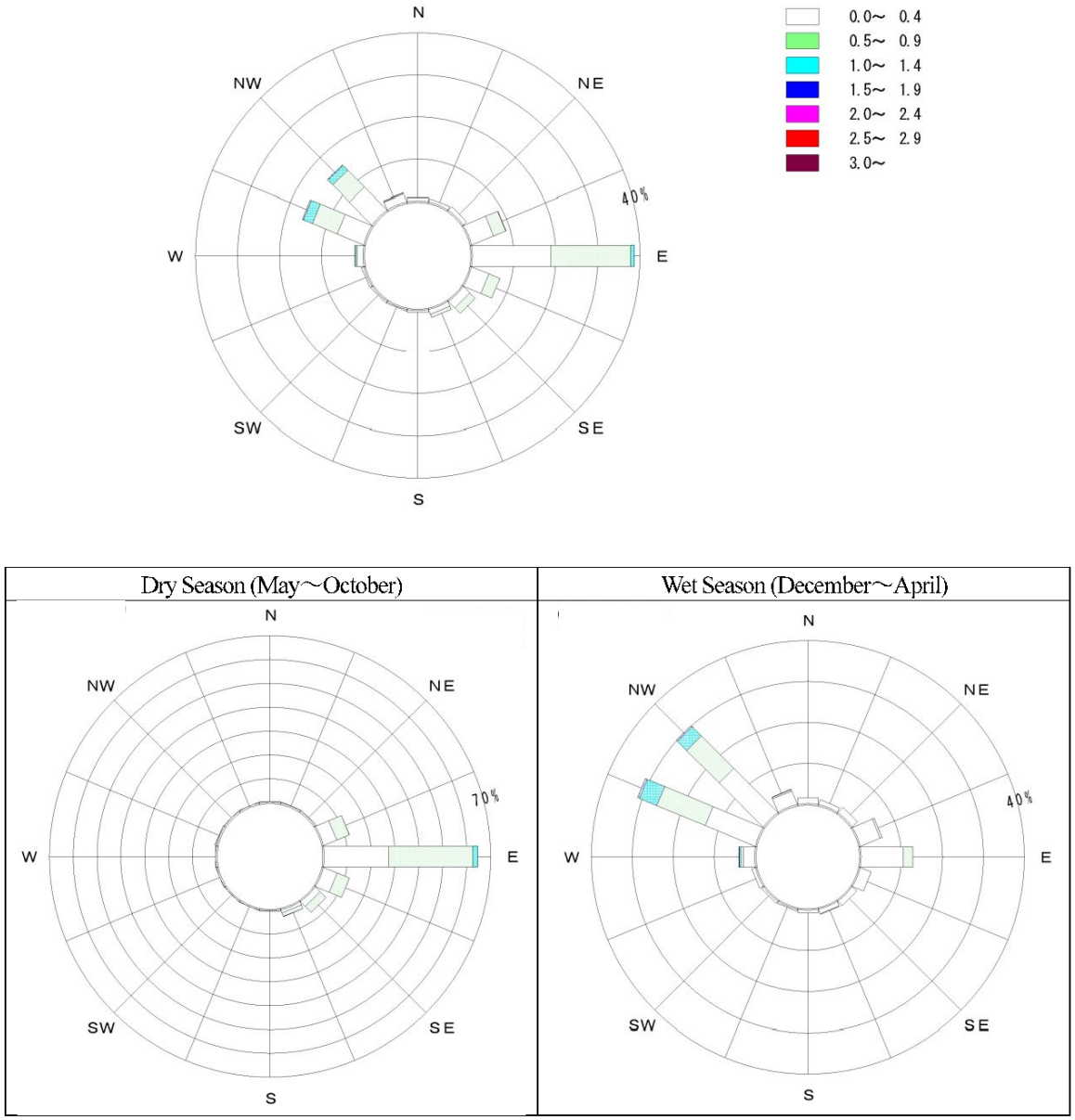
Figure 7 shows the correlation between wave height and period. According to this correlation, the period tends to increase as wave heights increase at all three sites. Figure 8 shows the interannual variation of annual maximum significant wave heights, with the highest heights occurring off Rembang, followed by Pemalang and Indramayu, although in some years the order is reversed. Figure 9 shows the relationship of maximum significant wave heights between locations. These relationships show that the order of wave heights is Rembang, Pemalang, and Indramayu, in that order. Figure 10 shows the annual variation of the mean period of the largest significant wave of the year. Figure 11 shows the relationship between the mean period at the three sites. Figure 12 shows the annual change in the mean direction of the largest significant wave of the year. Figure 13 shows the relationship between the wave directions at the three sites: the wave direction off Pemalang is more N-biased than that off Rembang and Indramayu because the angle is larger than that off Rembang and Indramayu.



Source：Edited by JICA Study Team based on Google Earth

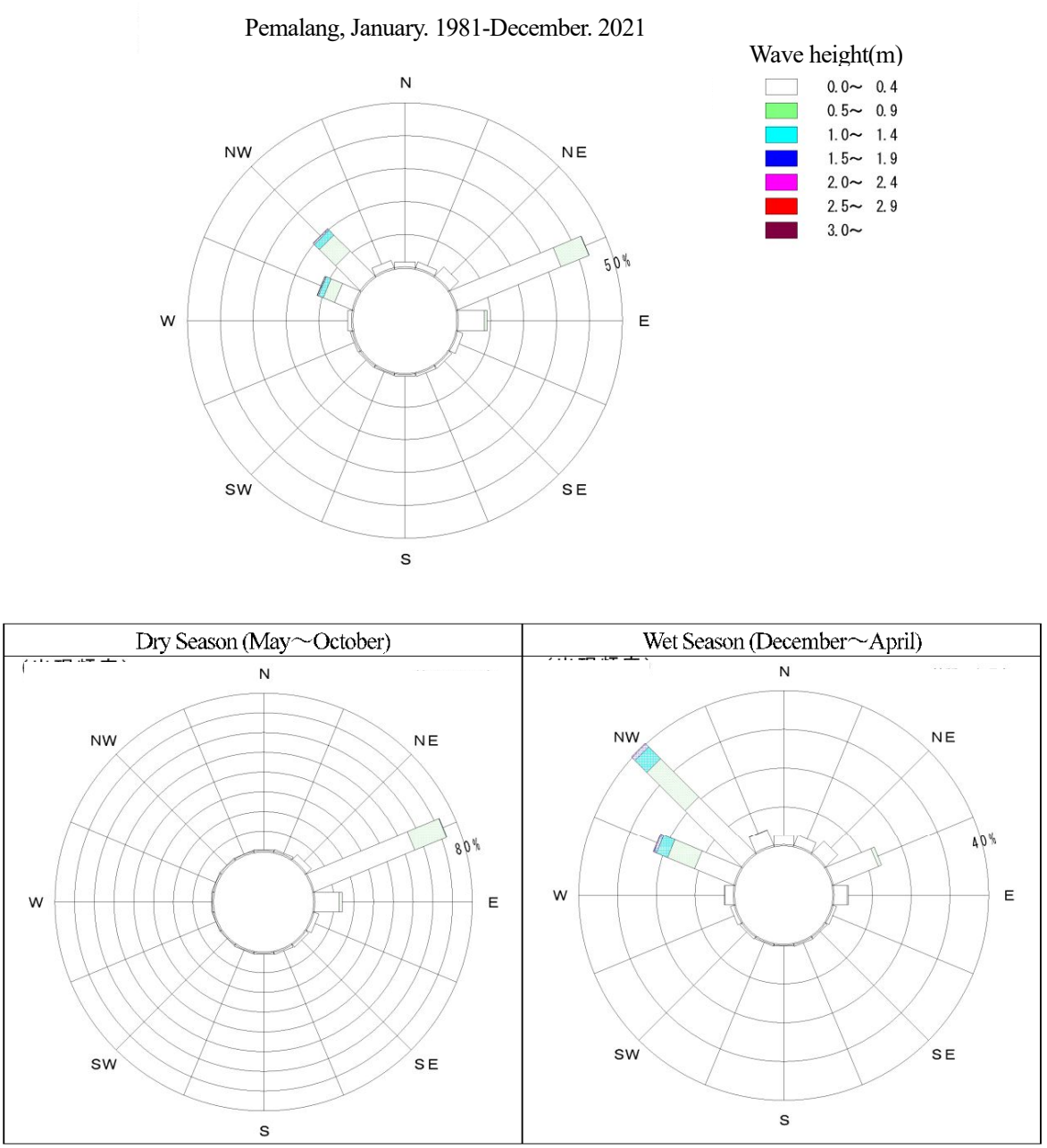
Figure 2 Comparison of Frequency of Wave Direction

(Left: Indramayu, Middle: Pemalang, Right: Rembang)



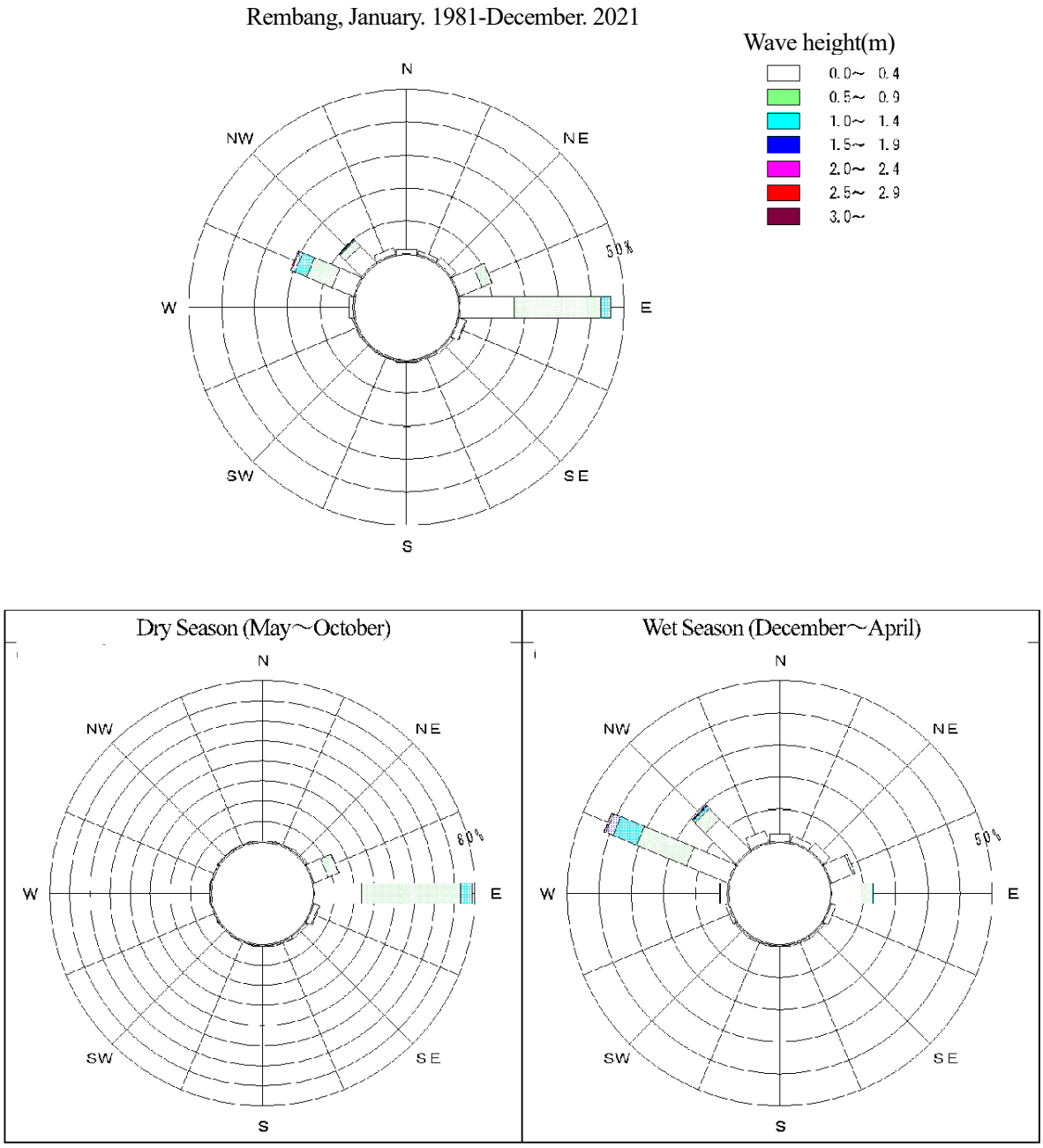
Source：JICA Study Team

Figure 3 Frequency of Wave Direction and Height in Indramayu



Source：JICA Study Team

Figure 4　Frequency of Wave Direction and Height in Pemalang



Source：JICA Study Team

Figure 5 Frequency of Wave Direction and Height in Rembang

Table 1 Maximum Wave Height of the Year

【Indramayu】

year	time	Hmax(m)	Tm(s)	H1/3(m)	WDm(deg)
1981	1981/1/13 9:00	4.19	5.7	2.18	311
1982	1982/1/19 9:00	3.83	5.7	2.00	316
1983	1983/11/27 2:00	3.72	5.2	1.92	286
1984	1984/1/4 8:00	3.42	5.1	1.76	303
1985	1985/2/21 9:00	2.84	4.7	1.47	293
1986	1986/1/17 9:00	3.31	5.2	1.72	306
1987	1987/1/15 9:00	2.96	5.0	1.54	298
1988	1988/12/15 8:00	3.79	5.3	1.96	301
1989	1989/2/5 7:00	3.37	5.2	1.75	309
1990	1990/1/5 12:00	3.81	5.3	1.97	303
1991	1991/2/23 21:00	2.90	4.8	1.51	300
1992	1992/7/9 2:00	2.49	5.1	1.31	85
1993	1993/12/24 8:00	4.24	5.5	2.19	282
1994	1994/8/11 4:00	3.04	5.4	1.59	90
1995	1995/12/8 8:00	3.54	5.3	1.83	298
1996	1996/12/14 4:00	4.21	5.6	2.18	288
1997	1997/2/20 9:00	3.28	5.3	1.71	308
1998	1998/8/18 22:00	2.58	5.5	1.36	87
1999	1999/12/14 21:00	3.81	5.3	1.97	281
2000	2000/2/3 9:00	3.22	5.0	1.66	306
2001	2001/2/11 7:00	4.58	5.8	2.38	306
2002	2002/8/14 16:00	2.79	4.6	1.44	167
2003	2003/1/10 4:00	3.04	5.5	1.60	294
2004	2004/2/11 20:00	2.92	4.8	1.51	311
2005	2005/1/5 12:00	2.79	5.0	1.46	304
2006	2006/12/29 6:00	4.73	5.8	2.45	296
2007	2007/1/1 21:00	4.03	5.2	2.06	288
2008	2008/2/11 9:00	3.41	5.2	1.77	309
2009	2009/2/5 7:00	3.34	4.9	1.72	302
2010	2010/1/14 8:00	3.96	5.5	2.05	308
2011	2011/1/11 9:00	4.29	5.9	2.24	309
2012	2012/1/25 9:00	3.98	5.6	2.07	318
2013	2013/1/9 17:00	3.99	5.3	2.05	280
2014	2014/1/21 15:00	3.49	5.5	1.83	318
2015	2015/12/16 19:00	3.40	5.2	1.77	297
2016	2016/12/22 23:00	3.27	5.2	1.70	278
2017	2017/11/30 21:00	4.09	5.4	2.11	281
2018	2018/1/13 5:00	3.29	5.2	1.71	306
2019	2019/1/22 11:00	3.18	5.3	1.66	313
2020	2020/12/8 22:00	4.04	5.4	2.09	288
2021	2021/1/29 10:00	3.16	5.2	1.65	308
Mean		3.52	5.3	1.83	281

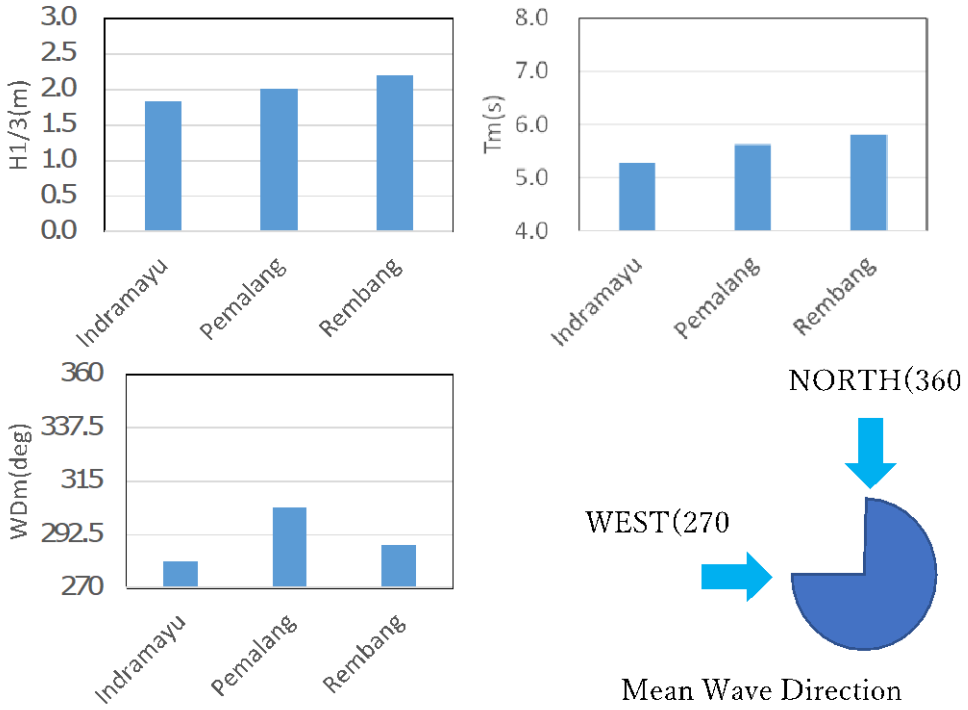
【Pemalang】

year	time	Hmax(m)	Tm(s)	H1/3(m)	WDm(deg)
1981	1981/1/13 9:00	4.98	6.3	2.58	309
1982	1982/1/19 8:00	4.47	6.0	2.32	310
1983	1983/11/27 10:00	4.29	5.8	2.21	301
1984	1984/1/4 10:00	4.03	5.6	2.07	303
1985	1985/2/21 18:00	3.54	5.3	1.82	304
1986	1986/1/19 21:00	4.30	5.7	2.21	303
1987	1987/1/26 10:00	3.84	5.5	1.98	298
1988	1988/12/15 9:00	3.97	5.7	2.05	304
1989	1989/2/5 9:00	3.68	5.5	1.90	308
1990	1990/1/26 7:00	4.54	5.9	2.33	303
1991	1991/2/23 19:00	3.59	5.3	1.85	302
1992	1992/12/2 7:00	2.07	4.5	1.08	299
1993	1993/1/29 21:00	4.09	5.7	2.11	314
1994	1994/1/24 11:00	3.07	5.3	1.60	307
1995	1995/12/8 9:00	3.49	5.7	1.81	303
1996	1996/12/14 4:00	3.47	5.6	1.80	298
1997	1997/2/22 23:00	3.71	5.4	1.91	298
1998	1998/12/30 9:00	2.65	4.9	1.38	300
1999	1999/2/8 7:00	3.90	5.7	2.02	306
2000	2000/2/3 21:00	3.75	5.5	1.93	301
2001	2001/2/11 9:00	5.13	6.4	2.67	305
2002	2002/2/10 4:00	2.78	5.2	1.45	308
2003	2003/2/6 9:00	3.19	5.2	1.64	305
2004	2004/2/12 3:00	2.99	5.2	1.56	305
2005	2005/1/17 4:00	2.58	4.9	1.35	303
2006	2006/12/29 9:00	5.57	6.4	2.88	300
2007	2007/12/28 10:00	4.26	5.8	2.20	307
2008	2008/2/15 8:00	4.09	5.7	2.11	300
2009	2009/2/5 9:00	4.44	5.7	2.27	304
2010	2010/1/14 9:00	4.52	6.1	2.34	310
2011	2011/1/11 21:00	4.59	6.2	2.39	310
2012	2012/1/25 8:00	4.46	6.0	2.31	312
2013	2013/1/9 20:00	4.57	6.0	2.35	294
2014	2014/1/21 18:00	4.08	6.0	2.13	311
2015	2015/12/17 6:00	3.57	5.6	1.86	300
2016	2016/12/21 11:00	2.92	5.1	1.51	301
2017	2017/1/29 12:00	4.12	6.0	2.15	301
2018	2018/1/28 15:00	3.65	5.3	1.88	304
2019	2019/1/27 23:00	3.41	5.4	1.77	312
2020	2020/12/8 22:00	4.51	6.0	2.34	302
2021	2021/1/29 11:00	3.92	5.7	2.02	304
Mean		3.87	5.6	2.00	304

【Rembang】

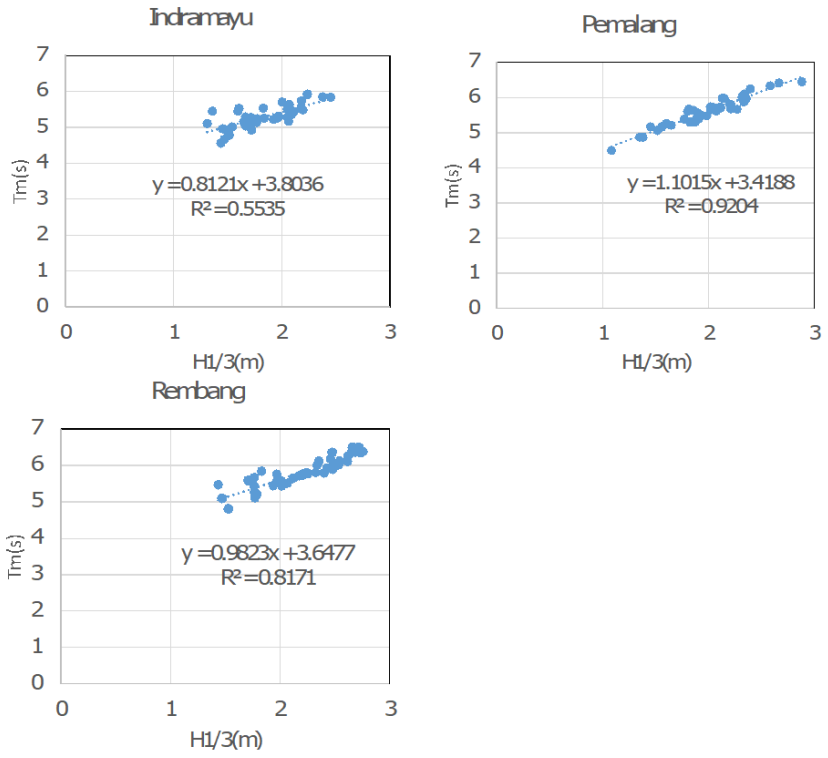
yesr	time	Hmax(m)	Tm(s)	H1/3(m)	WDm(deg)
1981	1981/1/12 7:00	5.29	6.4	2.75	305
1982	1982/1/18 9:00	4.27	5.8	2.21	303
1983	1983/11/28 8:00	4.90	6.1	2.54	297
1984	1984/2/20 19:00	4.02	5.5	2.07	299
1985	1985/2/19 8:00	2.97	4.8	1.53	301
1986	1986/1/19 21:00	5.06	6.1	2.61	297
1987	1987/12/22 9:00	4.25	5.7	2.20	296
1988	1988/12/15 9:00	4.36	5.8	2.25	298
1989	1989/3/10 8:00	3.45	5.1	1.77	296
1990	1990/1/25 6:00	5.04	6.3	2.62	298
1991	1991/2/18 10:00	3.91	5.4	2.01	296
1992	1992/7/8 16:00	2.74	5.5	1.44	84
1993	1993/1/28 7:00	4.67	5.8	2.40	301
1994	1994/1/24 10:00	2.81	5.1	1.47	298
1995	1995/3/2 16:00	4.09	5.6	2.12	287
1996	1996/12/16 12:00	3.78	5.8	1.97	298
1997	1997/2/21 9:00	4.20	5.7	2.17	298
1998	1998/8/18 16:00	3.27	5.6	1.71	88
1999	1999/12/25 8:00	3.79	5.6	1.97	295
2000	2000/1/22 8:00	3.42	5.3	1.77	296
2001	2001/2/11 20:00	5.15	6.4	2.68	297
2002	2002/2/3 10:00	3.47	5.2	1.79	301
2003	2003/1/10 9:00	3.36	5.7	1.76	300
2004	2004/2/12 8:00	3.74	5.4	1.94	294
2005	2005/12/30 10:00	3.39	5.4	1.76	302
2006	2006/12/29 21:00	5.07	6.5	2.66	293
2007	2007/1/2 7:00	5.08	6.3	2.65	297
2008	2008/2/15 7:00	4.81	5.9	2.48	293
2009	2009/2/5 9:00	4.81	6.0	2.49	300
2010	2010/1/14 8:00	5.27	6.4	2.74	302
2011	2011/1/11 22:00	4.73	6.4	2.48	302
2012	2012/3/14 8:00	4.70	5.9	2.43	301
2013	2013/1/10 5:00	5.21	6.5	2.72	297
2014	2014/1/21 22:00	4.72	6.2	2.46	303
2015	2015/12/17 12:00	3.48	5.8	1.83	300
2016	2016/12/21 9:00	3.86	5.6	2.00	300
2017	2017/2/7 1:00	4.92	6.0	2.54	302
2018	2018/1/29 8:00	4.32	5.8	2.24	297
2019	2019/1/22 16:00	4.49	6.0	2.34	300
2020	2020/12/9 3:00	4.53	6.1	2.35	308
2021	2021/1/29 11:00	4.50	5.8	2.32	296
Mean		4.24	5.8	2.20	288

Source： JICA Study Team



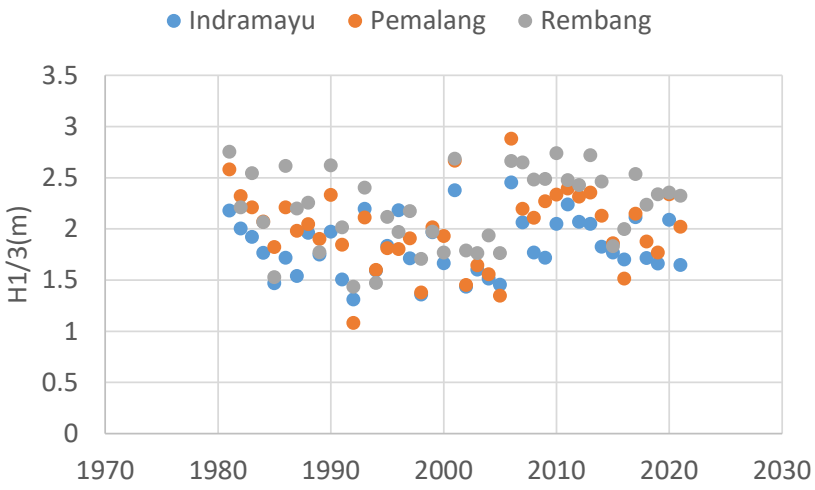
Source：JICA Study Team

Figure 6　Average Value of Maximum Significant Wave Height of the Year During 1981-2021



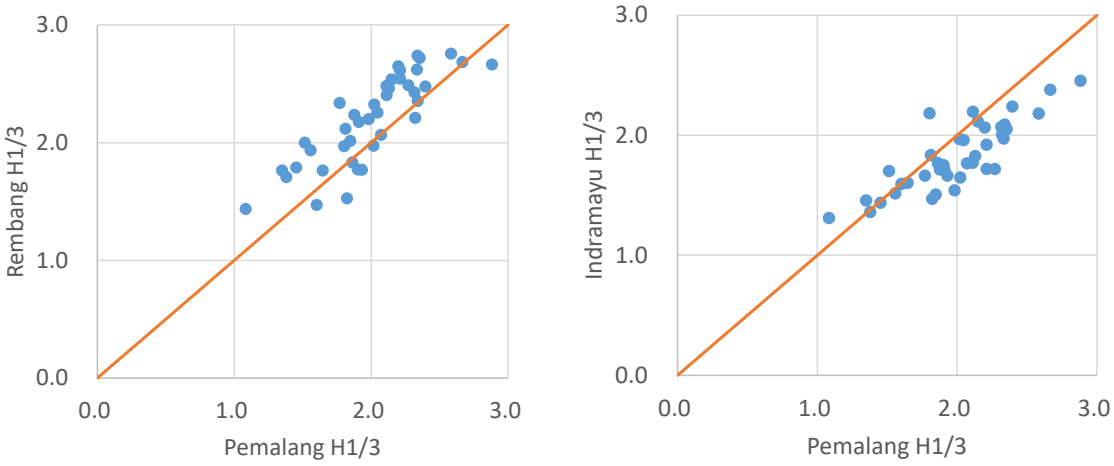
Source：JICA Study Team

Figure 7　Relationship of Wave Height and Wave Period



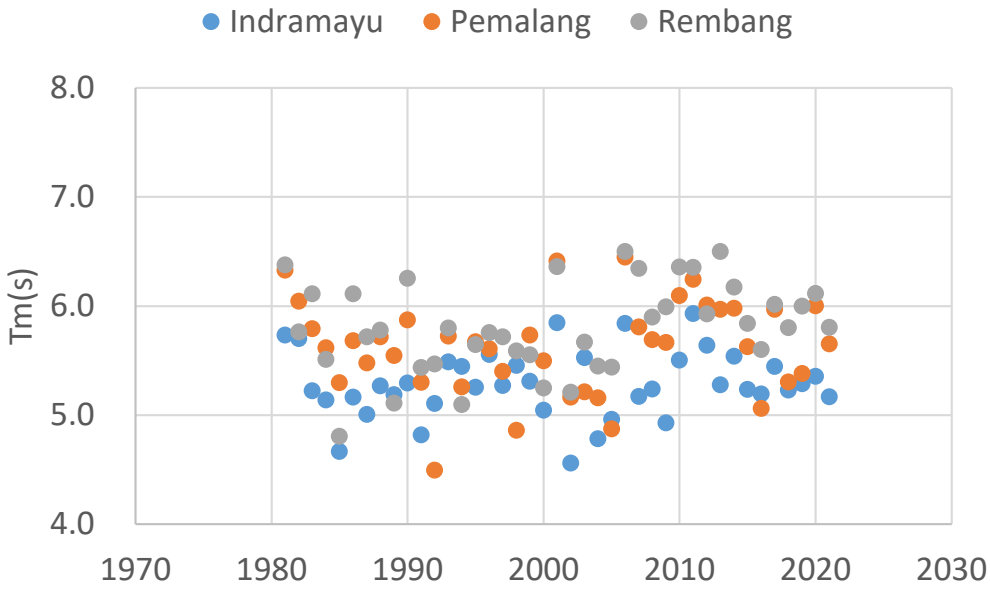
Source：JICA Study Team

Figure 8 History of Changes in the Mean Period of the Annual Maximum Significant Wave



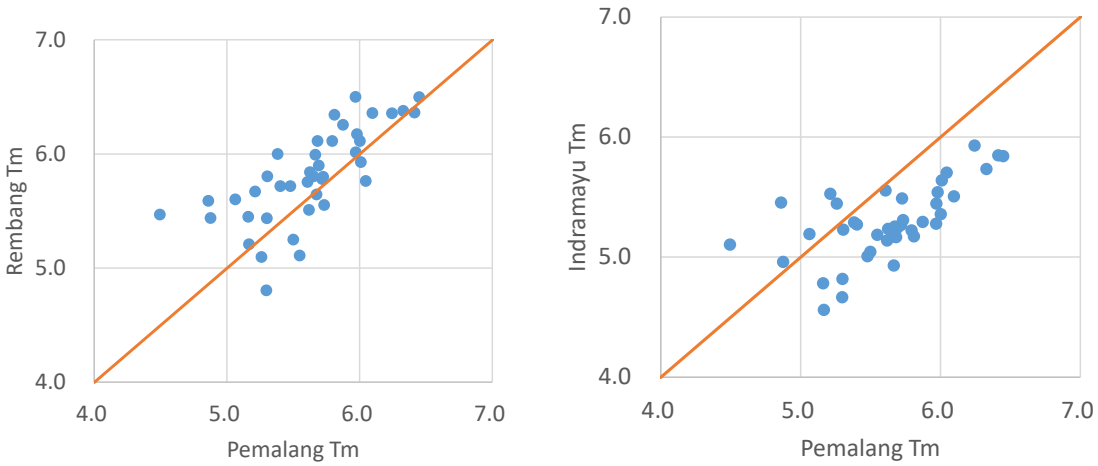
Source：JICA Study Team

Figure 9 Comparison of the Average Period of the Annual Maximum Significant Wave by Locations



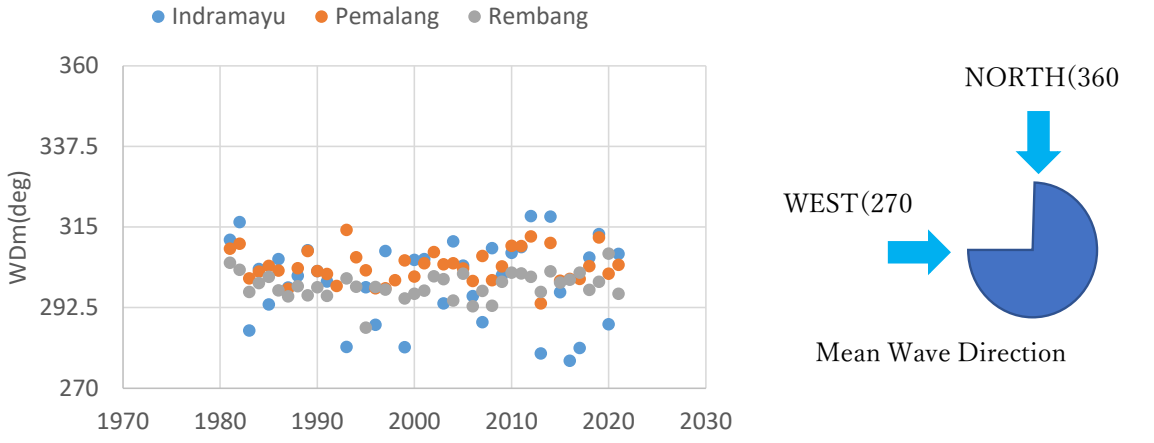
Source：JICA Study Team

Figure 10　History of Wave Direction of Maximum Wave



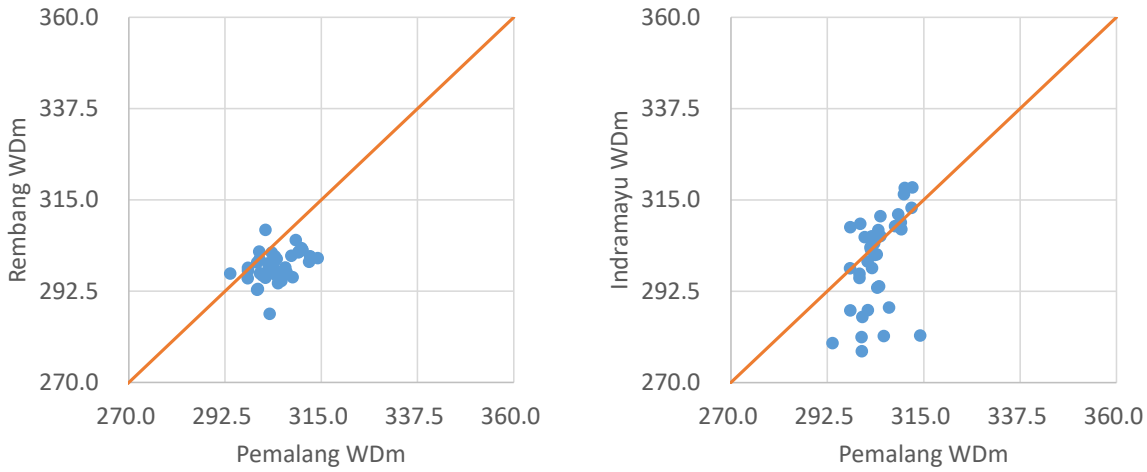
Source：JICA Study Team

Figure 11　Comparison of Wave Direction by Location



Source：JICA Study Team

Figure 12 History of Wave Directions of Annual Maximum Significant Wave



Source：JICA Study Team

Figure 13 Comparison of the Mean Wave Direction of the Annual Maximum Significant Waves

Table 2 Annual Top 10 Waves in Indramayu

	1981	Hmax(m)	T1/3(s)	H1/3(m)	α(deg)
1	1981/1/13 9:00	4.19	5.7	2.18	311
2	1981/2/3 9:00	3.02	4.8	1.56	296
3	1981/2/8 9:00	3.00	4.9	1.55	299
4	1981/11/16 13:00	2.66	4.5	1.38	283
5	1981/2/26 9:00	2.57	4.5	1.33	294
6	1981/1/27 10:00	2.48	4.6	1.29	309
7	1981/12/3 8:00	2.49	4.3	1.29	294
8	1981/3/1 5:00	2.28	4.5	1.19	311
9	1981/12/18 10:00	2.24	4.3	1.16	305
10	1981/12/24 20:00	2.15	4.5	1.13	311
	上位10波平均	2.71	4.7	1.41	301

	1982	Hmax(m)	T1/3(s)	H1/3(m)	α(deg)
1	1982/1/19 9:00	3.83	5.7	2.00	316
2	1982/2/14 9:00	3.25	5.1	1.68	302
3	1982/2/5 11:00	2.49	4.5	1.29	295
4	1982/1/27 9:00	2.49	4.5	1.29	305
5	1982/7/8 7:00	2.33	5.0	1.23	86
6	1982/6/30 4:00	2.26	4.6	1.18	92
7	1982/8/7 5:00	2.20	4.9	1.16	90
8	1982/7/4 6:00	2.06	5.0	1.09	87
9	1982/8/2 21:00	1.99	4.4	1.04	88
10	1982/7/31 11:00	1.95	4.7	1.03	78
	上位10波平均	2.49	4.8	1.30	174

	1983	Hmax(m)	T1/3(s)	H1/3(m)	α(deg)
1	1983/11/26 4:00	3.49	5.1	1.81	291
2	1983/12/28 6:00	2.33	4.5	1.22	299
3	1983/12/1 6:00	2.32	4.4	1.21	297
4	1983/8/30 9:00	2.11	4.5	1.11	82
5	1983/7/9 18:00	2.15	4.5	1.09	131
6	1983/1/3 10:00	2.08	4.5	1.09	314
7	1983/8/2 9:00	2.05	4.6	1.08	86
8	1983/8/21 22:00	1.96	4.6	1.03	88
9	1983/8/14 17:00	1.96	4.1	1.01	155
10	1983/6/13 4:00	1.89	4.4	0.99	90
	上位10波平均	2.23	4.5	1.16	183

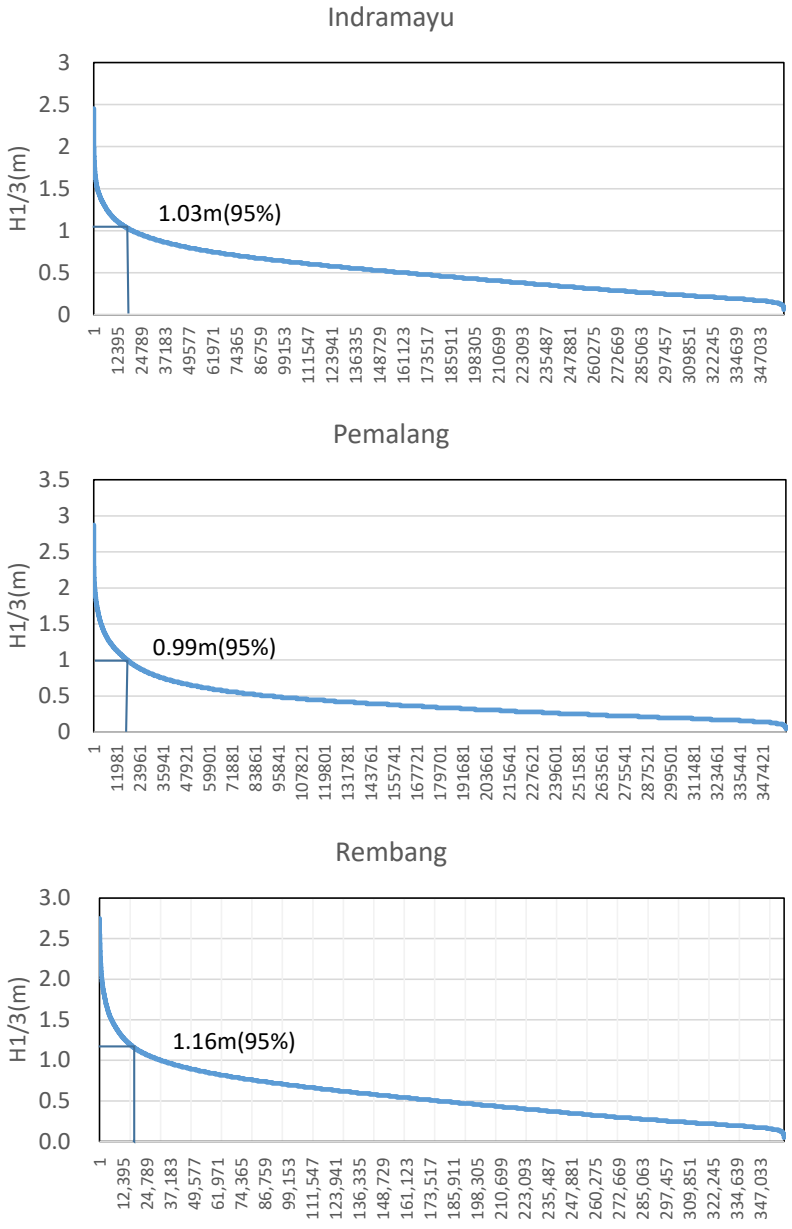
	1984	Hmax(m)	T1/3(s)	H1/3(m)	α(deg)
1	1984/1/4 8:00	3.42	5.1	1.76	303
2	1984/2/20 8:00	2.96	4.8	1.53	299
3	1984/12/11 5:00	2.84	4.6	1.46	283
4	1984/7/1 9:00	2.58	4.8	1.35	91
5	1984/12/28 10:00	2.45	4.5	1.27	291
6	1984/6/12 4:00	2.31	4.7	1.21	82
7	1984/11/27 10:00	2.30	4.5	1.20	290
8	1984/4/30 8:00	2.17	4.5	1.13	93
9	1984/3/5 0:00	2.18	4.2	1.13	291
10	1984/7/6 17:00	2.11	4.7	1.11	83
	上位10波平均	2.39	4.6	1.24	215

	1985	Hmax(m)	T1/3(s)	H1/3(m)	α(deg)
1	1985/2/21 9:00	2.84	4.7	1.47	293
2	1985/4/18 9:00	2.52	4.6	1.31	288
3	1985/12/27 9:00	2.32	4.6	1.21	308
4	1985/12/1 10:00	2.30	4.2	1.19	284
5	1985/3/2 8:00	2.27	4.2	1.17	298
6	1985/3/8 10:00	2.13	4.5	1.11	283
7	1985/7/19 9:00	2.08	4.8	1.10	84
8	1985/1/18 10:00	2.07	4.2	1.08	313
9	1985/8/23 9:00	1.80	4.3	0.95	86
10	1985/8/15 10:00	1.72	4.4	0.91	83
	上位10波平均	2.20	4.5	1.15	232

Source：JICA Study Team

The 95% frequency waves are shown below as wave characteristics. 95% frequency waves are obtained by arranging 40 years of estimated wave data in order from the highest to lowest wave heights and extracting the wave heights in the top 5% of the order. In other words, the wave heights below that level account for 95% of the frequency of occurrence. The wave heights are used for estimating the limit depth for littoral sediment movement. The wave heights are generally about 1 m at all three sites, although Rembang is a little higher.

- Indramayu: 1.03m
- Pemalang: 0.99m
- Rembang: 1.16m



Source：JICA Study Team

Figure 14 95% Frequency Wave Height

6.1.2 Extreme Value Statistical Analysis

The annual maximum significant waves was extracted at three points from the 41 years of data, and the extreme value statistical analysis was performed using those data. As shown before, the target area has seasonal waves from the east and west, and the probability wave set here is the design wave at each location. In addition, some locations are greatly affected by waves from both east and west directions, making it necessary to conduct extreme statistical analysis for waves from both directions.The analysis results are shown in Figure 15 to Figure 19. As the probability distribution function, the Weibull distribution (k = 2.0) was the most applicable. The period was obtained from the correlation between wave height and period shown in Figure 7 above. As for wave height, the probability wave height tends to increase from Indramayu to Rembang, similar to the trend of the maximum wave height in the year as shown previously. However, for Rembang, there is a tendency to deviate from the approximation function for wave heights of 20 years or more.

Table 3 Result of Extreme Value Statistical Analysis

① Indramayu

Return Period (year)	Indramayu					
	Wave angle <360		180<Wave angle <360		Wave angle <180	
	Wave Heights H1/3(m)	Wave Period Tm(s)	Wave Heights H1/3(m)	Wave Period Tm(s)	Wave Heights H1/3(m)	Wave Period Tm(s)
1	1.28	4.8	1.26	4.8	0.96	4.5
2	1.79	5.3	1.79	5.3	1.30	5.1
5	2.06	5.5	2.06	5.5	1.48	5.4
10	2.21	5.6	2.22	5.6	1.58	5.5
20	2.35	5.7	2.35	5.7	1.66	5.7
30	2.42	5.8	2.43	5.8	1.71	5.7
50	2.50	5.8	2.51	5.8	1.76	5.8
100	2.60	5.9	2.62	5.9	1.83	5.9

Source: JICA Study Team

② Pemalang

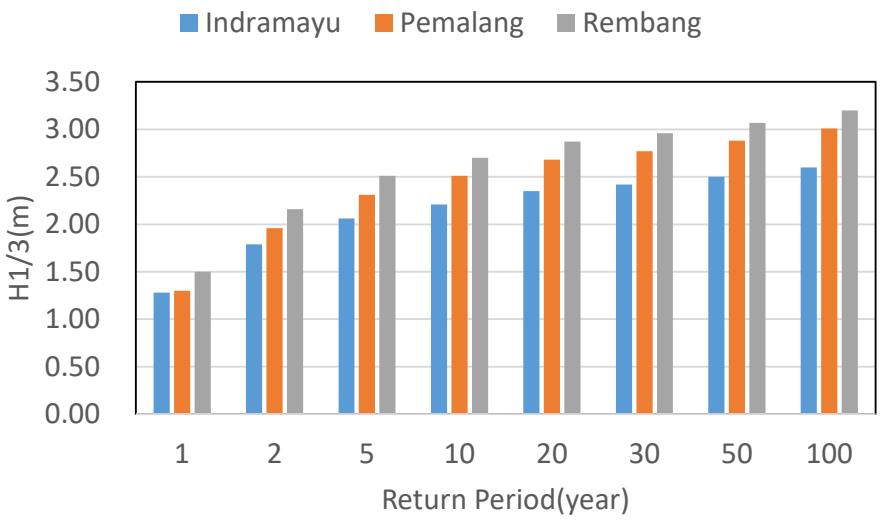
Return Period (year)	Pemalang			
	Wave angle <360		Wave angle <180	
	Wave Heights H1/3(m)	Wave Period Tm(s)	Wave Heights H1/3(m)	Wave Period Tm(s)
1	1.30	4.9	0.75	4.2
2	1.96	5.6	1.06	4.9
5	2.31	6.0	1.23	5.3
10	2.51	6.2	1.33	5.5
20	2.68	6.4	1.41	5.7
30	2.77	6.5	1.45	5.8
50	2.88	6.6	1.50	5.9
100	3.01	6.7	1.57	6.0

Source: JICA Study Team

③ Rembang

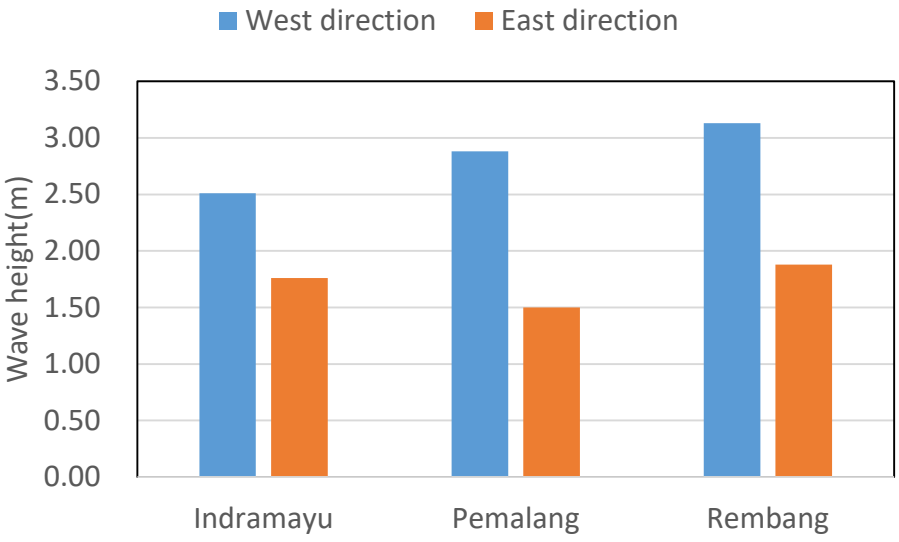
Return Period (year)	Rembang					
	Wave angle <360		180<Wave angle <360		Wave angle <180	
	Wave Heights H1/3(m)	Wave Period Tm(s)	Wave Heights H1/3(m)	Wave Period Tm(s)	Wave Heights H1/3(m)	Wave Period Tm(s)
1	1.50	5.1	1.41	5.0	1.19	4.9
2	2.16	5.8	2.13	5.7	1.39	5.2
5	2.51	6.1	2.51	6.1	1.55	5.5
10	2.70	6.3	2.73	6.3	1.66	5.6
20	2.87	6.5	2.91	6.5	1.76	5.8
30	2.96	6.6	3.01	6.6	1.81	5.9
50	3.07	6.7	3.13	6.7	1.88	6.0
100	3.20	6.8	3.28	6.9	1.96	6.1

Source: JICA Study Team



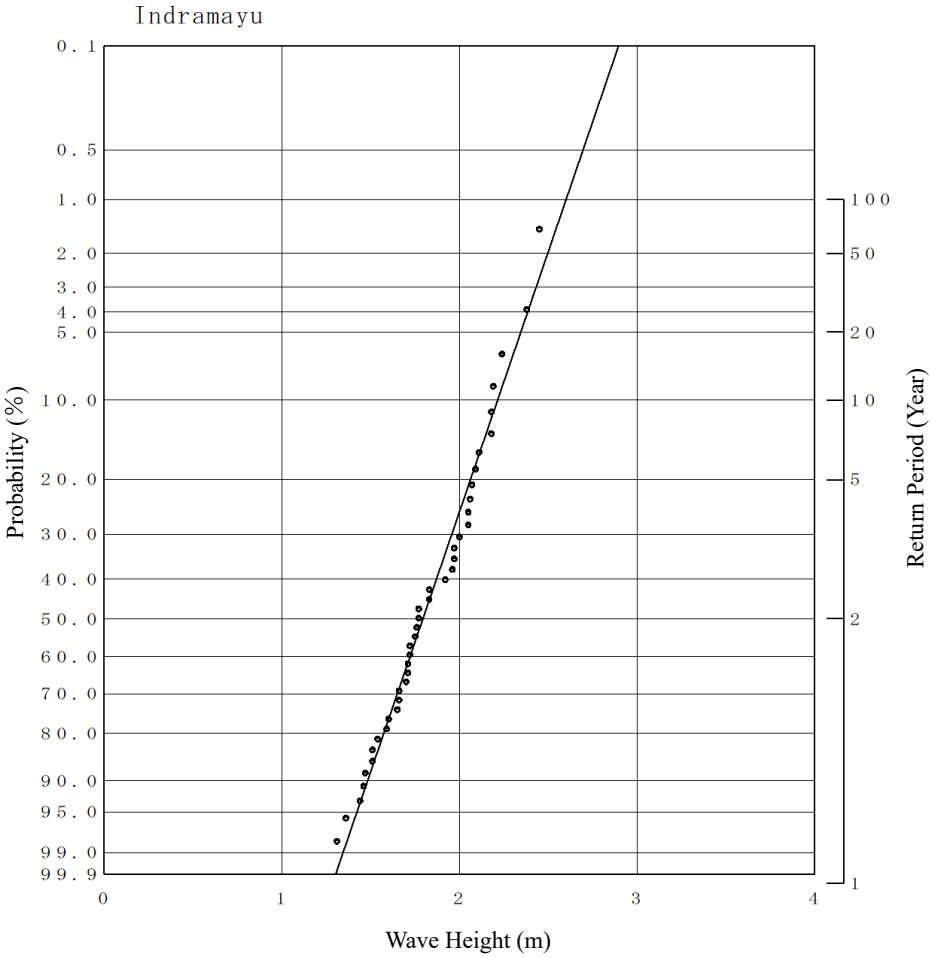
Source：JICA Study Team

Figure 15 Comparison of Probable Wave Height by Location (All directions)



Source：JICA Study Team

Figure 16 50-year Probability Wave Heights for Wave Direction by East-West

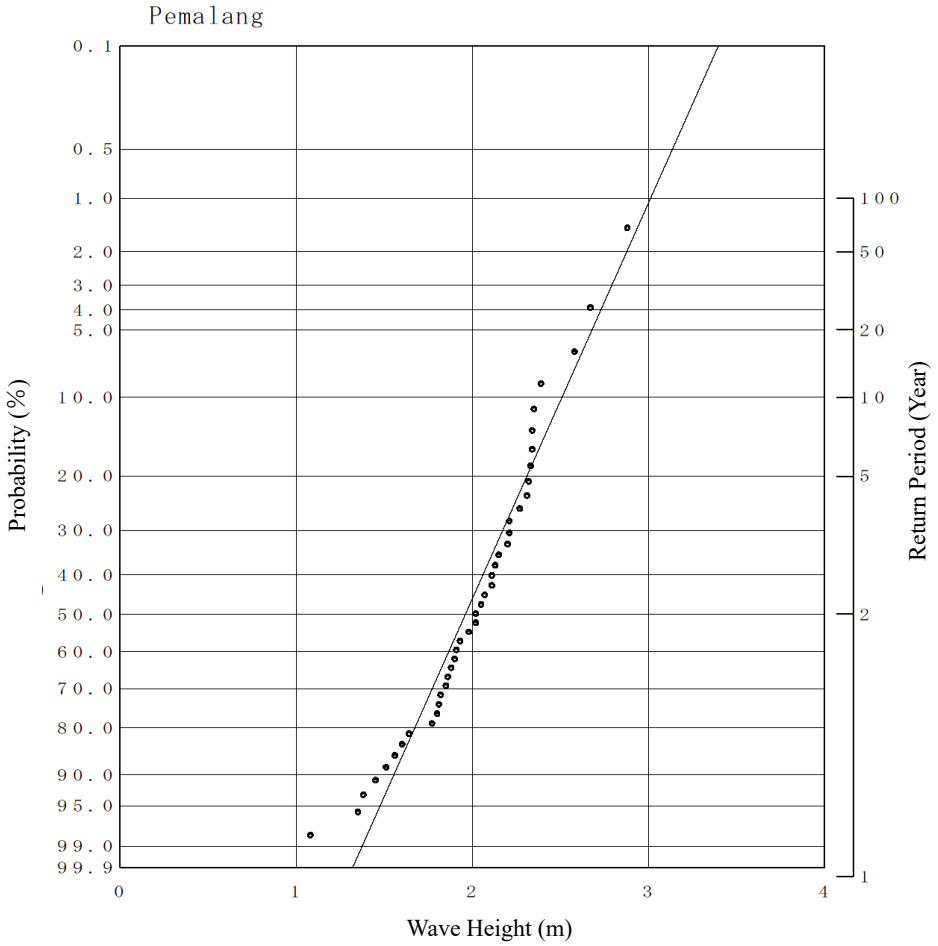


Number of data : 41(41 years)
Optimal function : Weibull func. (k=2.00)
Correlation Coef. : 0.991

Year	Wave height(m)
1	1.28
2	1.79
5	2.06
10	2.21
20	2.35
50	2.50
100	2.60

Source：JICA Study Team

Figure 17 Result of Extreme Value Statistical Analysis in Indramayu

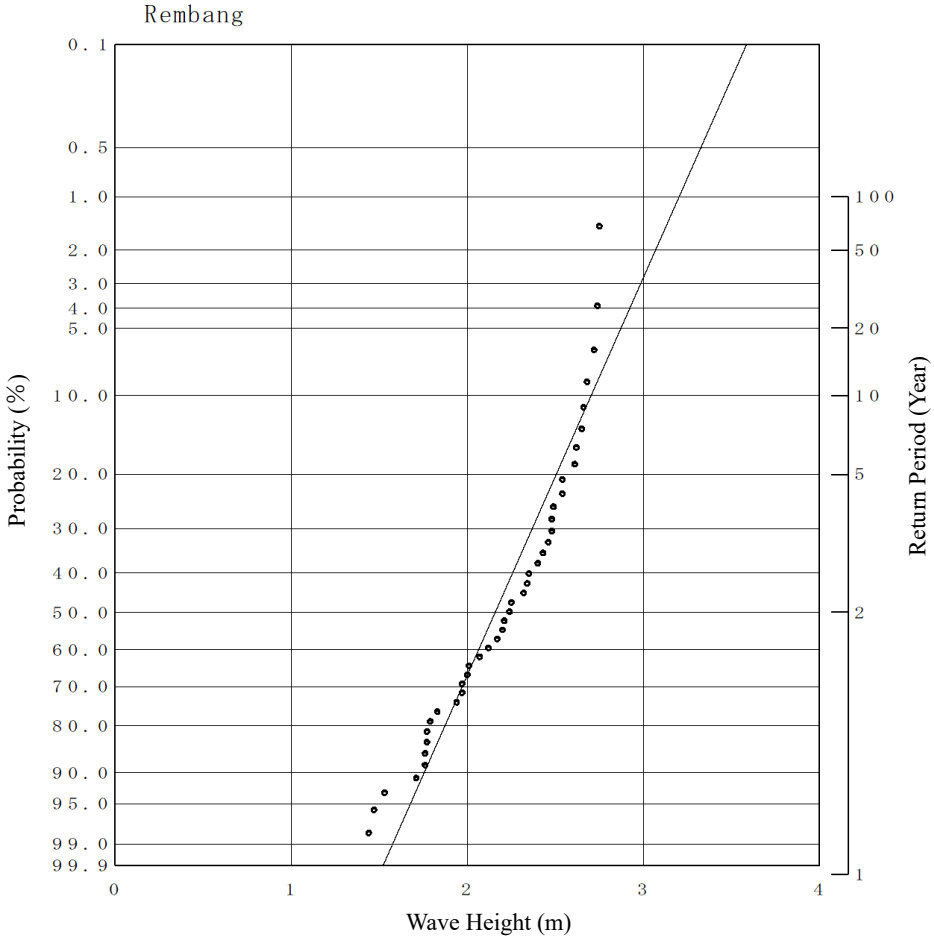


Number of data : 41(41 years)
Optimal function : Weibull func. (k=2.00)
Correlation Coef. : 0.973

Year	Wave height(m)
1	1.30
2	1.96
5	2.31
10	2.51
20	2.68
50	2.88
100	3.01

Source：JICA Study Team

Figure 18 Result of Extreme Value Statistical Analysis in Pemalang



Number of data : 41(41 years)
Optimal function : Weibull func. (k=2.00)
Correlation Coef. : 0.957

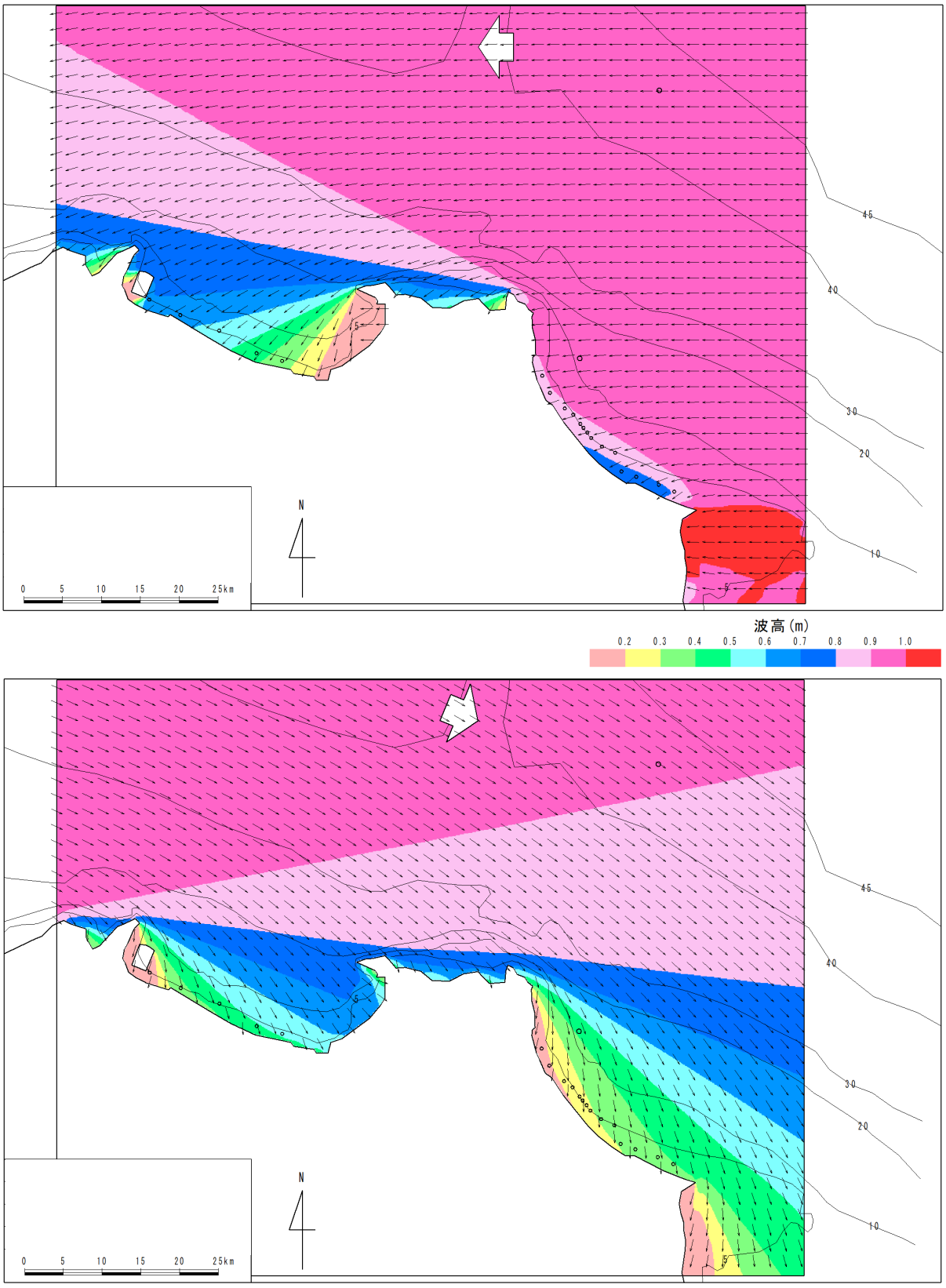
Year	Wave height(m)
1	1.50
2	2.16
5	2.51
10	2.70
20	2.87
50	3.07
100	3.20

Source：JICA Study Team

Figure 19 Result of Extreme Value Statistical Analysis in Rembang

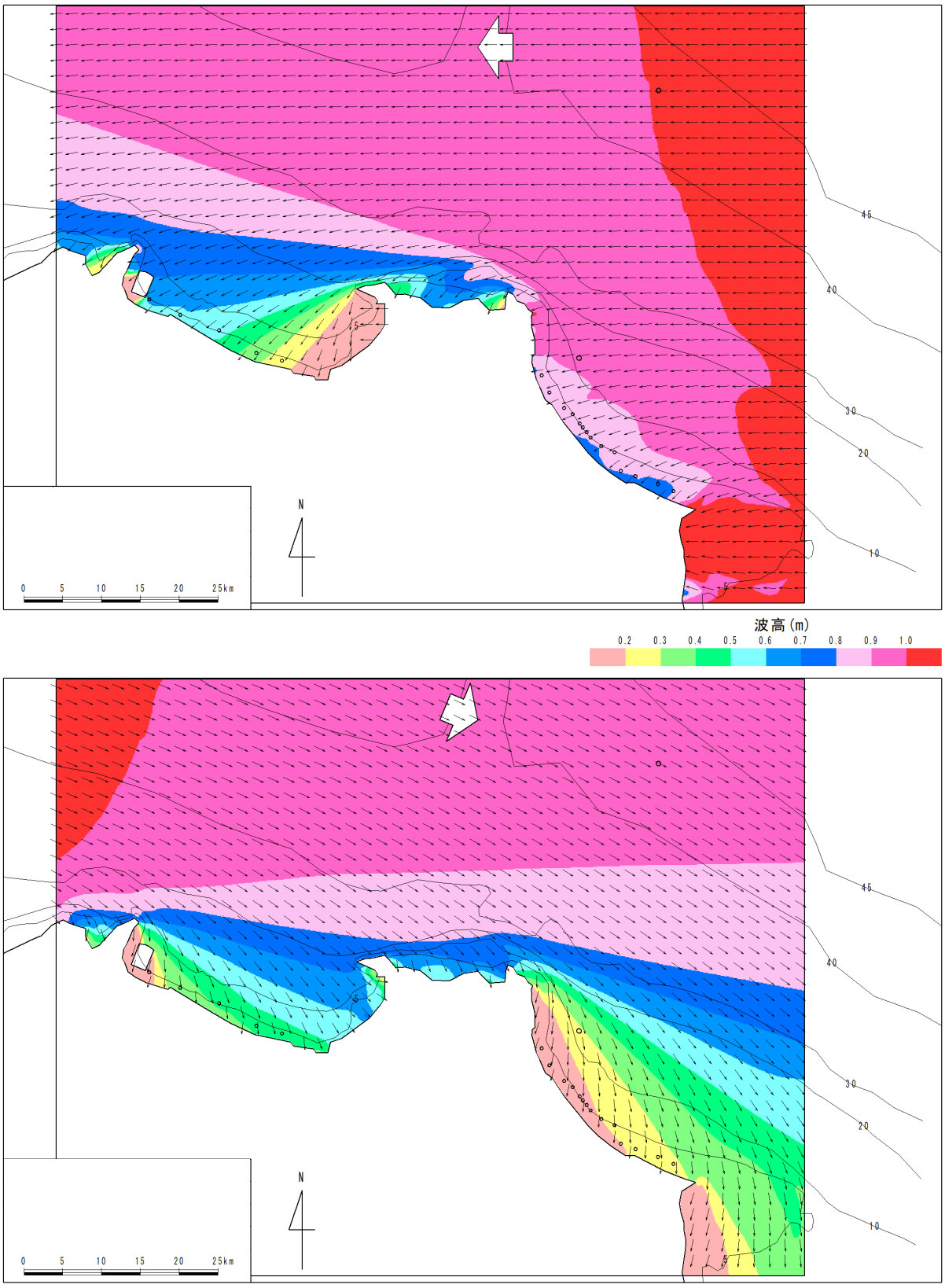
6.1.3 Coastal Wave Characteristics

The wave characteristics along the target coast were analyzed by wave deformation calculations. The analysis method is described below. The energy equilibrium equation was used as the wave deformation model. Incident wave directions were set for 16 directions from W to E as incident wave conditions. Two periods were set based on the estimation results: 3 s, which is close to the lower limit, and 6 s, which is close to the upper limit. The incident wave height was set to 1.0 m, which was necessary for the analysis of the wave height ratio. The parameter Smax, which represents the directional dispersion of the waves, was set to 25. The wave height ratio distributions calculated under these conditions are shown in Figure 20 through Figure 24 for wave directions from the two dominant directions along each coast with periods of 3s and 6s, respectively. From the calculation results, the wave height distribution for each coast is summarized as follows.



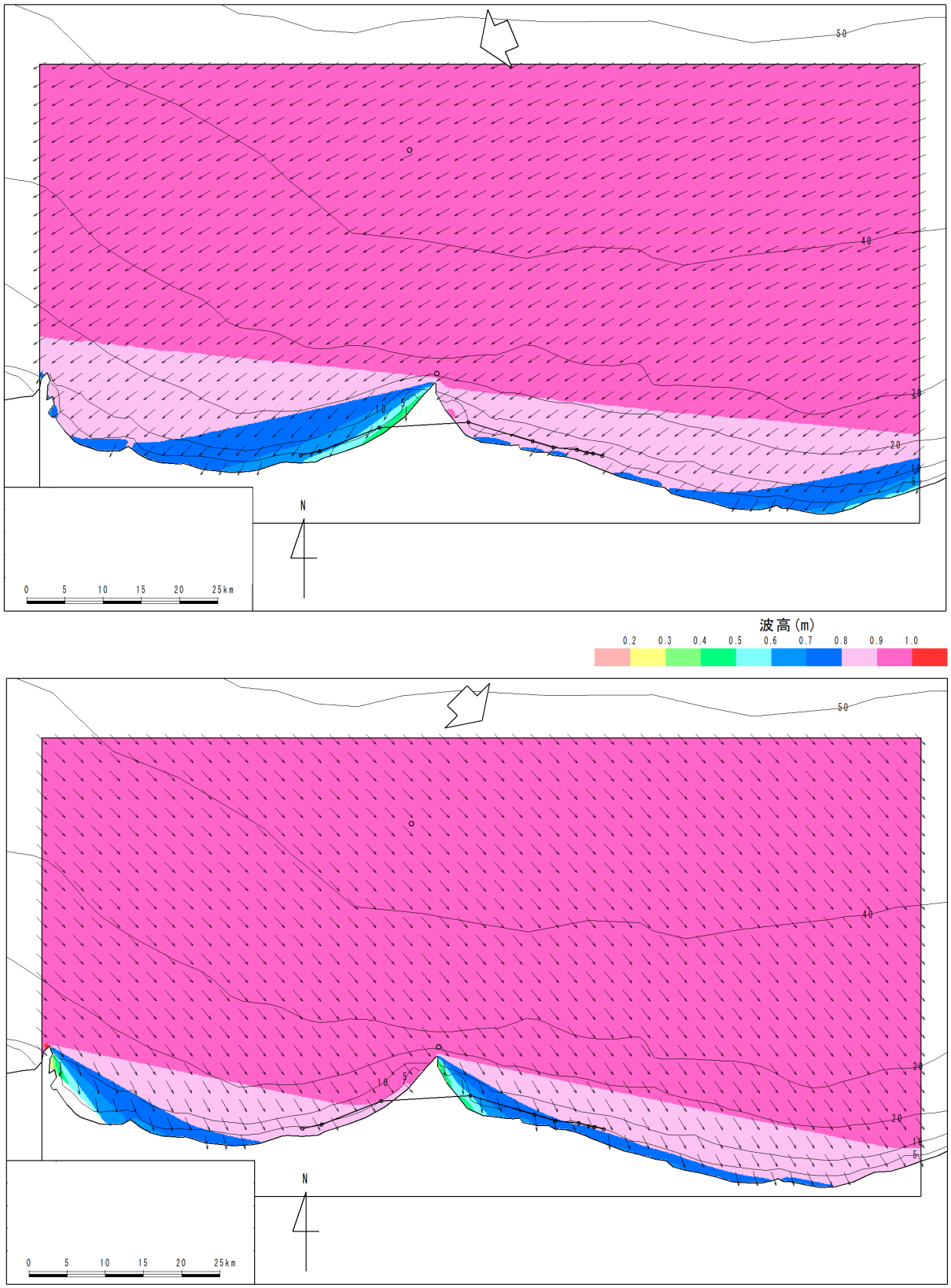
Source：JICA Study Team

Figure 20 Wave height distribution Indramayu T=3s (top: wave direction E, bottom: wave direction WNW)



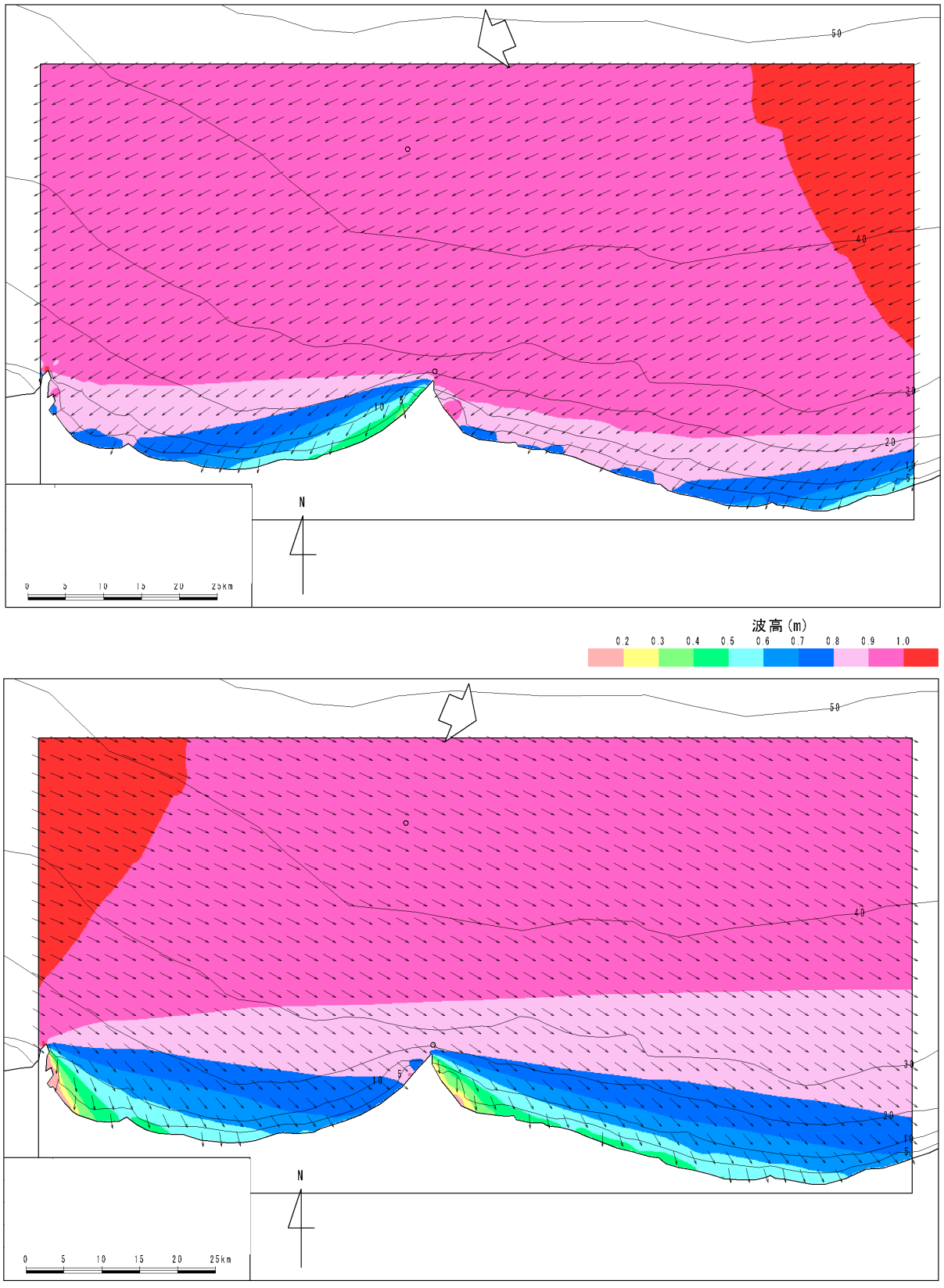
Source：JICA Study Team

Figure 21 Wave height distribution Indramayu T=6s (top: wave direction E, bottom: wave direction WNW)



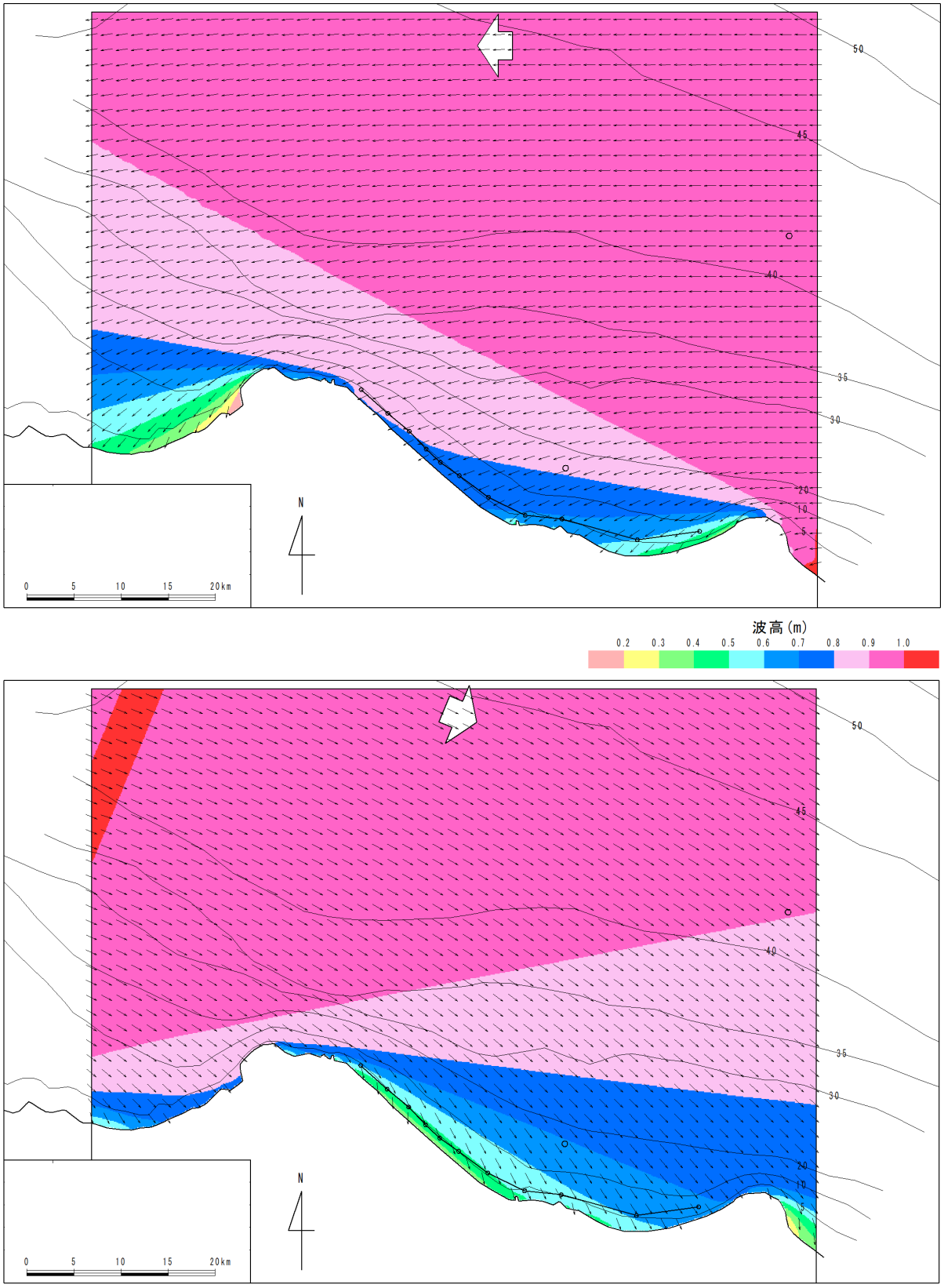
Source：JICA Study Team

Figure 22 Wave height distribution Pemalang T=3s (top: wave direction ENE, bottom: wave direction NW)



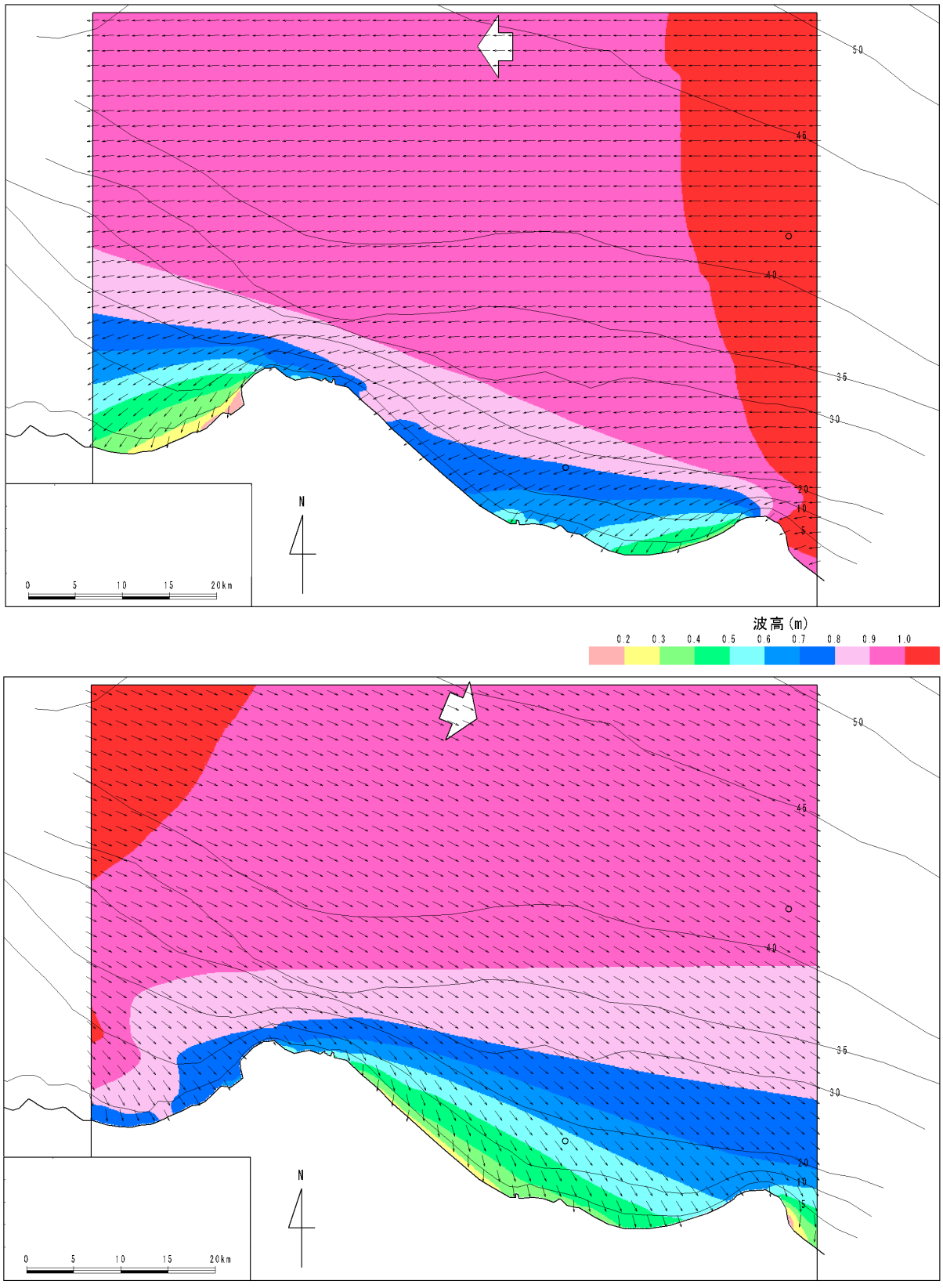
Source：JICA Study Team

Figure 23 Wave height distribution Pemalang T=6s (top: wave direction ENE, bottom: wave direction NW)



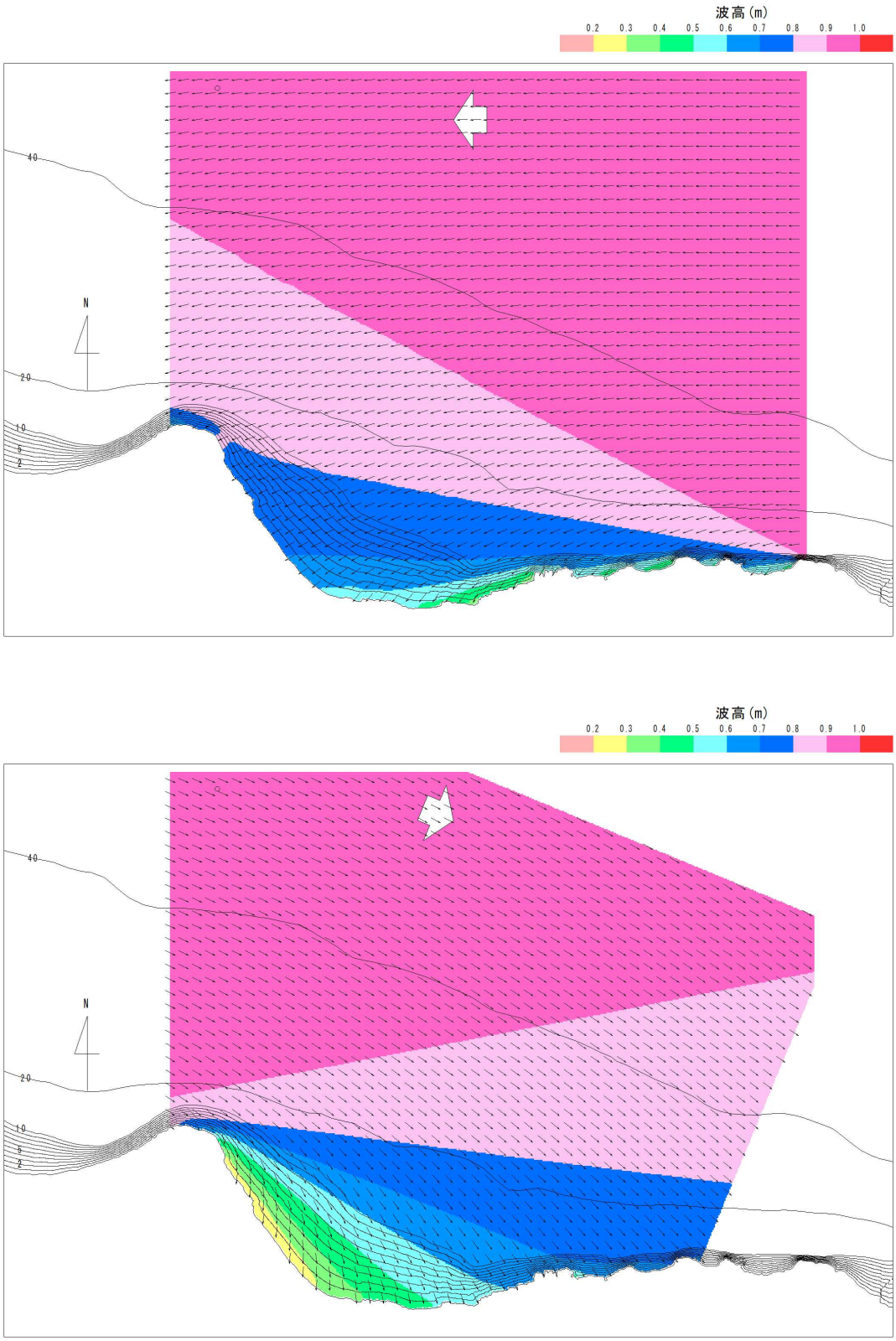
Source：JICA Study Team

Figure 24 Wave height distribution Rembang T=3s (top: wave direction E, bottom: wave direction WNW)



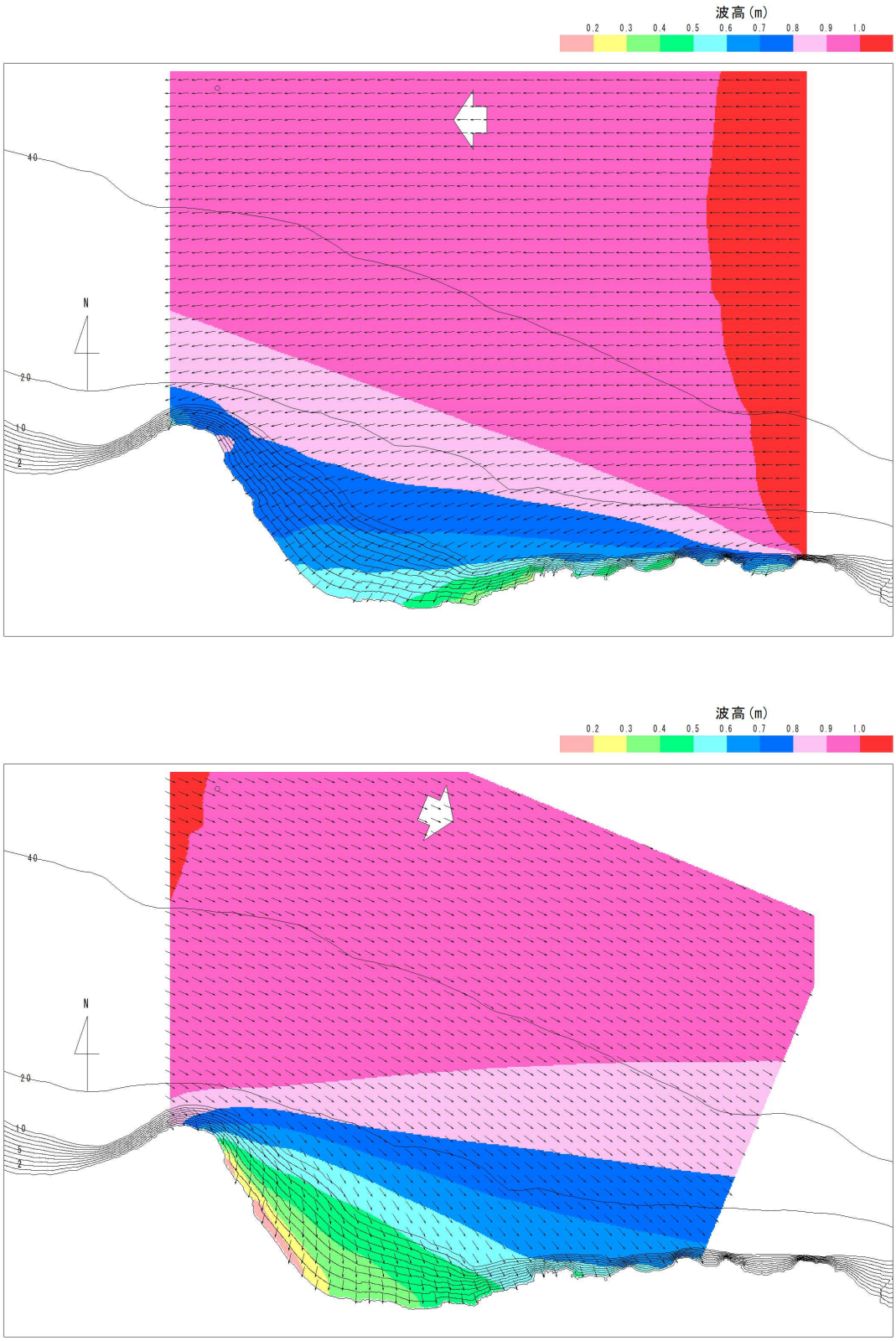
Source：JICA Study Team

Figure 25 Wave height distribution Rembang T=6s (top: wave direction E, bottom: wave direction WNW)



Source：JICA Study Team

Figure 26 Wave height distribution Tuban T=3s (top: wave direction E, bottom: wave direction WNW)



Source： JICA Study Team

Figure 27 Wave height distribution Tuban T=6s (top: wave direction E, bottom: wave direction WNW)

Source：Edited by JICA Study Team based on Google Earth

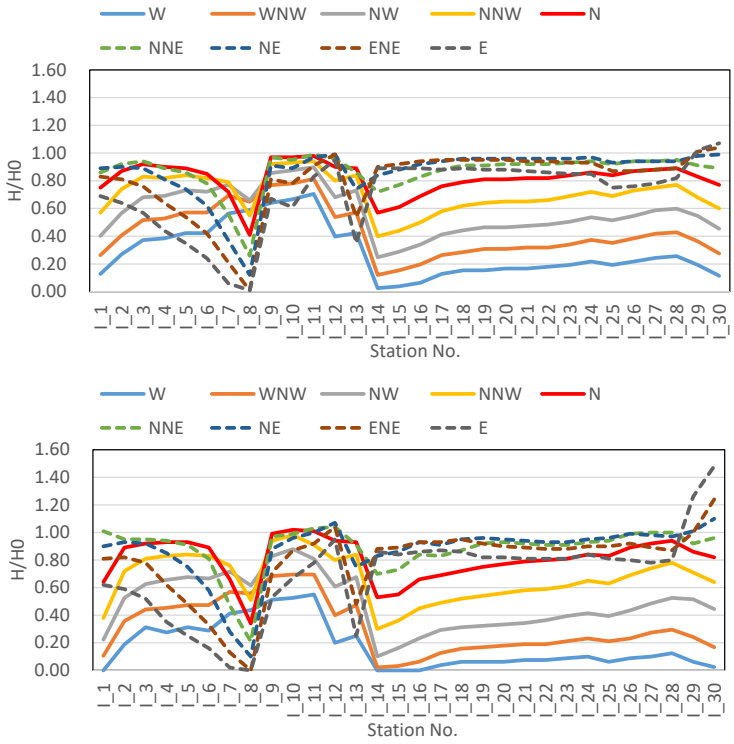
Figure 28　Wave Height Extraction Point in Indramayu

Source：Edited by JICA Study Team based on Google Earth

Figure 29　Wave Height Extraction Point in Pemalang-Pekalongan

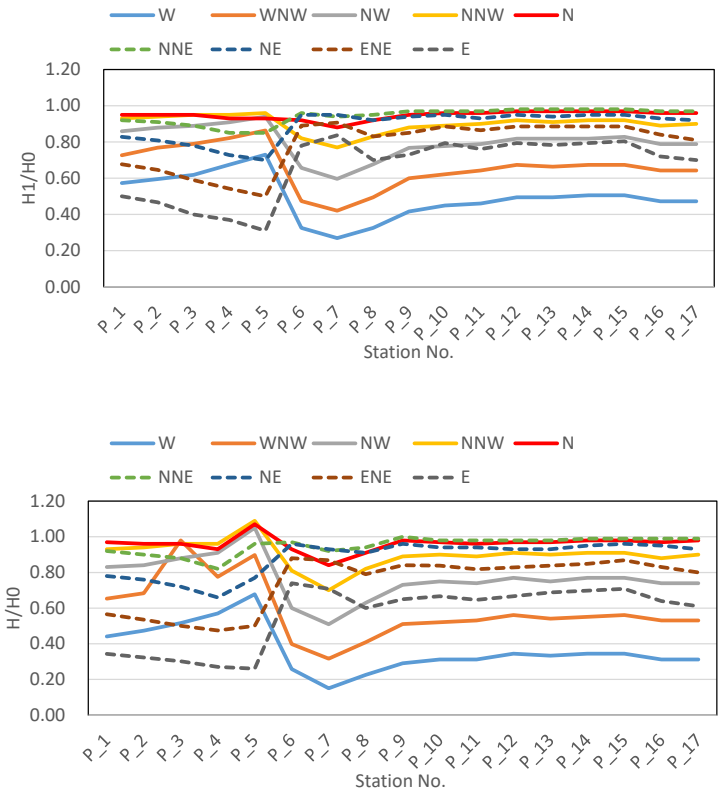
Source：Edited by JICA Study Team based on Google Earth

Figure 30 Wave Height Extraction Point in Rembang



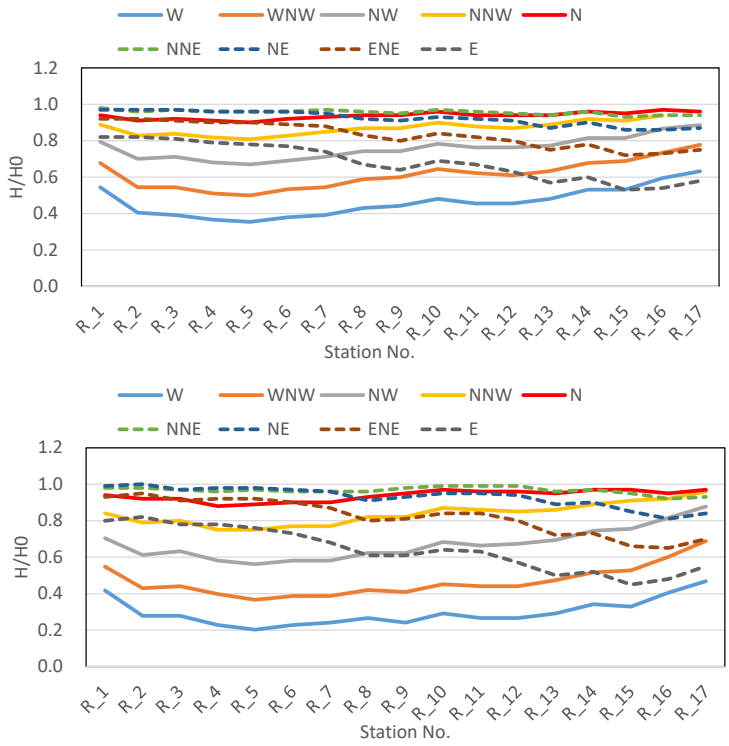
Source：JICA Study Team

Figure 31 Coastal distribution of wave heights in Indramayu (top: T=3 s, bottom: T=6 s)



Source：JICA Study Team

Figure 32　Coastal distribution of wave heights in Pemalang-Pekalongan (top: T=3 s, bottom: T=6 s)



Source：JICA Study Team

Figure 33　Coastal distribution of wave heights in Rembang-Tuban (top: T=3 s, bottom: T=6 s)

6.1.4 Equivalent Deepwater Wave Height

The equivalent deepwater waves were calculated as the external force to be used in the facility design based on the results of extreme value analysis under the estimated offshore waves in each area and the wave height distribution in the coastal direction obtained under the wave deformation calculations. The waves used in the analysis were 50-year probability waves. Table 4 shows the equivalent deepwater wave heights at representative stations along each coast (see Figure 26, Figure 27, and Figure 28 for station numbers). The period was obtained from the correlation of annual maximum wave height and period (Figure 7) and was 5.8 s for Indramayu, 6.6 s for Pemalang-Pekalongan, and 6.7 s for Rembang-Tuban, respectively.

Table 4 Equivalent deepwater wave heights in coastal areas

Area	Staion No.	H0'(m)	H0'_d(m)
Indramayu	Z1-S1	1.09	1.1
	Z1-S2	1.32	1.4
	Z2-S1	1.57	1.6
	Z2-S2	1.65	1.7
	Z2-S3	1.70	
	Z4-S1	1.51	1.6
	Z4-S2	1.48	1.5
	Z4-S3	1.51	1.6
	Z5	1.53	
	Z6-S1	1.51	
	Z6-S2	1.44	1.5
	Z6-S3	1.44	
	Z6-S4	1.43	
	Z6-S5	1.43	
	Z6-S6	1.43	
	Z6-S7	1.48	
	Z7-S1	1.43	
	Z7-S2	1.41	
	Z7-S3	1.37	1.4
	Z7-S4	1.41	1.5
Pemalang-Pekalongan	Z1-S1	2.39	2.4
	Z1-S2	2.42	2.5
	Z2-WEST	2.62	2.7
	Z2-EAST	1.47	1.5
	Z3-S1	2.16	2.2
	Z3-S2	2.13	
	Z3-S3	2.22	2.3
	Z3-S4	2.16	2.2
	Z3-S5	2.22	2.3
	Z3-S6	2.22	
Rembang-Tuban	Z1-S1	2.20	2.2
	Z1-S2	1.92	2.0
	Z1-S3	1.98	
	Z1-S4	1.82	1.9
	Z1-S5	1.76	1.8
	Z1-S6	1.82	1.9
	Z1-S7	1.82	
	Z2-S1	1.95	2.0
	Z2-S2	2.14	2.2
	Z3-WEST	2.33	2.4
	Z3-EAST	2.56	2.6

Note) Ho'_d is the value rounded up to the nearest 10 cm from Ho' at adjacent points.

Source: JICA Study Team

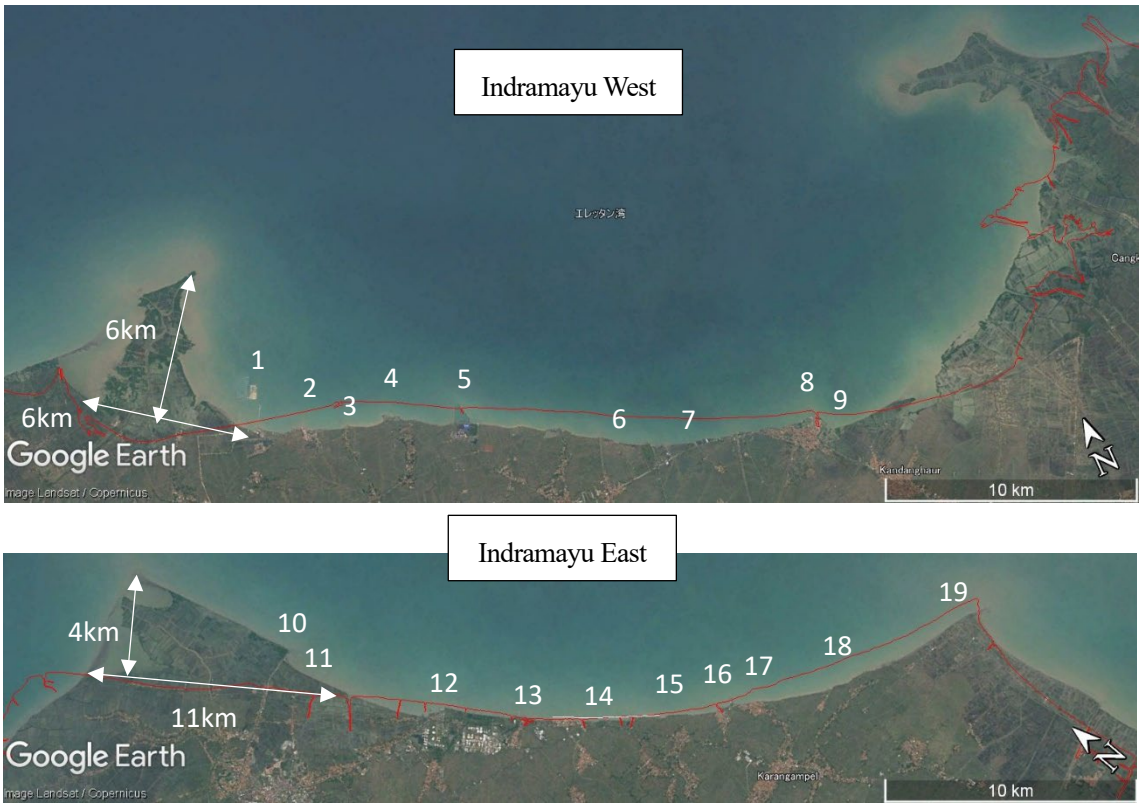
6.2 Long-term Topographic Change

We compared the 1938 surveyed topographic map (Tohoku University Library Gaiho-zu Digital Archive) with the current topography (Google Earth) and summarized the changes in shoreline profiles.

6.2.1 Indramayu

On the west side, there is a shoreline retreat of up to about 1 km, while on the east side, there is a shoreline advance of up to about 1.5 km. On the east side, however, a maximum shoreline retreat of about 1 km is observed near the spit topography. As a feature of the overall topographic change, an estuarine delta, which did not exist in 1938, has developed at the western end of Erettan Bay. The area of this landform is about 1.8 x 10^7 m^2. On the other hand, the shoreline is uniformly receding at the bottom of the bay, with an average value of about 700 m. Multiplied by the length of the bay (23 km), the erosion area is approximately 1.61 × 10^7 m^2, which is almost the same as the area of the estuarine delta. However, since the sedimentation area of the estuary delta is estimated to be caused by sediment discharged from the mouth of the river, it is unlikely that the sediment in the eroded area moved toward the estuary delta.

On the other hand, its eastern side also has a large overhang at its western end, with an area of about 2.2 x 10^7 m2. On the other hand, the eastern end of the site, 17-18 (about 5 km), shows an average of about 580 m, and 18-19 (about 650 m) shows a shoreline recession of about 650 m. The erosion area is about 6×10^6 m2 . The erosion area is approximately 6 x 10^6 m2. For reference, in Cirebon, which extends from the easternmost spit to the south, an average of about 1 km of shoreline advance is observed in a section of about 16 km, with a depositional area of about 1.6×10^7 m2.

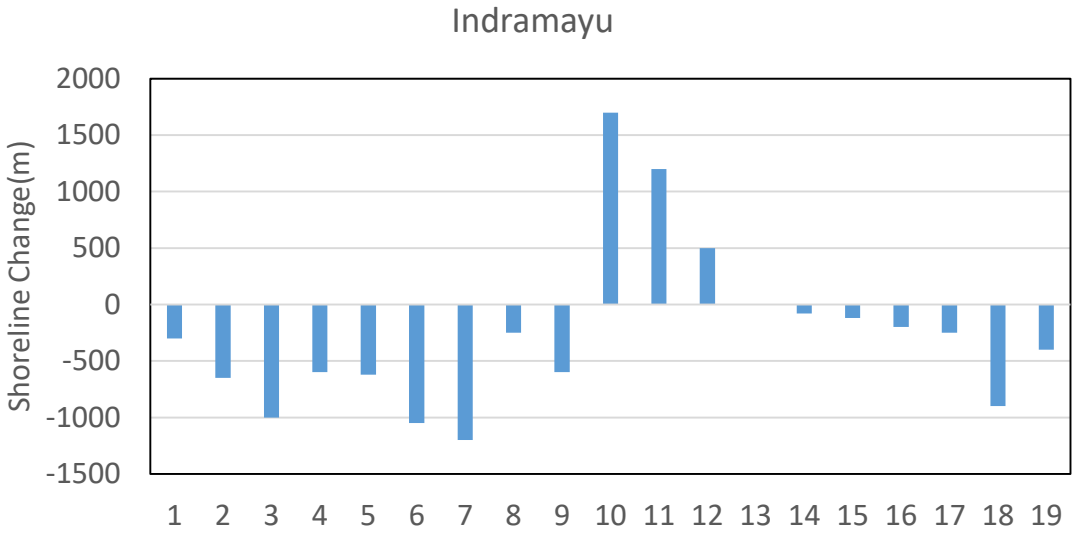


Source: Edited by JICA Study Team based on Google Earth

Figure 34 Shoreline position of Indramayu coast in 1938 (red line)

Source：Edited by JICA Study Team based on Google Earth

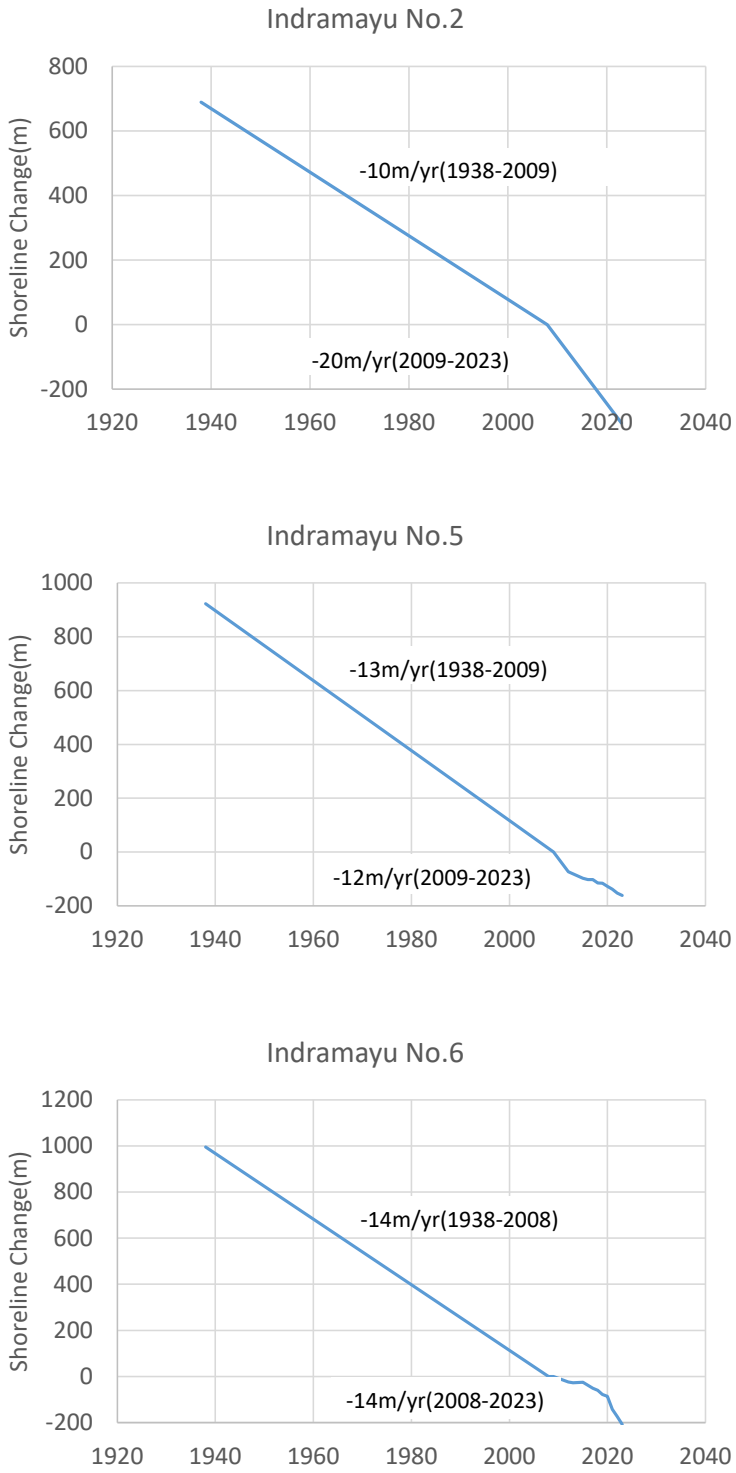
Figure 35 Shoreline location of Cirebon coast in 1938



Source：JICA Study Team

Figure 36 Shoreline change in Indramayu during 1938-2023

The rates of recession for sites No. 2, 5, and 6 in the heavily eroded Indramayu West and site No. 18 in the Indramayu East, shown above, from 1938 to 2009 and since then, show that the erosion rate was about 10 m to 14 m/year from 1938 to 2009, and has been receding at the same rate since then.

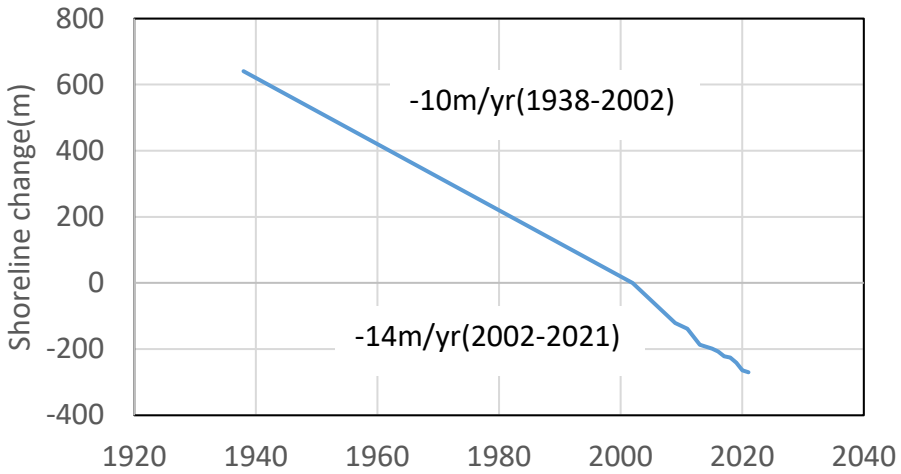


Source：JICA Study Team

Figure 37 Long-term Shoreline Change Rate in Indramayu West

Source: Edited by JICA Study Team based on Google Earth

Figure 38 Topographic change around offshore breakwaters in Indramayu East



Source：JICA Study Team

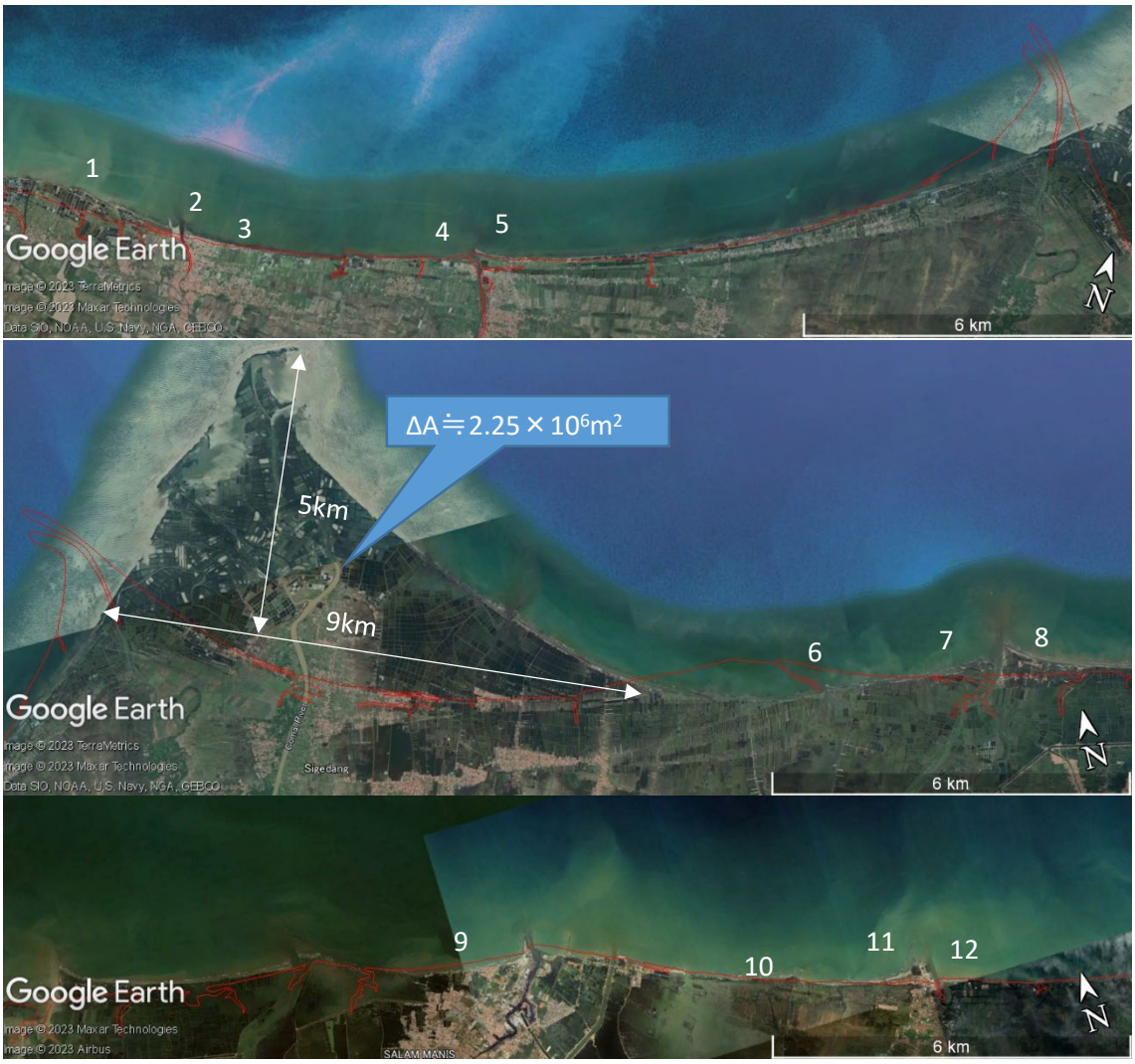
Figure 39 Long-term Shoreline Change Rate in Indramayu East

6.2.2 Pemalang-Pekalongan

In Pemalang, a protruding topography has developed due to sediment discharge from the river. Its tip was located more westward in 1938, but has since moved eastward over the past approximately 85 years. Approximately 2.25 million m^2 of land has been added to the east; the west side of Pemalang has moved forward about 300 m at Point 1, but the shoreline position remained almost unchanged in the subject area. At Site 5, where there is a large jetty, the shoreline has moved forward about 50 m due to the jetty, but at Site 4, which is estimated to be underlain by littoral drift, the shoreline has hardly changed at all.

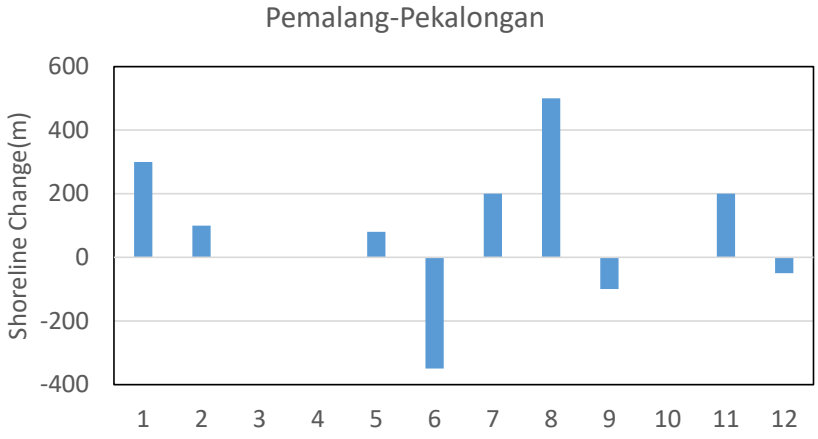
On the east side of Pemalang, the shoreline has moved forward significantly, but at points 7 and 8, the shoreline position is almost the same as the current shoreline position. However, on the east side of the Jetty, the shoreline advances about 500 m, while on the west side it advances 200 m. The difference in the amount of advance between the two shows a step differential profile. Despite these changes, it is presumed that the area around points 7 and 8 is a convergence point (where coastal sediment balance is maintained), which changes depending on the amount of sediment discharged from the river.

At Pekalongan, the shoreline recedes by about 100 m at location 9, where the urban area extends behind it, but less significant shoreline changes occur further to the east, with a shoreline advance of about 200 m at location 11 on the area boundary and a shoreline recession of about 50 m at location 12 to the east.



Source：Edited by JICA Study Team based on Google Earth

Figure 40 Shoreline position of Pemalang-Pekalongan coastline in 1938 (red line)



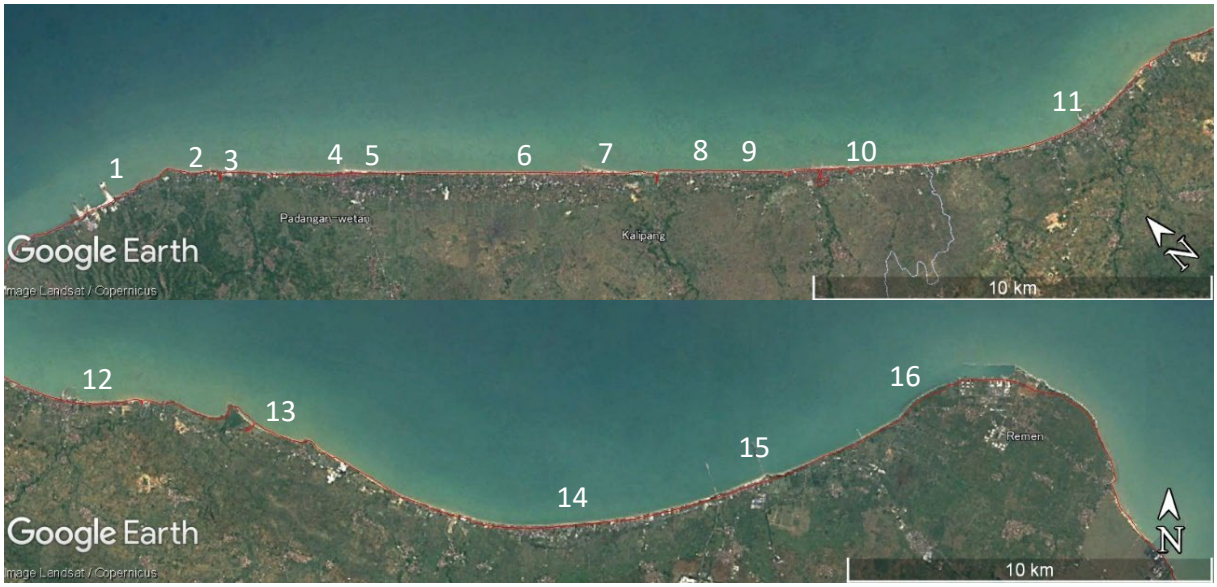
Source：JICA Study Team

Figure 41 Shoreline change in Pemalang-Pekalongan during 1938-2023

6.2.3 Rembang-Tuban

At Rembang, most of the shoreline has advanced 100 to 150 m, except for a few sites. Point 6, which is retreating, now has a group of jetties. Point 8 is on the west side of the offshore breakwater. At Point 6, the eastern side of the large jetty (Point 7) has moved forward by approximately 150 m. This is presumably due to the westward longshore drift sand being blocked by this large-scale jetty and the westward longshore drift sand being trapped by the offshore breakwater at Point 8.

For the area east of Point 12 (Tuban), the shoreline is mostly unchanged or advancing, with no significant shoreline recession.



Source: Edited by JICA Study Team based on Google Earth

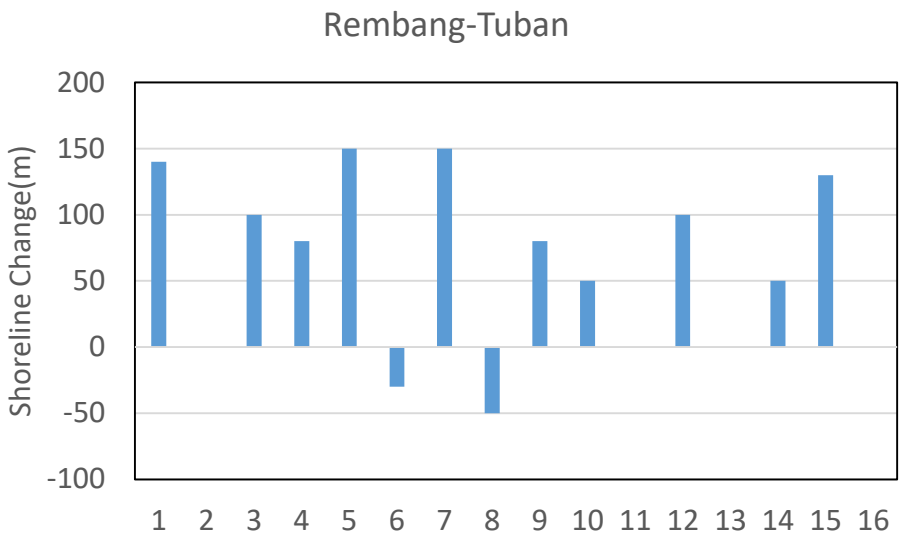
Figure 42 Rembang-Tuban shoreline location in 1938 (red line)

Source: Edited by JICA Study Team based on Google Earth

Figure 43 Shoreline position in 1938 around Jetty and groins in Rembang (red line)

Source：Edited by JICA Study Team based on Google Earth

Figure 44 Shoreline position around offshore breakwaters in 1938 (red line)



Source：JICA Study Team

Figure 45 Shoreline change in Rembang-Tuban during 1938-2023

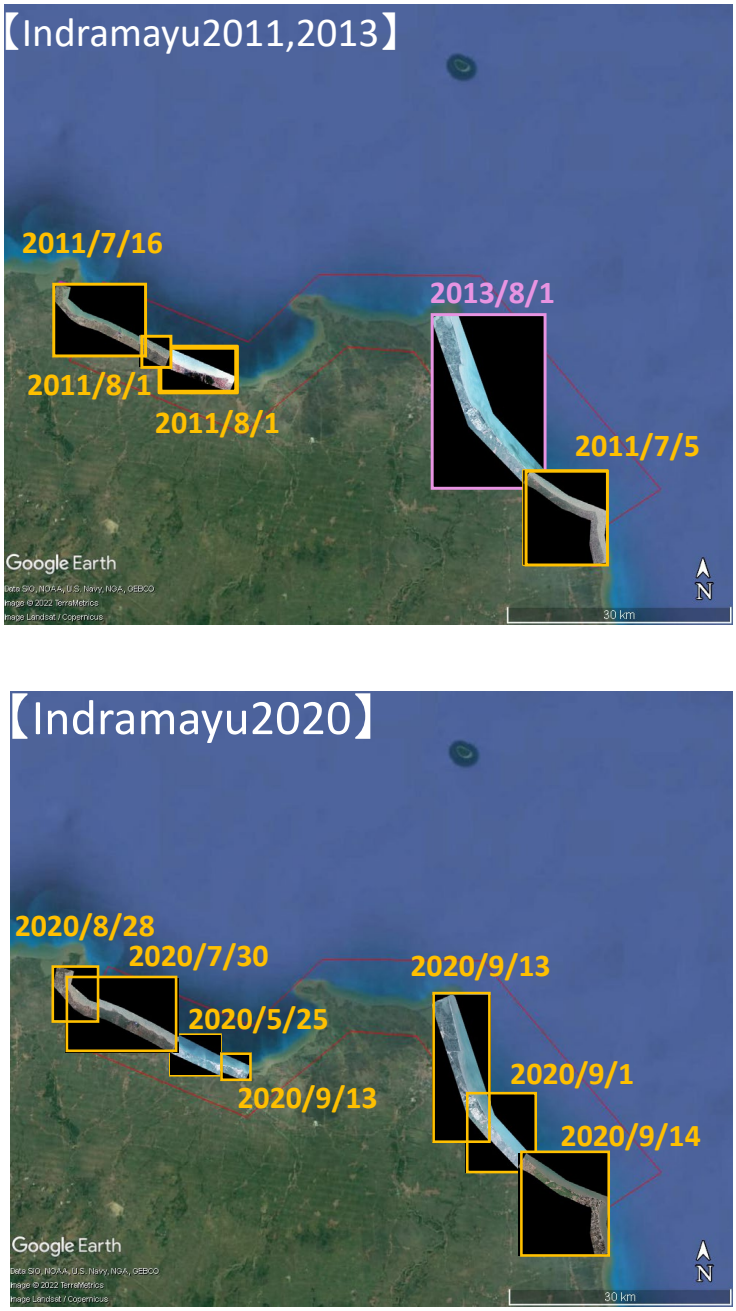
6.3 Recent Morphological Change Characteristics

Recent shoreline changes were analyzed using shoreline position read from satellite images. Table 5 and Figure 44 to Figure 46 show the satellite image data used in the analysis. Satellite images taken in the past 20 years were collected. In addition, the entire target area was selected to be taken at the same time as much as possible. Older images were collected around 2002, the most recent around 2022, and images from the intermediate time around 2013. In cases where the shoreline location could not be confirmed, images taken in the around time were used. For Indramayu, the two times were chosen because images around 2002 were not available.

Table 5 Satellite Image Used for Analysis

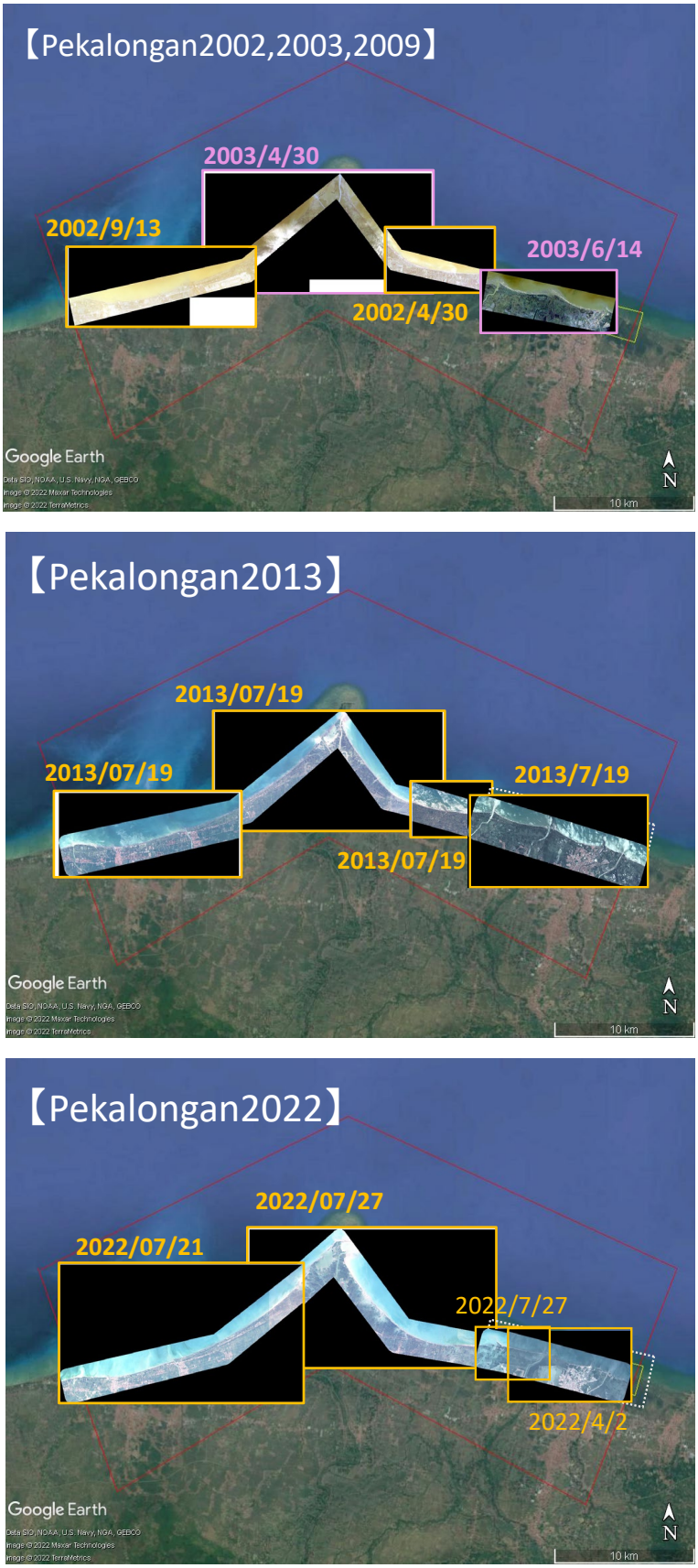
Time	Year	Indramayu	Pemalang-Pekalongan	Rembang-Tuban
First	2002	-	Center (April, September)	-
	2003	-	Center (April), East (June)	-
	2008	-	-	Center (April, May) West (May, July)
	2009	-	-	Center (July)
Second	2011	West end (July) West (August) East end (July)	-	-
	2013	East (August)	Center and East (July)	Center (July, September) West (July)
Third	2020	West end (August) West (May, September) East and East end (September)	-	-
	2022	-	Center (July) East (April, July)	Center (June, August) West (June)

Source: JICA Study Team



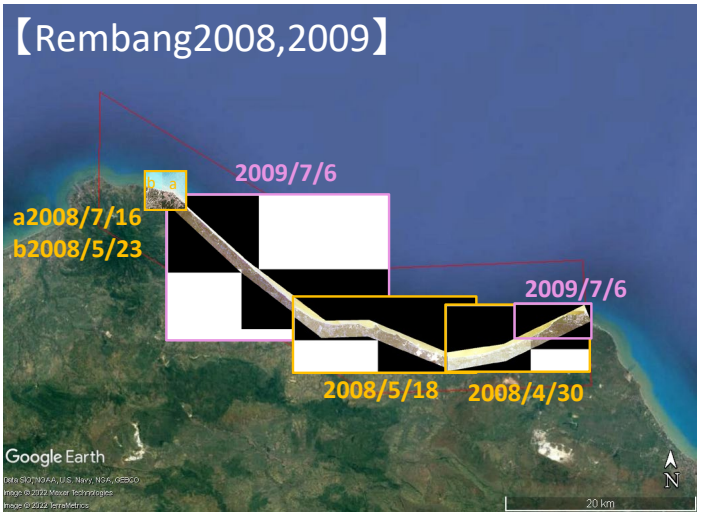
Source: Edited by JICA Study Team based on Google Earth

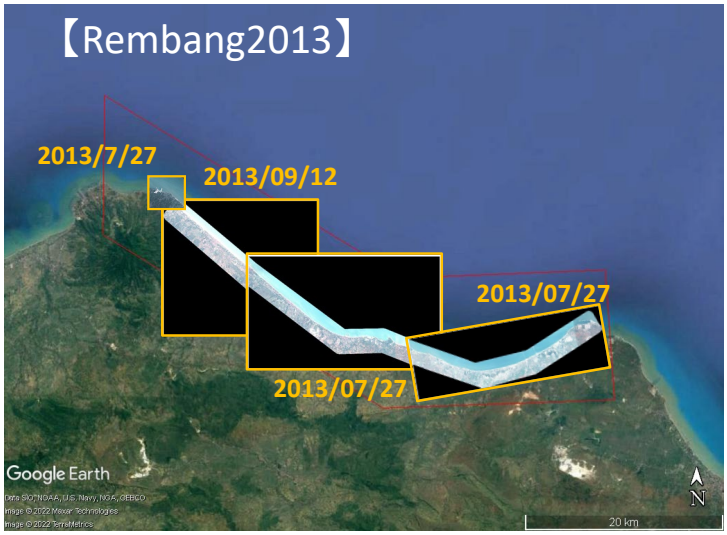
Figure 46 Indramayu Satellite Image Analysis Coverage (Top: 2011 and 2013, Bottom: 2020)

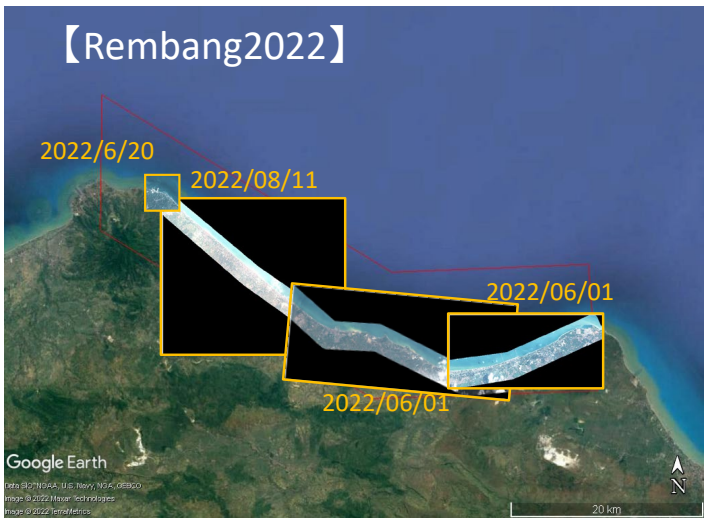


Source: Edited by JICA Study Team based on Google Earth

Figure 47 Pemalang-Pekalongan Satellite Image Analysis Coverage (Top: 2002, Middle: 2013, Bottom: 2020)





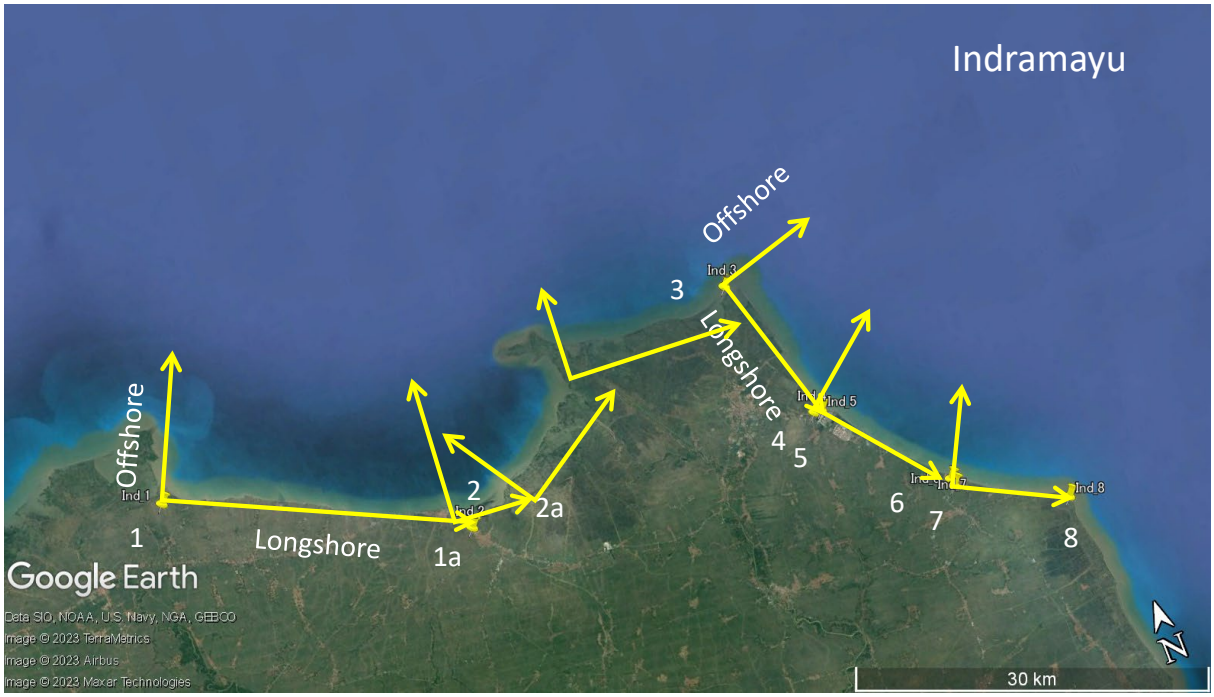


Source：Edited by JICA Study Team based on Google Earth

Figure 48 Rembang-Tuban Satellite Image Analysis Coverage (Top: 2008, Middle: 2013, Bottom: 2022)

6.3.1 Indramayu

Shoreline changes were summarized by dividing the area into seven zones under the baseline shown in Figure 47.



Source: Edited by JICA Study Team based on Google Earth

Figure 49 Coordinate system for measuring the location of coastline in Indramayu

Shoreline changes over a period of about 10 years from 2011 to 2020 show the following characteristics by site.

■ Western part of West Indramayu (Figure 48)

➢ Shoreline advance near Patimban Harbor, presumed to be caused by sediment transport into the shield area of the harbor breakwater.

➢ Significant shoreline recession west of Fish Pond, presumed to be caused by the westward littoral drift of sand blocked by the protruding Fish Pond and by the discharge of silt and clay by wave action

➢ Shoreline recession over a wide area, where rubble dikes were not installed, or where rubble mound breakwater had subsided or disappeared, were presumed responsible for the discharge of land sediment into the sea.

➢ No significant shoreline change is observed because of the installation of the seawall and the absence of sandy beach in front of the seawall.

■ Eastern part of West Indramayu (Figure 49)

➢ Shoreline recession is notable on the right bank of the west end of the training wall at the river mouth, and a sand spit has developed in the eastward direction due to the eastward longshore drift.

➢ Shoreline advances to the location where mangrove forests have been planted by Hybrid Engineering, and retreats slightly in other areas.

■ Center of Indramayu (Figure 50)

Although there are some areas that have been inundated due to shoreline breaches, overall the shoreline is advancing.

■ Western part of East Indramayu (Figure 51)

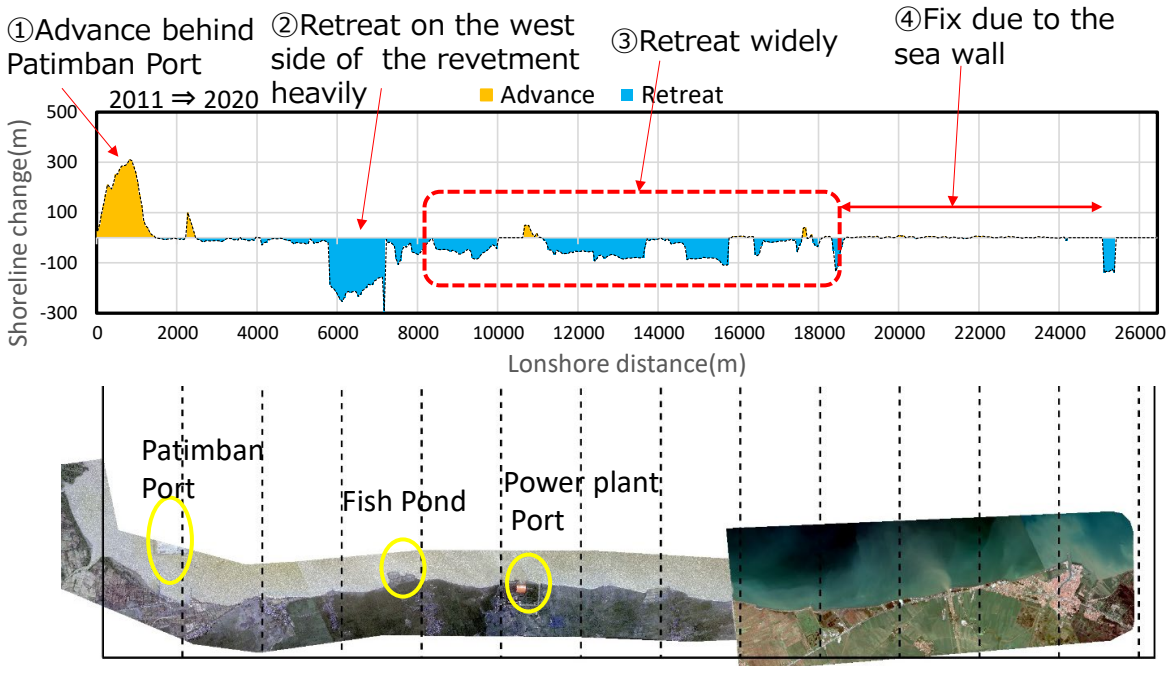
- Shoreline retreats on the left bank of the training wall at the river mouth.
- Shoreline is relatively stable between the right bank of the training wall at the river mouth and the harbor facilities.

■ Center of East Indramayu (Figure 52)

Shoreline change is small and stable

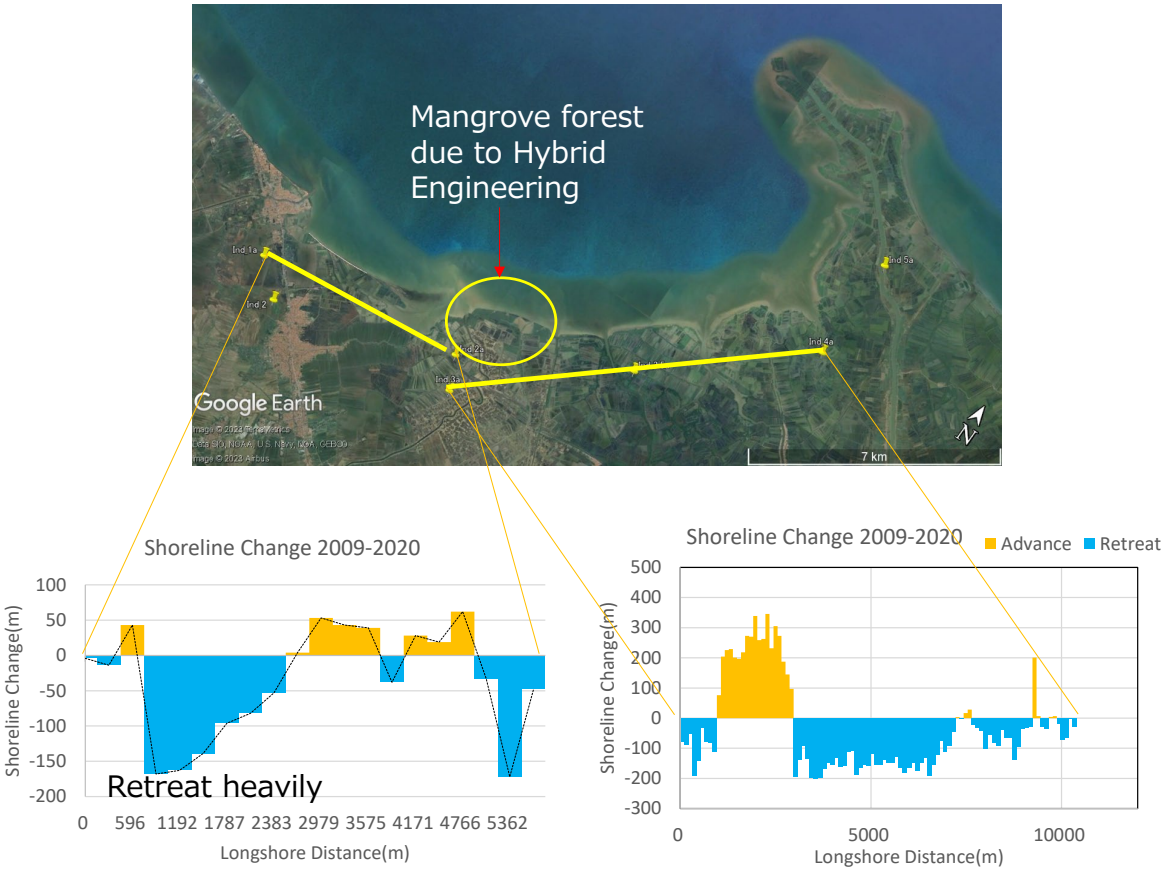
■ Eastern part of East Indramayu (Figure 53)

- Significant shoreline retreat on the west side
- Stable near the spit on the east side



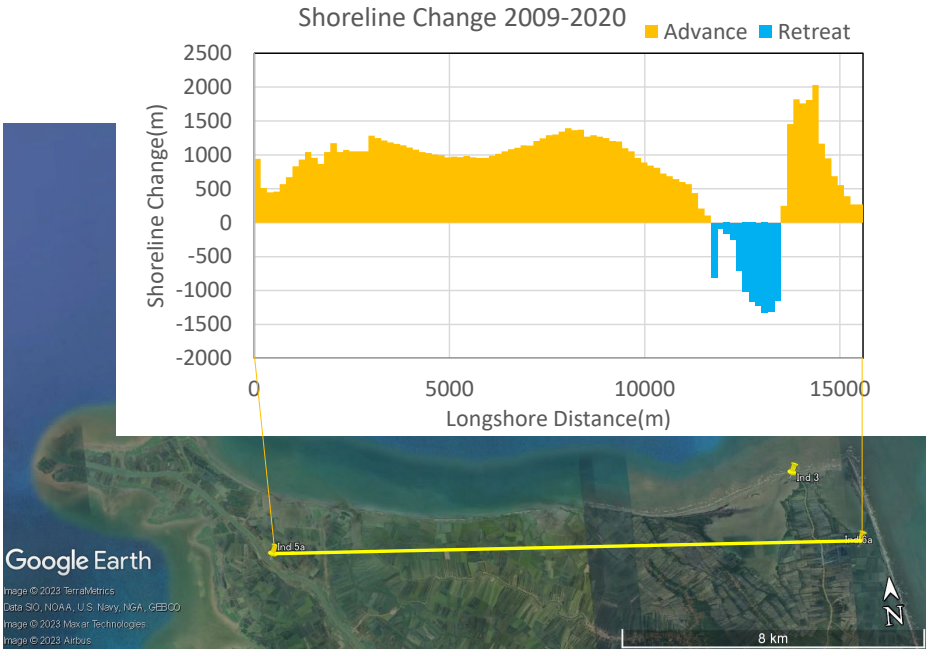
Source：JICA Study Team

Figure 50 Shoreline change in the west part of Indramayu West between 2011 and 2020



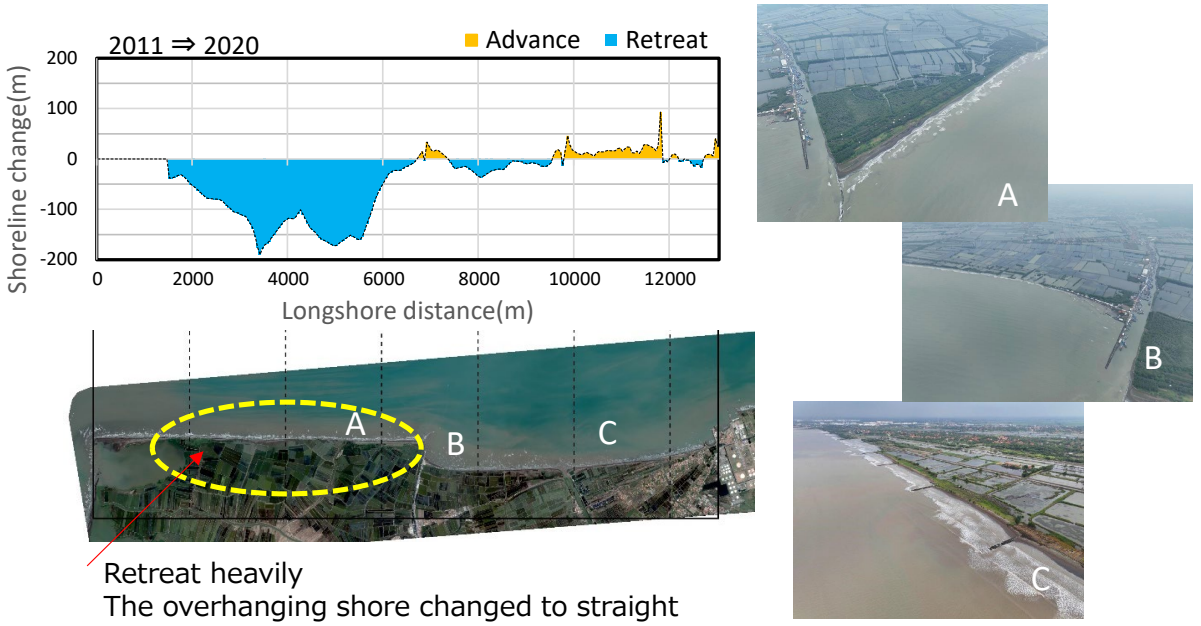
Source: Edited by JICA Study Team based on Google Earth

Figure 51 Shoreline change in the east part of Indramayu West between 2011 and 2020



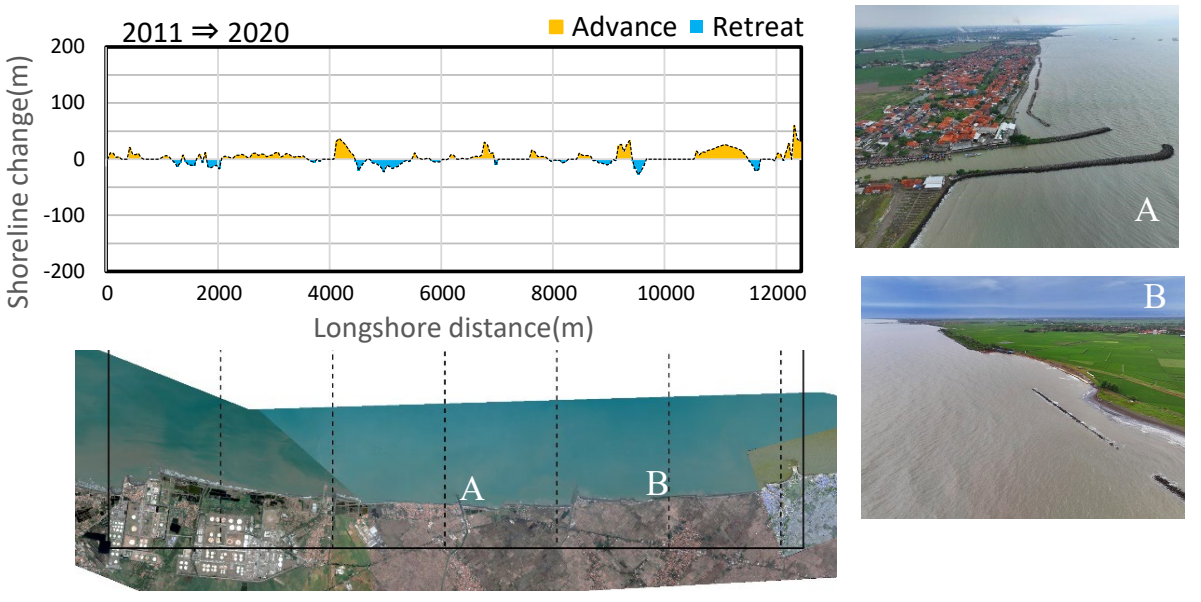
Source: Edited by JICA Study Team based on Google Earth

Figure 52 Shoreline change in Indramayu Central between 2009 and 2020



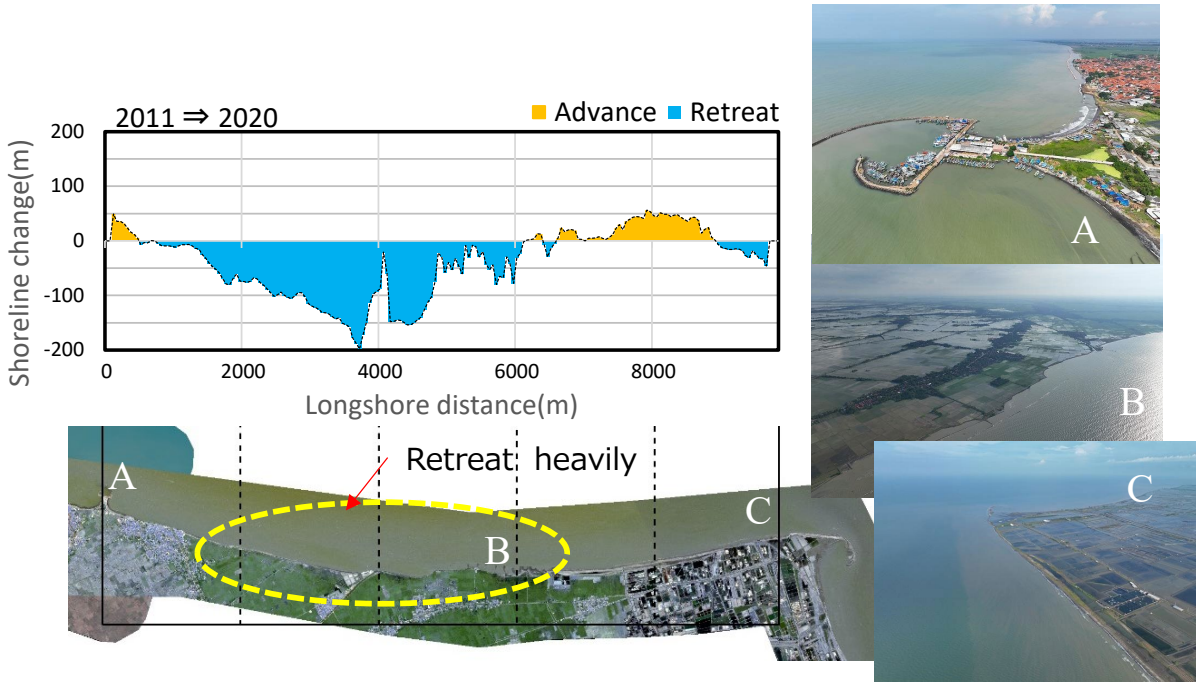
Source: JICA Study Team

Figure 53 Shoreline change in the west part of Indramayu East between 2011 and 2020



Source: JICA Study Team

Figure 54 Shoreline change in the central part of Indramayu East between 2011 and 2020

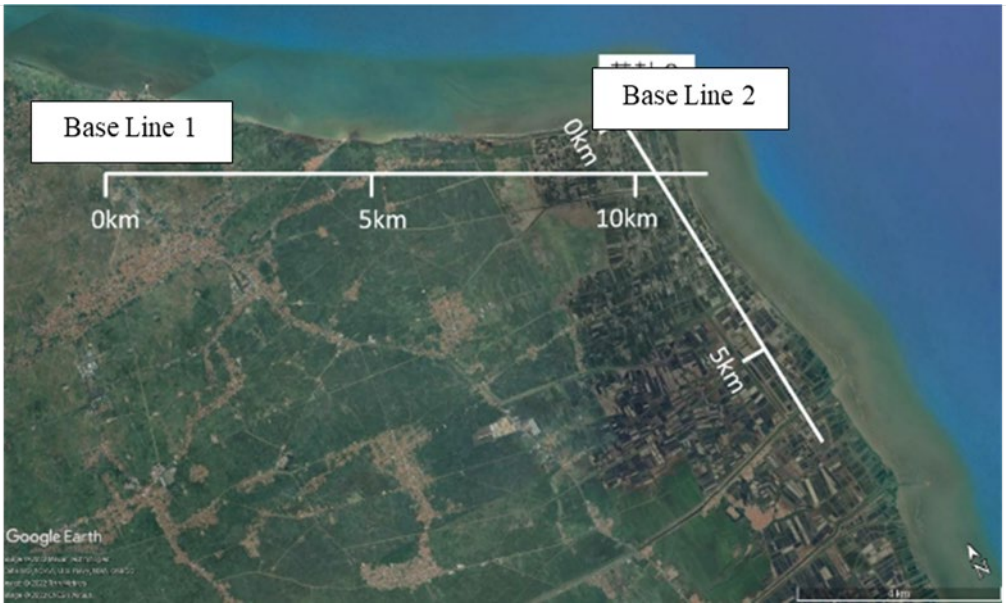


Source: JICA Study Team

Figure 55 Shoreline change in the east part of Indramayu East between 2011 and 2020

6.3.2 Indramayu East Part

The history of shoreline change in the east part of Indramayu eroded heavily is organized in detail according to the satelliet image taken in 2002, 2011, 2015 and 2020. The coordinate system is shown in Figure 54.

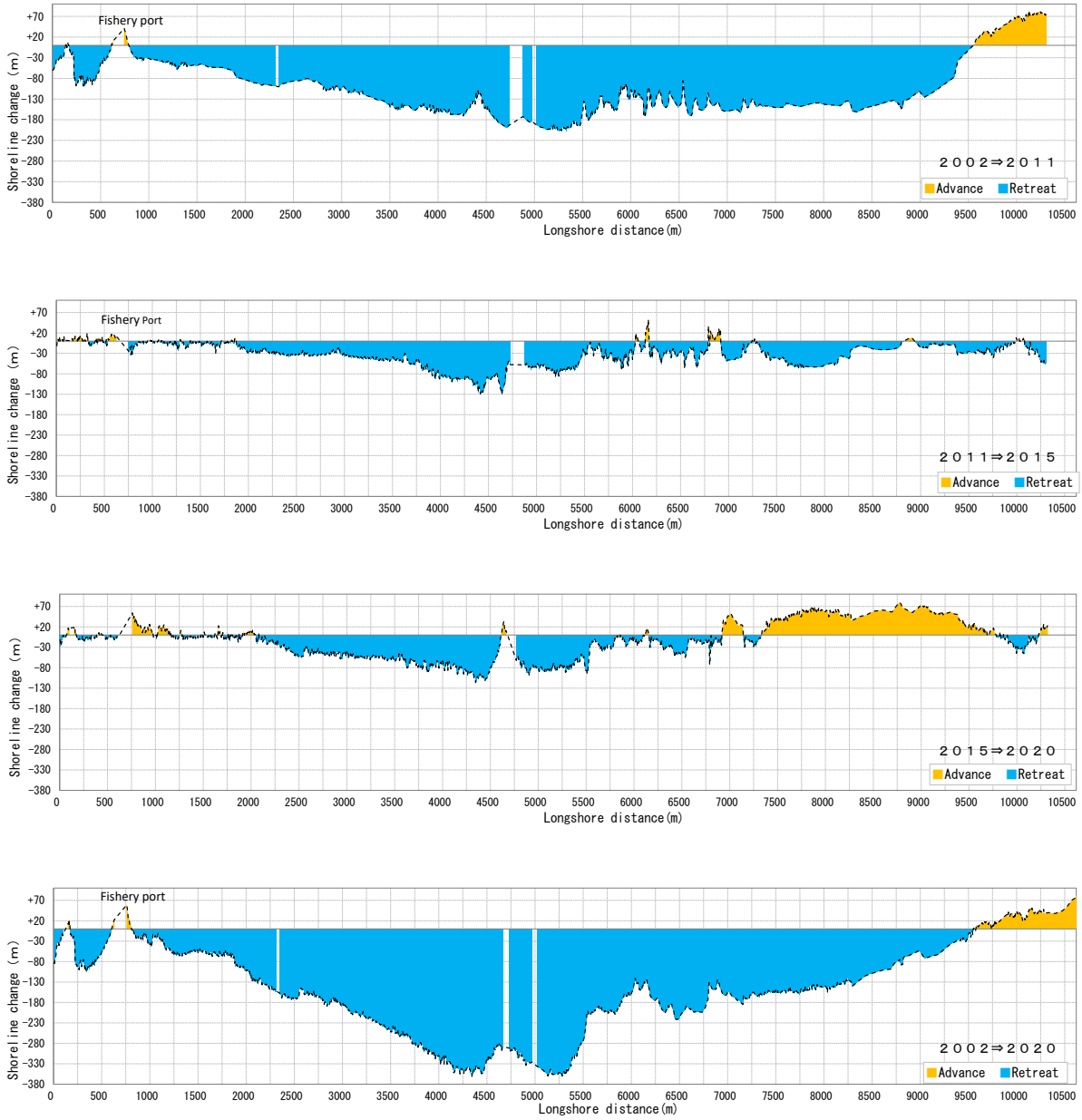


Source: Edited by JICA Study Team based on Google Earth

Figure 56 Coordinate system measuring the coastline in the east part of Indramayu East

(1) The coast from Wine Cup Fishery Port to the sand spit at the eastern end

The shoreline changes along axis 1 (Figure 55) shows that the shoreline retreat is progressing with a peak approximately at the center between Wine Cup Fishery Port and the sand spit at the eastern end. The amount of erosion in the center has reached 350 m in the last 18 years. However, due to the breakwater built after 2011, the Wine Cup fishery port side has almost returned to its shoreline position in 2002. On the other hand, although sedimentation is progressing east of the peak of erosion, the shoreline has not recovered to the level of the 2002 shoreline.

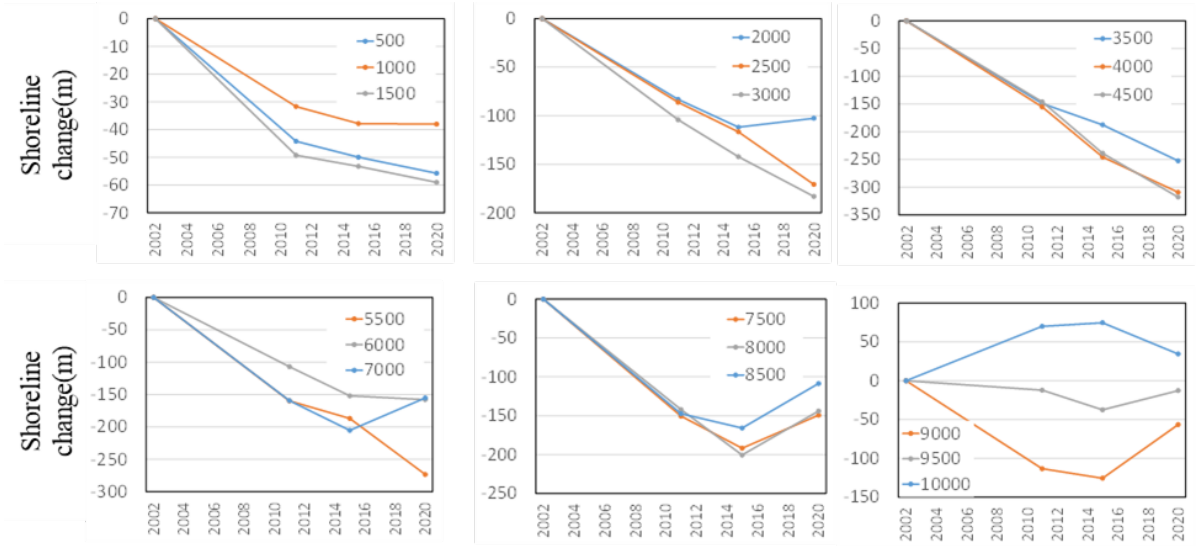


Source： JICA Study Team

Figure 57 Shoreline change alongshore the coordinate axis No.1

Acoording to the temporal changes in the shoreline position at every 500 m pitch on axis 1 (Figure 56), the retreat of the shoreline has slowed or stopped since 2015 in the section up to x = 2,000 m on the Wine Cup fishery port side, because of the effect of the stone revetment at the shore and the offshore breakwater. On the other hand, the shoreline retreat in the x = 2,500 to 5,500 m section is progressing at a nearly constant speed. This rate has not changed significantly from the rate shown in the previous long-term topographic change (Figure 37 above), but it has become somewhat faster in recent years. This seems to be due to the obstruction of westward coastal sand drift by the offshore breakwater. Additionally, this section corresponds to a section where the offshore breakwater has not yet been constructed. In the x=6,000 to 9,000 m section, the shoreline has stopped receding since 2015, and there are some places where it is starting to recover. This can be caused by the effect of the offshore breakwater in this section. The shoreline east of x=9,500 m is stable.

Therefore, because the shoreline recession has been alleviated, stopped, and even recovered due to the installation of the offshore breakwater, the effect of the offshore breakwater must be realized.



Source: JICA Study Team

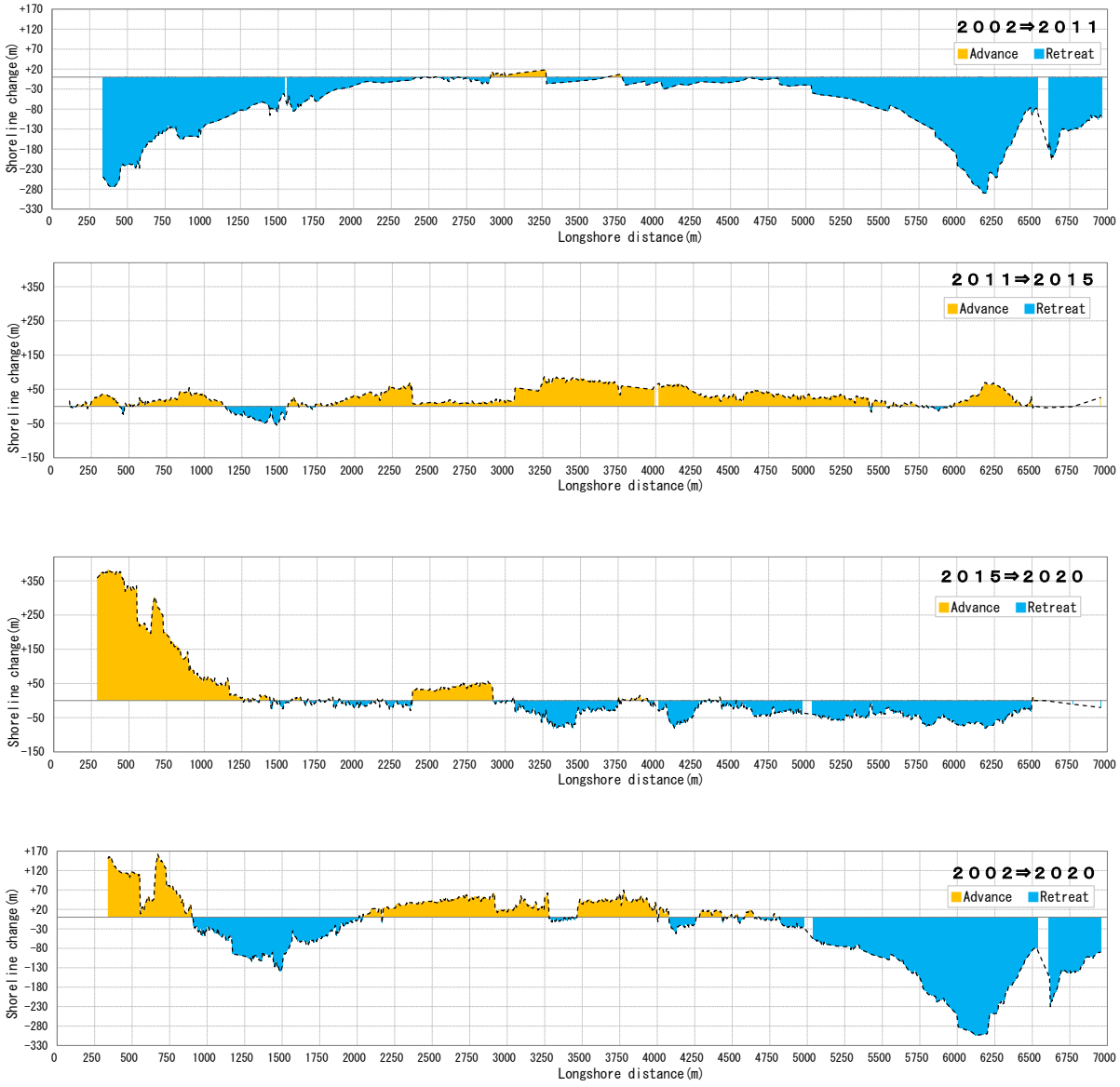
Figure 58 History of shoreline change alongshore coordinate axis No.1

Source: JICA Study Team

Figure 59 Diffraction wave due to the offshore breakwaters

(2) The coast from Sandspit to Cirebon

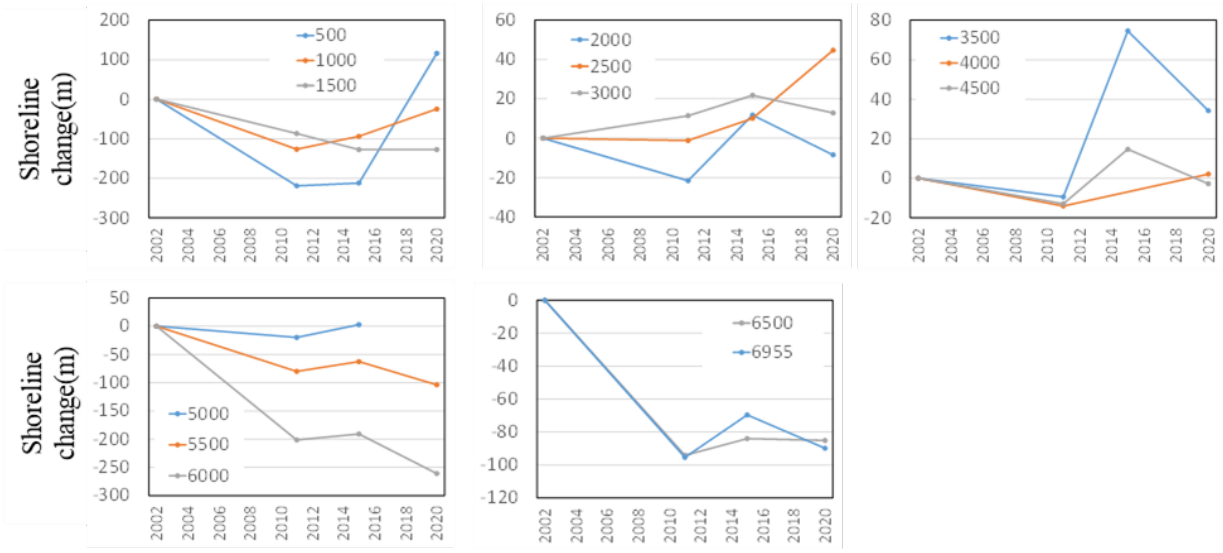
The shoreline changes along base axis 2 (Figure 58) shows that in the x = 0 to 1,000 m section on the sand spit side, the shoreline retreated significantly from 2002 to 2011, but has since recovered. Although there are advances and retreats in the shoreline near the center, there are no major changes in the shoreline in one direction. The shoreline eastward from x=5,000 m significantly retreated from 2002 to 2015 and has not recovered since then.



Source: JICA Study Team

Figure 60 Shoreline change alongshore the coordinate axis No.2

According to the temporal shorline changes (Figure 59), the shoreline in the section x = 500 to 5,000 m seemes to be almost stable, although there are some fluctuations, whereas the shoreline east of x = 5,500 m is receding. However, shoreline east of x = 6,500 m has stopped retreating since 2011.



Source：JICA Study Team

Figure 61 History of shoreline change alongshore the coordinate axis No.2

6.3.3 Pemalang-Pekalongan

Shoreline changes were summarized by dividing the area into three zones under the baseline shown in Figure 60.

Source: Edited by JICA Study Team based on Google Earth

Figure 62 Coordinate system measuring coastline in Pemalang-Pekalongan

The shoreline change over the 20 years from 2002 to 2022 show the following characteristics for each location.

■Pemalang West (Figure 61)

① The shoreline is moving forward, which is estimated to be due to the amount of sediment discharged from two nearby rivers.

② The shoreline where some jetties constructed is almost stable except at the base of the west end of jetty.

③The shoreline advances at the east side of the jetty and recedes at the west side of the jetty. These shoreline changes semme to be caused by trapping the westward littoral drift due to the jetty.

④No significant shoreline changes are observed.

■Pemalang East (Figure 62)

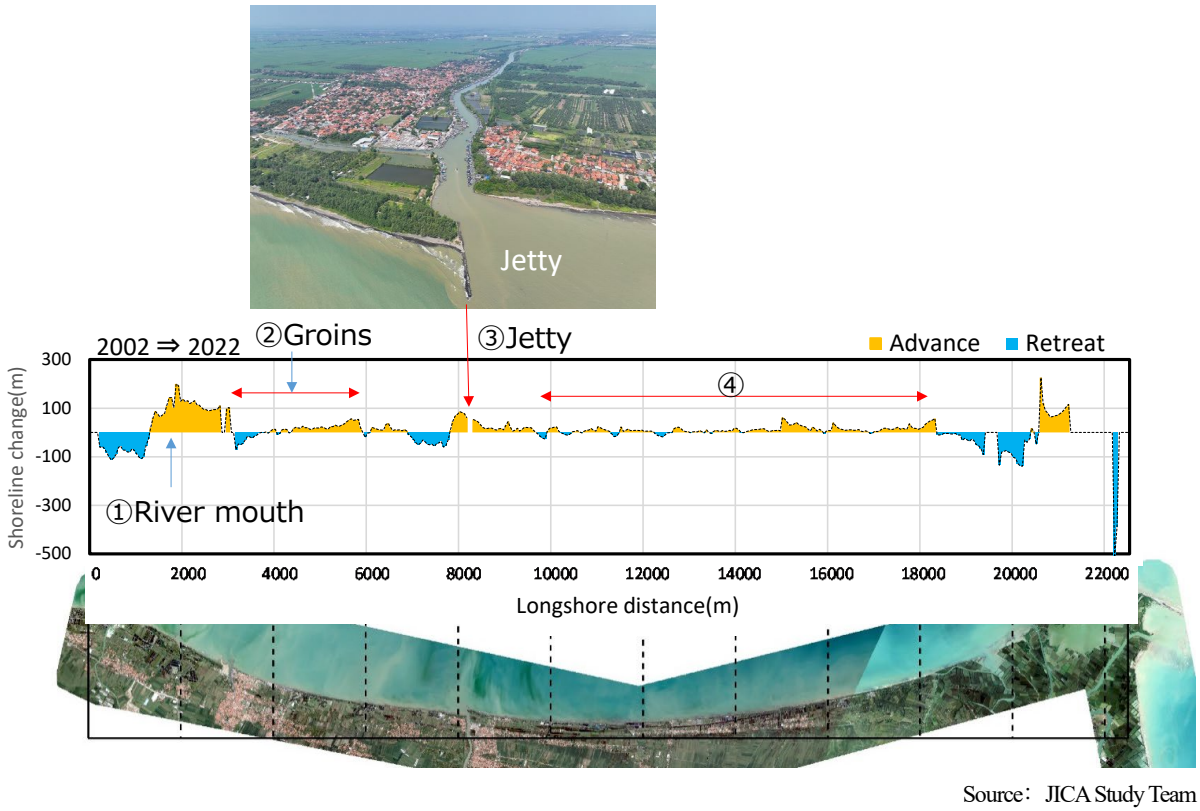
① The central shoreline has collapsed and a large amount of seawater has invaded inland. These seeme to be caused by land subsidence.

■Pekalongan (Figure 63)

① The shoreline has largely retreated on the west side of the jetty at the river mouth. It seemes to be caused by the prevention of westward littoral sand drift.

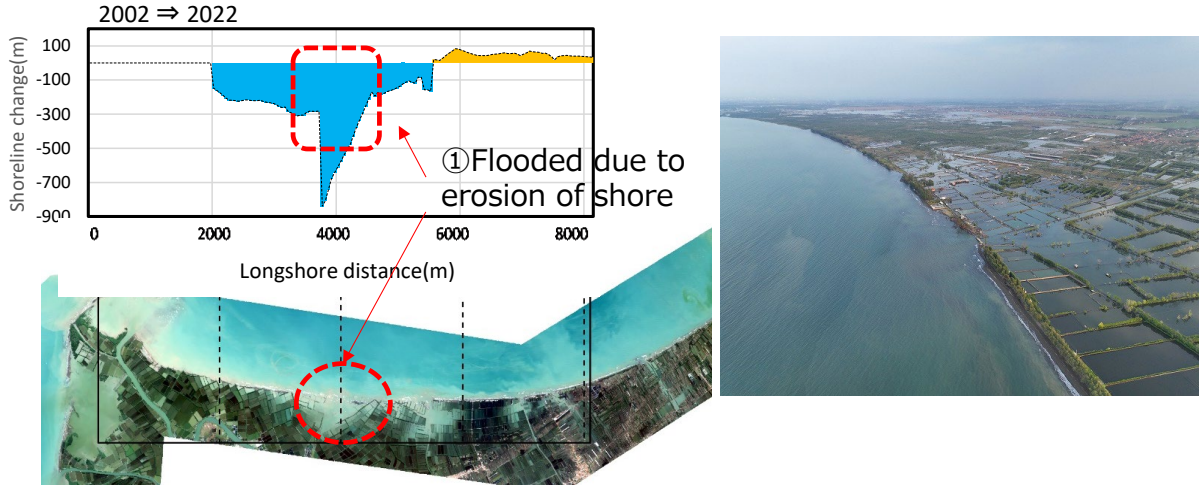
②The shoreline has receded significantly to the east and west of the jetty at the river mouth. These semme to be caused by land subsidence in addition to preventing westward littoral snad drift.

③A seawall has been installed and there is no sandy beach in front of it, so there will be no change in the shoreline.



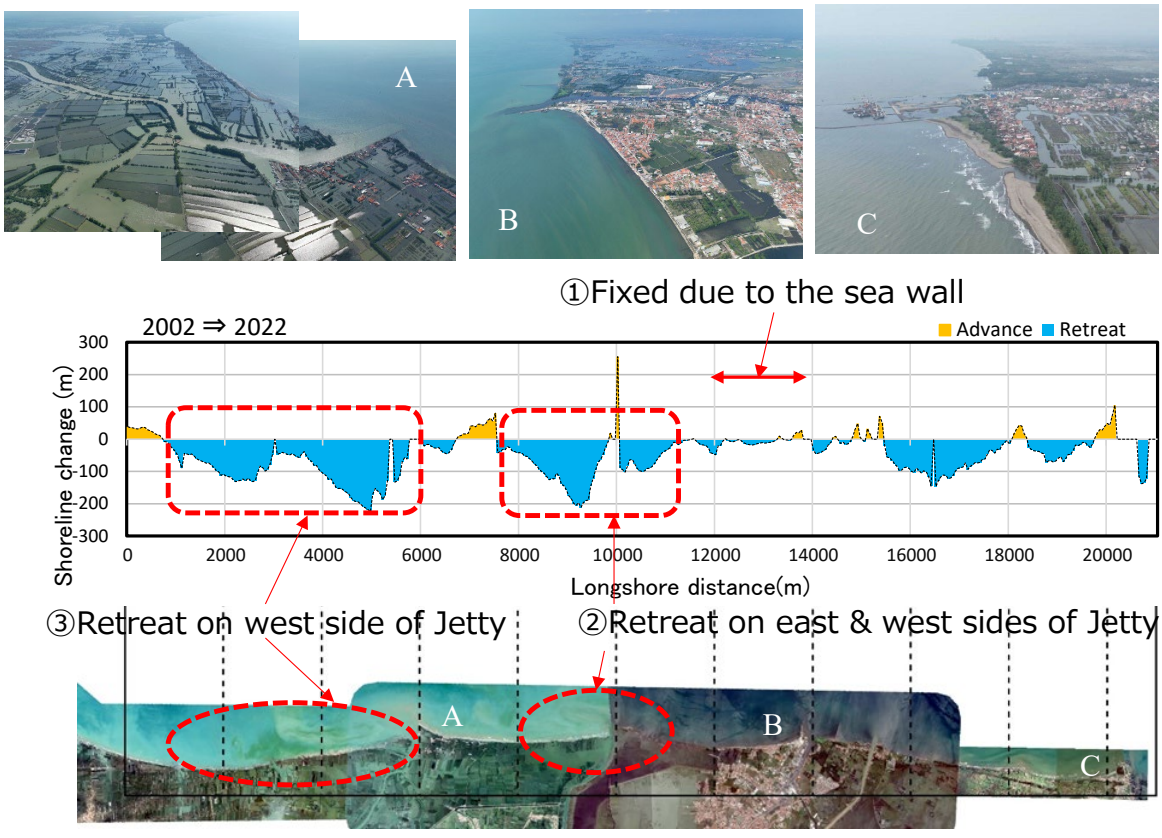
Source: JICA Study Team

Figure 63 Shoreline change in the west part of Pemalang West between 2002 and 2022



Source：JICA Study Team

Figure 64 Shoreline change in Pemalang East between 2002 and 2022



Source：JICA Study Team

Figure 65 Shoreline change in Pekalongan between 2002 and 2022

6.3.4 Rembang-Tuban

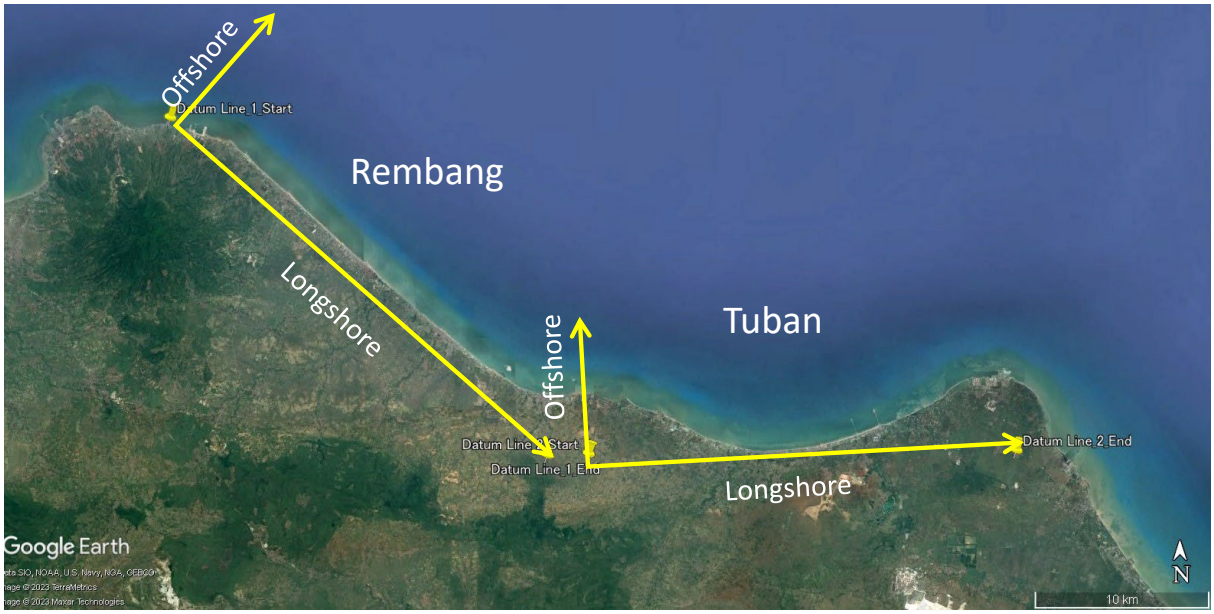
Shoreline changes were summarized by dividing the area into two zones under the baseline shown in Figure 64.

■ Rembang (West Side)

- In 2008-2013 (5 years), the shoreline is generally retreating, with the advancing areas mainly on the east side where the jetties are located.
- In 2013-2022 (9 years), the amount of shoreline recession is slightly less on the west side of x = 14,000 m, but still continues to recede, except on the east side of the jetty.
- On the other hand, east of x = 14,000 m, the shoreline is advancing.
- In the 2008 - 2022 period (14 years), the 2008 - 2013 period shows the strongest change.

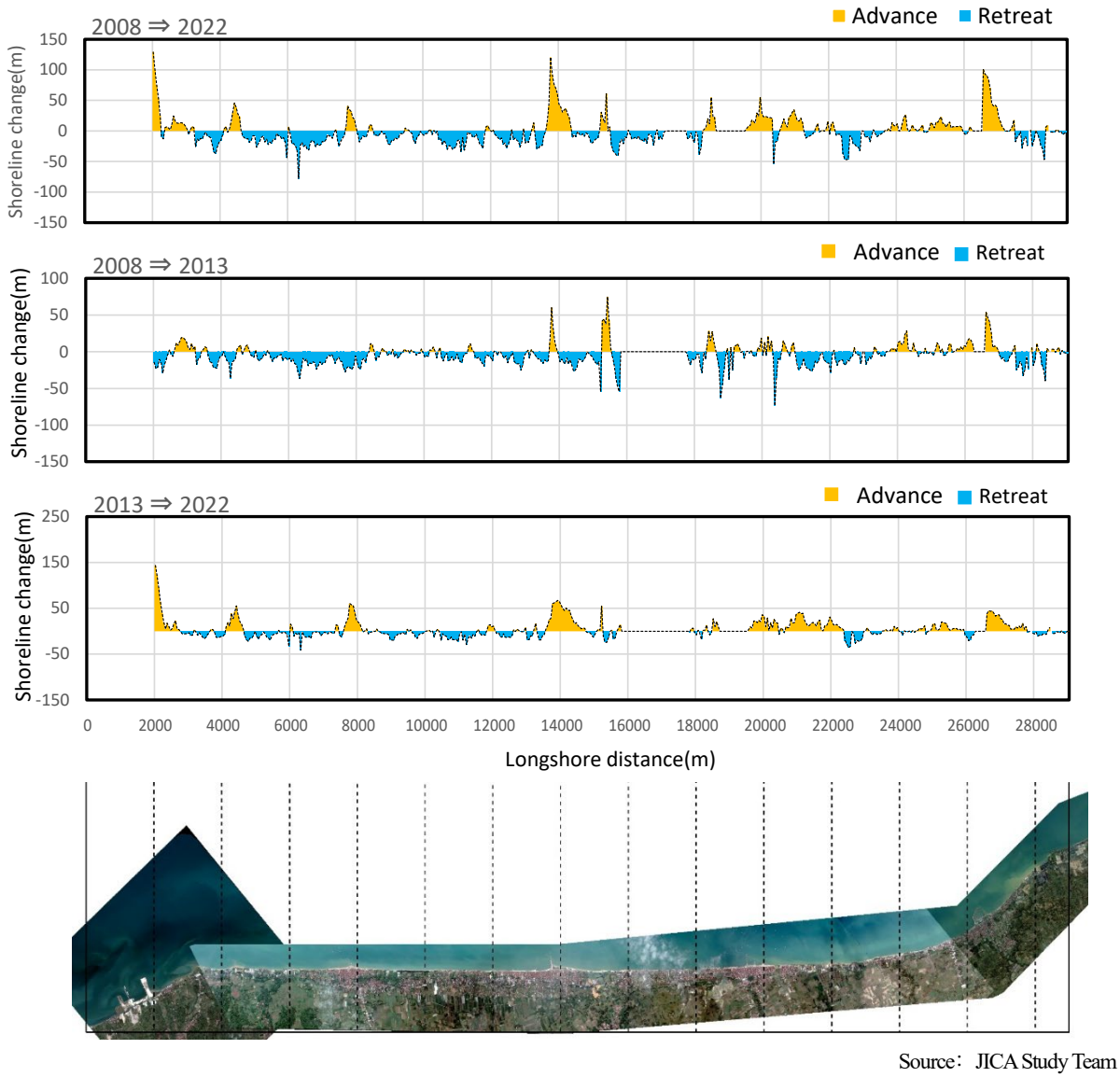
■ Tuban (East Side)

- In 2008 - 2013 (5 years), the shoreline tended to retreat on the west side and advance on the east side from x = 8,000 m.
- In 2013 - 2022 (9 years), the shoreline has generally retreated, and in particular, the maximum retreat in the section x = 8,000 to 9,000 m exceeds 100 m.
- In 2008–2022 (14 years), the trend of the shoreline change is almost same as 2008–2013, similar to the West-Side,



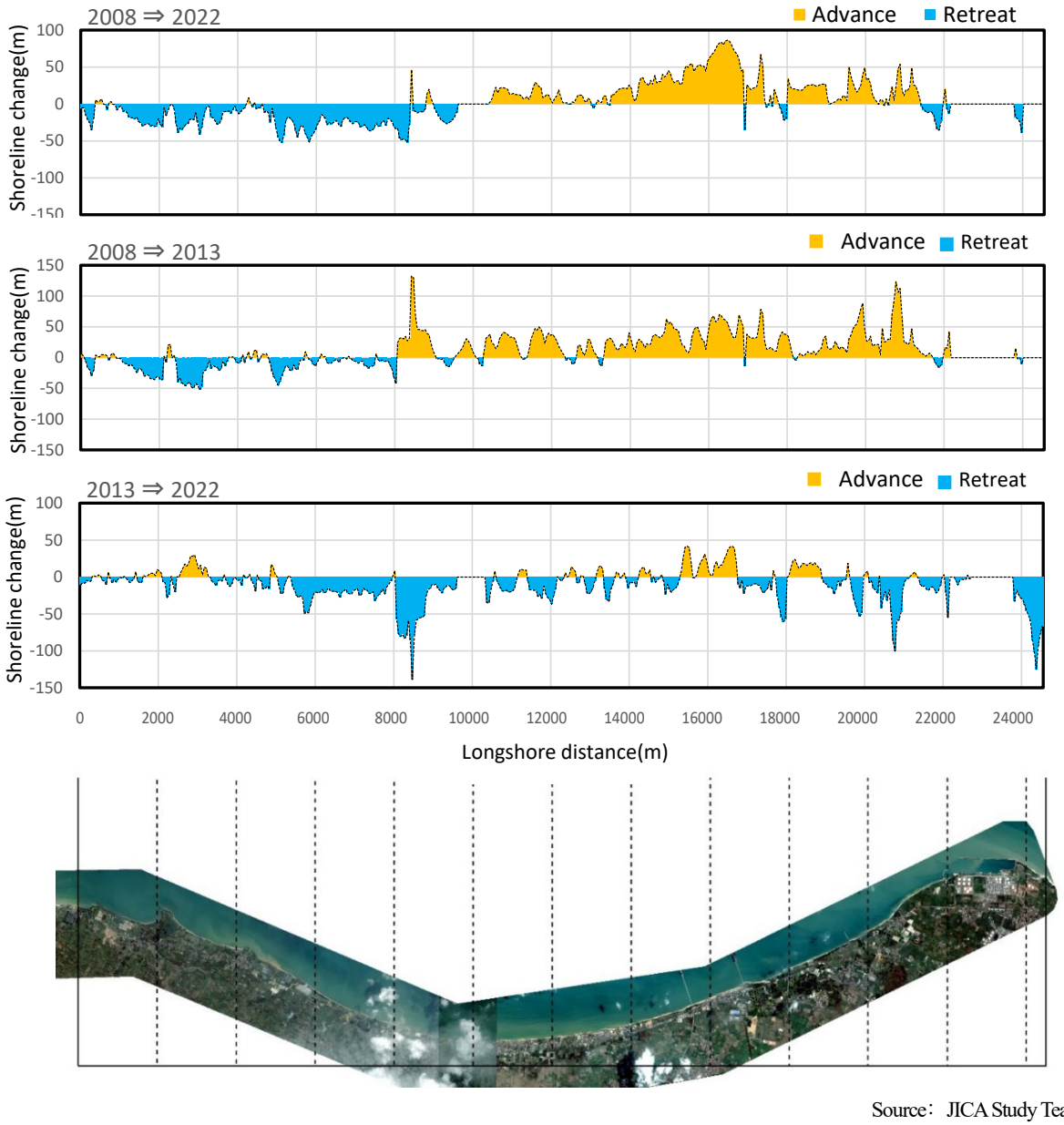
Source：Edited by JICA Study Team based on Google Earth

Figure 66 Coordinate System for Reading Shoreline Position



Source: JICA Study Team

Figure 67 Shoreline change in Rembang (Top : 2008–2022, Middle : 2008–2013, Bottom : 2013–2022)



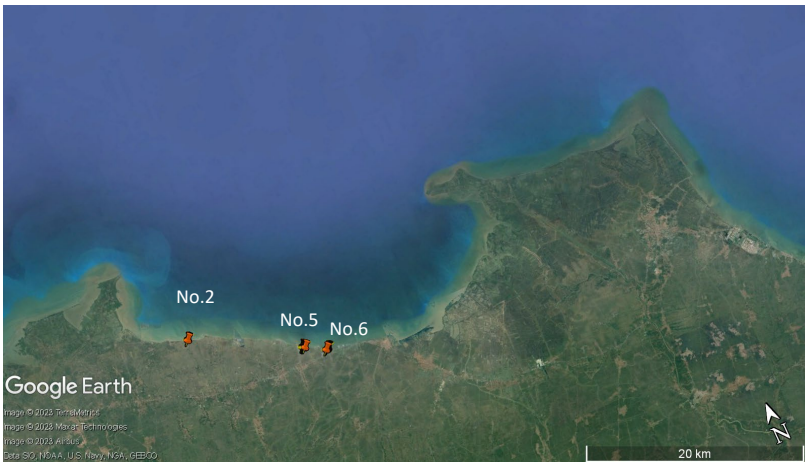
Source: JICA Study Team

Figure 68 Shoreline change in Tuban(Top : 2008–2022, Middle : 2008–2013, Bottom : 2013–2022)

6.4 Characteristic topographical change

6.4.1 Coast with curve in Indramayu

We believed that the curved topography seen along the Indramayu coast would be helpful in predicting future topographical changes and in countering erosion, so we confirmed the topography on site during this survey. The overview of three site N0.2, No.5 and No.6 of them (Figure 67) is introduced below.



Source：Edited by JICA Study Team based on Google Earth

Figure 69 Location of survey for the curved topography in Indramayu

(1) No.2 (Figure 68,Figure 69)

In 2008, there was a Fish Pond at this location, but rapid erosion has been losing these facilities. The breakwater has been extended by approximately 50 m since 2022, and the shape of the beach (shoreline) in its shielding area has rotated clockwise. Due to the extension of the breakwater, a clockwise circulation flow became dominant behind the breakwater, which is presumed to have caused the sediment near point A to move toward point B.

(2) No.5 (Figure 70,Figure 71)

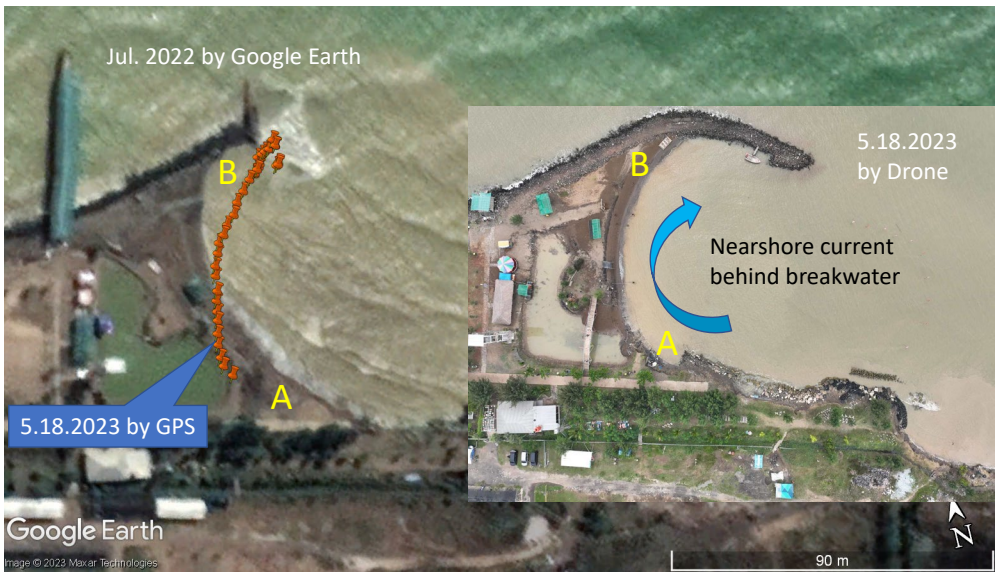
Behind the loss of the rubble revetmant, the shoreline is retreating at a rate of approximately 12 m/year. Additionally, as the wave-dissipating effect has been losing due to sinking the rubble revetment and the opening width increases, the amount of shoreline retreat also tends to increase. During the period when the opening width of about 160 m was maintained for about 8 years, the retreat rate decreased. However, the shoreline retreated again as the both side of revetment sank. As a result of a field survey on this curved beach, it was found that the bottom sediment near the shoreline was composed of fine sand. However, at the western end of the beach, clay soil is exposed. Therefore, it seemed that this clay soil was eroded away, the silty soil was washed offshore by wave action, and the sandy soil was deposited near the shoreline.

(3) No.6 (Figure 68, Figure 69)

The erosion progresses where the rubble revetment lost due to subsidence, etc., forming a curved topography as same as No.5. As the defect width of the rubble revetment increases, the erosion length of the curved central part gradually increases.

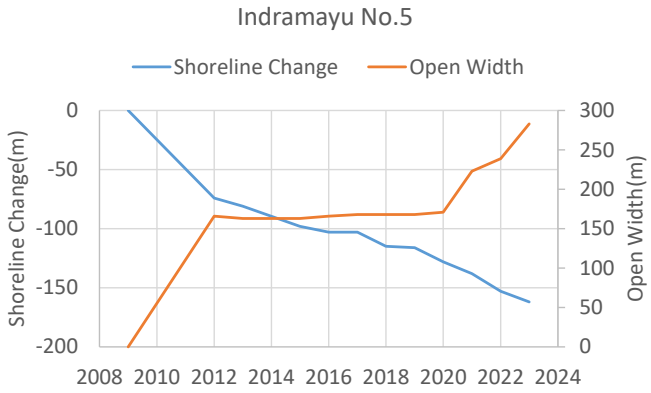
Source：Edited by JICA Study Team based on Google Earth

Figure 70 History of topography change near the survey point No.2 in Indramayu



Source: Edited by JICA Study Team based on Google Earth

Figure 71 Mechanism of topography change in the survey point No.2



Source:Top and middle; Edited by JICA Study Team based on Google Earth, Bottom;JICA Study Team

Figure 72 History of topography change near the survey point No.5 in Indramayu

The curved beach
Left : West side, Right : East side

The foreshore slope:1/13
The berm height:0.8m

The offshore slope:1/18

The sediment of beach :
fine sand (Silt is a little)

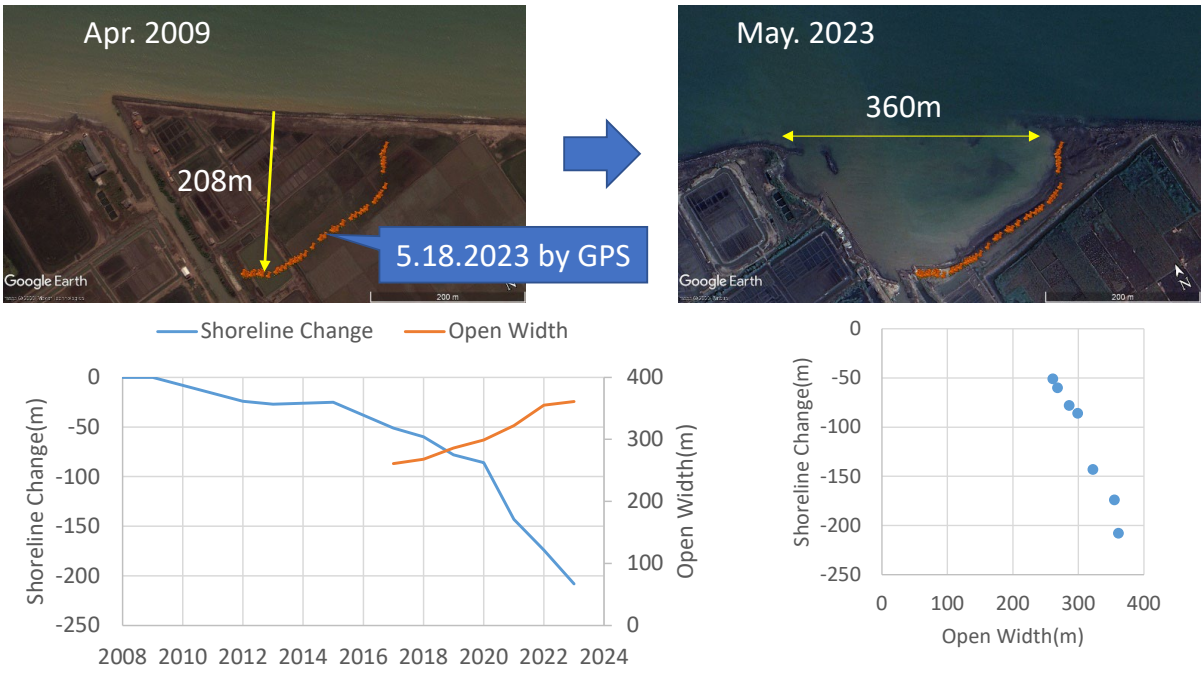
The clay soil exposed in
west side of the beach

Source: JICA Study Team

Figure 73 Beach condition near the survey point No.5 in Indramayu

Source: JICA Study Team

Figure 74 History of topography change near the survey point No.6 in Indramayu



Source: JICA Study Team

Figure 75 History of parameter for curved topography in the survey point No.6

6.4.2 Coast with steps in Indramayu

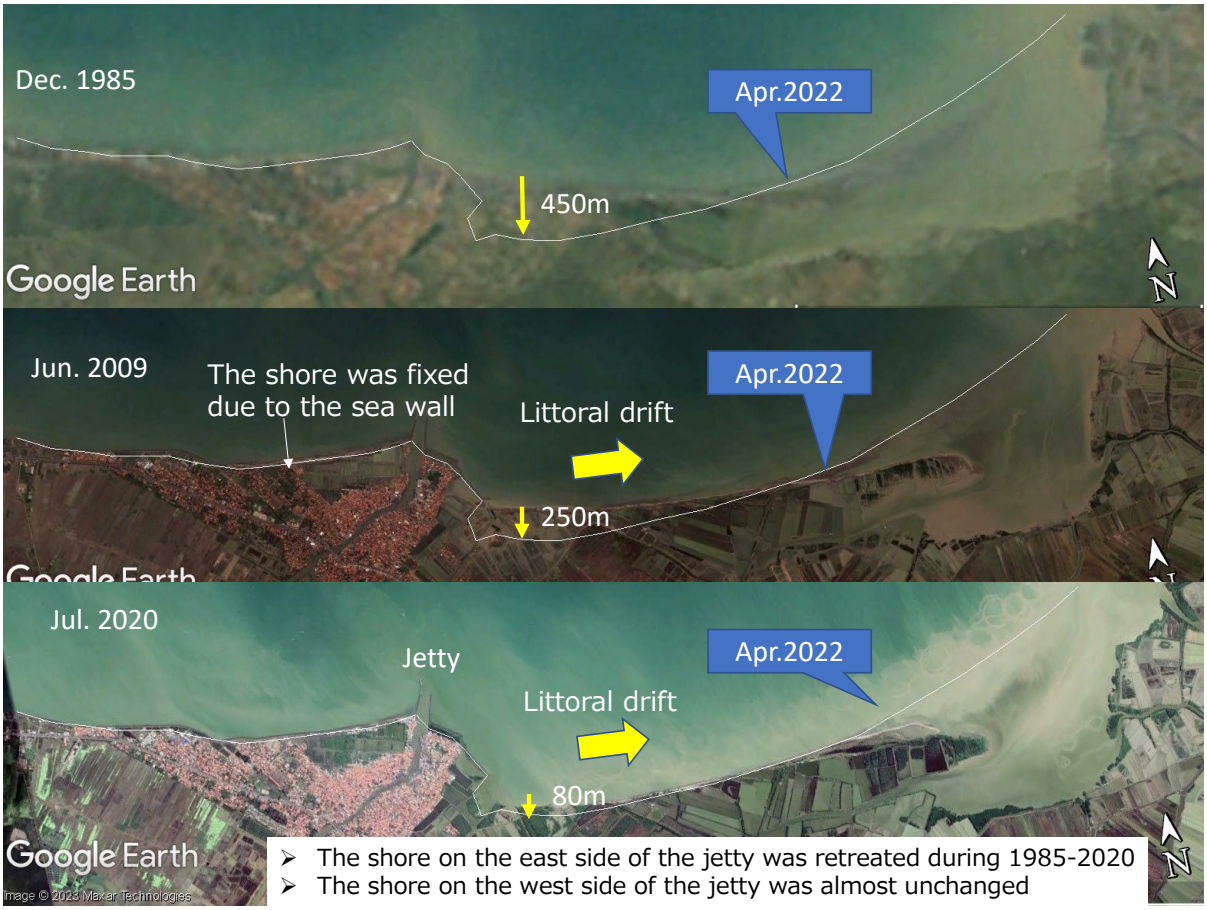
We considered the factors behind the unevenness of the coastline at Indramayu as shown in Figure 74.

Source: Edited by JICA Study Team based on Google Earth

Figure 76 Stepped topography in Indramayu

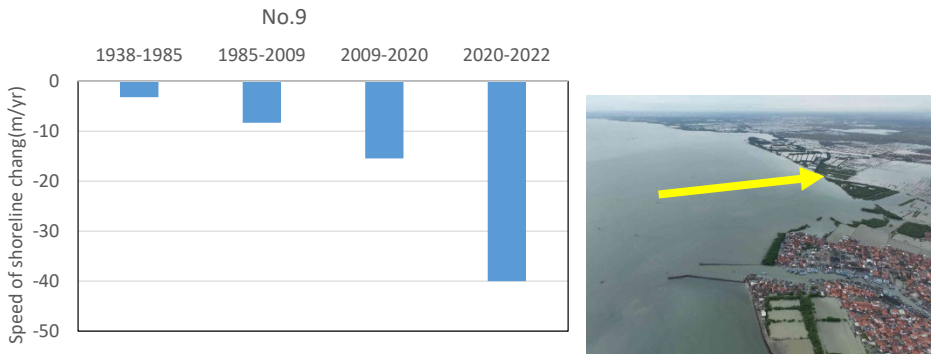
(1) Step A

Figure 75 shows the formation process of the step at the river mouth in Indramayu West. In 1985, the topography of the river mouth was somewhat prominent, but there was almost no difference in level between the left and right shores. In 2009, the jetties were constructed on the left and right sides of the river mouth, and a seawall was constructed on the west side of the river mouth, and there is no sandy beach in front of it. On the other hand, the shoreline on the right side (east side) of the river mouth has receded, and will be approximately 450 m further back in 2022 than it was in 1985. At the same time, a sand spit has developed on the right shore side, and the area that was an ocean area in 1985 has turned into a closed area due to the sand spit.



Source: Edited by JICA Study Team based on Google Earth

Figure 77 Topography change process of the step A in Indramayu West

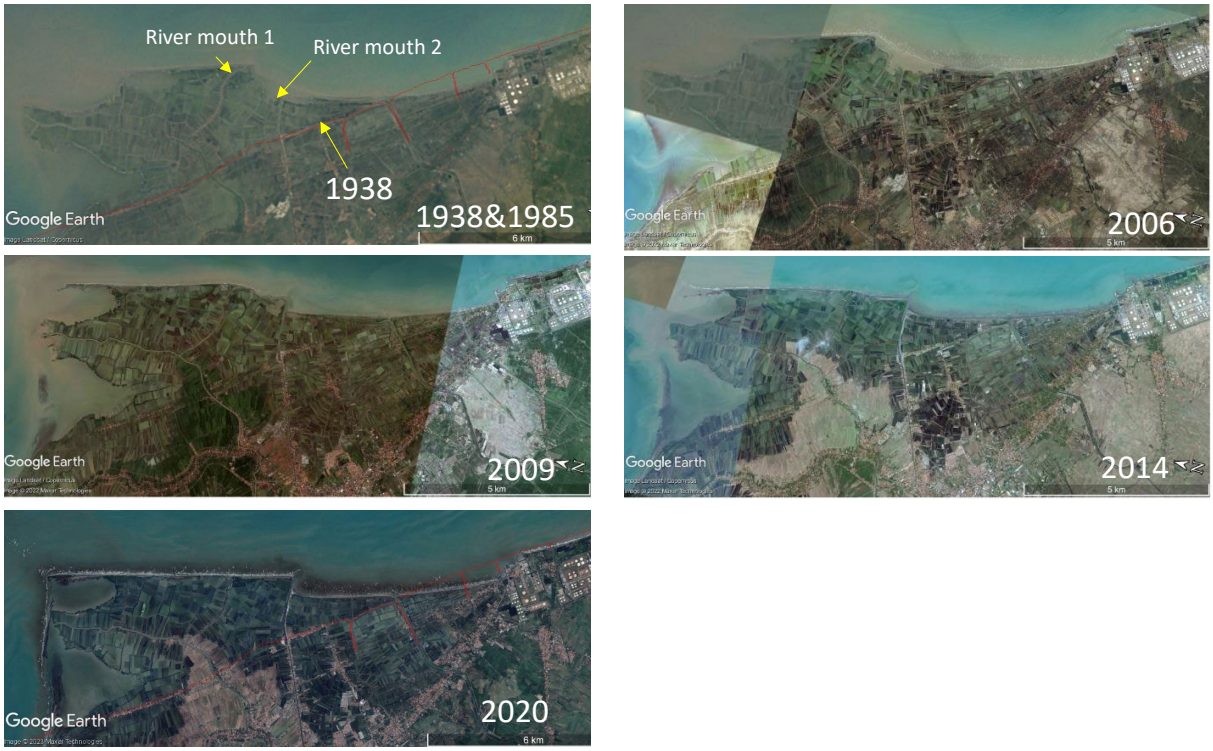


Source: JICA Study Team

Figure 78 Retreat speed of shoreline in the step A

(2) Step B

Near the western end of Indramayu East, there is currently a difference in level of approximately 450m between both ends of the river mouth jetty and the port breakwater. The formation process of this step was summarized according to aerial photographs(Figure 77, Figure 78). In 1938, the coastline around this area was a nearly straight coast, although the direction of coast was different. In 1985, there were two river mouths on the west side, and the area had become a prominent topography due to sediment discharged from these rivers. On the other hand, port facilities are being constructed on the east side, and the shoreline on the west side has receded significantly, resulting in the target coastline changing into a gently curved topography. Subsequently, a jetty was constructed at the river mouth in the western end, and sediment accumulation progressed on the left shore (west side) of the jetty, and the shoreline now reaches the tip of the jetty. On the other hand, the position of the shoreline on the right shore side of the jetty has not changed significantly, so there is a large difference between the east and west sides of the jetty.



Source: Edited by JICA Study Team based on Google Earth

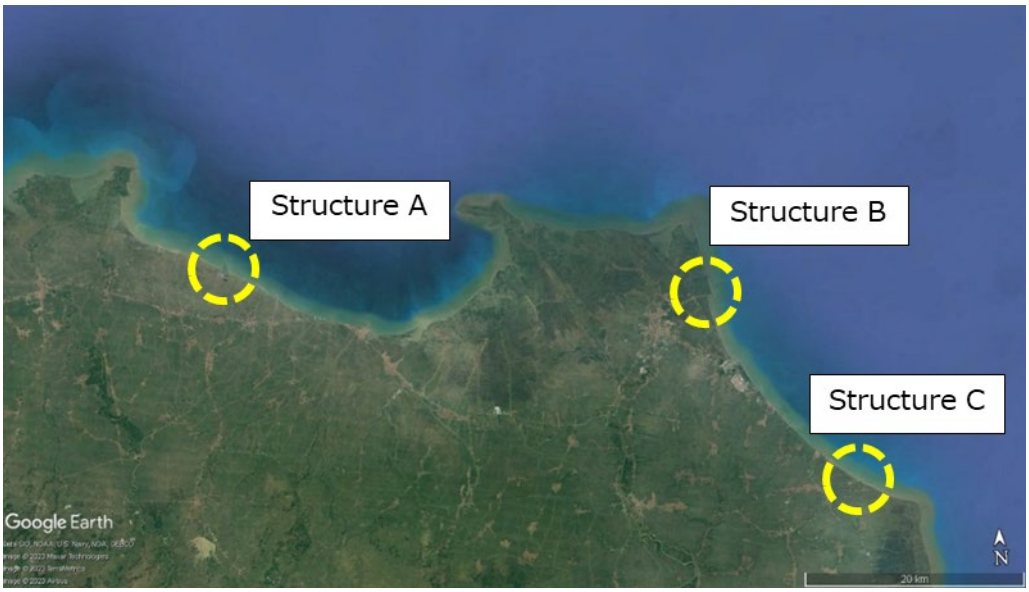
Figure 79 Topography change process of the step B in Indramayu East

Source: Edited by JICA Study Team based on Google Earth

Figure 80 Topography change process due to the construction of jetty at the step B in Indramayu East

6.4.3 Coast around coastal structures in Indramayu

We considered the factors behind the topographical changes seen around the structures at the location shown in Figure 6.4.13 in Indramayu.



Source: Edited by JICA Study Team based on Google Earth

Figure 81 Topography change around structures in Indramayu

(1) Structure A

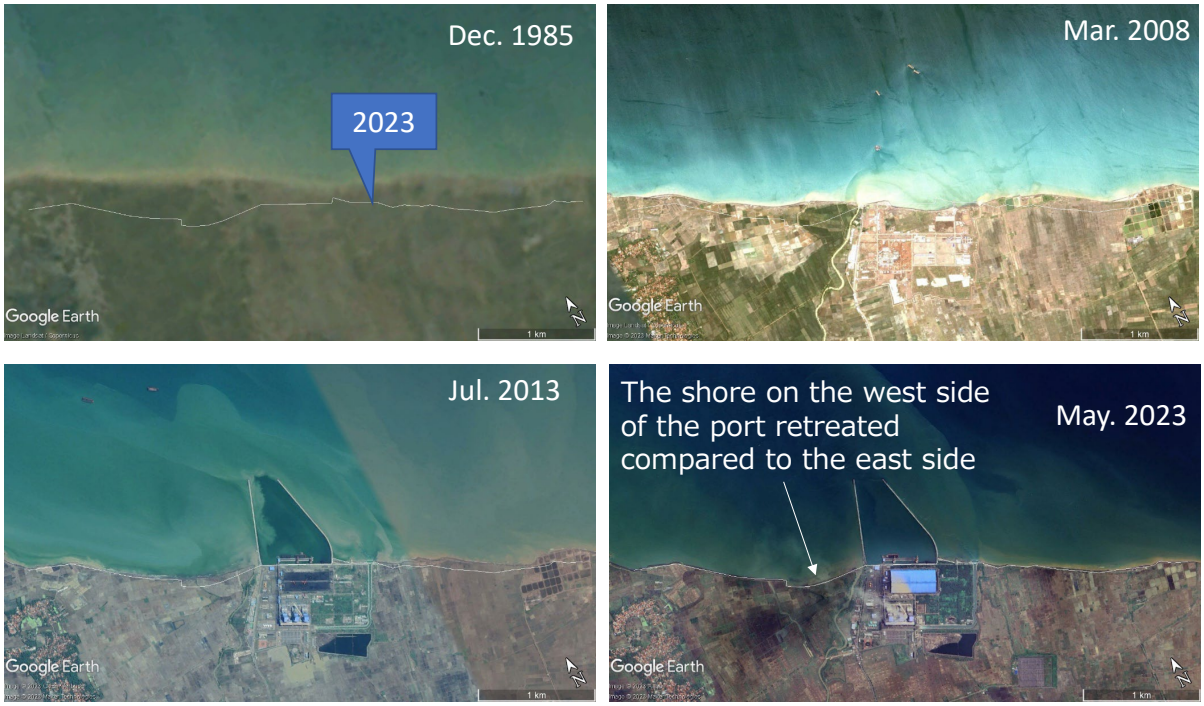
Figure 80 shows the topographical changes around the power plant breakwater. The western shoreline has retreated somewhat due to the construction of the breakwater.

(2) Structure B

Figure 81 shows the topographical changes around the jetty installed in the stepped topography A shown in Figure 74. As shown in the figure, a wave shielding area was created by the jetty, and it can be seen that sedimentation is progressing in the shielding area. The sedimentation must be caused by the flow toward the shielded area.

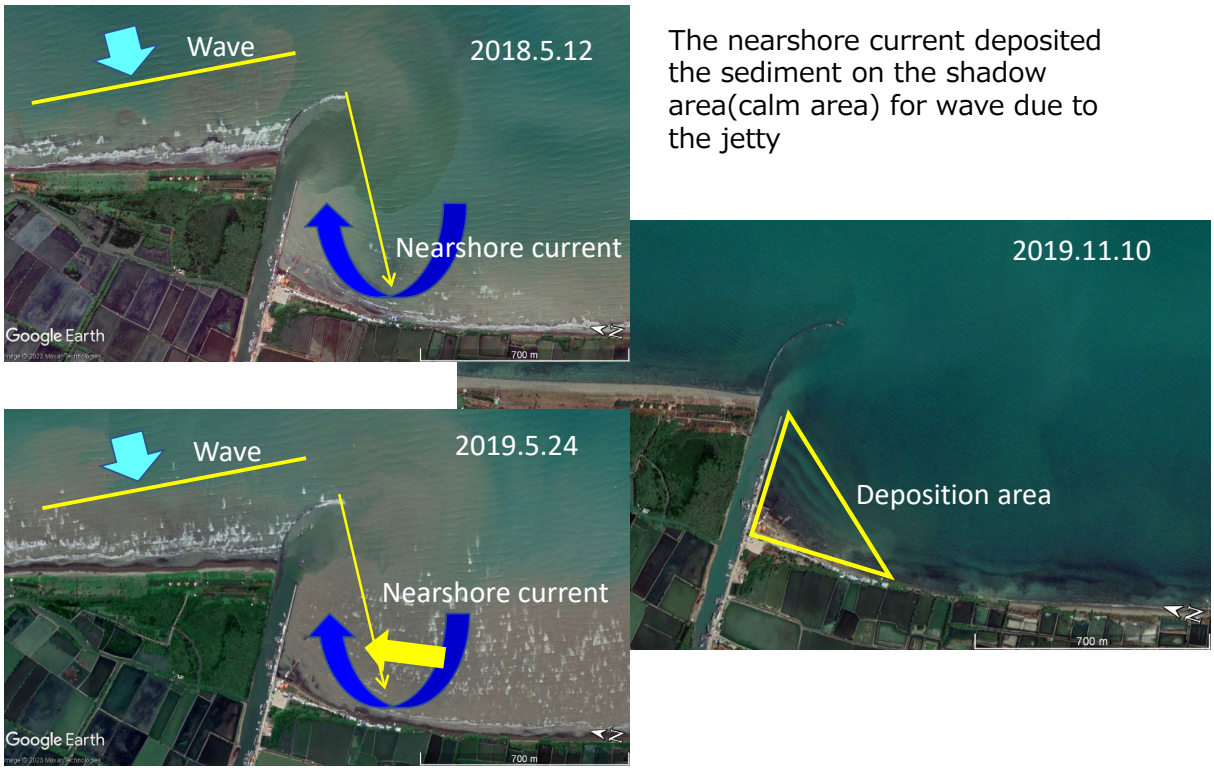
(3) Structure C

Figure 82 shows the topographical changes around the wine cup-shaped fishery port breakwater. Although the shorelines on both sides of the fishery port are advancing, the amount of advance of the shorelines on both sides is approximately the same. That is reason why the dominant sand littoral drift cannot exists.



Source: Edited by JICA Study Team based on Google Earth

Figure 82 Topography change near the structure A



Source: Edited by JICA Study Team based on Google Earth

Figure 83 Topography change near the structure B

Source: Edited by JICA Study Team based on Google Earth

Figure 84 Topography change near the structure C

6.4.4 Coast around offshore breakwater in Tuban

The offshore breakwaters were constructed southward since about 2000 on the coast of north side of the reclaimed land(Figure 83 Point A). The shoreline has been advanced behind them(Figure 84). On the coast of south side of the reclaimed land, the offshore breakwater were constructed in front of the residential area in 2013, after that the place behind them was reclaimed(Figure 85).

Source: Edited by JICA Study Team based on Google Earth

Figure 85 Location of offshore breakwaters in Tuban

Source: Edited by JICA Study Team based on Google Earth

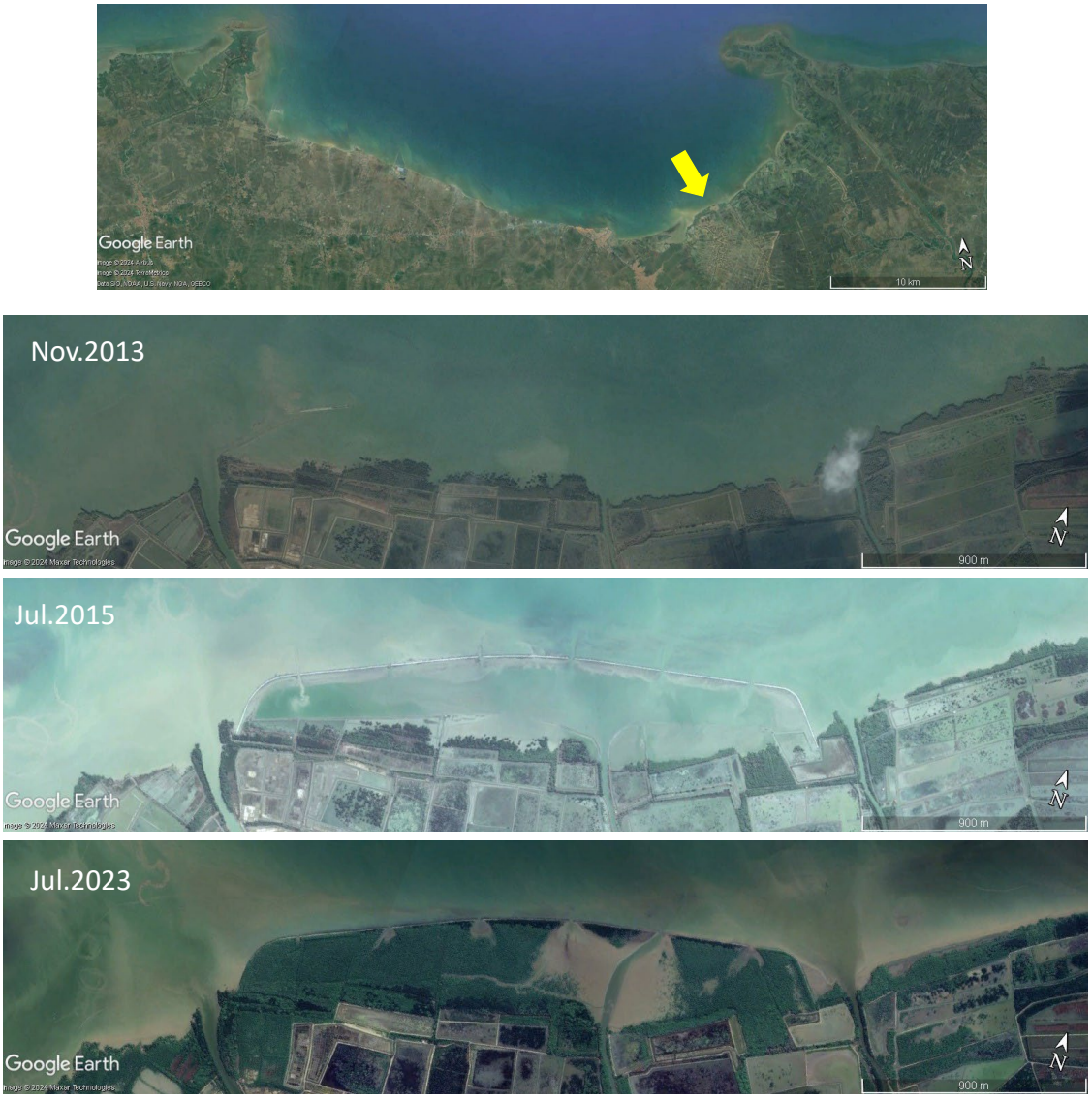
Figure 86 Topography change around offshore breakwaters in nortern side of reclaimed land(Point A)

Source: Edited by JICA Study Team based on Google Earth

Figure 87 Topography change around offshore breakwaters in southern side of reclaimed land(Point B)

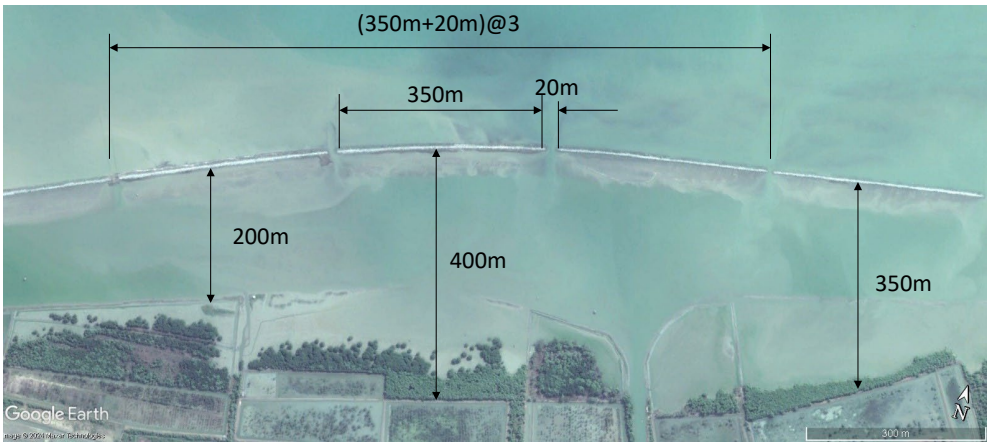
6.4.5 Coast around the Green infrastructure

Examples of the topography changes due to the mangrove plantation with wave-dissipation facilities are shown below. The mangrove plantation has been implemented behind the wave-dissipation facilities made of stone in Indramayu(Figure 86). The mangroves seemes to be maintained and to become shallower behind the offshore breakwaters. Figure 87 shows the layout specifications of offshore breakwaters. In Cirebon and Demak , not selected as the priority area, the mangrove plantations have been implemented with offshore breakwaters(Figure 88～Figure 90). It seemes that the mangrove forest are growing behind the offshore breakwaters, making the depth shallower behind them.



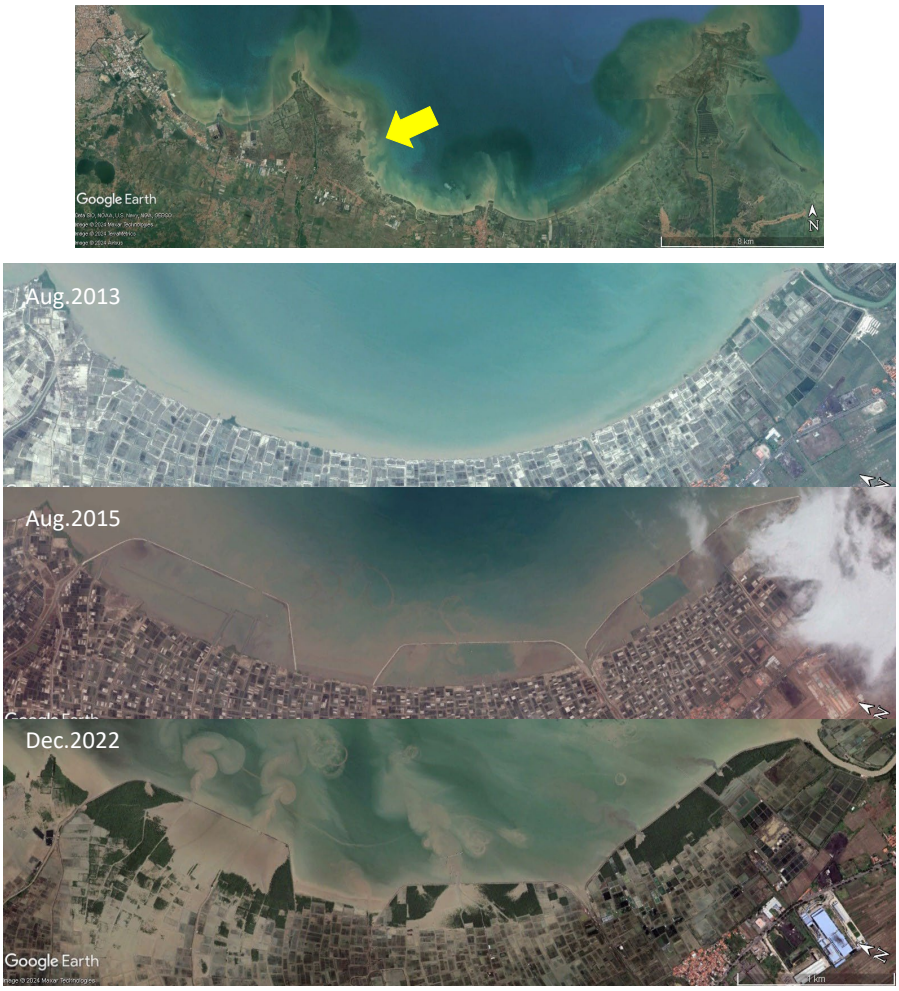
Source: Edited by JICA Study Team based on Google Earth

Figure 88 Topography change around the green infrastrucure(Indramayu)



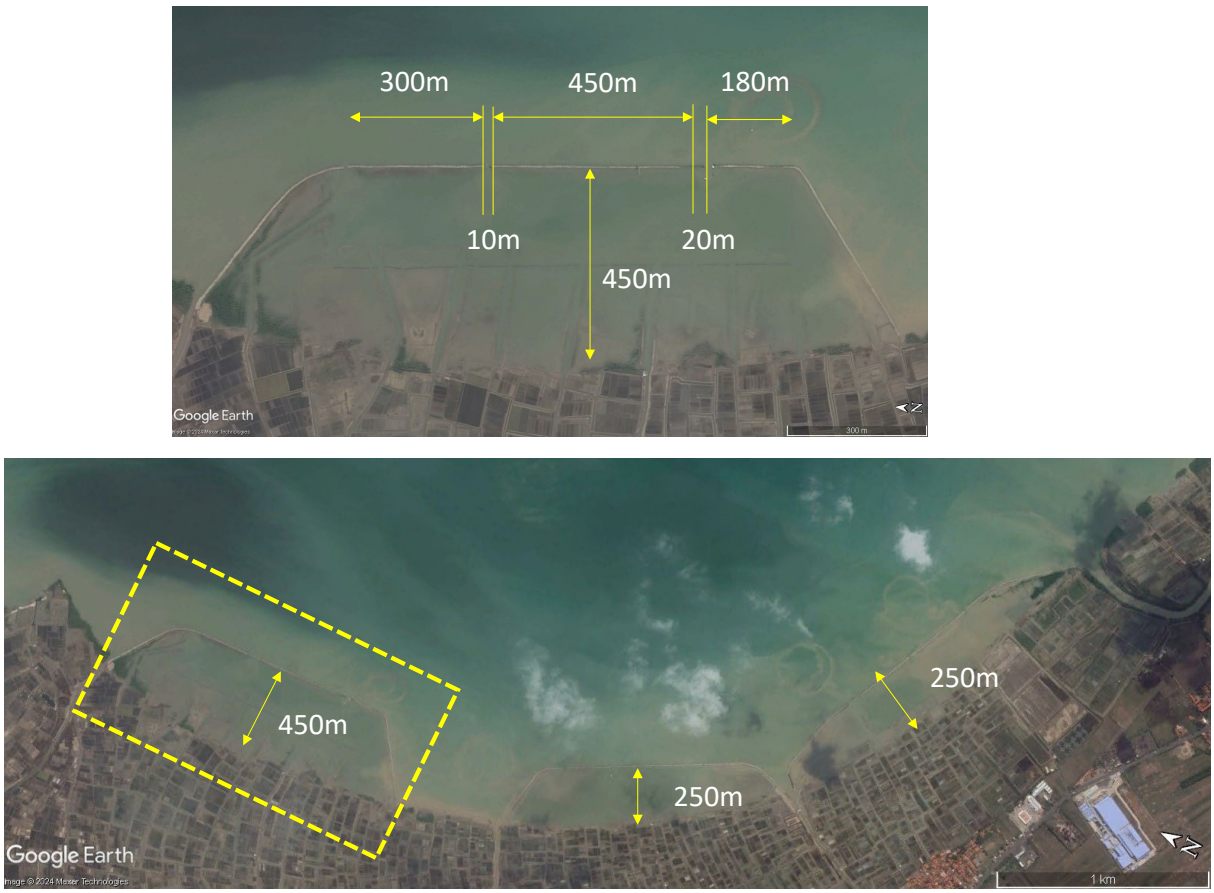
Source: Edited by JICA Study Team based on Google Earth

Figure 89 Layout of offshore breakwaters(Indramayu)



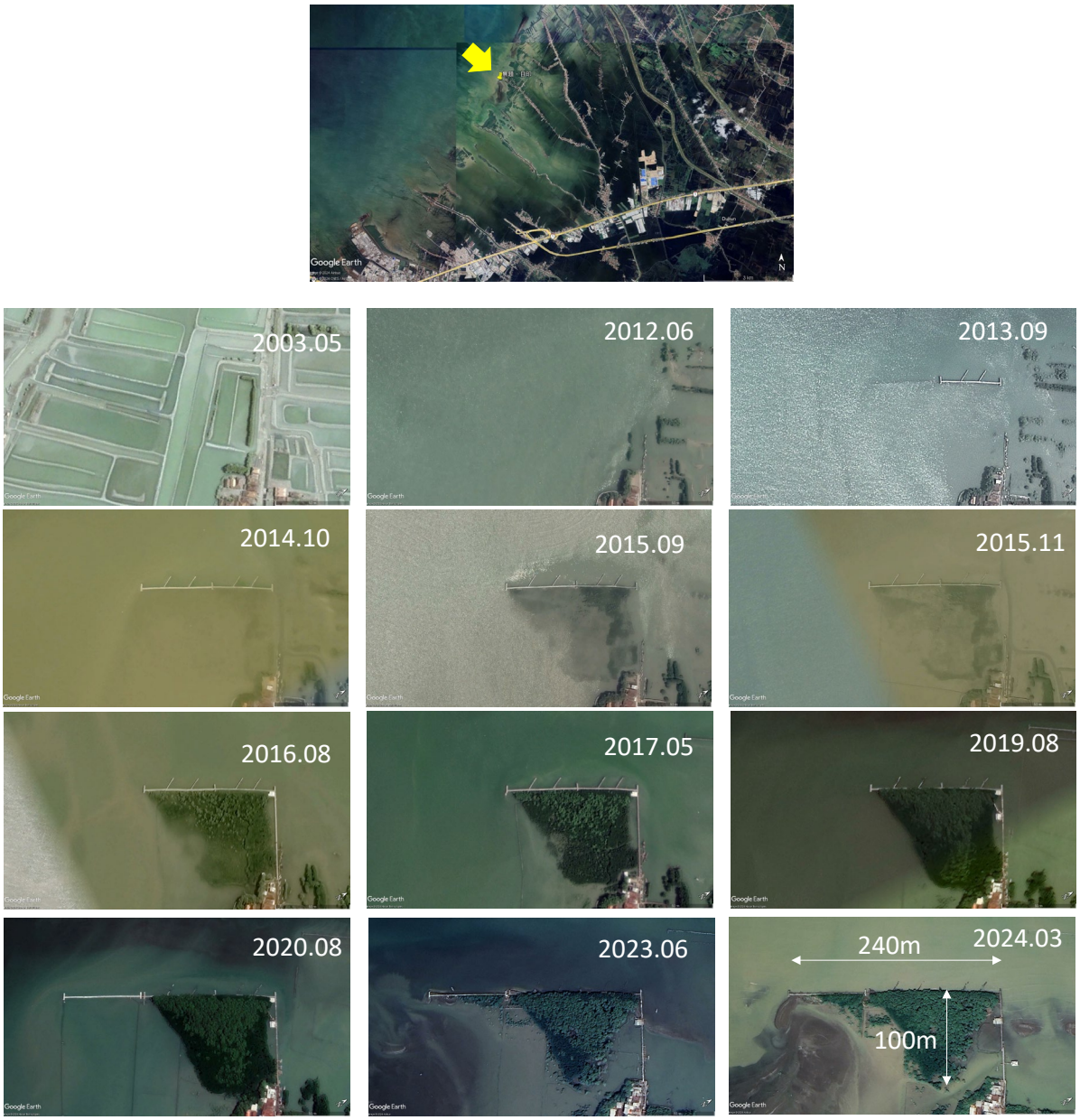
Source: Edited by JICA Study Team based on Google Earth

Figure 90 Topography change around the green infrastrucure(Cirebon)



Source: Edited by JICA Study Team based on Google Earth

Figure 91 Layout of offshore breakwaters (Cirebon)



Source: Edited by JICA Study Team based on Google Earth

Figure 92 Topography change around the green infrastrucure (Demak)

6.5 Source of Sediment Supply

6.5.1 Indramayu

The rivers flowing into IndramayuCoast are organized in Table 6. Of these, the Cipunagara River, which drains the western edge of the territory, and the Cimanuk River, which drains the center, have by far the largest basin areas. In particular, the basin of the Cimanuk River accounts for about half of the total basin area. The Cimanuk River splits in two at its mouth and supplies sediment to the east and west coasts of the area. In addition, several dams have been constructed in the Cimanuk and Cipunagara basins.

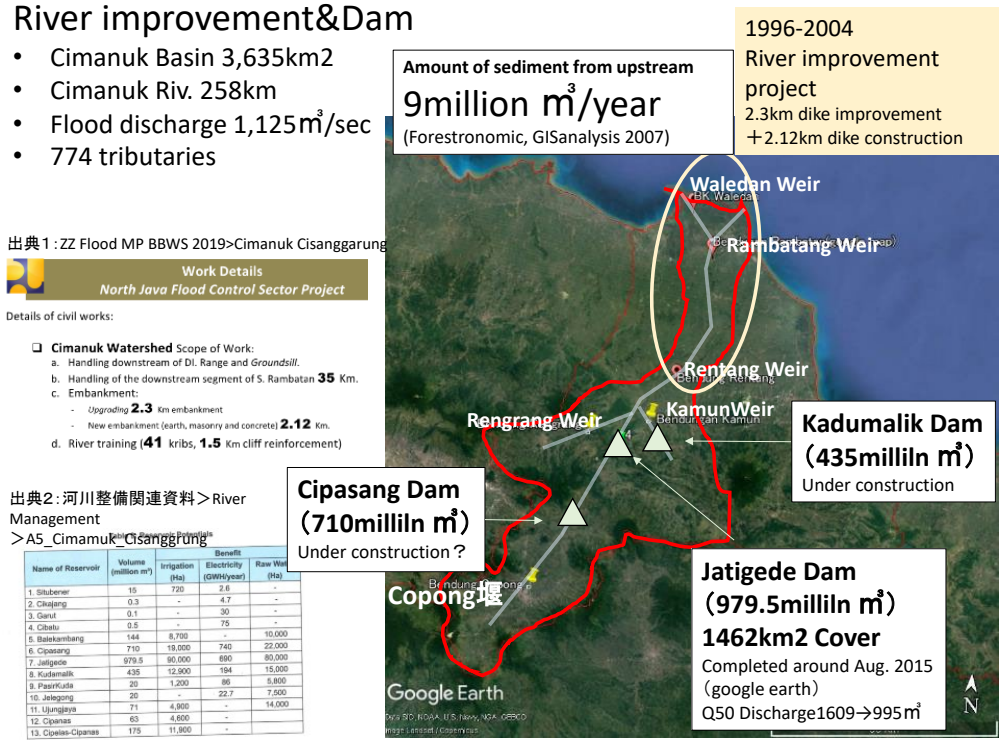
Table 6 List of Major Rivers Flowing Into Indramayu Area

No.	Name	Area (km2)	ratio of Area	River Name
1	CIPUNAGARA	1,359.81	20.0%	Sungai Cipunagara
2	K. SEWO	97.12	1.4%	Kali Sewo
3	No name	29.30	0.4%	-
4	No name	23.40	0.3%	Kali Mangsetan
5	No name	37.11	0.5%	K. Ujungwaru
6	No name	22.89	0.3%	Kali Bugel
7	No name	10.91	0.2%	-
8	CILANGAN	206.14	3.0%	Kali Menir/Ci Pancuh
9	CILANANG	326.17	4.8%	Kali Perawan/Ci Lalanang
10	No name	23.98	0.4%	-
11	CIPANAS	391.21	5.8%	Kali Cilet/Kali Cipanas
12	No name	61.99	0.9%	Kali Anyar
13	CIPANAS	343.96	5.1%	Kali Pangkalan
14	CIMANUK	3,635.68	53.6%	Kali Cimanuk/Kali Rambatan
15	No name	88.10	1.3%	Kali Prawirakepolo
16	No name	58.99	0.9%	Kali Gebangsawit, Kali Gabus, Kali Genggong
17	No name	23.23	0.3%	Kali Dutamati
18	No name	44.94	0.7%	Ci Gedang
Total		6,784.91		

Source: JICA Study Team

Source: Edited by JICA Study Team based on Google Earth

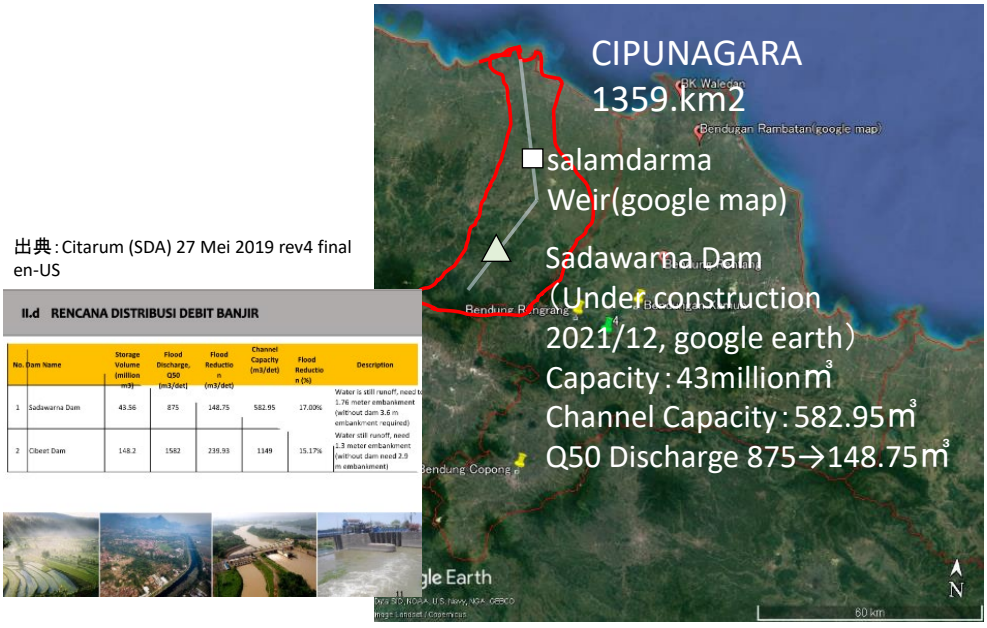
Figure 93 Basins of Major Rivers Flowing Into Indramayu Area



Name of Reservoir	Volume (million m³)	Benefit: Irrigation (Ha)	Benefit: Electricity (GWH/year)	Benefit: Raw Wat (Ha)
1. Situbener	15	720	2.6	-
2. Cikajang	0.3	-	4.7	-
3. Garut	0.1	-	30	-
4. Cibalu	0.5	-	75	-
5. Balekambang	144	8,700	-	10,000
6. Cipasang	710	19,000	740	22,000
7. Jatigede	979.5	90,000	690	80,000
8. Kudamalik	435	12,900	194	15,000
9. PasirKuda	20	1,200	86	5,800
10. Jelegong	20	-	22.7	7,500
11. Ujungjaya	71	4,900	-	14,000
12. Cipanas	63	4,600	-	
13. Cipelas-Cipanas	175	11,900	-	

Source： Eddited by JICA Study Team based on the documents by BBWS Cimanuk Cisanggarung and Google Earth

Figure 94 Status of Dams in the Cimanuk Basin



No.	Dam Name	Storage Volume (million m3)	Flood Discharge, Q50 (m3/det)	Flood Reduction (m3/det)	Channel Capacity (m3/det)	Flood Reduction (%)	Description
1	Sadawarna Dam	43.56	875	148.75	582.95	17.00%	Water is still runoff, need to 1.76 meter embankment (without dam 3.6 m embankment required)
2	Cibeet Dam	148.2	1582	239.93	1149	15.17%	Water still runoff, need 1.3 meter embankment (without dam need 2.9 m embankment)

Source： Edited by JICA Study Team based on the documents by BBWS Cimanuk Cisanggarung and Google Earth

Figure 95 Status of Dams in the Cipunagara Basin

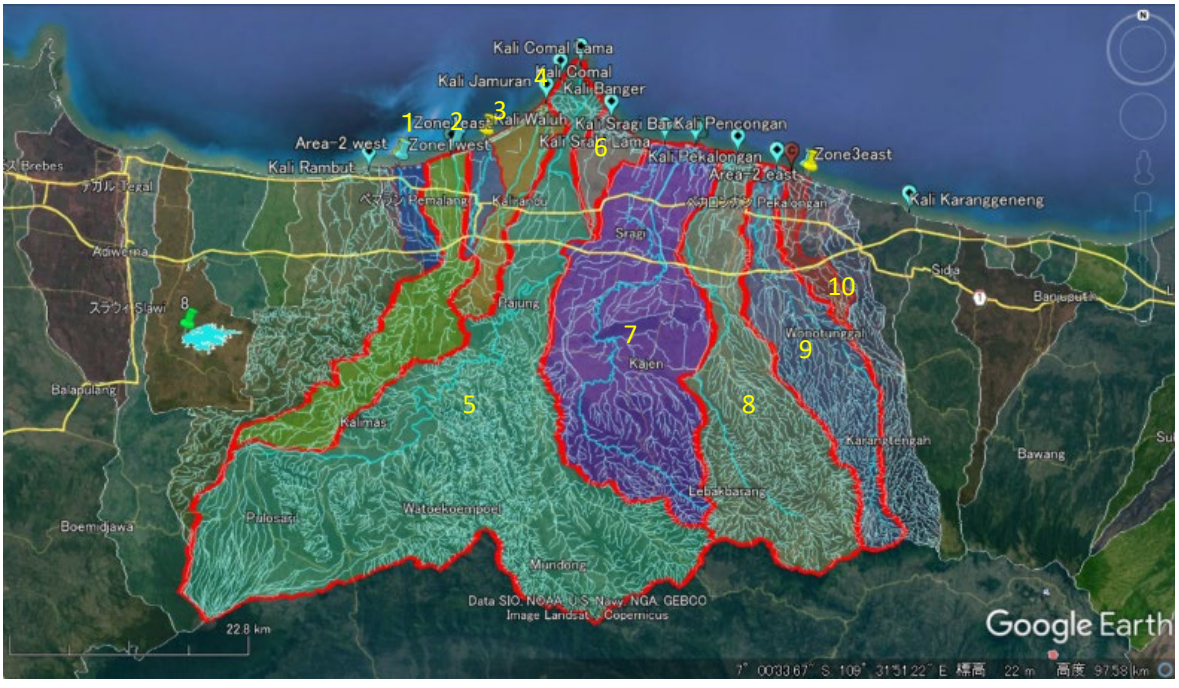
6.5.2 Pemalang-Pekalongan

The rivers flowing out to the Pemalang-Pekalongan coast are summarized in Table 7. Of these, the Comar River, which flows into the center of the region, has the largest basin area, accounting for about 40% of the total basin area. The Sragi River and Sengkarang River, which flow into Pekalongan in the eastern area, also account for about 15-20% of the basin area, and are sources of sediment supply to the Pekalongan coastal area.

Table 7 List of Major Rivers Flowing Into the Pemalang-Pekalongan Area

No.	River Basin Name	Area (km2)	Ratio of Area	River Name
1	GENTONGAN	27.76	1.3%	Kali Wirasa/Kali Srengsreng
2	WALUH	157.18	7.6%	Kali Elon
3	UNTER	25.90	1.3%	Kali Waluh
4	RANDU	69.55	3.4%	Kali Jamuran/Kali Randu
5	COMAL	821.40	39.7%	Kali Comal/Kali Comal Lama
6	BANGER	37.17	1.8%	Kali Banger
7	SRAGI	401.59	19.4%	Kali Srabi Lama/Kali Sragi Baru
8	SENGKARANG	306.31	14.8%	Kali Pencongan/Kali Sengkarang
9	KUPANG	180.22	8.7%	Kali Pekalongan/Kali Kupang/ Kali Banger
10	SUSUKAN	33.71	1.6%	Kali Susukan
	Total	2,067.79		

Source：JICA Study Team



Source：Prepared by JICA Study Team based on Google Earth

Figure 96 Basins of Major Rivers Flowing Into the Pemalang-Pekalongan Area

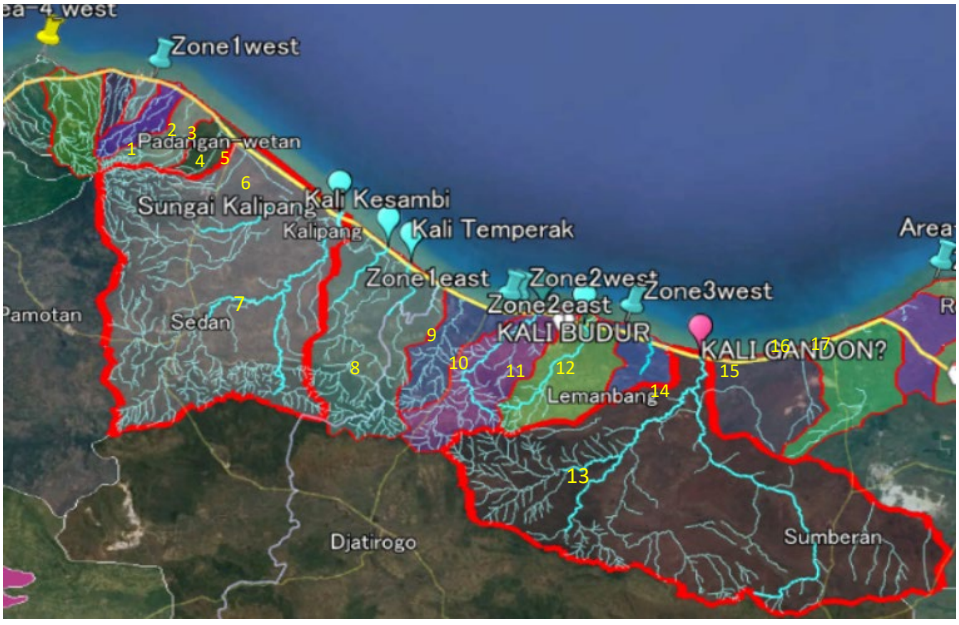
6.5.3 Rembang-Tuban

The rivers flowing out to the coast are summarized in Table 8. The Kesambi River, which flows into Rembang on the west side of the area, accounts for about 25% of the total basin. The Purumpung Klero River, which flows into Tuban on the east side of the area, accounts for about 30% of the total basin. Each river is a source of sediment supply to both coastal areas.

Table 8 List of Major Rivers Flowing Into the Rembang-Tuban Area

No.	River Basin Name	Area (km2)	Ratio of Area	River Name
1	KLADEN	17.16	2.4%	Kali Banu, Kali Dalananyar
2	SRANDUK	5.18	0.7%	Kali Sanduk,Kali Grasak
3	RANDUALAS	3.19	0.4%	Kali Randualas
4	KEPEL	8.84	1.2%	No name
5	KRESAK	11.79	1.6%	Kali Nggempol
6	ANYAR	8.21	1.1%	Kali Glonggong
7	KESAMBI	180.71	24.8%	Kali Kesambi
8	TEMPERAK	63.63	8.7%	Kali Temperak
9	LATSARI	18.84	2.6%	No name
10	BONCONG	33.54	4.6%	Kkali Boncong
11	BUDUR	28.51	3.9%	Kali Budur
12	BANCAR	11.35	1.6%	No name
13	PRUMPUNG KLERO	223.19	30.7%	Kali Gandon
14	DASIN	31.02	4.3%	No name
15	SOCOREJO	28.99	4.0%	No name
16	PURWOREJO	16.95	2.3%	No name
17	MENTOSO	23.57	3.2%	No name
Total		727.88		

Source: JICA Study Team



Source: Prepared by JICA Study Team based on Google Earth

Figure 97 Basins of Major Rivers Flowing Into the Rembang-Tuban Area

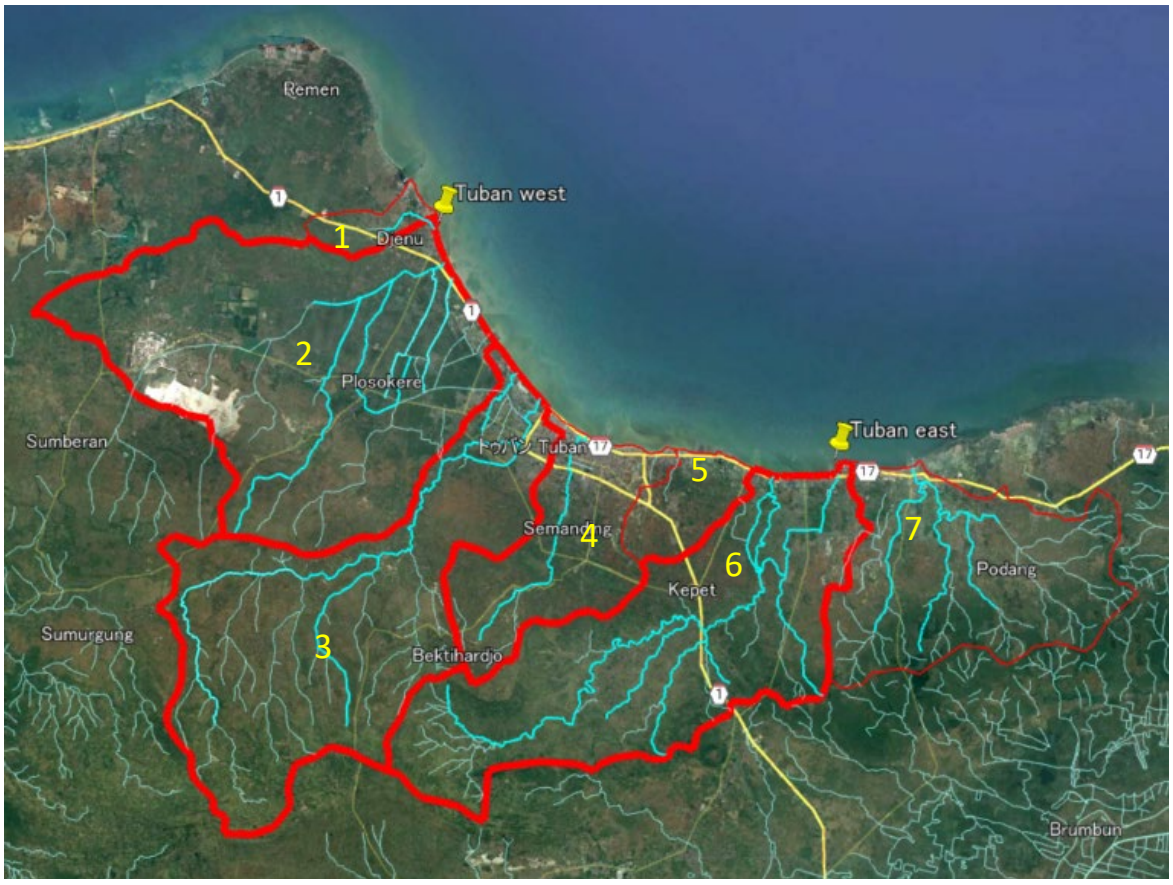
6.5.4 Tuban

The rivers flowing out to the coast are summarized in Table 9. There are three basins with a catchment area of over 100 km^2, but it is estimated that there is no significant sediment discharge because there are no jutting topography out into the sea at the river mouths. No dams have been constructed in any of the river basins.

Table 9 List of Major Rivers Flowing Into the Tuban Area

No.	River Basin Name	Area (km2)	River Name	Remark
1	KALIUNTU	5.99	KALI KALIUNTU	BPDAS SOLO
2	LAORSEMUT	125.96	KALI LAORSEMUT,KALI MENENGAN	BPDAS SOLO
3	LENGKONG	108.50	KALI LENGKONG, KALI KELOR	BPDAS SOLO
4	KARANG	38.02	SUNGAI BETO / KALI KARANG	BPDAS SOLO
5	TASIKMADU	12.50	No name	BPDAS SOLO
6	KLERO	102.13	KALI KLERO / KALI KLAREK	BPDAS SOLO
7	LOHGUNG	63.87	KALI WANGUN,KALI CAPER	BPDAS SOLO

Source: JICA Study Team



Source: Prepared by JICA Study Team based on Google Earth

Figure 98 Basins of Major Rivers Flowing Into the Tuban Area

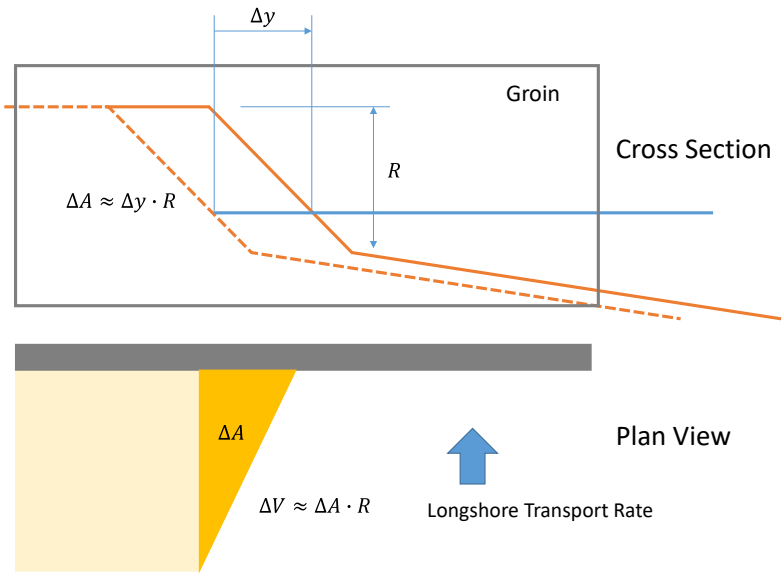
6.6 Longshore Sediment Transport

The predominant direction of littoral snad drift and the amount of it were estimated from the shoreline changes summarized above.

6.6.1 Rembang

Many jetties have been built in this coastal area, and the shoreline changes around jetties such as advancing on the east side and retreating on the west side are obvious. Therefore, the predominant direction of longshore sediment transport is estimated to be from east to west. Since part of this coastal sedimentation is captured by the jetty, deposition occurs on the upper side of the coastal sedimentation of the jetty, and as a result the shoreline advances. The amount of sediment captured by the jetty was estimated from the amount of advance. The estimation method is shown in Figure 97. Calculate the increased area due to the shoreline advancing on the upper side of the jetty, and multiply that area by the height of the foreshore. Assuming that the height R of the foreshore part is the berm height above the water surface and near the shoreline at low tide below the water surface, the berm height around the target jetty is about + 2.0 m (approximately the berm height is almost same as eye level from the right of Figure 98), and at low tide it is about –0.5 m (the tidal range of Rembang is about 1.0 m), so R = 2.5 m. In addition, since the seabed slope is gentle at about 1/80 offshore from 0.5 m, and the water depth at the tip of the jetty is shallow at about -2 m, the amount of sedimentation in this part was ignored.

The estimated result is shown in Table 10 and the relationship between the offshore length of facilities and trapped sedimentation is shown in Figure 99. From these results, it is estimated that approximately 6,000 to 8,000 m³/year of sediment was captured at facilities with an offshore length of approximately 200 to 300 m. Since this amount of sediment is a part of the amount of longshore sediment transport rate, it is presumed that the amount of longshore sediment transport is at least greater than this sediment amount.



Source: JICA Study Team

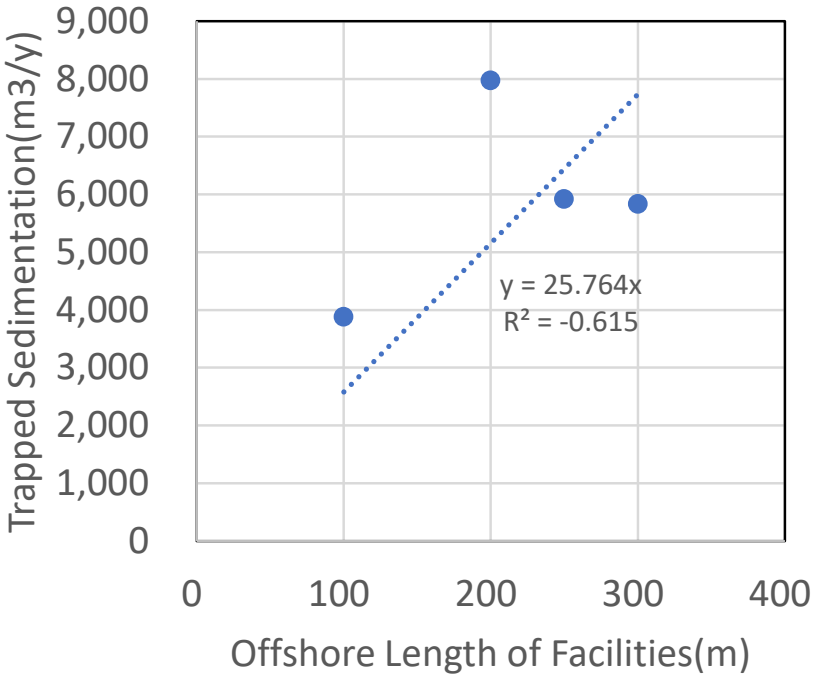
Figure 99 Estimation Method of Trapped Sedimentation by Jetty

Source： JICA Study Team

Figure 100 Beach Around the Jetty in Rembang

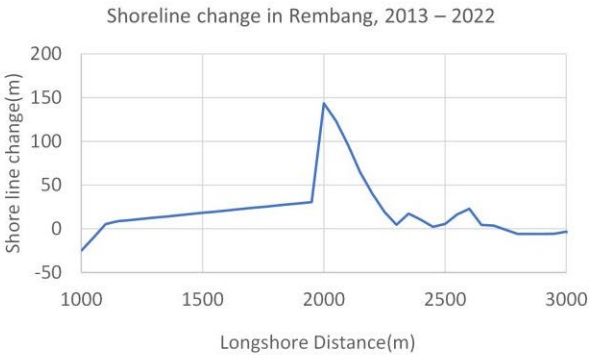
Table 10 Sediment Volume Trapped by Jetty

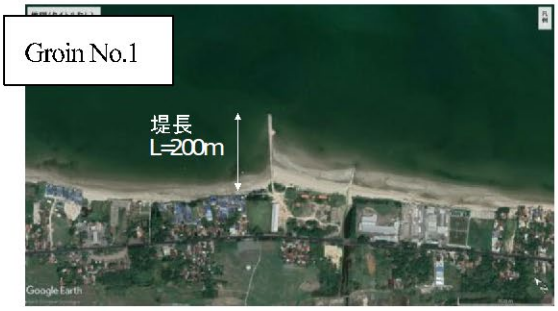
Facilities.	Rigion	Initial year	Latest year	Start coord.	End coord.	Length of facility (m)	advance shore (m)	Section area (m2)	Mean advance shore (m)	Deposition thicness (m)	Volume (m3)	duration (year)	Trapped sedimentation (m3/y)
Groin_1	West	2013	2022	2,000	2,700	200	140	28,723	41	2.5	71,808	9	7,979
Groin_2	West	2013	2022	7,750	8,100	100	60	13,988	40	2.5	34,970	9	3,886
Groin_3	West	2008	2022	13,750	14,350	250	120	33,181	55	2.5	82,951	14	5,925
Breakwater	West	2008	2022	26,550	27,150	300	100	32,698	54	2.5	81,744	14	5,839

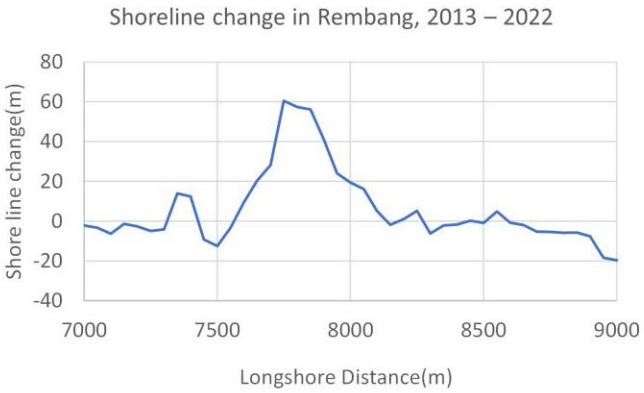


Source: JICA Study Team

Figure 101 Relationship Between Offshore Length of Facilities and Trapped Sedimentation

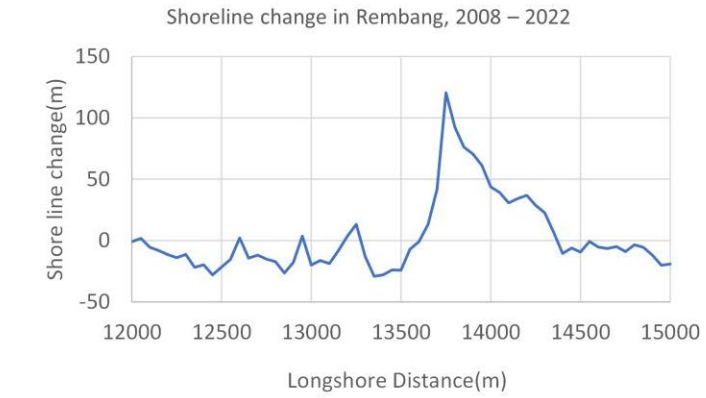


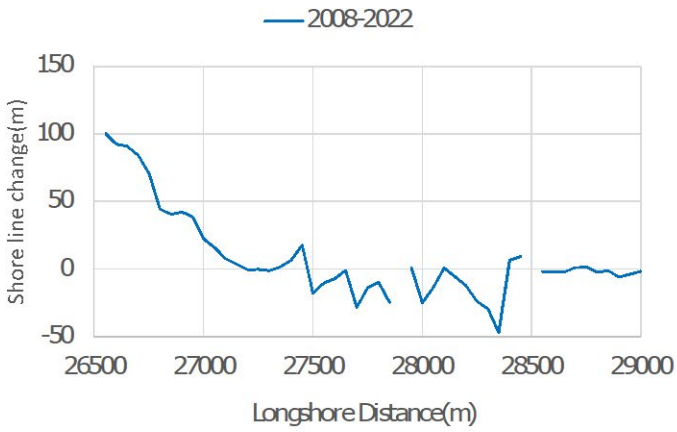


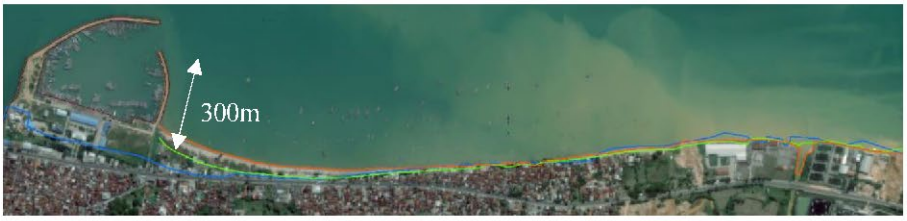


Source: Aerial Photo Groin No.1 by Google Earth, Groin No.2 by JICA Study Team

Figure 102 Shoreline Change Caused by Trapping Longshore Sediment Transport





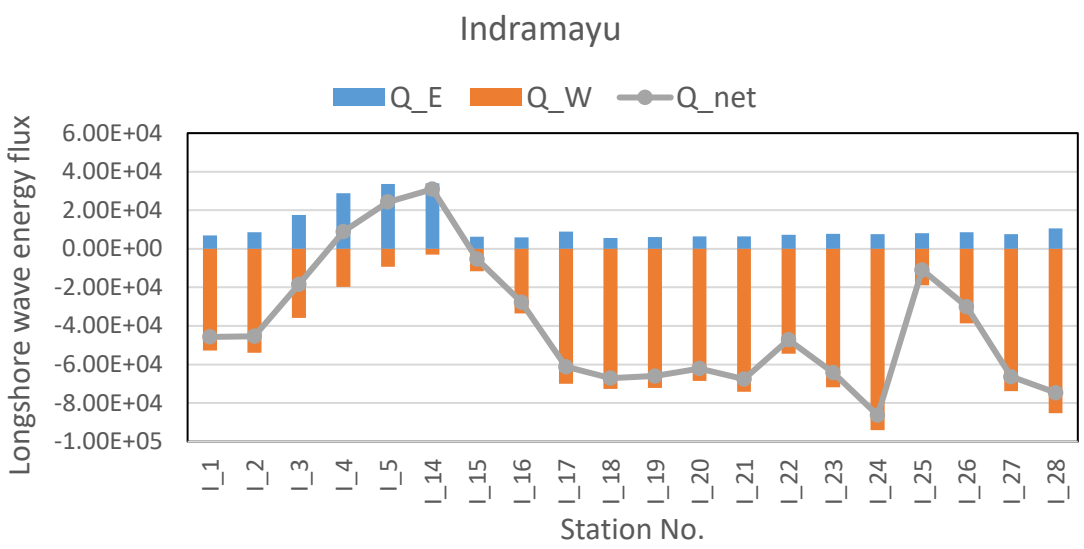


Source: Aerial Photo Groin No.3 by Google Earth, Port by JICA Study Team

Figure 103 Shoreline Change Caused by Trapping Longshore Sediment Transport

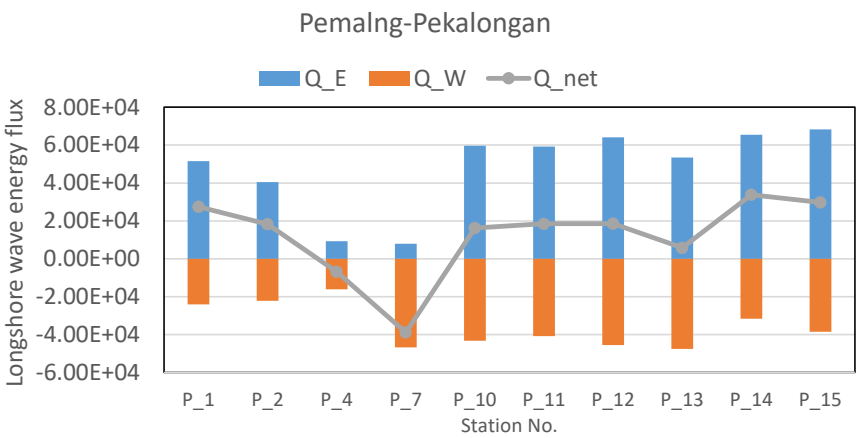
6.7 Longshore Sediment Transport estmated by Wave Analysis

The dominant direction of littoral sand drift in each coastal area was estimated from the estimated wave data of ERA5 and wave deformation calculation using the energy balance equation. The coastal sediment distribution along the Indramayu, Pemalang-Pekalongan, Rembang-Tuban and Tuban coasts is shown in Figure 93, Figure 94,Figure 95 and Figure 105, respectively. In each figure, the littoral sand drift in eastward (Q_E) and westward (Q_W) directions and also the composite of both (Q_net) are shown.



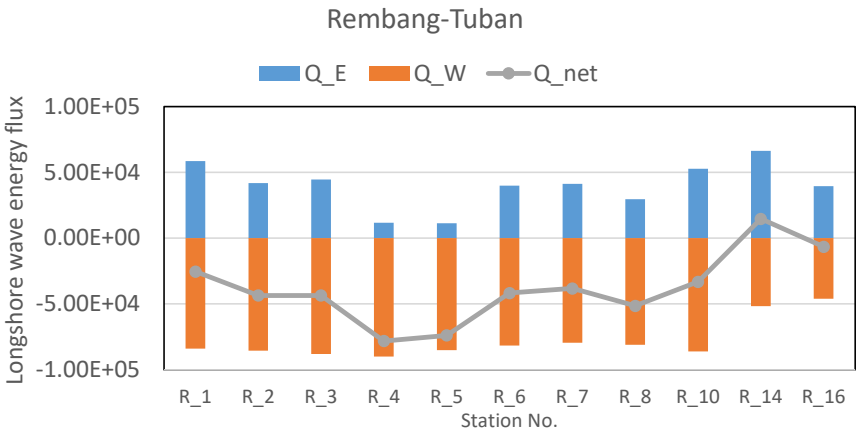
Source: Top ; Edited by JICA Study Team based on Google Earth, Bottom ; JICA Study Team

Figure 104 Characteristics of longshore sediment transport in Indramayu



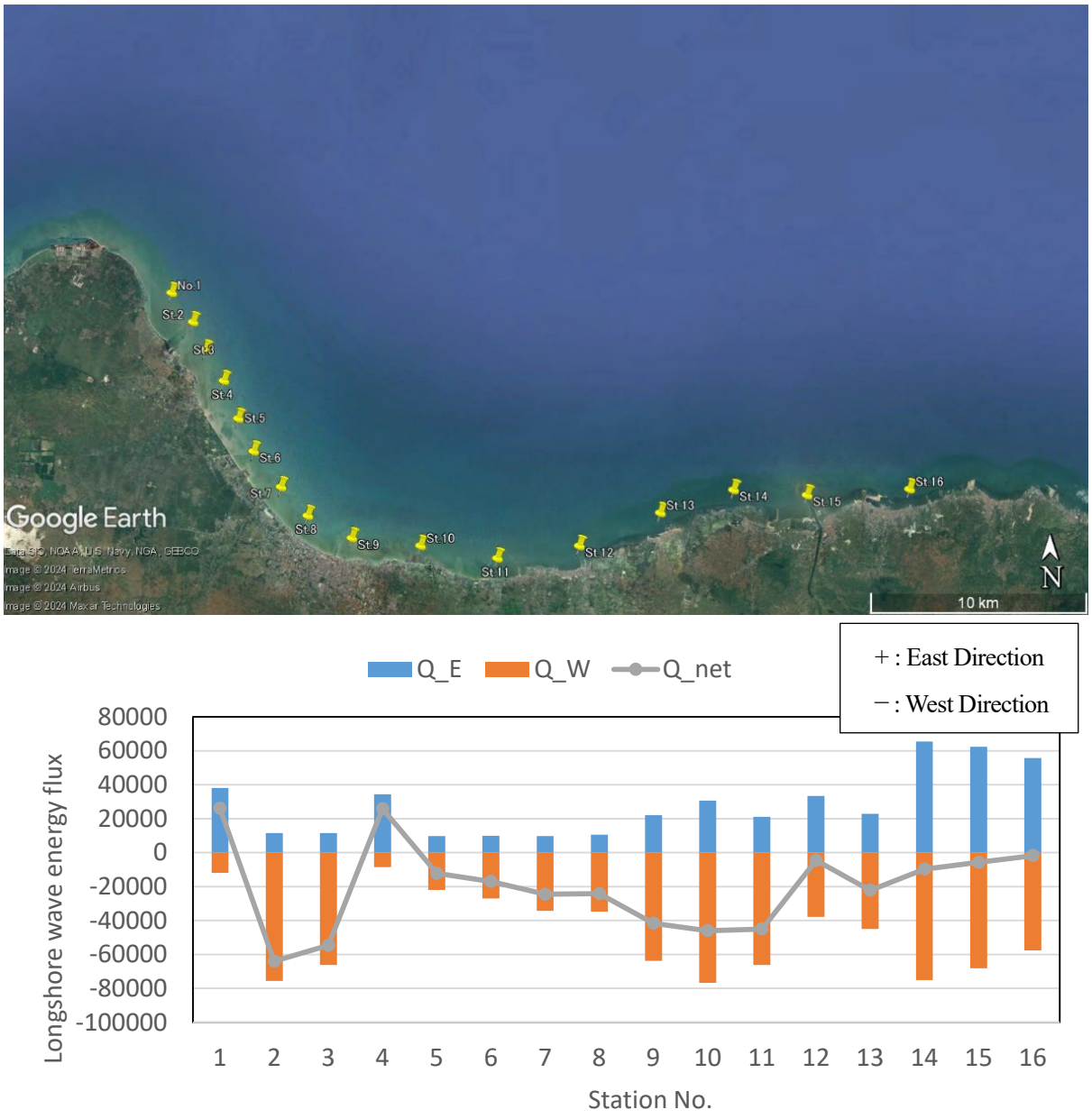
Source:Top ; Edited by JICA Study Team based on Google Earth, Bottom ; JICA Study Team

Figure 105 Characteristics of longshore sediment transport in Pemalang-Pekalongan



Source:Top ; Edited by JICA Study Team based on Google Earth, Bottom ; JICA Study Team

Figure 106 Characteristics of longshore sediment transport in Rembang-Tuban



Source:Top ; Edited by JICA Study Team based on Google Earth, Bottom ; JICA Study Team

Figure 107 Characteristics of longshore sediment transport in Tuban

6.8 Tidal flood

In order to assess the risk of flooding in the target coastal area, we determined the inundation area in the hinterland based on ground elevation and water level conditions. As shown after, the inundation area shown here is not determined by tracing the process of seawater flooding inland, but is simply determined by comparing with the ground elevation inland and the high tide water level.

6.8.1 Cause of tidal flood

The actual phenomenon occur when the sea level rises due to a storm surge and then high waves attack, and the following two phenomena occur individually or simultaneously.

A) Sea level rises and land area is flooded

B) Land areas are flooded due to high waves overtopping

The following are assumed to be the causes of sea level rise.

① High tide level due to astronomical tide (maximum tide level of the year)

② Water level rise due to pressure difference due to low pressure, wind blowing, etc.

③ Water level rise due to waves (Wave Set-up)

④ Sea level rise due to climate change

⑤ Relative sea level rise due to land subsidence

Here, for A), we will evaluate sea level rise caused by factors except ②.

6.8.2 Estimated method of tidal flood

Calculations will be made under the following conditions using the ``level flooding method," which sets the flooded area based on a set sea level and comparison with the ground elevation of the hinterland.

- Flood route

Even if the altitude near the coast is high, if the water level behind coast is lower than the set water level, it will be evaluated as being at risk of flooding. Particularly in erosional areas, there is a risk of loss of areas at higher elevations due to erosion, and the risk of flooding to hinterland areas at lower elevations is expected to increase.

- Scope behind the evaluation target

Evaluate the area up to 1 km behind the shoreline.

- Calculation of flooded area

The distribution of the inundated area in the coastal direction was determined by calculating the inundated area behind the established baseline in 50 m increments in the coastal direction.

6.8.3 Condition of sea-level rise

(1) High tide level due to astronomical tides

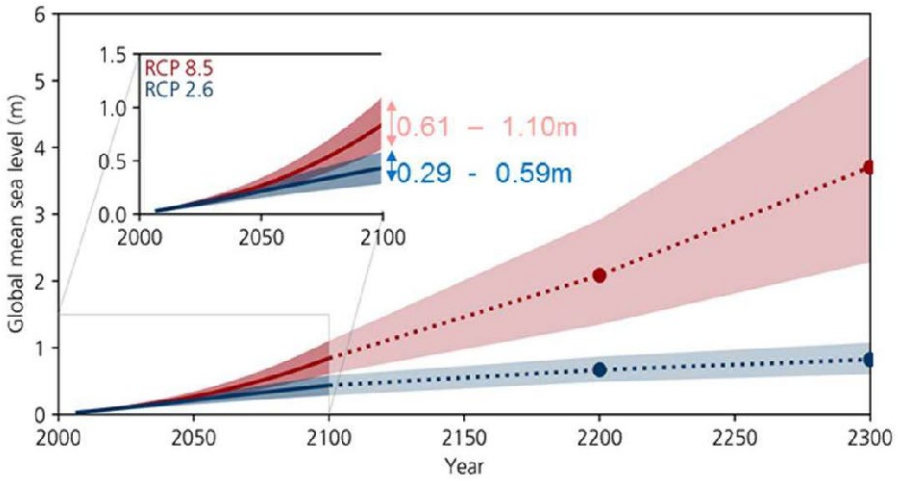
This is the annual maximum tide level condition for the area.

(2) Water level rise due to waves (Wave Set-up)

According to Goda's method(Goda,2008), the equivalent deepwater wave height at each point for a 50-year return wave is used as wave condition. The seabed slope is asuumed to be the foreshore slope 1/10, because the wave height is approximately 1 to 1.5 m, and it is assumed that the waves will break near the foreshore at high tide.

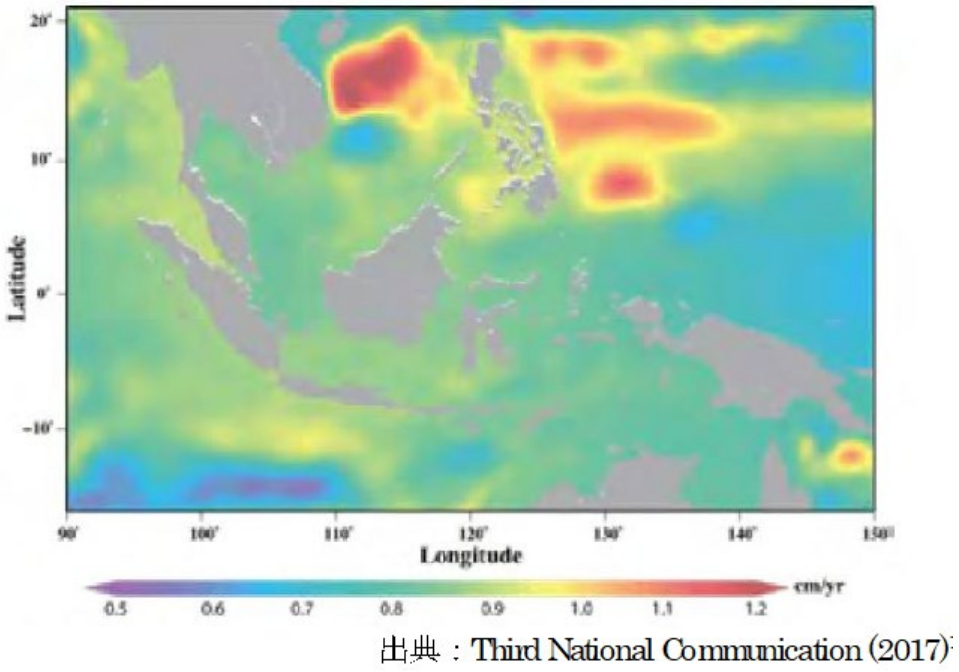
(3) Sea level rise due to climate change

The Special Report on the Ocean and Cryosphere (SROCC, 2019) issued by the IPCC predicts the amount of sea level rise shown in Figure 106. From these, it is assumed that the global average sea level rise at the end of the 21st century under the RCP2.6 scenario is 0.29 to 0.59 m≒0.4 m. According to Third National Communication (2017), the rate of sea level rise in the waters surrounding the Java Sea is predicted to be 0.8 to 0.9 cm/year based on RCP4.5 (Figure 107). At this rate, the amount of sea level rise at the end of the 21st century will be approximately 0.8 m, approximately twice that of RCP2.6.



Source : IPCC SROCC, 2019

Figure 108 Sea level rise by IPCC SROCC



Source:Third National Communication(2017)

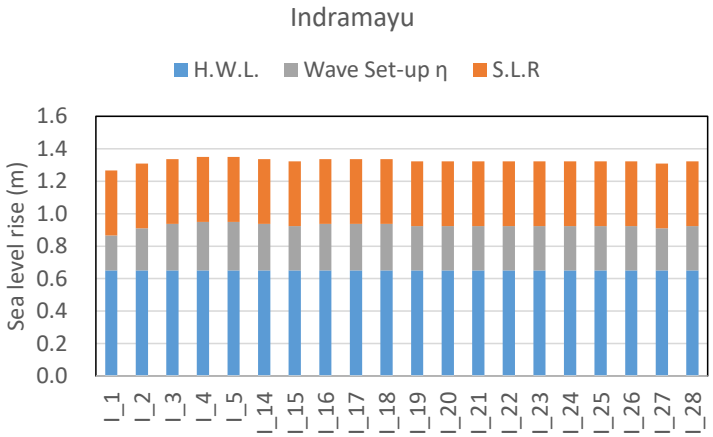
Figure 109 Distribution of sea level rise speed between 2006 and 2040 based on RCP4.5

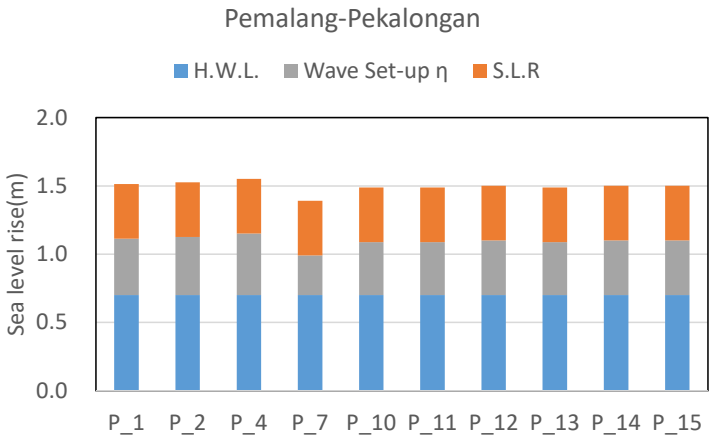
(4) Relative sea level rise due to land subsidence

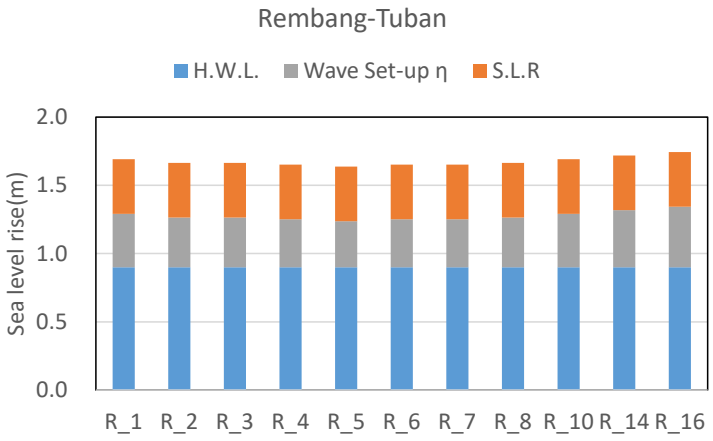
The amount of land subsidence 50 years from now on each coast. Acoording to existing data, only Pekalongan of Pemalang-Pekalongan should be considered for land subsidence along the target coast, and the rate of land subsidence is set at 7 cm/year. However, if this value is used, it will be 3.5 m in 50 years, which is considered excessive.

6.8.4 Sea Level Rise

Among the factors for water level rise listed above, ground subsidence is highly regional, and there are many uncertain factors regarding future ground subsidence rates. Therefore, the water level rise by causes (H.H.W.L: Annual maximum tide level, Wave Set-up η: Amount of water level rise due to waves, S.L.R: Amount of sea level rise due to climate change) except land sunsidence was calculated. The water levels above mean sea level for each coastal area are shown below. The station numbers in the coastal direction are the same as those shown in Figure 26 to Figure 28.







Source: JICA Study Team

Figure 110 Estimation condition of water level rise

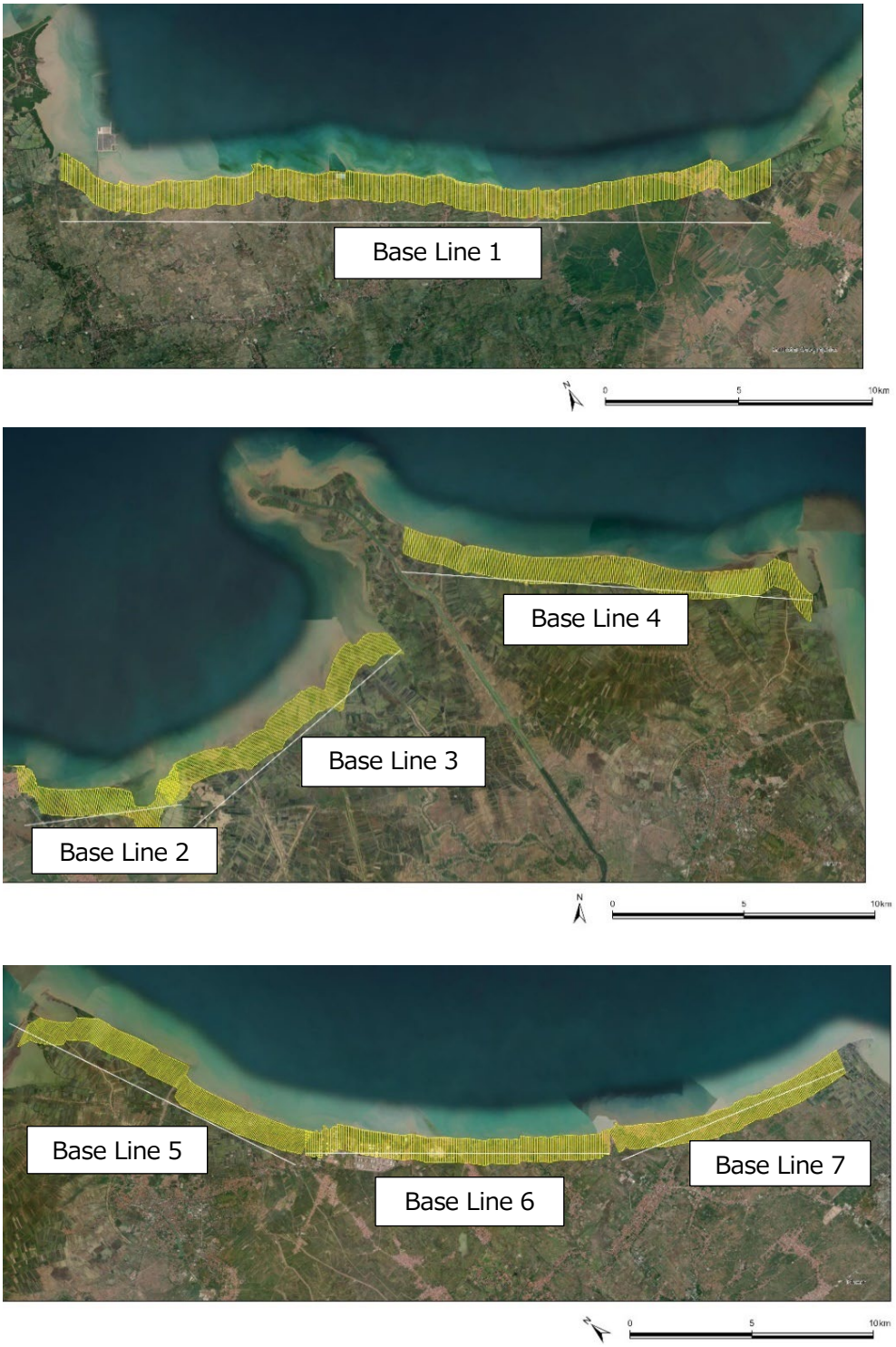
Table 11 Estimation result of water level

Coast	Staion.No.	H.W.L.	S.L.R	$H_{1/3}$_50	Tm_50	H'0/L0	Tan θ	η /H0	Wave Set-up η	Land subsidence		D.W.L		
		(m)	(m)	(m)	(s)				(m)	m/yr※	m/50yr	with L.S	without L.S.	without L.S.and SLR
Indramayu	I_1	0.65	0.40	1.10	5.80	0.0210	0.10	0.197	0.22	0.00	0.00	1.27	1.27	0.87
	I_2	0.65	0.40	1.40	5.80	0.0267	0.10	0.185	0.26	0.00	0.00	1.31	1.31	0.91
	I_3	0.65	0.40	1.60	5.80	0.0305	0.10	0.179	0.29	0.00	0.00	1.34	1.34	0.94
	I_4	0.65	0.40	1.70	5.80	0.0324	0.10	0.177	0.30	0.00	0.00	1.35	1.35	0.95
	I_5	0.65	0.40	1.70	5.80	0.0324	0.10	0.177	0.30	0.00	0.00	1.35	1.35	0.95
	I_14	0.65	0.40	1.60	5.80	0.0305	0.10	0.179	0.29	0.00	0.00	1.34	1.34	0.94
	I_15	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_16	0.65	0.40	1.60	5.80	0.0305	0.10	0.179	0.29	0.00	0.00	1.34	1.34	0.94
	I_17	0.65	0.40	1.60	5.80	0.0305	0.10	0.179	0.29	0.00	0.00	1.34	1.34	0.94
	I_18	0.65	0.40	1.60	5.80	0.0305	0.10	0.179	0.29	0.00	0.00	1.34	1.34	0.94
	I_19	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_20	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_21	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_22	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_23	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_24	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_25	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_26	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
	I_27	0.65	0.40	1.40	5.80	0.0267	0.10	0.185	0.26	0.00	0.00	1.31	1.31	0.91
	I_28	0.65	0.40	1.50	5.80	0.0286	0.10	0.182	0.27	0.00	0.00	1.32	1.32	0.92
Pemalan-Pekalongan	P_1	0.70	0.40	2.40	6.60	0.0353	0.10	0.173	0.41	0.00	0.00	1.51	1.51	1.11
	P_2	0.70	0.40	2.50	6.60	0.0368	0.10	0.171	0.43	0.00	0.00	1.53	1.53	1.13
	P_4	0.70	0.40	2.70	6.60	0.0397	0.10	0.168	0.45	0.00	0.00	1.55	1.55	1.15
	P_7	0.70	0.40	1.50	6.60	0.0221	0.10	0.195	0.29	0.00	0.00	1.39	1.39	0.99
	P_10	0.70	0.40	2.20	6.60	0.0324	0.10	0.177	0.39	0.07	3.50	4.99	1.49	1.09
	P_11	0.70	0.40	2.20	6.60	0.0324	0.10	0.177	0.39	0.07	3.50	4.99	1.49	1.09
	P_12	0.70	0.40	2.30	6.60	0.0338	0.10	0.175	0.40	0.07	3.50	5.00	1.50	1.10
	P_13	0.70	0.40	2.20	6.60	0.0324	0.10	0.177	0.39	0.07	3.50	4.99	1.49	1.09
	P_14	0.70	0.40	2.30	6.60	0.0338	0.10	0.175	0.40	0.07	3.50	5.00	1.50	1.10
	P_15	0.70	0.40	2.30	6.60	0.0338	0.10	0.175	0.40	0.07	3.50	5.00	1.50	1.10
Rembang-Tuban	R_1	0.90	0.40	2.20	6.70	0.0314	0.10	0.178	0.39	0.00	0.00	1.69	1.69	1.29
	R_2	0.90	0.40	2.00	6.70	0.0286	0.10	0.182	0.36	0.00	0.00	1.66	1.66	1.26
	R_3	0.90	0.40	2.00	6.70	0.0286	0.10	0.182	0.36	0.00	0.00	1.66	1.66	1.26
	R_4	0.90	0.40	1.90	6.70	0.0271	0.10	0.185	0.35	0.00	0.00	1.65	1.65	1.25
	R_5	0.90	0.40	1.80	6.70	0.0257	0.10	0.187	0.34	0.00	0.00	1.64	1.64	1.24
	R_6	0.90	0.40	1.90	6.70	0.0271	0.10	0.185	0.35	0.00	0.00	1.65	1.65	1.25
	R_7	0.90	0.40	1.90	6.70	0.0271	0.10	0.185	0.35	0.00	0.00	1.65	1.65	1.25
	R_8	0.90	0.40	2.00	6.70	0.0286	0.10	0.182	0.36	0.00	0.00	1.66	1.66	1.26
	R_10	0.90	0.40	2.20	6.70	0.0314	0.10	0.178	0.39	0.00	0.00	1.69	1.69	1.29
	R_14	0.90	0.40	2.40	6.70	0.0343	0.10	0.174	0.42	0.00	0.00	1.72	1.72	1.32
	R_16	0.90	0.40	2.60	6.70	0.0371	0.10	0.170	0.44	0.00	0.00	1.74	1.74	1.34

Source: JICA Study Team

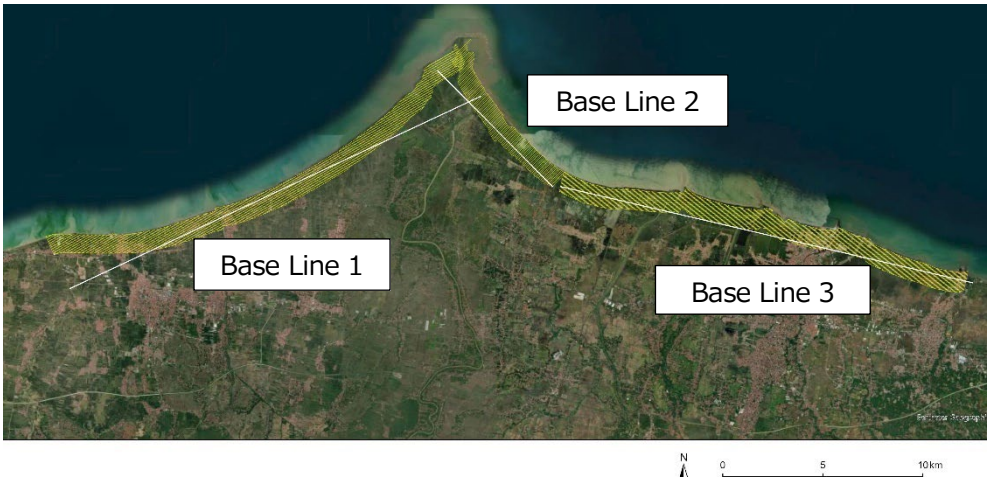
6.8.5 Target Area of Tidal flood

The area for calculating the inundation area was set as 1 km inland from the current coastline, on base of the basic axis set in the shoreline change analysis. The range is shown in below.



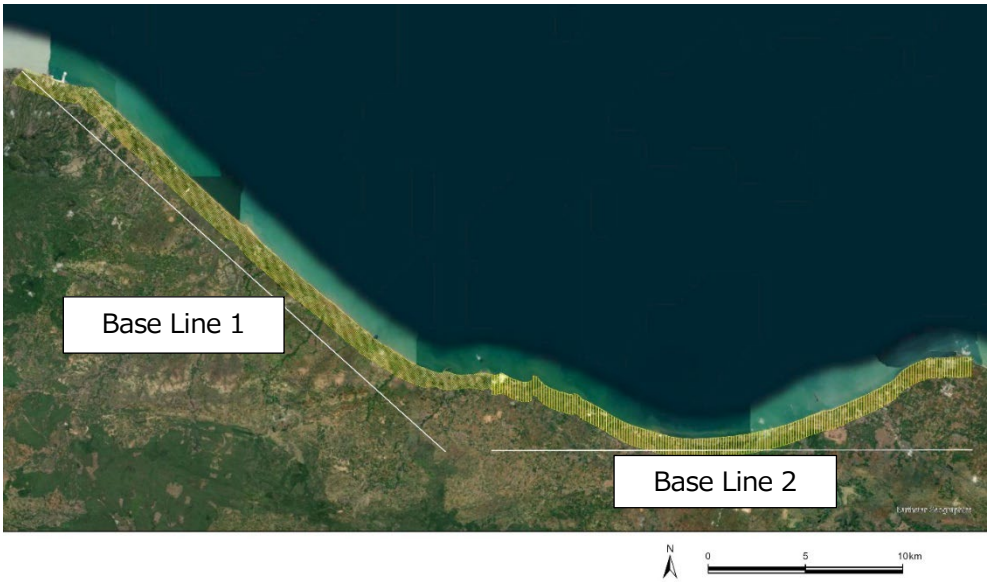
Source: Edited by JICA Study Team based on Google Earth

Figure 111 Estimation area for flooding in Indramayu



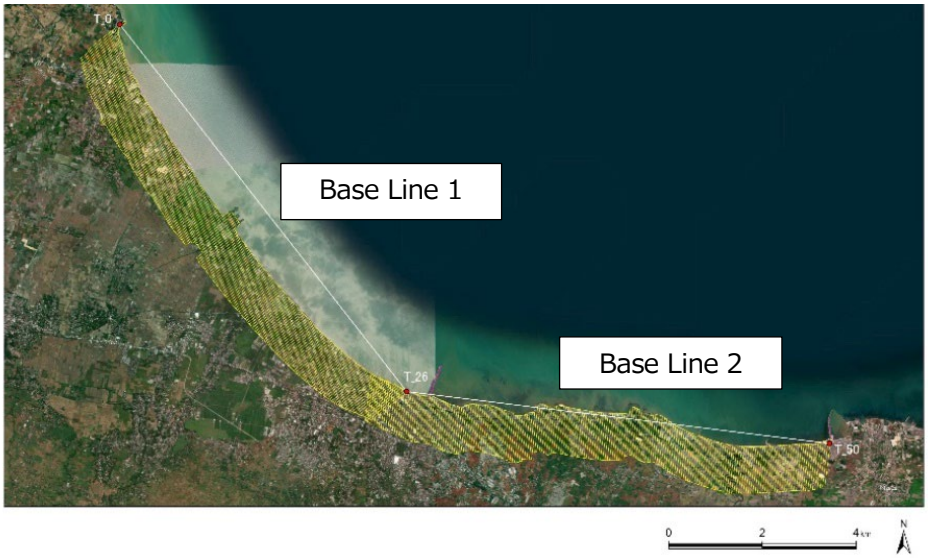
Source: Edited by JICA Study Team based on Google Earth

Figure 112 Estimation area for flooding in Pemalang-Pekalongan



Source: Edited by JICA Study Team based on Google Earth

Figure 113 Estimation area for flooding in Rembang-Tuban



Source: Edited by JICA Study Team based on Google Earth

Figure 114 Estimation area for flooding in Tuban

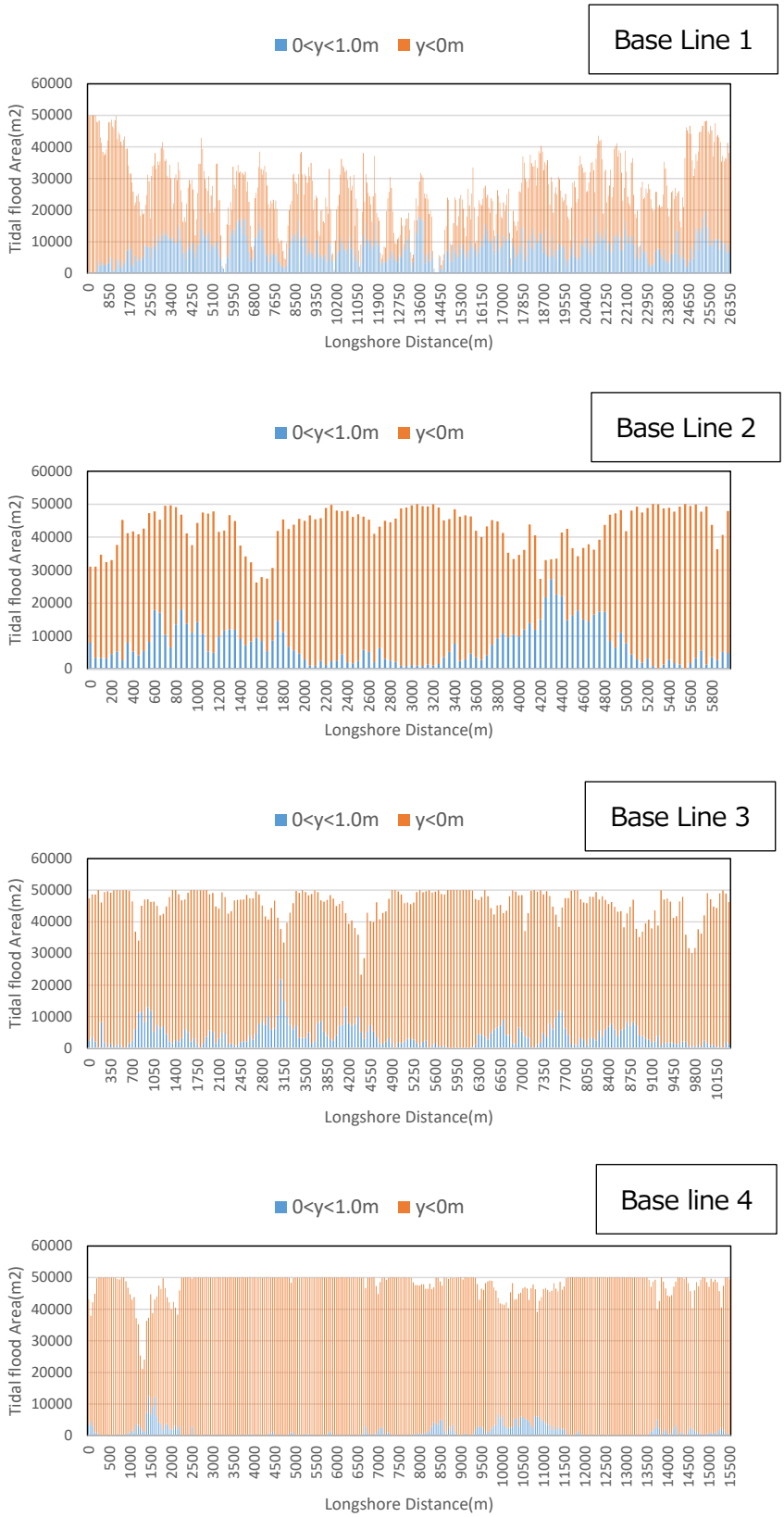
6.8.6 Area of Tidal flood

Inundation calculations were performed by determining the inundated area within 1 km from the shoreline at the set water level. The water level conditions based on the distribution in the coastal direction in each coastal area were set as follows, excluding the amount of sea level rise due to climate change from the amount of water level rise.

- Indramayu total baseline: 1.0 m
- Pemalang-Pekalongan Baseline 1: 1.2 m, Baseline 2: 1.1 m, Baseline 3: 1.1 m
- Rembang-Tuban Baseline 1: 1.3 m, Baseline 2: 1.4 m
- Tuban Baseline 1: 1.3 m, Baseline 2: 1.3m

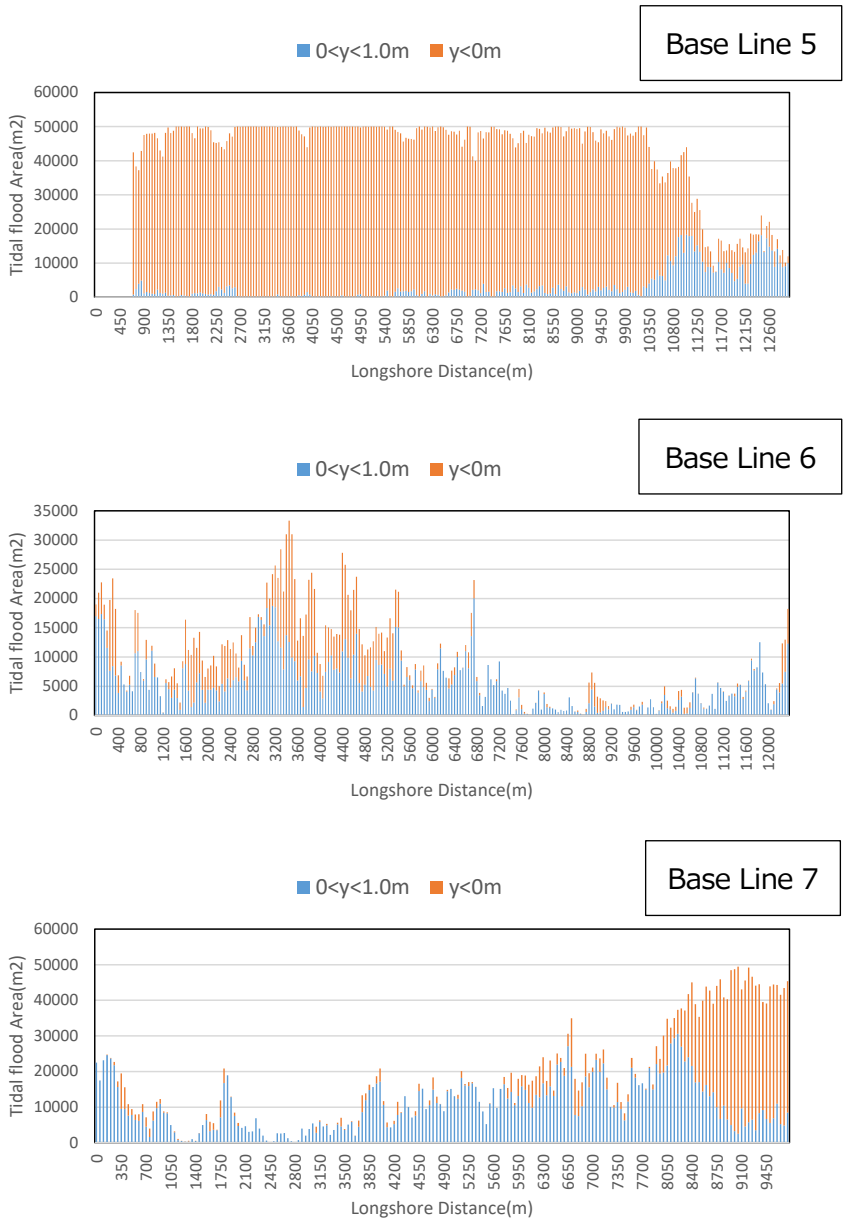
Figure 112 to Figure 115 show the inundation areas calculated under the above water level conditions for each coastal area and each baseline. Since there are some places where the back ground is below 0 m, the figure is calculated by dividing the area below 0 m and the area above 0 m and below the set water level.

It can be seen that in Indramayu, there are many places where the ground height is less than 0 m on baselines 1 to 5. In Pemalang-Pekalongan, most of the ground heights at Baseline 2 are below 0 m. On the other hand, Rembang-Tuban and Tuban have relatively high ground elevation, so there are few areas below 0 m, and the area below the set water level is also smaller than other coasts.



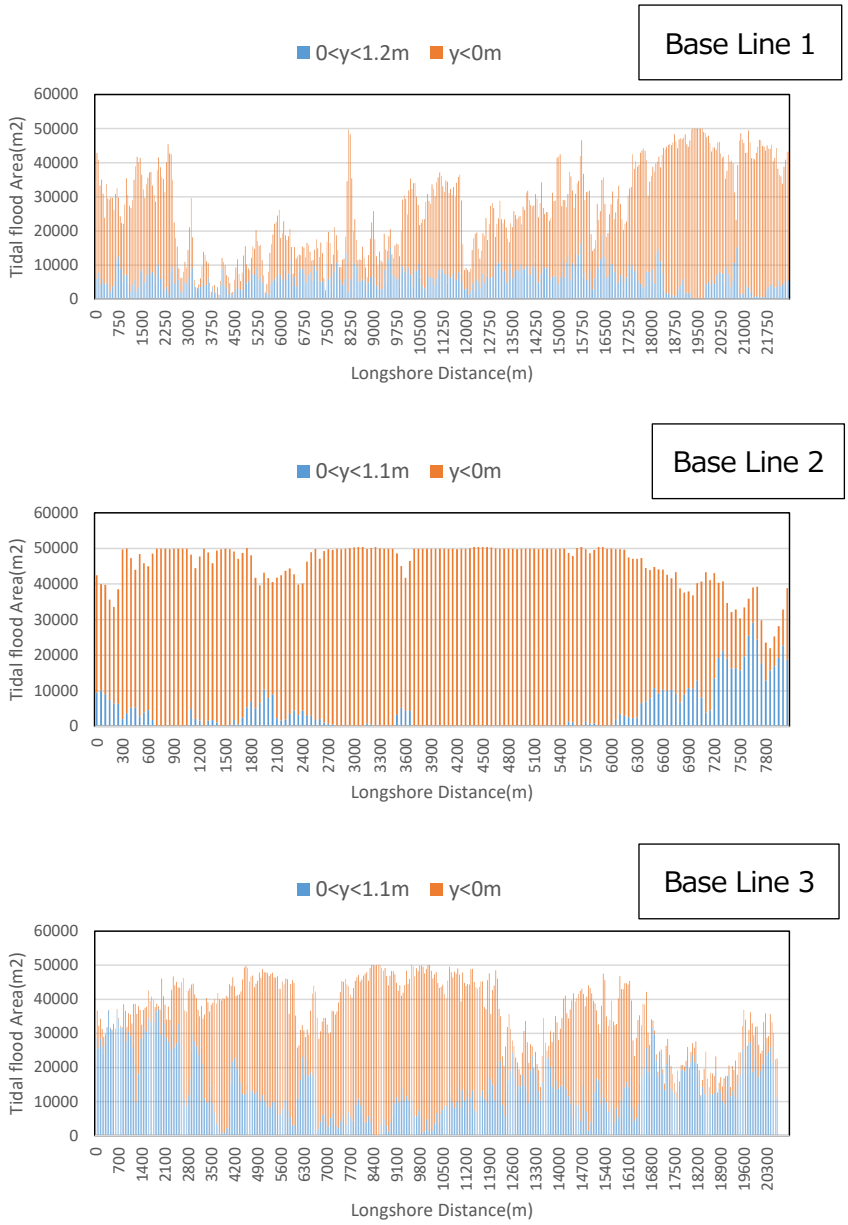
Source: JICA Study Team

Figure 115 Flooded area in Indramayu (1)



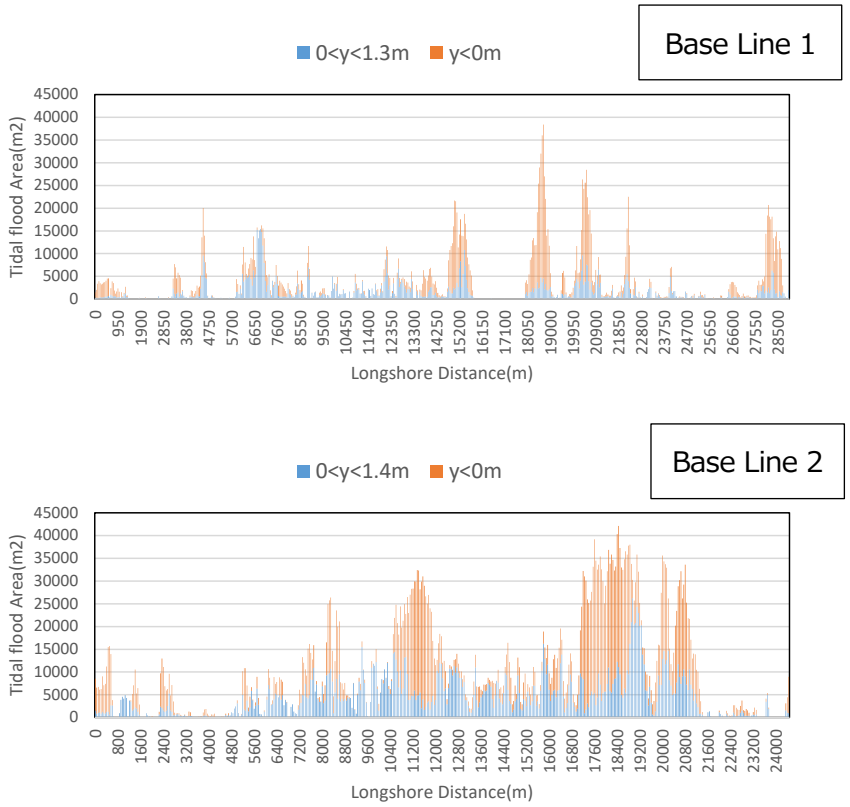
Source: JICA Study Team

Figure 116 Flooded area in Indramayu (2)



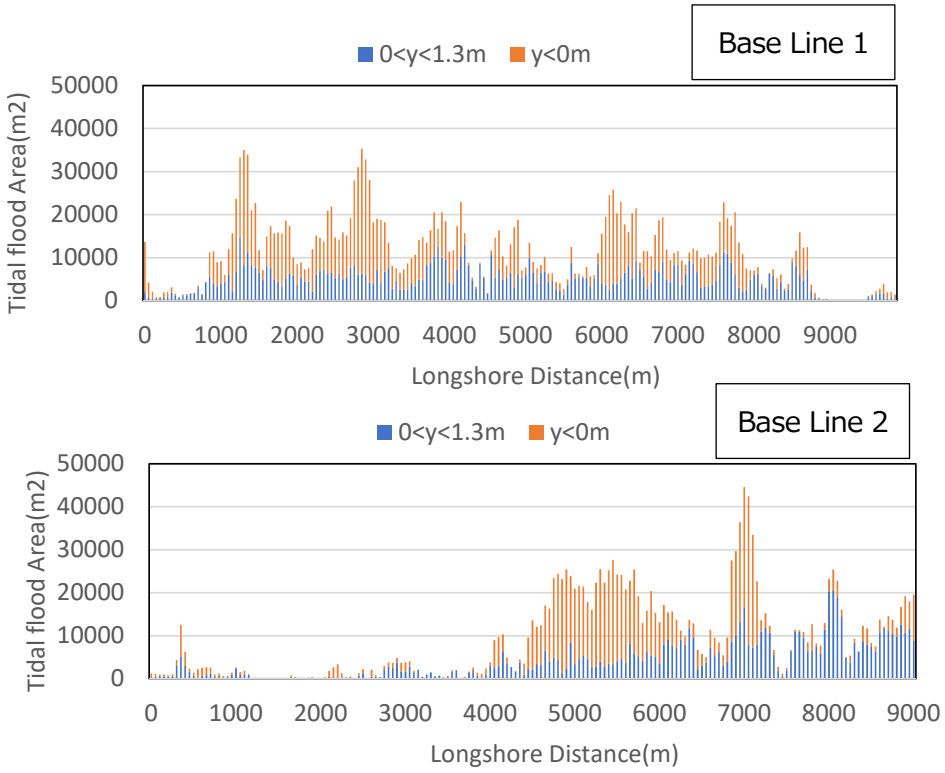
Source: JICA Study Team

Figure 117 Flooded area in Pemalang-Pekalongan



Source: JICA Study Team

Figure 118 Flooded area in Rembang-Tuban



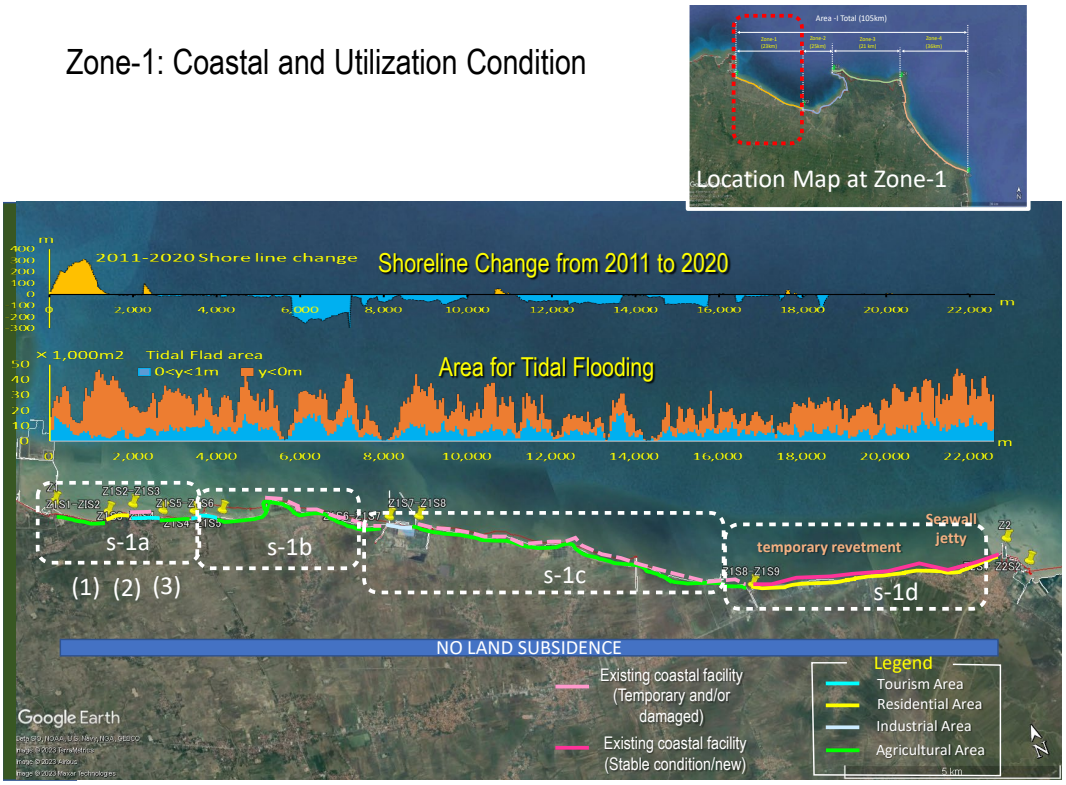
Source: JICA Study Team

Figure 119 Flooded area in Tuban

Appendix-8
Assessment of Coastal Conditions

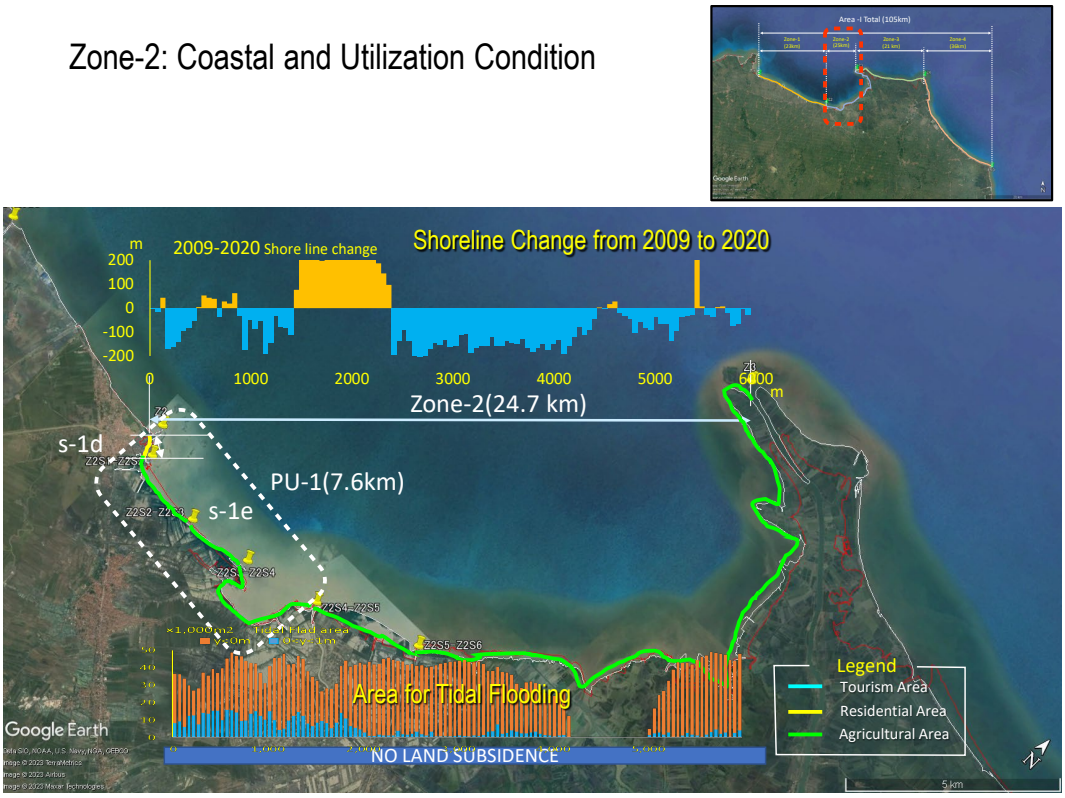
Appendix-8 Assessment of Coastal Conditions

A) Area-I: Indramayu



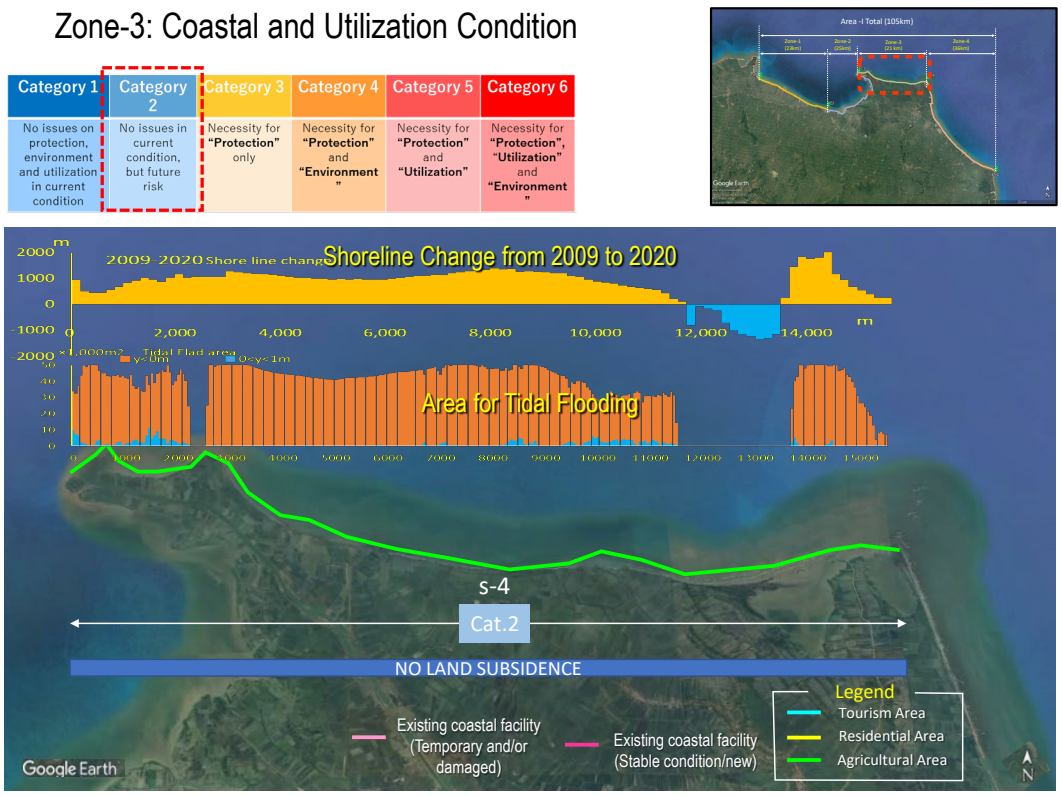
Source: Edited by JICA Study Team based on Google Earth

Figure 1 Area-I S-1 の評価 Figure



Source: Edited by JICA Study Team based on Google Earth

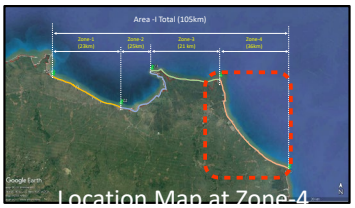
Figure 2　Area-I　S-2、3 の評価 Figure

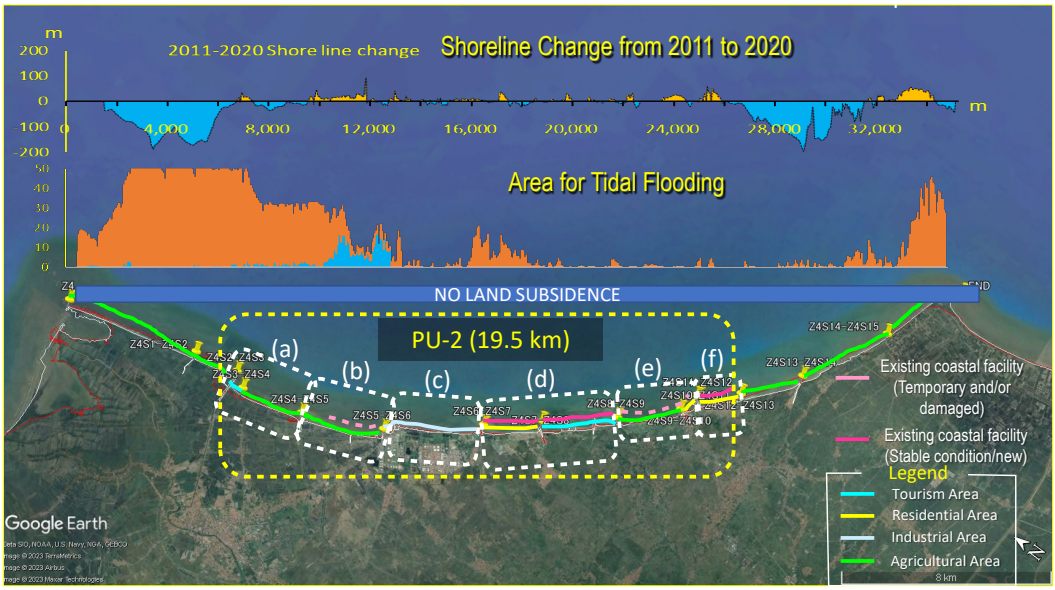


Source: Edited by JICA Study Team based on Google Earth

Figure 3　Area-I　S-4 の評価 Figure

Zone-4: Coastal and Utilization Condition

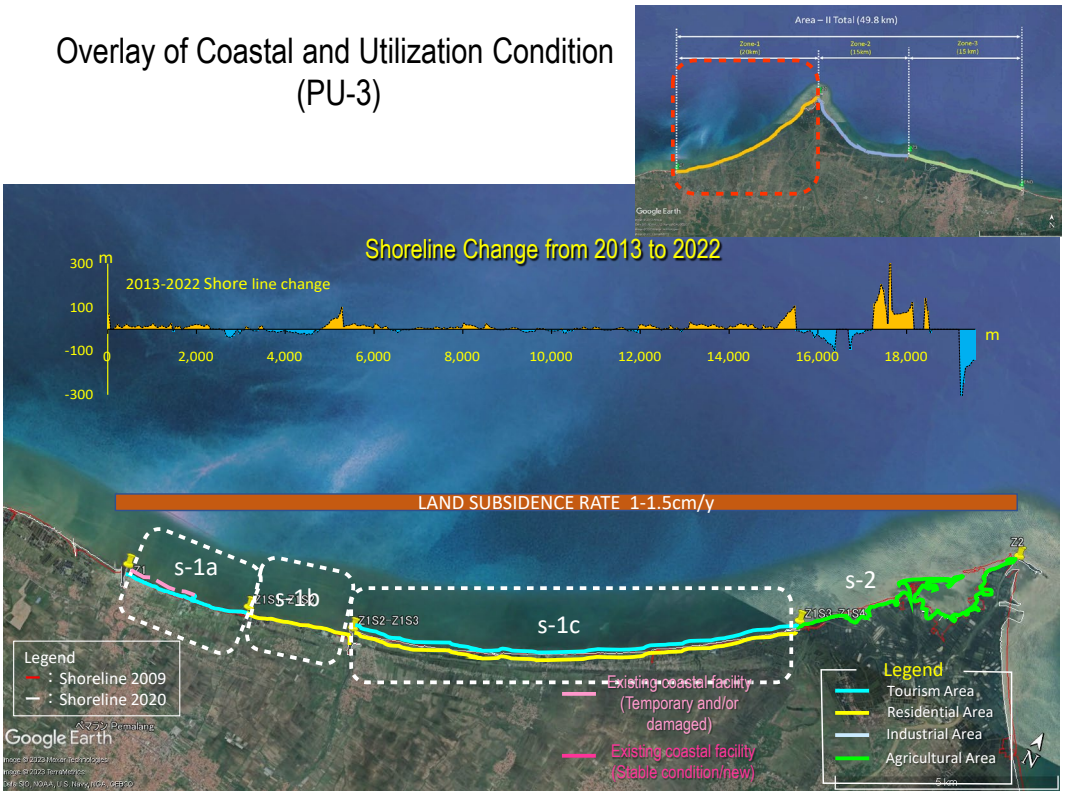




Source: Edited by JICA Study Team based on Google Earth

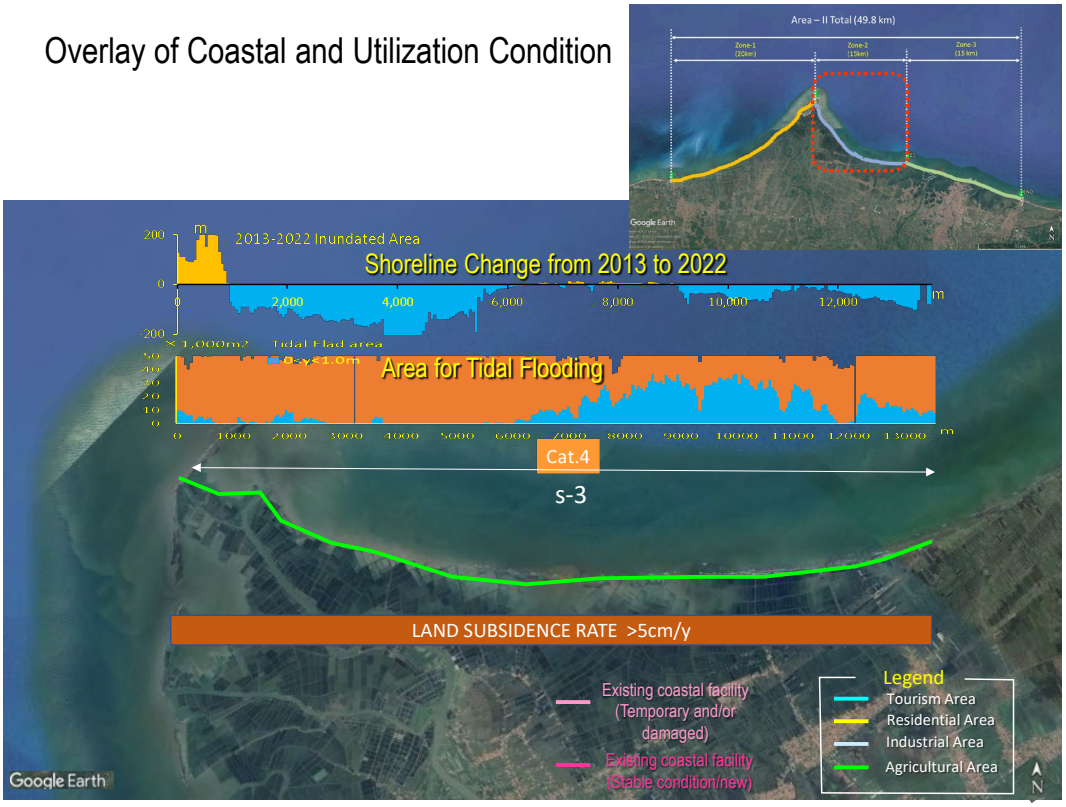
Figure 4　Area-I　S-5、6、7 の評価 Figure

B) Area-II: Pemalang-Pekalongan



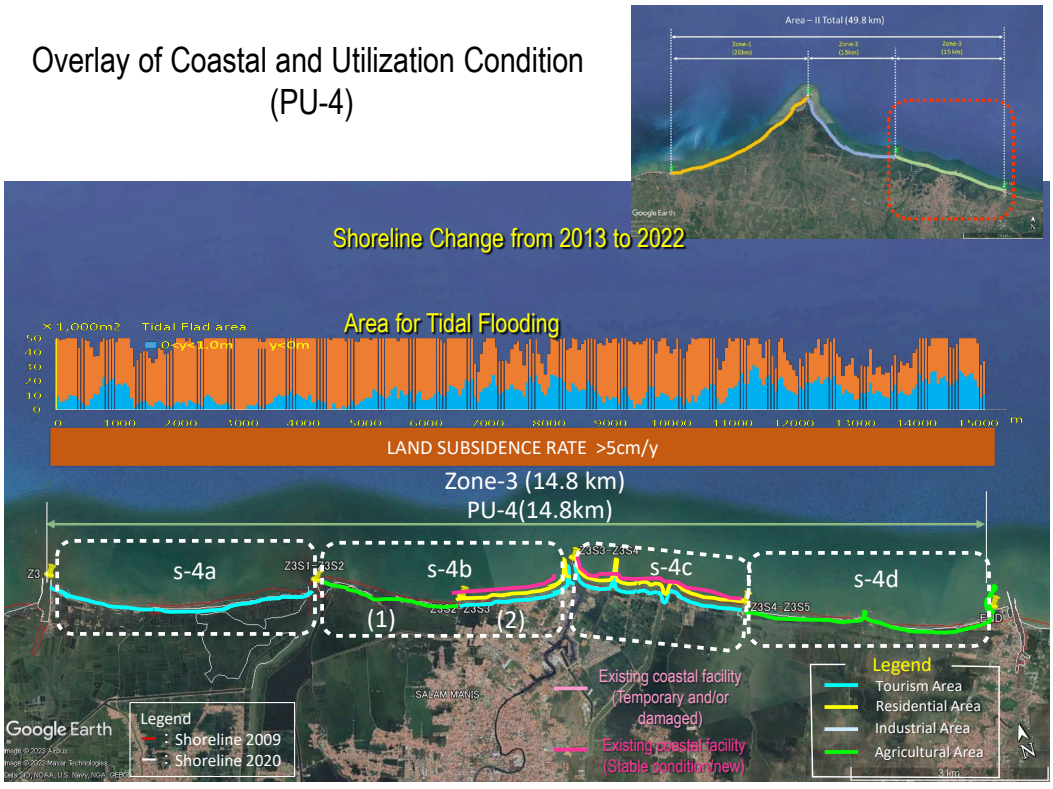
Source: Edited by JICA Study Team based on Google Earth

Figure 5　Area-II　S-1、2 の評価 Figure



Source: Edited by JICA Study Team based on Google Earth

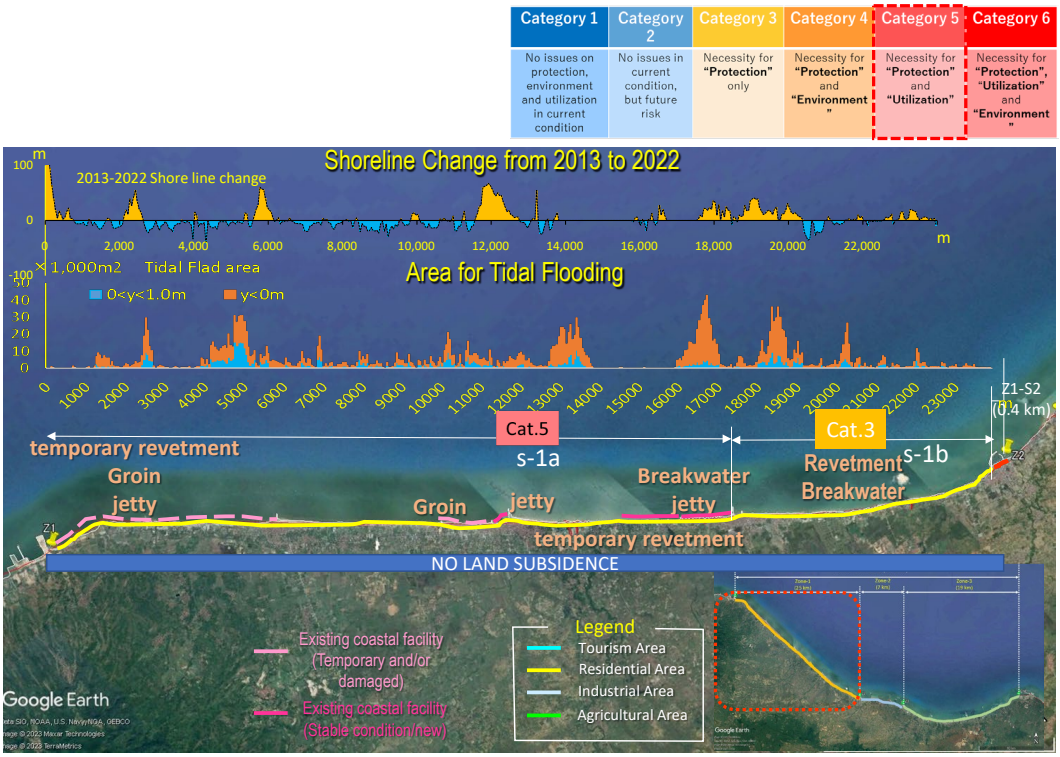
Figure 6 Area-II S-3 の評価 Figure



Source: Edited by JICA Study Team based on Google Earth

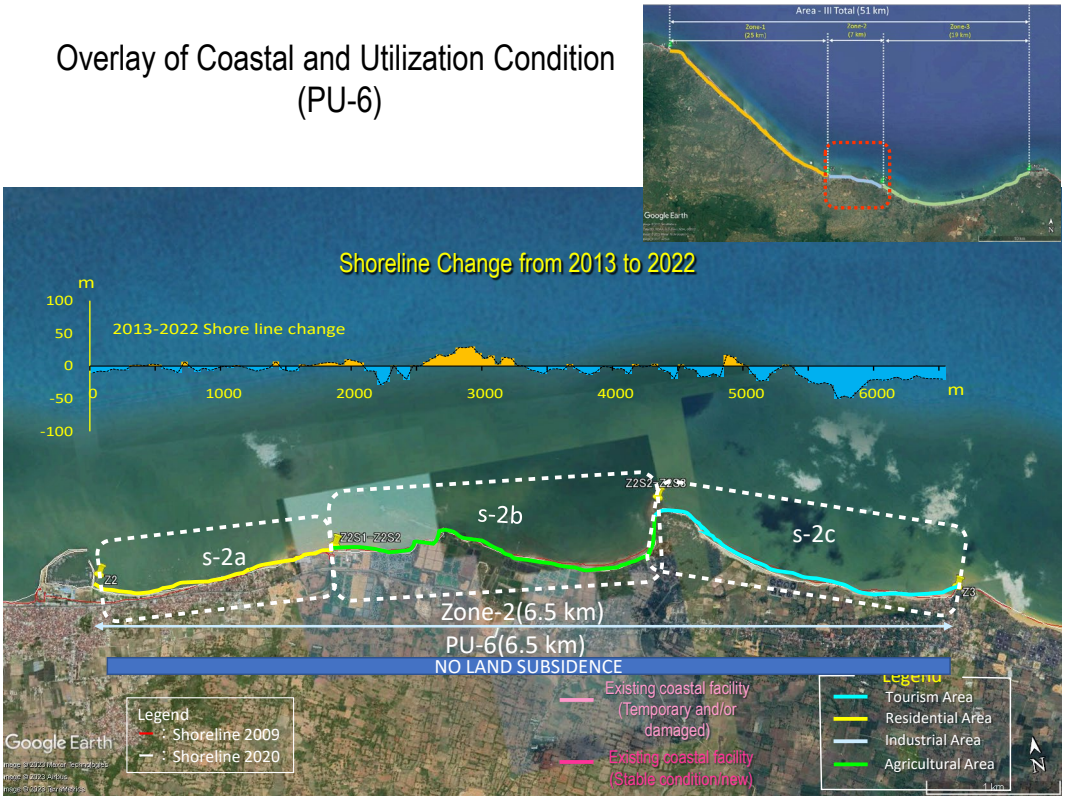
Figure 7 Area-II S-4 の評価 Figure

C) Area-III: Rembang-Tuban



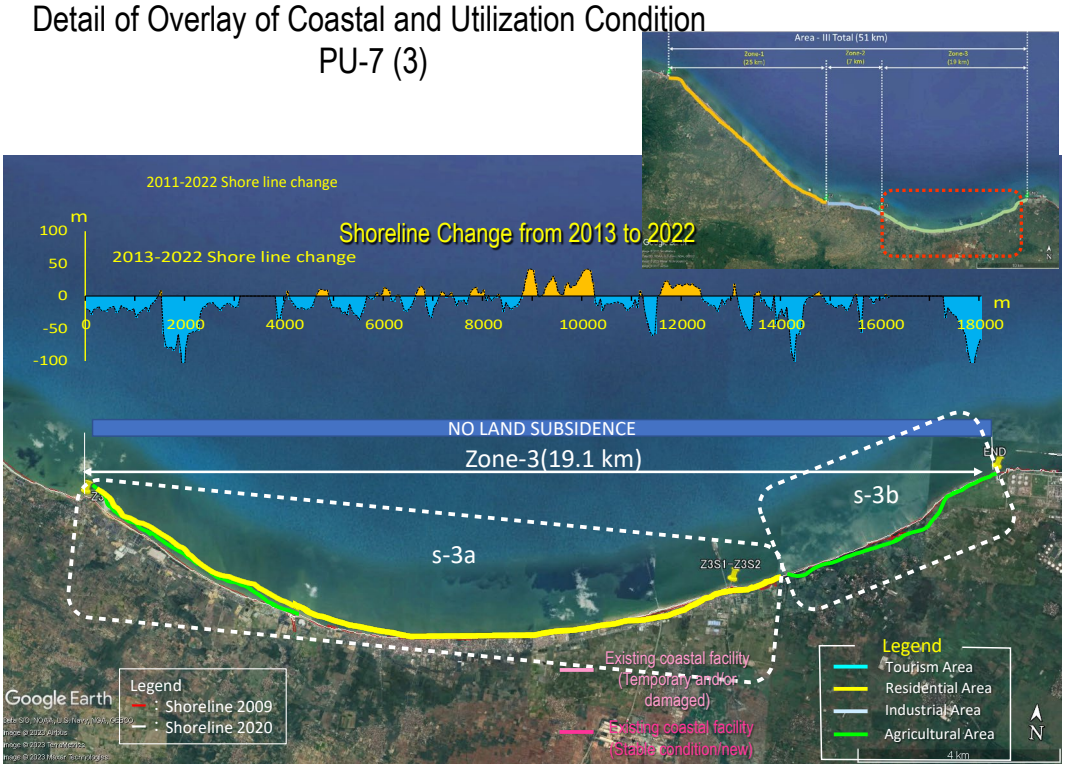
Source: Edited by JICA Study Team based on Google Earth

Figure 8 Area-III S-1Coastal Conditions



Source: Edited by JICA Study Team based on Google Earth

Figure 9 Area-III S-2Coastal Conditions



Source: Edited by JICA Study Team based on Google Earth

Figure 10 Area-III S-3Coastal Conditions