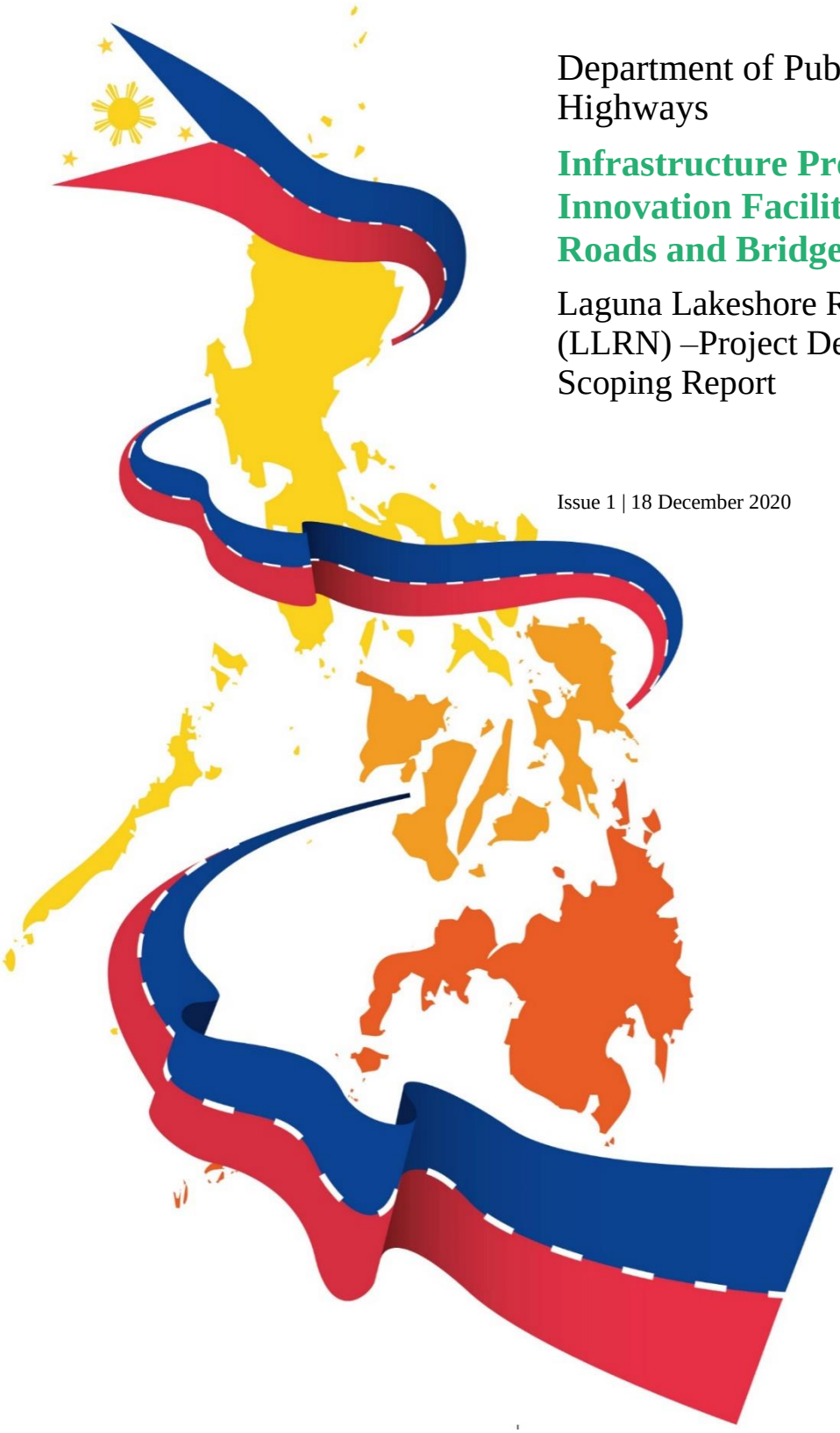

Department of Public Works and Highways

Infrastructure Preparation and Innovation Facility – Output 1 – Roads and Bridges

Laguna Lakeshore Road Network (LLRN) –Project Description for Scoping Report

Issue 1 | 18 December 2020

IPIF ROADS & BRIDGES

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1 Basic Project Information

1.1 Project Information

Name of Project	Laguna Lakeshore Road Network (LLRN) Project
Location	**National Capital Region:** • Taguig City; and • Muntinlupa City **Region IV-A / CALABARZON** • San Pedro City; • Biñan City; • Santa Rosa City; • Cabuyao City; and • Calamba
Nature of Project	Road Network
Project Category	Category A: Environmentally Critical Project Roads and Bridges *Bridges and viaducts (including elevated roads), new construction*
Alignment Length	37.6 km

1.2 Proponent's Profile

The Department of Public Works and Highways (DPWH), the main proponent of the project is the lead engineering and construction agency of the Government, tasked in ensuring and designing infrastructure developments such as national highways, bridges, flood control and other related public works.

DPWH has appointed Ove Arup and Partners Hong Kong Ltd (Arup), as the lead consultant for the Environmental and Social Impact Assessment of Laguna Lakeshore Road Network (LLRN) Project. Arup is a multinational firm which provides engineering, design, planning, project management and consulting services for all aspects of the built environment.

EcosysCorp, Inc. was hired by Arup as its sub-consultant to carry out the Environmental Impact Assessment (EIA) including the social aspects such as conduct of public consultation, Information and Education Campaign (IEC), perception survey, among others for the Project.

Proponent name	Department of Public Works and Highways (DPWH)
Address	Bonifacio Drive Port Area, 652 Zone 068, Manila, 1018 Metro Manila, Philippines
Authorized signatory/ representative to apply for ECC	**Emil K. Sadain, CESO I** Undersecretary for UPMO Operations and Technical Services Department of Public Works and Highways

	Room 211, 2nd Floor, DPWH Main Office, Bonifacio Drive, Port Area, Manila, Philippines
Recommending Approvals	**Sharif Madsmo H. Hasim** Director Department of Public Works and Highways Roads Management Cluster II (Multilateral) Unified Project Management Office (UPMO)
	Soledad R. Florencio Project Manager III Department of Public Works and Highways Roads Management Cluster II (Multilateral) Unified Project Management Office (UPMO)
DPWH Contact Person	**Zenaida B. Mauhay** Project Manager II Roads Management Cluster II (Multilateral) Unified Project Management Office Department of Public Works and Highways 2nd Street, Port Area Manila, Philippines zenaida730@yahoo.com +63 2 5304 3727
Arup Contact Person	**David Rollinson** Environmental and Social Safeguards Coordinator Ove Arup and Partners Hong Kong Ltd (Philippines Branch) david.rollinson@arup.com +63 2 3485 8200
EcosysCorp Contact Person	**Annabelle Herrera** President EcosysCorp, Inc. aherrera@ecosyscorp.com +63 2 7759 0012

2 Project Description

The Laguna Lakeshore Road Network (LLRN) Project is one of the seven projects under the Infrastructure Preparation and Innovation Facility (IPIF) which aims to support the Department of Public Works and Highways to deliver more effective, efficient and innovative infrastructure projects all over the country. LLRN caters the area in the vicinity of Laguna de Bay, with a road network scheme that is divided into two phases:

Figure 1 The Outline Master Plan Phase I and Phase II of LLRN

Phase I runs along the western coastline of the Lake while Phase II stretches in the Northern to Southern coastline via an eastern route. The current study is for Phase I of the project.

2.1 Project Location and Area

Description of Project Area

The proposed LLRN Feasibility Study is to provide a road corridor to facilitate traffic flow from Metro Manila to the province of Laguna in Region IV. The preparation of the Feasibility Study (FS) will be used to develop the preferred road connector scheme including preliminary engineering, economic, and environmental and social impacts.

The final alignment with a total of approximate length of 37 kilometres is to be built along the west shoreline of Laguna Lake. Majority of the proposed road is along Laguna Lake shoreline with a combination of viaduct and shoreline embankment. The alignment will start in Barangay Lower Bicutan in Taguig City and end in Calamba City. There will be eight (8) interchanges at the mainline - Lower Bicutan, Sucat, Alabang, Tunasan, San Pedro/Biñan, Santa Rosa, Cabuyao and Calamba. Interchanges are distributed along the course of the alignment and will provide access to seven cities in the western side of Laguna Lake. These interchanges are proposed to connect to municipal boundaries at the nearest public road.

Figure 2 LLRN Phase I Alignment

Table 1 Location of LLRN interchanges

Region	Province	City	Location of interchange
National Capital Region		Taguig	Lower Bicutan
		Muntinlupa	Sucat
			Tunasan
			Alabang
Region IVA	Laguna	San Pedro City	San Pedro/ Biñan
		Biñan City	
		Santa Rosa City	Santa Rosa
		Cabuyao City	Cabuyao
		Calamba City	Calamba

Impact Areas

Table 2 Direct and Indirect Impact Areas

Impact Areas	Direct Impact Areas (DIA)	Indirect Impact Areas (IIA)
Taguig	Main and direct LLRN alignment of LLRN within portion of Barangay Lower Bicutan	Side of LLRN alignment within portions of Barangays Lower Bicutan, Upper Bicutan and Bagumbayan
Muntinlupa	Main and direct LLRN alignment of LLRN within portion of Barangays Sucat, Alabang and Tunasan	Side of LLRN alignment within portions of Barangays Sucat, Buli, Cupang, Alabang, Bayanan, Putatan, Poblacion and Tunasan

Impact Areas	Direct Impact Areas (DIA)	Indirect Impact Areas (IIA)
San Pedro City	Main and direct LLRN alignment of LLRN within portion of Barangay Landayan	Side of LLRN alignment within portions of Barangays Cuyab, San Roque, and Landayan consistent to the design and alignment
Biñan City	Main and direct LLRN alignment of LLRN within portion of Barangay Dela Paz	Side of LLRN alignment within portions of Barangays Dela Paz, Malaban, Casile, and San Antonio consistent to the design and alignment
Santa Rosa City	Main and direct LLRN alignment of LLRN within portion of Barangays Aplaya and Sinalhan	Side of LLRN alignment within portions of Barangays Aplaya, Caingin and Sinalhan consistent to the design and alignment
Cabuyao City	Main and direct LLRN alignment of LLRN within portion of Barangay Marinig	Side of LLRN alignment within portions of Barangays Baclaran, Bigaa, Butong, Marinig, and Gulod consistent to the design and alignment
Calamba City	Main and direct LLRN alignment of LLRN within portion of Barangays Palingon and Bucal	Side of LLRN alignment within portions of Barangays Uwisan, Looc, Sampiruhan, Palingon, Lingga, Lecheria, Halang and Bucal consistent to the design and alignment

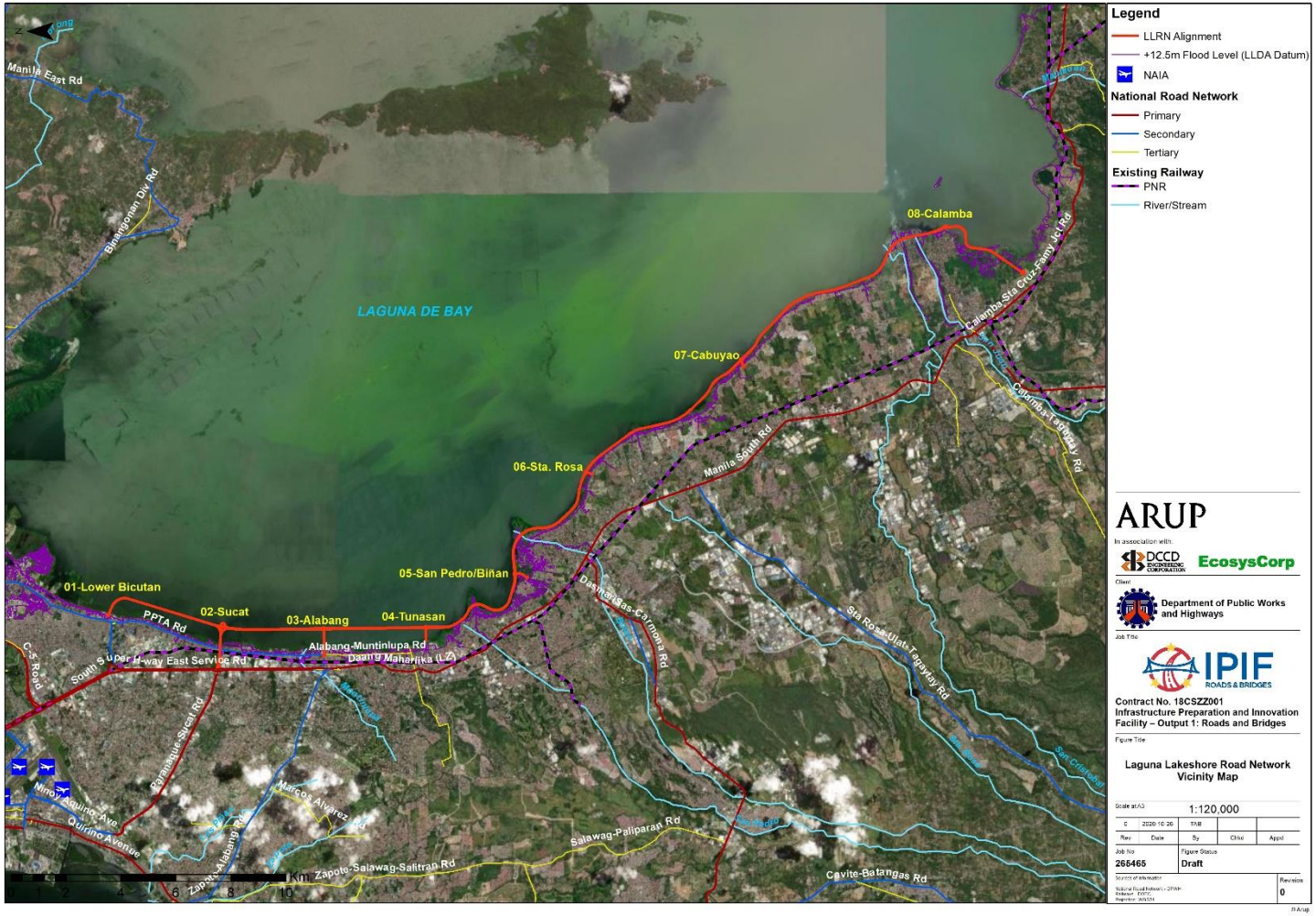


Figure 3 Vicinity Map

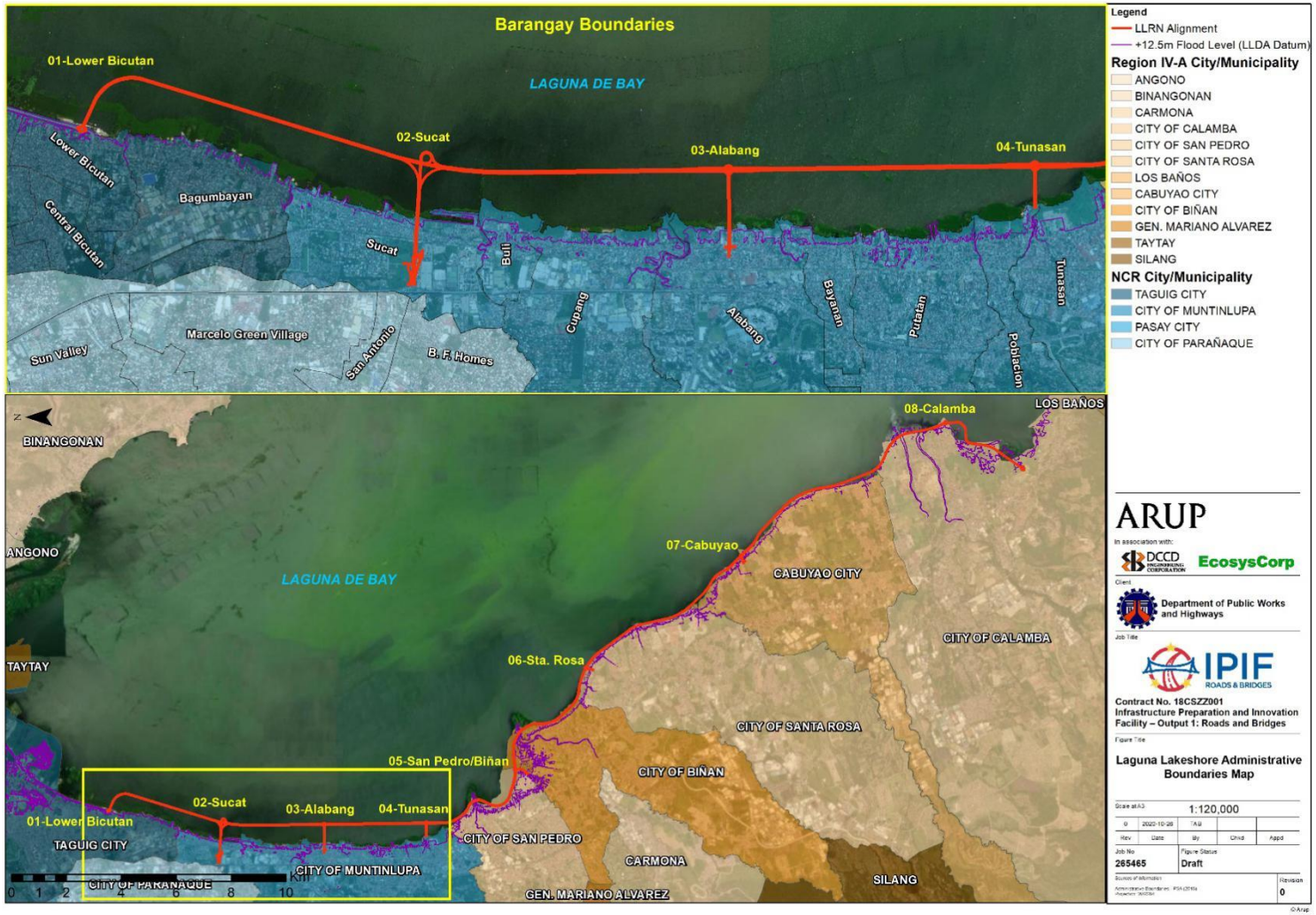


Figure 4 Municipal Boundary Map of Muntinlupa

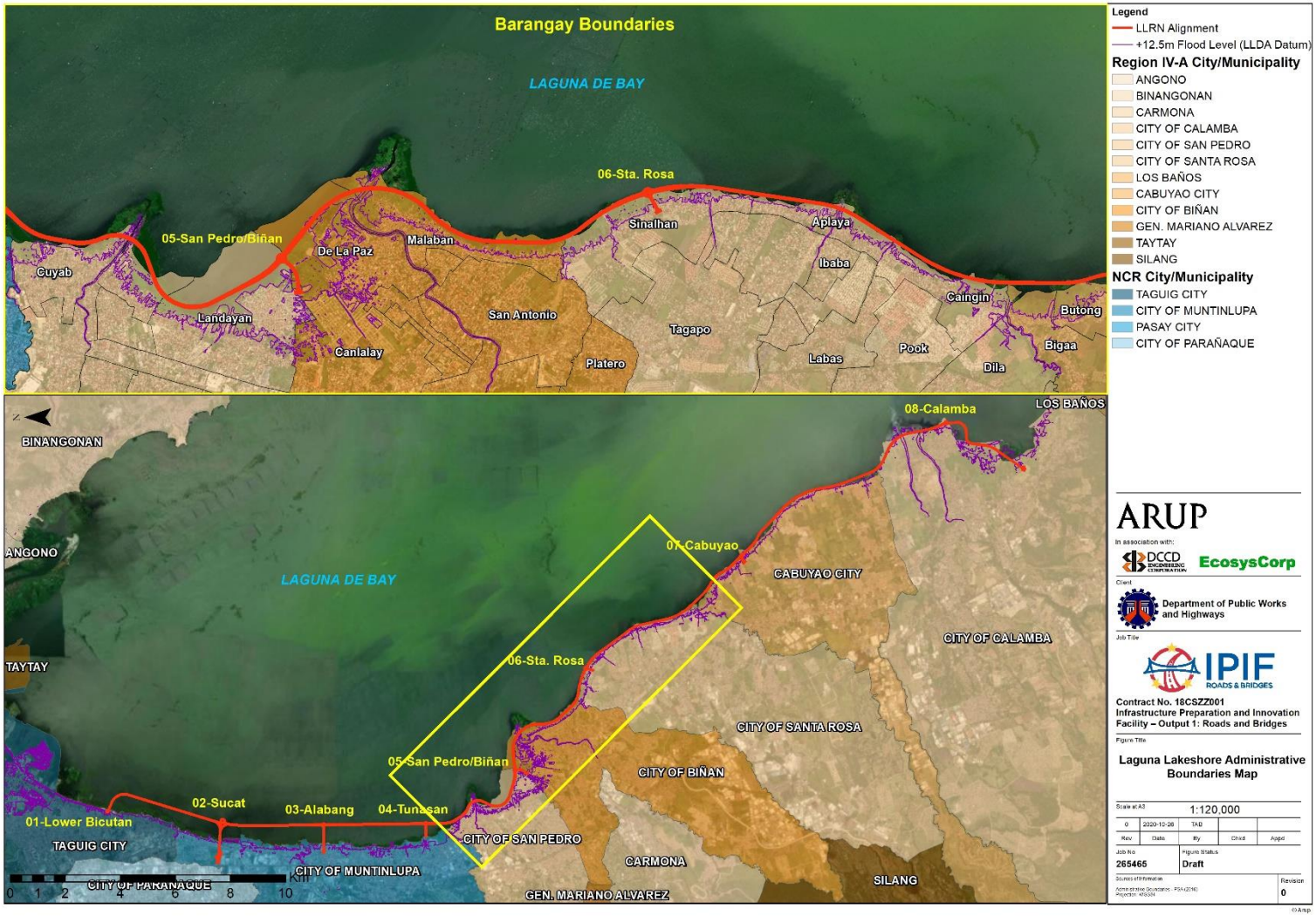


Figure 5 Municipal Boundary of San Pedro, Binan and Sta. Rosa

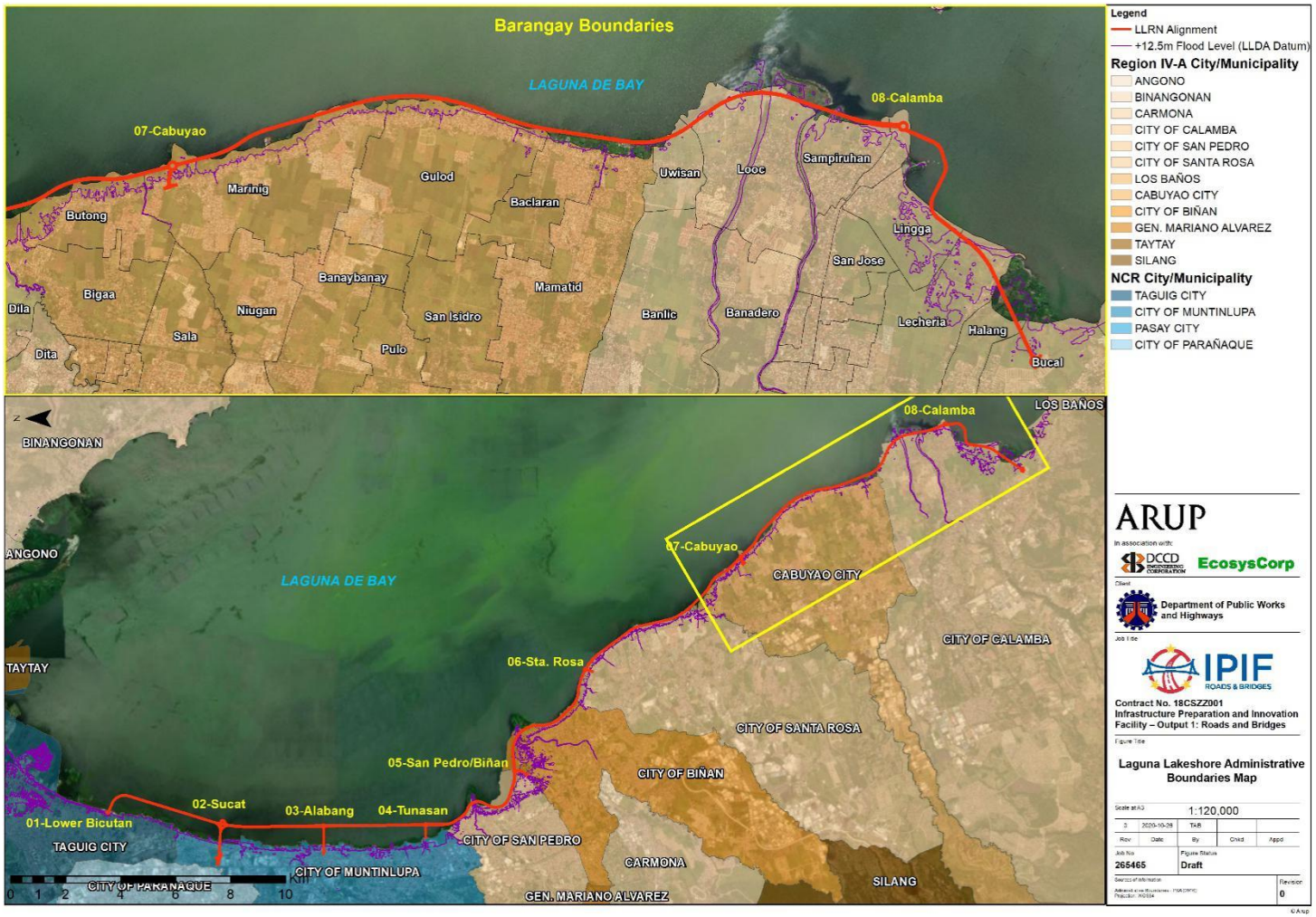


Figure 6 Municipal Boundary of Cabuyao and Calamba

2.2 Project Rationale

During the World Economic Forum (WEF) on the Association of Southeast Asian Nations held in Cambodia, Philippine President Rodrigo Roa Duterte presented the administration's 0 to 10-point socio-economic agenda. The 4th agenda aims to accelerate annual infrastructure spending to account for 5% of the gross domestic product. In line with this, the administration intends to spend 8-9 trillion pesos from 2017-2022 solely for infrastructure. These infrastructure projects will allow the recipient communities to have an easy access going to work, businesses, markets, education and other services. According to the project administration manual of the Asian Development Bank, for the infrastructure preparation and innovation facility, the impact of underdeveloped public infrastructure in the Republic of the Philippines will impede the potential of businesses and economic opportunities in the country.

The overarching intent of the project is to provide a safer and faster alternative to the motorists traveling south / north to vitalize the economies for the surrounding areas including Laguna, Rizal, Quezon and Batangas.

The project will provide:

- A resilient, reliable transportation link for residents and commuters
- Faster journey travel times
- Ease of access to tourism activities
- Enhanced internal circulation, mobility and external linkages to support the growth potential of the region

The project will provide **economic development opportunities** for:

- Enhanced productivity due to better accessibility and savings in travel time
- Improved land mix resulting from reclamation activities

The **economic outcomes** that this project will support are:

- Cost: Reducing the economic cost of transportation
- Economic development and diversification: Supporting economic development and diversification of the region
- Wider economic development: Supporting integrated, equitable economic development of the region within the country

The project will also impact upon **social outcomes**, the net result being positive:

- Accessibility: Enhancing community access to employment, education and other social services. Social benefits will primarily accrue to the residents in terms of enhanced access to the key health, education and other amenities provided within the National Capital Region.

However, there are likely to be some adverse social impacts during construction as a result of property resumptions and short-term income impacts for fisherfolks and associated businesses at the lakeshore. These impacts are detailed in the following section.

2.3 Project Components

Form of Road

The Phase 1 of LLRN will generally be a dual 2-lane (2x2) carriageway roadway with the exception between Sucat Interchange and Santa Rosa Interchange, where dual 3-lane (2x3) carriageway is proposed for the mainline for approximately 12km long.

Dual 2-lane carriageway slip road corridor are designed to connect LLRN to existing road network. Slip roads in between the proposed trumpet interchanges will be single lane per direction.

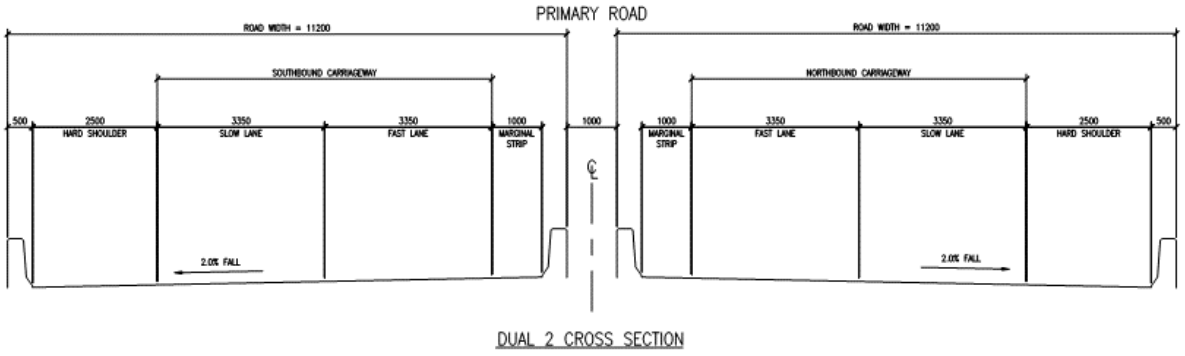


Figure 7 Functional Cross Section for Mainline

The LLRN will be an open highway, i.e. toll-free. Certain sections can include enhanced amenities for pedestrians such as a roadside promenade that includes a 3.5 m wide cycle track and sidewalk on the lakeside.

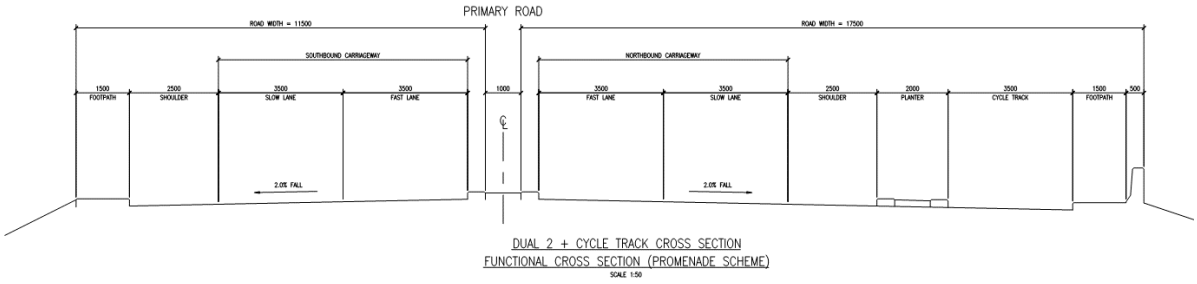


Figure 8 Functional Cross Section for Promenade Section

LLRN Phase I will be formed by two proposed sections for the recommended option:

Section 1 – Viaduct

From the starting point of LLRN at Lower Bicutan interchange, approximately 11.8km of viaducts is proposed to Tunasan interchange (**Error! Reference source not found.**). The viaduct is approximately 400-500m away from the shoreline. Adequate headroom or clearance underneath the viaduct will be provided for navigation of boats from/to the lake.

Grade-separated interchanges are proposed at Sucat and Alabang, while an at-grade interchange is proposed at Lower Bicutan. The Sucat interchange will utilize a trumpet interchange layout while Lower Bicutan and Alabang will be a grade-separated roundabout.

The interchanges are proposed to connect to the nearest existing shoreline roadway and further connection to Manila South Road will be carried out by local LGUs.

Figure 9 Viaduct Section of Mainline Alignment

Section 2 – Shoreline Viaduct & Embankment

From Tunasan Interchange to the end of LLRN Phase 1 at Calamba Interchange, approximately 25.8km of mixed shoreline viaduct and embankment is proposed (**Figure 10Error! Reference source not found.**). The LLRN roadway will be constructed by segments of viaducts and earth bund along the shoreline suitable to adjacent terrain and nearby drainage scheme. River bridges are proposed to span over major creeks or rivers that crosses the proposed alignments, such as San Christobal River and San Juan River near the headland of Cabuyao. Low level culverts are to be provided for river stream connecting to the lake. An intercepting channels and box culvert are also proposed along the western side of shoreline embankments to provide drainage capacity to the lake and shoreline area.

Grade-separated roundabout interchanges are proposed for Tunasan, San Pedro/Binan, and Santa Rosa, while at-grade roundabout interchanges are proposed for Cabuyao and Calamba. The interchanges are proposed to connect to the nearest existing shoreline roadway by embankments and further connection to local major roads will be undertaken by local LGUs. Apart from Tunasan, which was agreed to terminate at the shoreline, the local authority will address the connection from the main road to the Tunasan interchange.

Figure 10 Shoreline Viaduct +Embankment Section of Mainline Alignment

Along the shoreline, there are many fisherfolks and boats seen from satellite images, in **Figure 11**, particularly at San Pedro, Binan, Santa Rose and the northern part of Cabuyao. For easy understanding the fishing boat distribution, a density map has been prepared by using satellite image on one particular date.

Figure 11 Fishing Boat Density Map- April 2017

To reduce the impact to the fishery, fishery basins is a feasible facility to be incorporated along the LLRN mainline. Each fishery basin would be sized to fit the local fish boat demand and have adequate navigation clearance connect between the basin and Laguna lake. It is proposed all barangays along the shoreline to have minimum 1 fishery basin and more depending on demand. It will be useable all year around to avoid excessive relocation to existing fisherfolks. However, it is unavoidable that there might still be some fisherfolks and fish pans that need to be relocated.

Figure 12 Proposed Fishery Basin location

Viaduct

2.3..1 Overview

Preliminary design of viaduct consists of 3 parts, lake viaduct, embankment viaduct and land viaduct. Lake viaduct is proposed to be located at northern part of LLRN, coupled with interchanges and slip roads connected to the shoreline so as to have more extensive transport network. Embankment viaduct is short bridges proposed to connect the embankment openings near the river mouth to the lake. The Land Viaduct will connect the offshore viaduct to the existing national highway road system.

2.3..2 Lake Viaduct

At the northern portion of around 10km, a preliminary assessment of the ground conditions indicates the soil parament is weak. Expensive ground treatment will be required for any embankment or reclamation. And locally there are a lot of channels and piers along the shoreline, navigation from/to the lake are frequent. There are also some intake and outlet pipes from some existing and planning water treatment works or wastewater treatment works. Considering ground condition and local social impact, viaduct is a better option than embankment.

2.3..2.1 Superstructure Arrangement

Considering the navigation of vessels within the lake, 4m vertical clearance from the design water level (+2.022mSL) to the soffit level. As discussed previously, LLRN mainline is various from 2 lanes to 3 lanes in each direction due to the higher traffic demand in some location. The structural form of the viaduct considered in Stage I as precast AASHTO / NU girders or box girders. Typical beam and slab cross sections are shown in **Error! Reference source not found.** and **Error! Reference source not found.**.

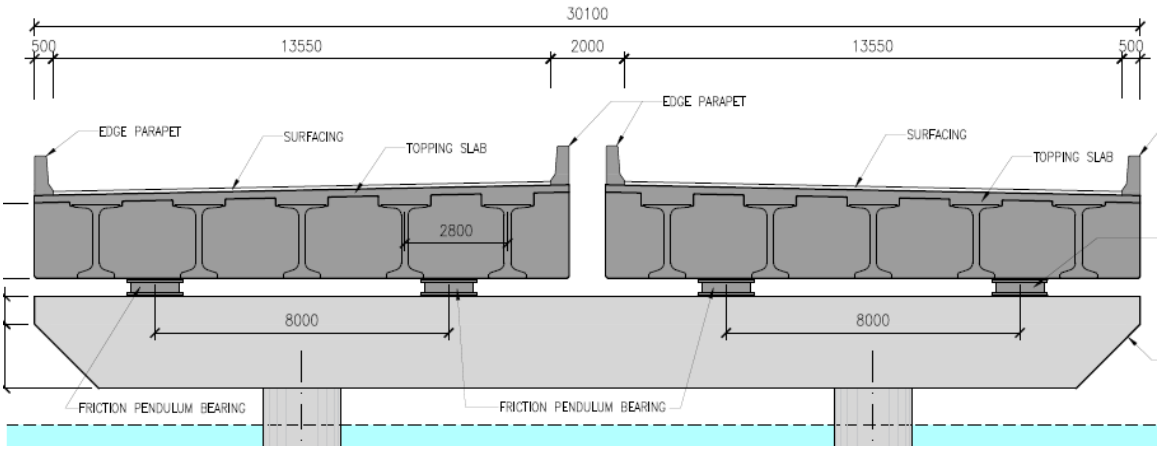


Figure 13 Typical Section of Lake Viaduct with AASHTO/NU Girder

Box girders are another possible superstructure option and could either be in prestressed or RC depending on proposed span. RC bridge could provide good performance with smaller span length. But with increase of span length, the prestressed box becomes more economical. Error! Reference source not found. show the typical cross-section of box girder. The internal void can also serve as a space to house utilities while providing safe maintenance access at the same time. **Error! Reference source not found.**

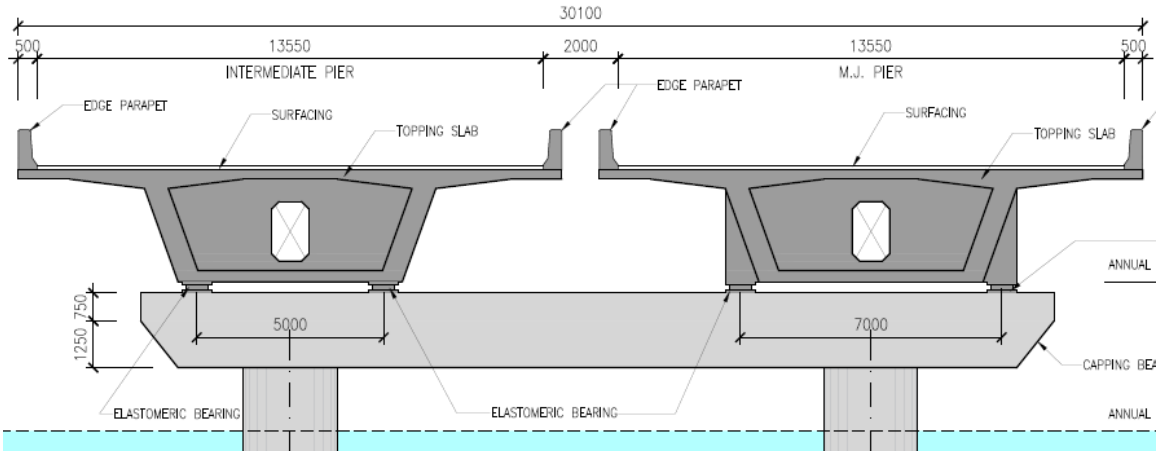


Figure 14 Typical Section of Lake Viaduct with Box Girder

2.3..2.2 Substructure Arrangement

The substructure of the viaduct could be monopiles, multiple piles with buried pile cap, or multiple pile with exposed pile cap (as shown in **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**). To minimise the impact to the lakebed and useable surface in the lake, monopiles are adopted (**Error! Reference source not found.**), i.e. no pile cap will be required. In addition, the construction time and cost, as well as environmental impact associated with the pile caps can be minimised. However, the monopile substructure is only suitable for certain height as the pile/pier becomes too slender when the road level is too high. At the same time, there is practical limit to the pile size and hence this limits the span length of the superstructure.

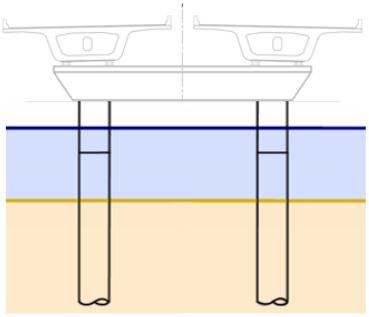


Figure 15 Monopile without Pile Cap

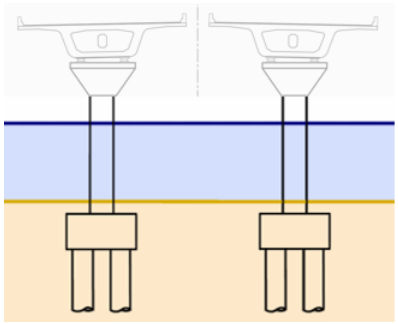


Figure 16 Multiple Pile with Buried Pile Cap

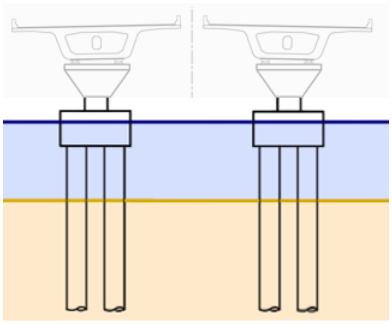


Figure 17 Multiple Pile with Exposed Pile Cap

In monopile scheme, a crosshead beam is adopted to support the superstructure, transfer vertical load from superstructure to monopile and to form a portal frame to enhance the structural stability in transverse direction of the viaduct. Dimension of the crosshead beam varies due to different superstructure type, articulations and foundation layout, etc. The typical arrangement is shown in **Error! Reference source not found.**.

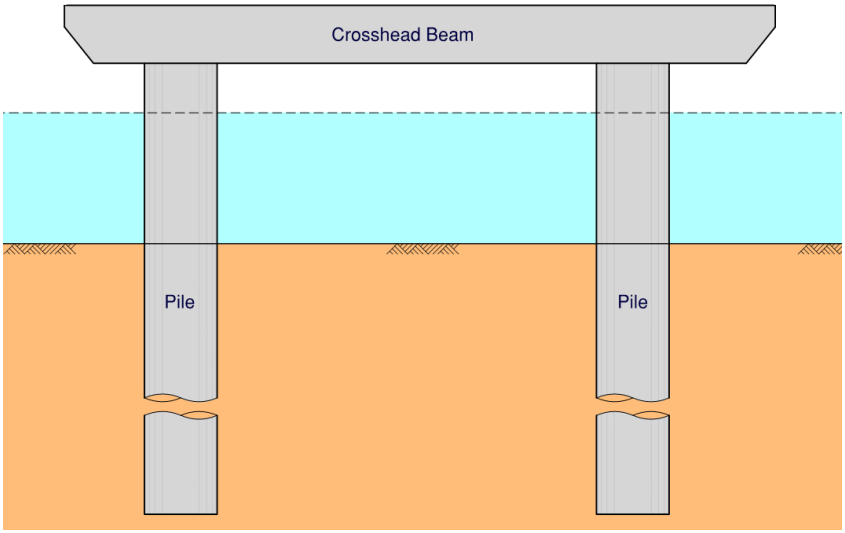


Figure 18 Typical Arrangement of Crosshead Beam

2.3..2.3 Foundation Arrangement

Both bored pile and driven steel pipe pile have been analysed in current study. The adoption of driven steel pipe pile could provide easier construction and less construction time as compared to bored pile. But considering the ground condition of LLRN, the driven pile is relatively difficult to be constructed. And the construction cost for driven steel pipe pile which need import material from oversea is higher than the bored pile. Hence, bored pile is recommended at this stage. Subject to more geotechnical information from Ground Investigation, the option for driven pile could be further study in detail design stage.

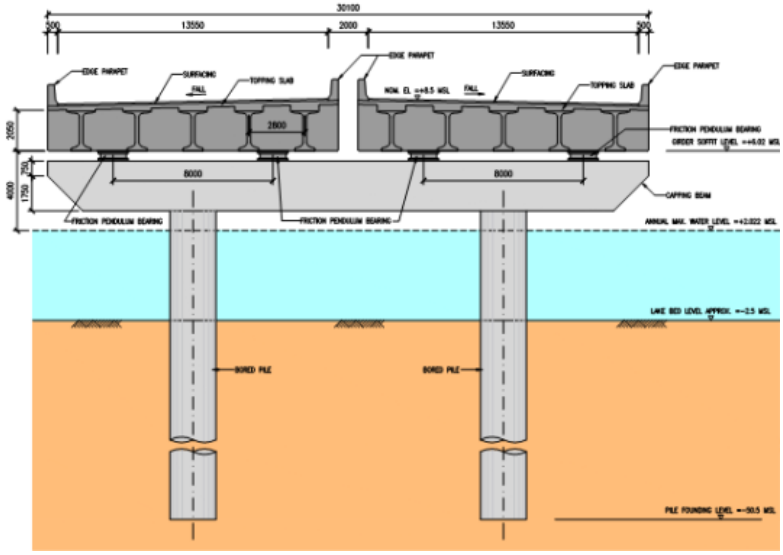


Figure 19 In-lake viaduct cross section and arrangement

2.3..3 Embankment Viaduct

As discussed previously, bridges need to be provided along the embankment at various location to allow boats navigation form/to the lake from the fishery basin and outlet opening for the rivers and streams. The structural form and general arrangement us similar with lake viaduct.

The typical span arrangement for embankment viaduct is 4 x 30m, which the total length is 120m for each bridge.

Figure 20 Embankment Viaduct at River outlet and fishery basin

2.3..3.1 General Arrangement

Similar to the lake viaduct, the embankment viaduct consists of dual 2-lane carriageway. Considering the navigation of vessels from/to the lake, 4m vertical clearance from the design water level (+2.022mSL) to the soffit level of superstructure. For 30 metre short span, precast NU girder is more appropriate as precast prestressed girders are commonly used in Philippines and local contractors are well experienced in constructing this type of viaduct with precast girders. 4 Nos. of 1.6m deep NU girder is proposed in each direction as shown in **Error! Reference source not found.**.

Monopile foundation is proposed, no pile cap will be required. In addition, the construction time and cost, as well as environmental impact associated with the pile caps can be minimised. A crosshead beam is required to support the superstructure, transfer vertical load from superstructure to monopile and to form a portal frame to enhance the structural stability in transverse direction of the viaduct.

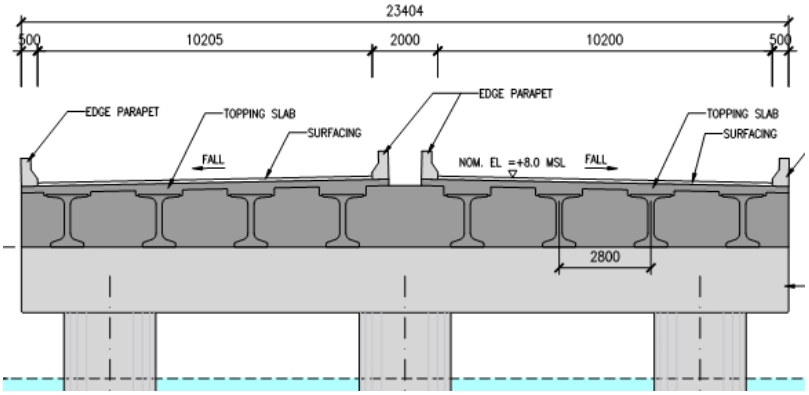


Figure 21 Typical Section of Embankment Viaduct with NU Girder

2.3..3.2 Articulation

For embankment viaduct, superstructure is proposed to be monolithically connected to the substructure at internal pier to form a strong frame enhancing the global stability of the bridge. Movement joints (M.J) are required at each abutment, and bearings are required at abutment (see **Figure 22Error! Reference source not found.**).

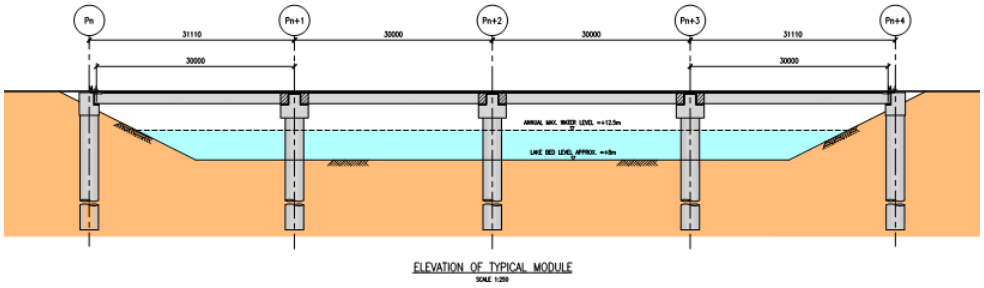


Figure 22 Typical Arrangement of Embankment Viaduct

Embankment

2.3..4 General

The proposed embankment scheme is an integrated scheme, as shown in **Figure 23Error! Reference source not found.**, to construct an earth filled embankment along the mainline. The embankment structure to serve as a wave breaker to protect the inland area. Along the shoreline embankment, there will be sufficient number of access opening for fishing boat access to the lake, rivers/ streams outlet. Intercepting channels and box culverts to be provide in regular interval to allow the catchment area along the shoreline embankment be drained. More discussion on each topic as follow.

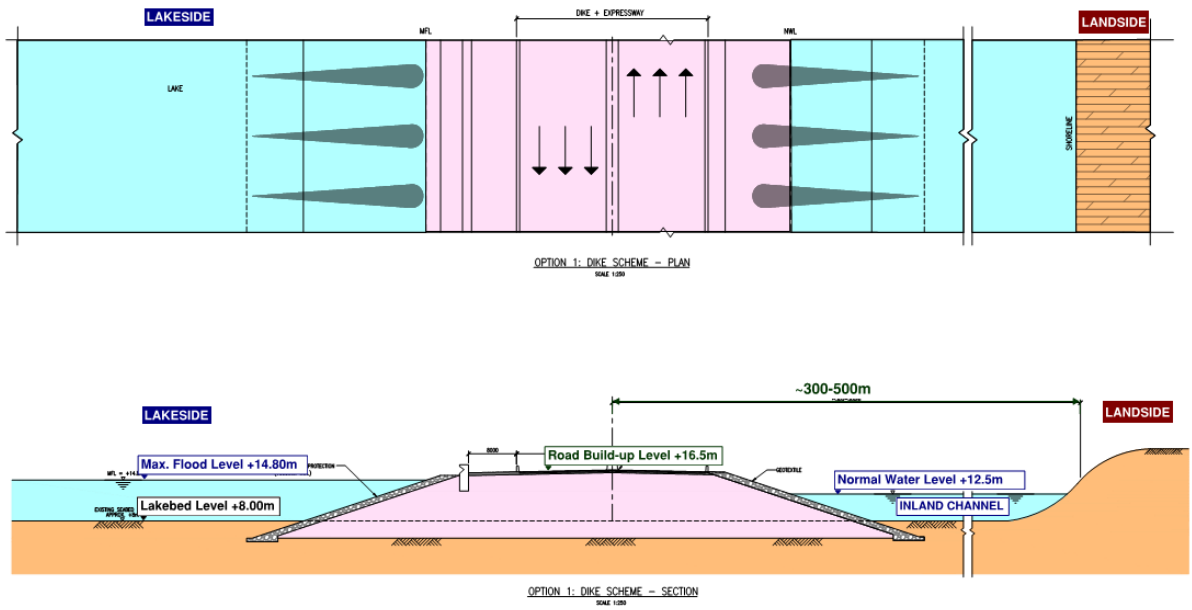


Figure 23 General Layout of Embankment

Figure 24 Rendered View for Embankment with opening

The embankment slope angles at both sides of embankment have been determined considering the following parameters:

- Seismic load
- Maximum wave height during the design event
- Shear strength parameters of available embankment material

The crest of the embankment is based on hydraulic and lake/ maritime assessment which determines the maximum water level, wave height and storm surge, etc to provide a safe level with sufficient freeboard for the users and its width is established to be compliant with the criteria for a high standard highway. The provision for permanent settlement of the foundation base, settlement of the dike body and the settlement during the construction must be taken into consideration in the design of dike crest level.

For the LLRN FS study, there are few types of embankment and the design criteria and consideration on each type to be discussed in following sections.

2.3..5 Shoreline Embankment Design Criteria

Majority of the embankment is located from Tunasan to Calamba. It is approximately 25.8km long embankment with many embankment viaducts to allow river outlet, existing fisher folk crossing. The embankment viaduct design already covered in section **Error! Reference source not found.**.

Figure 25 Proposed LLRN alignment

2.3..5.1 Proposed Works

Based on the limited site investigation data, the subsurface soil is generally loose and silty at the top 2m from the seabed, hence 2m thick top soil is proposed to be removed and replaced with a 0.5m stone blanket and a further 1.5m replacement sand underneath the stone blanket. It is proposed that the embankment to have a 1:3 slope.

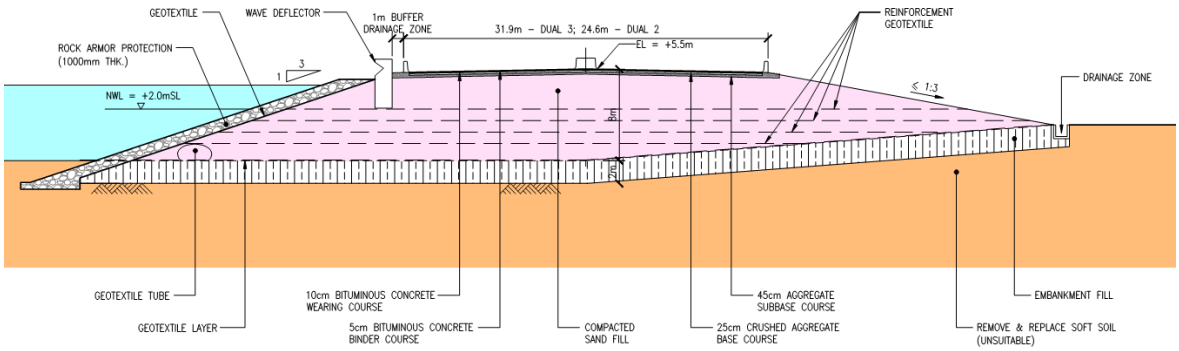


Figure 26 Typical Onshore Embankment with Stone Blanket at the bottom

In order not to adverse the river flow toward the Laguna lake, a wide opening on each river and stream outlets are proposed, illustrate in **Error! Reference source not found.**. More discussion on drainage design refer to Section **Error! Reference source not found.** in this report.

Figure 27 Typical Bridge over Streams/ Rivers

2.3..6 Embankment with Ground Treatment

2.3..6.1 Proposed Ground Treatment Works

As per the road alignment design, at Sucat and Alabang interchanges, there will be approximate 1km embankment, as shown in **Error! Reference source not found.** to allow the slip road connection flyover above the mainline. Based on the limited site investigation data, the subsurface soil is reported generally loose and silty at the top 3m from the lakebed, hence 2m thick top soil is proposed to be removed and replaced with a 0.5m stone blanket and a further 1.5m replacement sand underneath the stone blanket. Geotextile shall be laid on top of the stone blanket.

At the potential liquefaction area identified in Error! Reference source not found., proposed ground treatment consists of stone columns of 1.0m dia. at 2.0m triangular grid spacing with 20m length to be installed underneath the embankment within the liquefaction zone. Outside of potential liquefaction area, 1:3 slope embankment sitting on a stone blanket is proposed instead, further detail of the design can be referred to Section **Error! Reference source not found.**.

Figure 28 Sucat, Alabang Embankment required Ground Treatment

Figure 29 Sucat Interchange image

The embankment with stone column ground treatment is required length in approximated 1km in length of LLRN mainline based on current Geotechnical data. Until further ground investigation carried out to verify the ground condition, the ground treatment extend proposed in this study is subject to change.

From the most recent feasibility study conducted by the United States Agency for International Development (USAID) around the Laguna Lakeshore project site 2013, only 11 numbers of borehole logs have been retrieved and found useful. Most of the boreholes were concentrated in the northern portion of the alignment and indicated that area to be prone to liquefaction hazard and the thickness liquefiable zone is up to 20m thick below the lakebed. The southern part of the alignment is only represented by one borehole. It indicated that the liquefiable layer was only as thick as 2m at the top. It can be removed by dredging and replacing with stone blanket. The dredge soil can be used as fill materials and it is further discussed in section below. The available boreholes locations from this report as indicated in the map **Error! Reference source not found.** below.

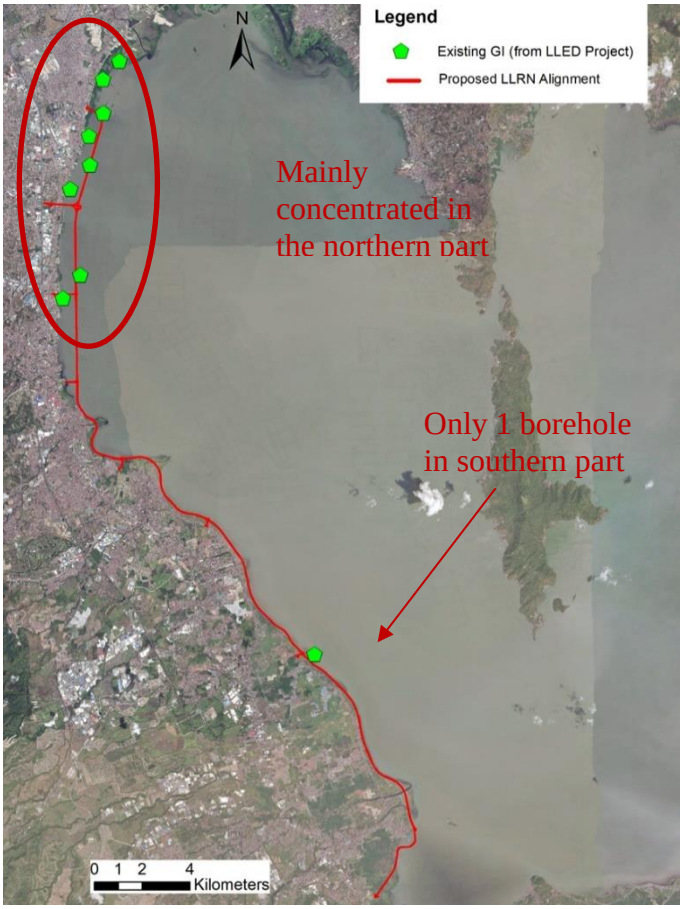


Figure 30 Existing Borehole data locations along the alignment

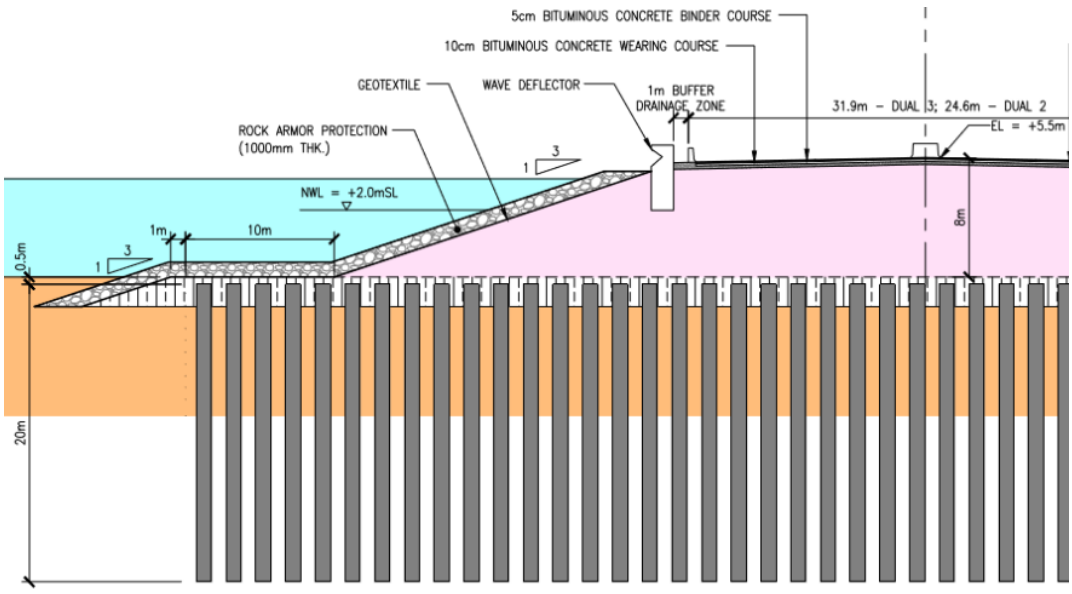


Figure 31 Typical Embankment Foundation Detail with Stone Column ground treatment

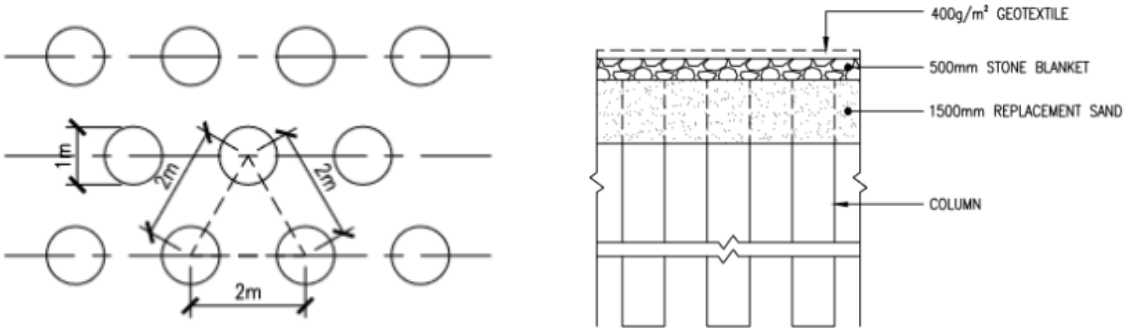


Figure 32 Typical Stone Column Layout Plan and Details

2.3..7 Slope Protection System

The slope surfaces should be covered with geotextile at landside and armour rock protection system at lakeside. The typical embankment arrangement is shown in Drawing No. IPIF1/LLRN/FS-PD/4001 to 4002.

Shallow revetment toes are applicable at the areas where the erosion rate is low, the revetment toes only resist the wave-induced currents at the embankment toe. Common types of shallow revetment toes are shown in the following Figure:

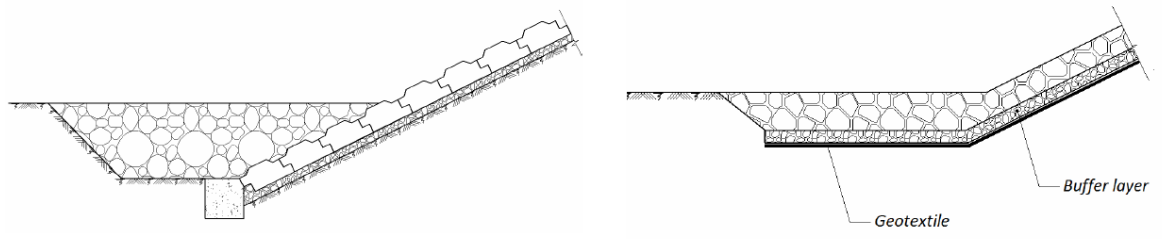


Figure 33 Extracted from Technical Standards in Sea Embankment Design

2.3..7.1 Armour Size

Based on the Hudson and van der Meer formulae for deep and shallow water conditions, the armour size assessment for the embankment determined that 2-ton armourstone would be adequate. The standard of damage in the design allows for minor movement and replacement of armour units in the aftermath of extreme events. Geofilters or underlayer rock may be constructed to prevent erosion of the finer embankment core materials through the larger rock armourstone.

2.3..7.2 Slope Arrangement

The embankment shall have a slope of 1V:3H with a crest level topping out at +16 m relative to project datum to achieve the allowable overtopping rate. The below arrangement may be considered depending on the construction method. The concrete crest wall may be used in place of naturally sloped armourstone on the landward side.

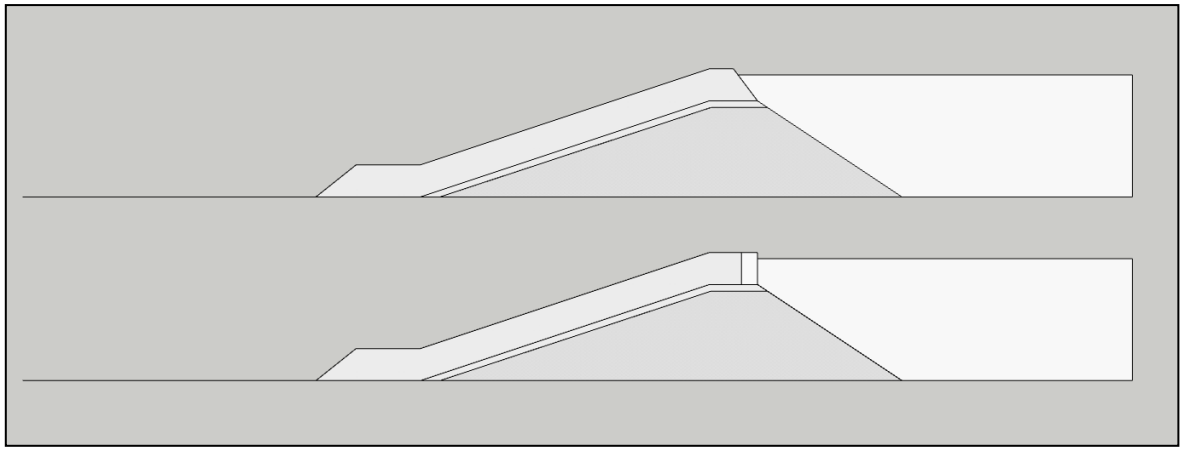


Figure 34 Embankment Arrangement for LLRN; a concrete crest wall may be raised to further limit overtopping discharge across the cope-line

It is recommended that full hydraulic modelling and a coastal flooding study should be carried out at the detailed design stage to reassess the wind-wave and overtopping conditions at the embankment once the alignment and structural form is finalised

2.3..8 Embankment Foundation and Settlement Control

Embankment foundation must ensure the stability in terms of stresses under the impacts of active loads and seismic load. In case the embankment foundation does not meet the design requirements and standards, additional ground improvement will be required.

Where the thin soft soil layer is encountered underneath the proposed embankment body, geotextile fabric can be placed between the embankment body and foundation for the purpose of filtration, drainage, isolation, reinforcement, uniform distribution of stresses, reduction of irregular settlement, reduction of lateral deformation and strengthening the stability of foundation soil. Based on the technical requirements and available conditions, one or more layers of geotextiles can be placed on the abutting surface and in the embankment body.

In case the embankment foundation is on soft soil, the construction time could be extensive, hence the effective method is to build up the embankment body gradually in layers, so that the soft soil can have sufficient time to consolidate, and thereby increasing its bearing capacity. To speed up consolidation of the reclamation area, provision of sand drain or vertical drain can be considered at sufficient spacing and depth along the reclamation area.

Interchanges

2.3..9 Land Viaduct Concept Design

The Land Viaduct will connect the offshore viaduct to the existing national highway road system. Strong Selection Criteria for Land Bridges Structural Form during this FS is in line with most common local practice and guidelines as specified in the Design Basis Report.

2.3..10 General Arrangement

During the preliminary stage and for the purpose of analysis, **Error! Reference source not found.** showing the typical arrangement of land viaduct having 4 spans in between movement joints were considered.

Piers in between the movement joints are assumed to have pin connection with the superstructure in both transverse and longitudinal directions. Columns act as cantilever in the longitudinal direction but not in the transverse direction. The superstructure, composed of I – girders with the deck slab, acts as a continuous composite section over the piers.

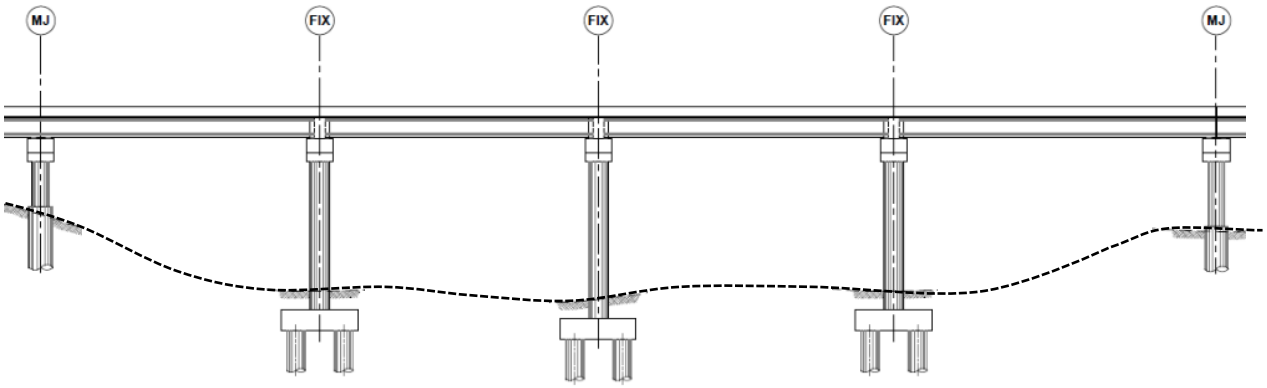


Figure 35 Typical Arrangement of Land Viaduct

2.3..11 Superstructure

Two options were considered for land viaduct. Option 1 is composed AASHTO Type VI Girders at 40-m span (**Error! Reference source not found.**) while Option 2 has NU 2000 Girders at 45-m span (**Error! Reference source not found.**). AASHTO girders are commonly used in the Philippines while NU girders are just being introduced in the ongoing Cebu-Cordova Link Expressway Project.

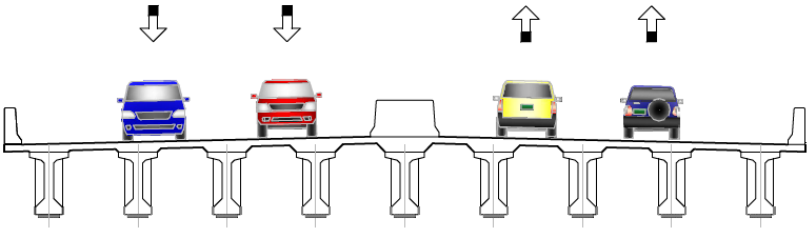


Figure 36 AASHTO Type VI

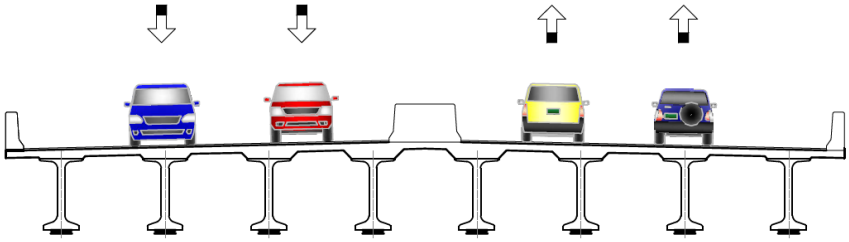


Figure 37 NU 2000 Girder

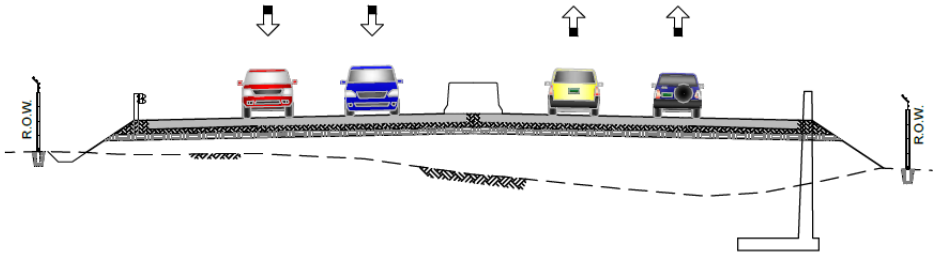


Figure 38 Typical Cross Section for Embankment Section

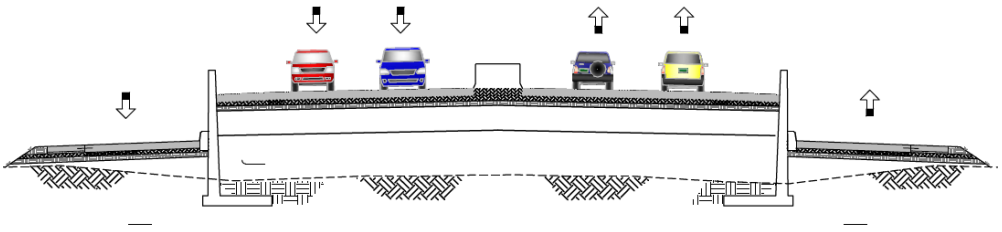


Figure 39 Typical Cross Section for Embankment w/ Side Road/Service Road

2.3..12 Substructure

For simplicity of the design and presentation on the results of preliminary analysis, columns were identified to rest on pile cap supported by bored piles foundation. Further analysis and validation of the proposed substructure configurations and foundation shall be done when Geotechnical data are already available. Error! Reference source not found. shows typical substructure configuration for viaduct piers.

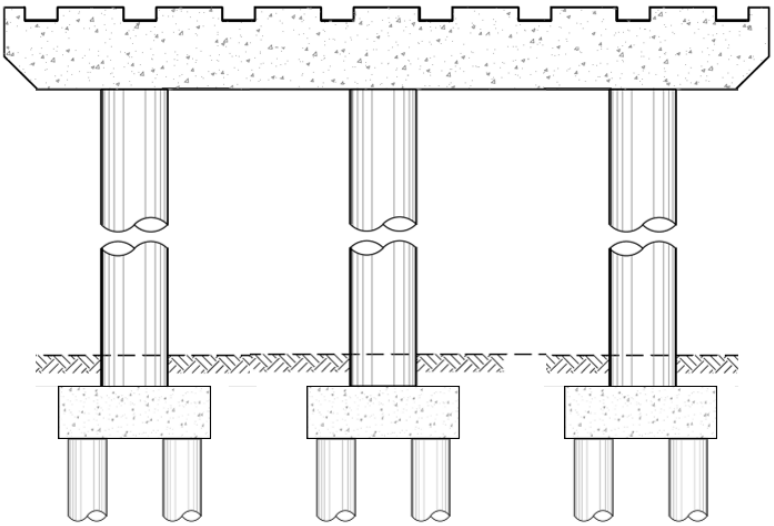


Figure 40 Typical Substructure Configuration

2.3..13 Foundation

Concrete and Steel piles were considered and studied as the solution to the foundation at land viaduct. A comparison was made as shown in **Error! Reference source not found.** and it showed that concrete bored piles have a great advantage than steel piles. Hence, concrete bored piles are proposed.

Table 3 Concrete Bored Piles vs Steel Piles

Criteria	Concrete Bored Piles Steel Piles *min.* *max.*	Remarks
Capacity		• Concrete bored piles have a larger skin friction compared to Steel piles. • Concrete bored piles can be socketed as opposed to Steel piles.
Constructability		• Based on the assumption that LLRN shoreline with various thickness of Alluvium up to 25m and bed rock data is limited, concrete bored piles are also proposed for ease of construction.
Cost		• The use of steel piles for rock-solid stratum is not practical to use.

2.3..14 Proposed Interchanges

The proposed LLRN alignment will have 8 interchanges to connect local communities. The interchange types were chosen based on criteria and constraints such as traffic volume and topographic/terrain constraints, but as well as capacity for new planned or future developments. The types of interchanges applied are presented in **Error! Reference source not found.**.

Table 4 Proposed Interchanges

Interchanges	Year 2025 Daily Traffic Flow		Proposed Interchange Type
	To LLRN	From LLRN	
Lower Bicutan	13,200	12,700	At-Grade Roundabout
Sucat	11,400	10,800	Trumpet Interchange
Alabang	8,300	6,700	Grade-Separated Roundabout
Tunasan	N/A	N/A	Grade-Separated Roundabout
San Pedro/ Binan	11,900	14,300	Grade-Separated Roundabout
Sta. Rosa	2,000	1,900	Grade-Separated Roundabout
Cabuyao	2,300	4,000	At-Grade Roundabout
Calamba	6,500	5,300	At-Grade Roundabout

2.3..14.1 Lower Bicutan Interchange

The Lower Bicutan Interchange is a roundabout located at C6 road. It is located at CH0+000 in LLRN. There are 3 arms at the roundabout, connecting north and southbound of C6 and proposed LLRN. The designed roundabout will connect into C6's dual 2-lane carriageway (2 x 3.35m lane width each direction) and paved with Portland Cement Concrete Pavement (PCCP).

The LLRN will be at-grade but rise up gently in the form of an abutment then in the form of viaduct to run eastward. The Lower Bicutan Barangay Hall is also very close to the west of C6. No residential structures will be affected.

Figure 41 Proposed Roundabout Connection, Lower Bicutan Interchange

2.3..14.2 Sucat Interchange

Sucat is the most important interchange in LLRN, as it provides the shortest connection to SLEX. It is located at CH4+500 in LLRN. The entry/exit to SLEX will be via Meralco Road. There are over 30% of traffic flow through this junction. But Sucat is also the most difficult junction to be constructed as there are many constraints and interfaces. An important constraint is PNR's upgrade of Sucat Station to accommodate a 2 levels railway.

The proposed trumpet interchange connection to existing road network will be located at the intersection of Meralco Road and East Service Road of SLEX, 790 meters from LLRN main alignment. It traverses a large area of private land with cogon grasses and different kinds of weeds including a Jeepney Terminal, and it crosses the PNR railway track, two (2) roads namely Manuel L. Quezon and T. Posadas Ave. and inhabited areas near the shore of Laguna Bay.

The LLRN slip road has to climb over it as the 3rd layer road to merge with Meralco Road. The advantage in directly connecting to Meralco Road will provide more safety and efficiency. It reduces the number of possible conflicts as the traffic goes continuously. Also, by channelizing the Entry/Exit traffic at East Service Road will provide the driver a lesser tendency to reduce the speed while entering or exiting the intersection from the carriageway.

Figure 42 Proposed Junction, Sucat Interchange

Figure 43 Proposed Trumpet Interchange, Sucat Interchange

There will also be an Intermodal Terminal for public vehicles near the new Station, thus it might be underneath the LLRN slip road bridge. Since this requires the slip road viaduct to be very high, the interchange at mainline will better be in the form of a trumpet interchange such that the slip road will fly over the mainline in a form of viaduct.

In traffic point of view, a trumpet interchange in fact performs better than at-grade priority junctions such as a roundabout. It might consider to employing an in-lake embankment (despite ground treatment my required based on the existing geologist study) for around 300m to 400m long to reduce the level of the mainline such that the slip road viaduct can be lowered as much as possible when crossing the mainline. At the western side of the railway, the land is high, the flyover may have to connect Meralco Road at a high elevation but desirable gradient will be adopted.

2.3..14.3 Alabang Interchange

The proposed grade separated roundabout interchange for Alabang is located at CH8+200 in LLRN. It will be connected to the local junction of Montillano Street, Manuel Quezon at North and Ilaya Road at South. The designed connection will be a dual 2-lane carriageway slip road corridor (2 x 3.35 m lane width each direction) and paved with Portland Cement Concrete Pavement (PCCP).

The interchange is also situated very close to SLEX, but the arrangement at the SLEX side is more convenient to connect the Northbound rather than Southbound of SLEX. Due to the constraints of the double railway line and the SLEX viaduct, the slip road is so short that there is not adequate length to provide a desirable gradient to connect Montillano Street.

The Montillano Street is itself a narrow road, at-grade with the existing railway and a junction at Llaya. A roundabout option is proposed underneath the mainline and the western leg will connect to this Montillano Street/Llya junction. Improvement at the western end of Montillano Street is expected for the connection to SLEX Southbound as well as to Skyway.

Figure 44 Proposed Grade-Separated Roundabout Interchange, Alabang Interchange

2.3..14.4 Tunasan Interchange

A provision of interchange as requested by the LGU of Muntinlupa has been considered with slip road 100m away from the shoreline and expected to connect at MCX. Major ROW acquisition is necessary but subject to the preference of LGU. The designed connection will be a dual 2-lane carriageway corridor (2 x 3.35m lane width per direction) and paved with Portland Cement Concrete Pavement (PCCP).

Figure 45 Proposed Grade-Separated Roundabout Interchange, Tunasan Interchange

2.3..14.5 San Pedro/ Binan Interchange

The proposed grade-separated roundabout connection is located at the Municipal Boundary of San Pedro/Binan along Laguna Lake shoreline. The slip road from the roundabout will connect to the inland by an at-grade levelled slip road. The slip road is expected to further run South-West to connect Manila South Road in the future, wherever possible subject to the LGU's ROW acquisition. Hence, the slip road is planned to connect to some roads within the new development or Hernandez Street at the existing shoreline in the current stage. The designed slip road connection will be a dual 2-lane carriageway corridor (2 x 3.35 m lane width each direction) and paved with Portland Cement Concrete Pavement (PCCP).

Figure 46 Proposed Grade-Separated Roundabout Interchange, San Pedro / Binan Interchange

2.3..14.6 Sta. Rosa Interchange

The proposed grade-separated interchange will be located at the Laguna Lake shoreline near Sta. Rosa. For the current stage, the slip road is proposed to connect from the at-grade roundabout to existing at-grade Brgy Sinalhan Road. The future road extension shall connect south west to the junction at Manila South Road/JP Rizal Street subject to the preference of the LGU. The designed slip road will be a dual 2-lane carriageway corridor (2 x 3.35 m lane width each direction) paved with Portland Cement Concrete Pavement (PCCP).

Figure 47 Proposed Grade-Separated Roundabout Interchange, Sta. Rosa Interchange

2.3..14.7 Cabuyao Interchange

The proposed junction layout will be an at-grade roundabout. For the current stage, the slip road is proposed to connect from the roundabout to the existing at-grade Marinig Road, but ultimately, the slip road shall extend westward to connect Manila South Road/ JP Rizal Street. However, it may have to span over the planned PNR double level railway, which will be an important constraint for design consideration, but the final routing is subject to the preference of the LGUs. The designed slip road will be a dual 2-lane carriageway corridor (2 x 3.35 m lane width each direction) paved with Portland Cement Concrete Pavement (PCCP).

Figure 48 Proposed Roundabout Interchange Option, Cabuyao Interchange

2.3..14.8 Calamba Interchange

The Calamba Interchange is an at-grade roundabout with a slip road connecting to the adjacent interface project, Calamba-Los Banos-Bay Bypass via another at-grade roundabout connection. Openings with sufficient vertical clearance for boats and ferries would be required to maintain access to the lake.

The intention of this interchange is designed for a grade-separated interchange for the future extension of LLRN mainline toward Los Banos across Laguna Lake. The mainline will continue as a dual 2-lane carriageway corridor in the form or viaduct or embankment across the Laguna Lake bay. Openings with sufficient vertical clearance for boats and ferries would be required to maintain access to the lake.

The designed slip road will be a dual 2-lane carriageway corridor (2 x 3.35m lane width each direction) paved with Portland Cement Concrete Pavement (PCCP). A short segment of slip road will be in-lake to pass around the existing port. This segment will have viaduct segment to provide vertical clearance for boat access to port.

Figure 49 Current Proposed At-Grade Roundabout Interchange, Calamba Interchange

Figure 50 Proposed Roundabout Interchange with Interface Project, Calamba-Los Banos-Bay Bypass

Land Drainage

The purpose of an effective drainage system is to ensure that rainwater runoff is discharged directly from the road surface. Two types of drainage provision are necessary for the project –

i. The drainage system collecting surface runoff on the road; and

ii. The drainage system which maintains the original waterway from land to the lake, as the proposed embankment may intercept the original drainage pathway.

The design of the drainage system will be in accordance with the DPWH Design Guidelines, Criteria and Standards (DGCS), Volume 4 Highway Design, 2015. The design of storm drainage requires the prediction of the magnitude of peak rates of surface run-off (hydrology analysis) followed by the design of the drainage structures and facilities to accommodate the surface run-off (hydraulic analysis). The resultant drainage system should be capable of collecting and handling the design flow and routing to the main outlet drain of the designated outfall. Each structure along the expressway project that crosses rivers, creeks, ditches and waterways should also be adequately sized to allow the unimpeded flow of water.

Effective drainage is a critical element in the design of highways, but should also be designed, built and maintained with consideration of the consequences on the environment.

2.3..15 Drainage Design of Shoreline Embankment

While the viaduct itself would serve as openings allowing conveyance of overland flow to the lake, the proposed drainage strategy at the shoreline embankment section involves provision of surface channels at toe of embankment slope to collect overland flow and discharge box culverts across the embankment to effectively discharge to the lake. The surface channels are proposed to be equipped with permeable bottom in order to mitigate accumulation of stagnant water. Preliminary hydraulic calculations on the sizing of surface channels and box culverts have indicated that rectangular surface channels of 3000(W) x 1000(H) and a single cell

2500(W) x 1500(H) discharge box culverts at equal spacings ranging from approximately 120m to 200m would adequately serve its catchment. A catchment plan highlighting the portion of overland flow conveyed to the intercepting channels and culverts is shown in **Error! Reference source not found.**.

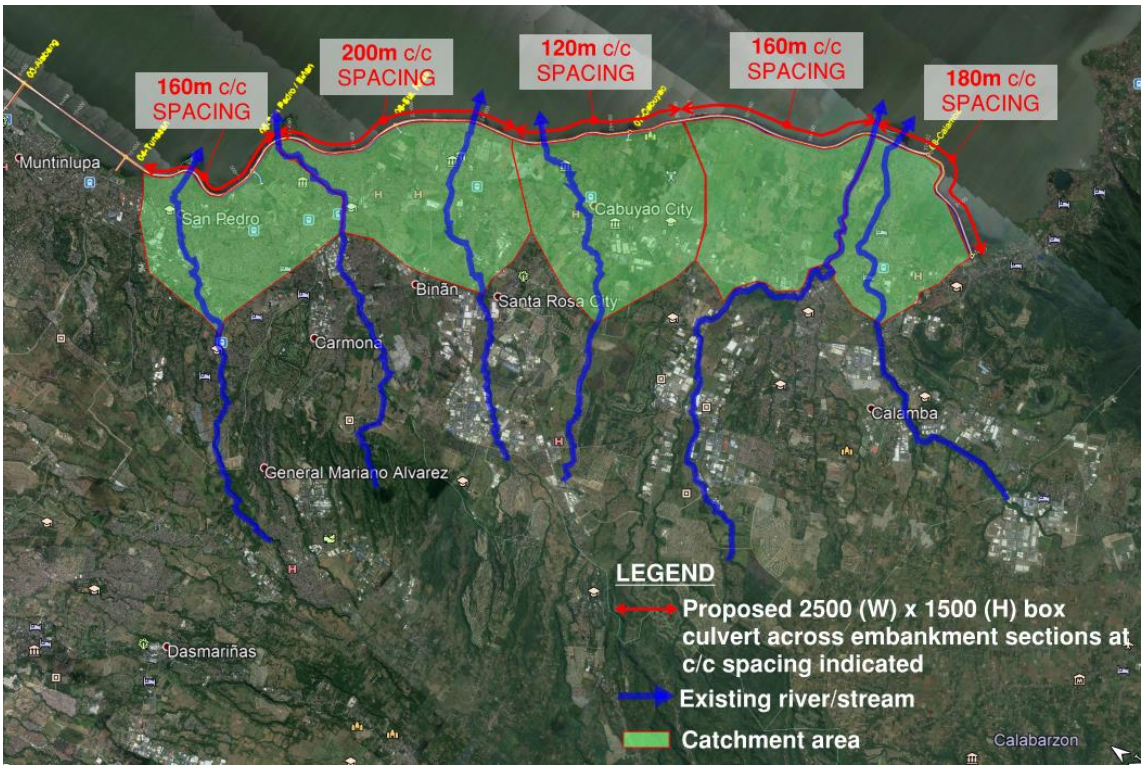


Figure 51 Catchment area plan of the overland flow

The overall land drainage discharge strategies as below:

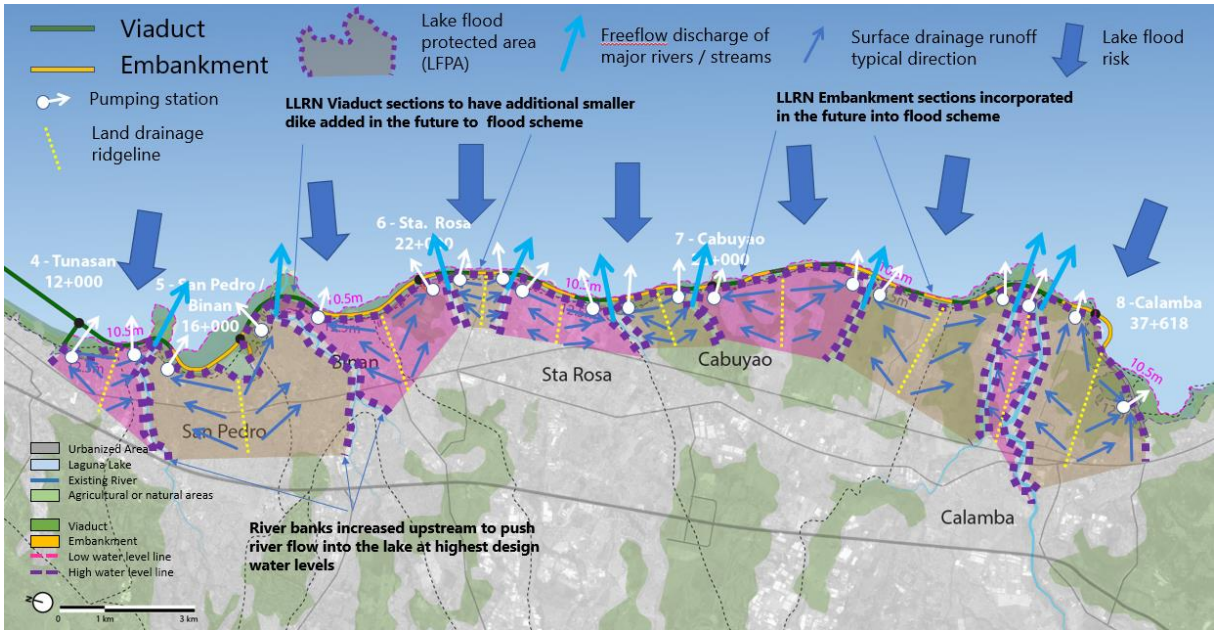


Figure 52 Overall land drainage strategies from Tunasan to Calamba

The proposed drainage strategy at shoreline embankment and its typical cross-section are shown in **Error! Reference source not found.** to **Error! Reference source not found.** respectively.

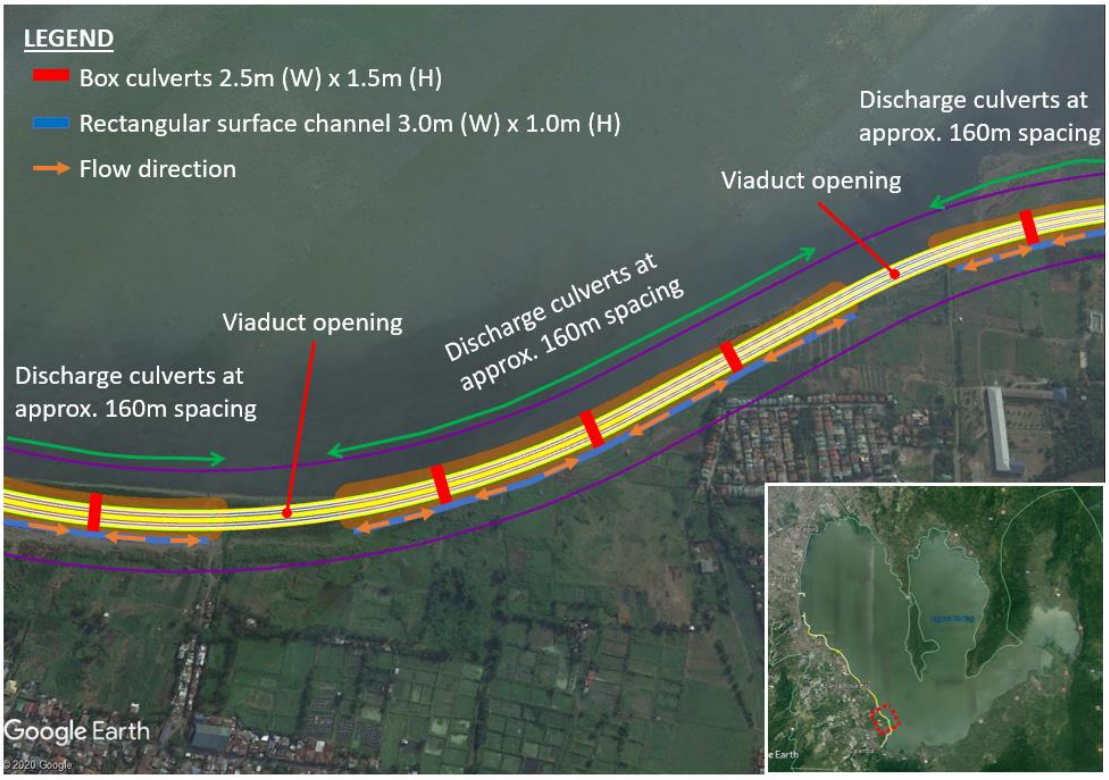


Figure 53 Preliminary drainage scheme at shoreline embankment

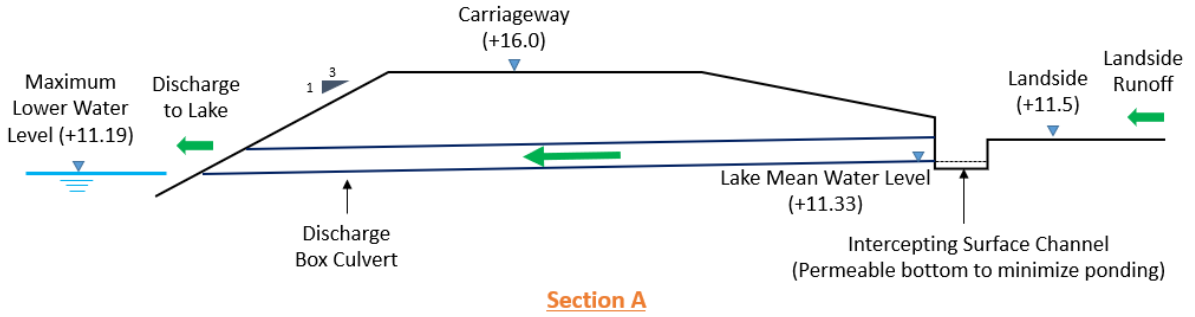


Figure 54 Typical cross-section of drainage system at shoreline embankment

Associated infrastructure facilities and buildings

Apart from the mainline above, the project will also need to include the associated infrastructure facilities/buildings for operation and maintenance purpose.

2.3..16 Administration building

An administration building might be required which will include facilities for inspection and maintenance staff, storage of records of maintenance activities and control room for the traffic control and surveillance system (TCSS) equipment if required.

2.3..17 Public assistance amenities

Since, this will be a long drive from the North to the South, especially during peak seasons, public amenities might be necessary such as toilets, information/assistance desks, parking areas, waiting areas, security outposts, gasoline stations, etc.

2.3..18 Maintenance Depot

These design standards contain principles and requirements for safety, serviceability and durability. It assumes that maintenance activities are performed during the working life of the bridge structures to enable them to fulfil the requirements for reliability. To preserve the intended reliability of the structures, there is an absolute requirement for ongoing inspection and maintenance. Replacement or repair of certain components shall be carried out as necessary to ensure that the reliability of the structures is not reduced during the intended service life.

The LLRN is primarily composed of viaducts, embankments, bridges, and interchanges. Maintenance of these components is important, and it may be necessary to procure appropriate machines such as Under Bridge Inspection Vehicles (UBIV) for viaducts, bridges and interchanges**Error! Reference source not found.**. This is likely to require a centralised depot where there will be parking spaces for maintenance vehicles, space for storage of spare parts, workshops as well as staff amenities and facilities.

Figure 55 Under Bridge Inspection Vehicles (UBIV)

Offshore viaducts and bridges may also be inspected, especially those portions of the structures above water, using inspection boats. Also, this may require a slipway or shelter.

2.3..19 Fishing Ports

The affected municipalities have fisher folks. It is very important to provide the fisher folks a port in each municipality. It must be deep enough for the fisher folks to moor anytime of the day. This should include the approach canal, wave protection, light house, warning and marking bouys, navigational aids, pontoons, walkways, waiting shades, marketplace, parking areas, gasoline stations, etc. For a similar port, please see **Figure 56Error! Reference source not found.**.

Figure 56 Typical Fishing Port

Future Road Extension

The current scope of LLRN aims to connect the nearest existing shoreline roadway for proposed interchanges. However, as part of a bigger improvement scheme to traffic around Laguna Lake, it is essential to provide connection from existing major roads, such as Manila South Road, to connect to LLRN.

The road classification proposed for slip road is Primary Road, primarily to match the road cross section and standard applied to LLRN mainline. The slip roads extension should be designed similar to currently proposed slip road corridor (minimum 2 lane per direction), in order to provide sufficient traffic capacity and avoid congestion ingress/egress to LLRN interchange. The routing of the slip road should minimize local impact and land resumption while maintaining a more direct connection to LLRN.

Based on design standard from Table 3-1 of DGCS Volume 4, the lane should be 3.35m wide, with 2.5m far side shoulder, 1.0m near side marginal strip and a 2.0m wide median including the parapet barrier. The design speed of 80km/h and maximum gradient of 4.0% are considered in flat topography but can be adjusted to 60km/h and maximum gradient of 5% if in rolling topography. For horizontal alignment of mainline, higher radius of curvature should be used to maintain the highspeed and comfortability of the highway, hence minimum radius of 120m must be maintained for rolling topography.

Multiple extension schemes for different interchanges were proposed to local LGU at this stage as illustrate in figures below. The preliminary design and implementation of final road extension will be undertaken by local LGUs.

Figure 57 Proposed schemes to connect Manila South Rd for San Pedro / Binan Interchange

Figure 58 Proposed extension to connect Manila South Rd for Santa Rosa Interchange

Figure 59 Proposed extension to Manila South Road for Cabuyao Interchange

2.4 Project Alternatives

2.4..1 Options Considered in Stage I

2.4..1.1 Initial Development of Options

During Stage I of the Feasibility Study, the study area of the LLRN Phase 1 mainline covered the western shoreline of Laguna Lake from Taguig City to Los Baños, Laguna (**Figure 60**). Five options including embankment, bridges and embankment were developed up to concept design (**Figure 61**).

Figure 60 Stage I Site Plan of the Study Area

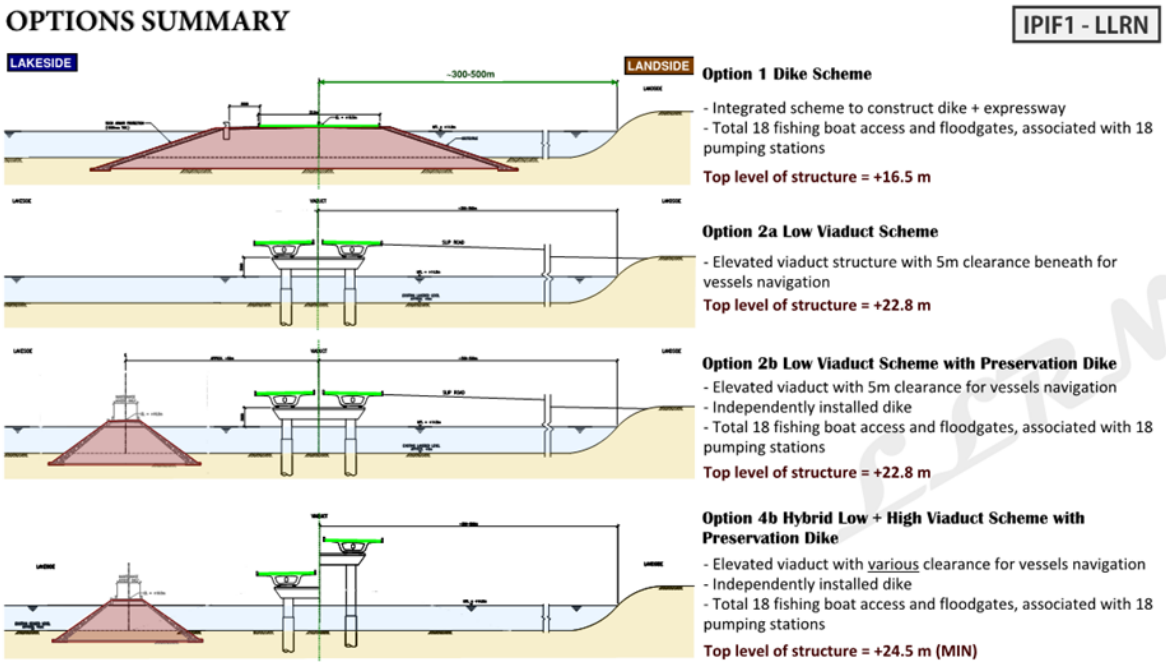


Figure 61 Summary of Options for Comparison and Scoring

Option 1- Embankment Option: it is an integrated scheme, as shown in **Figure 62**, to construct a dike + expressway along west lakeshore line with sufficient number of controlled flood gates along the dike.

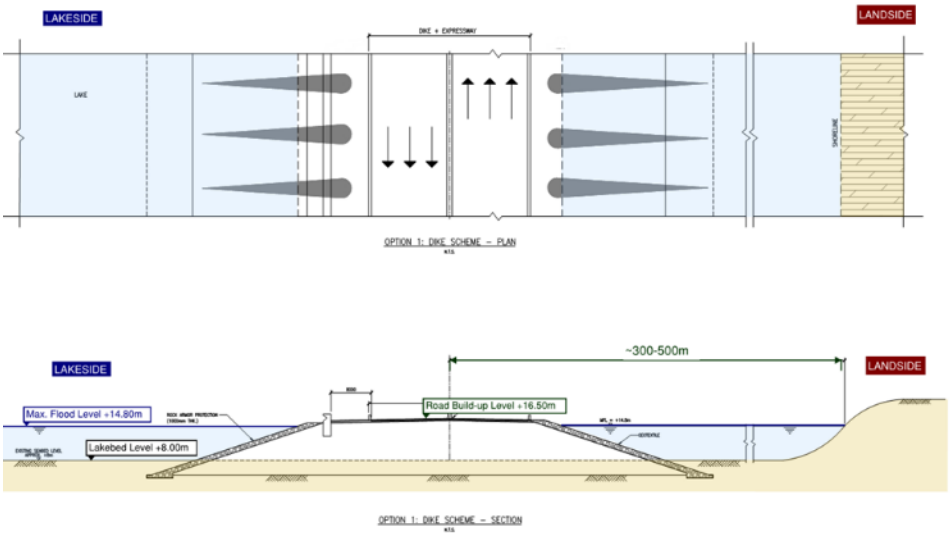


Figure 62 General Layout of Option 1

Option 2A, 2B and 4B were viaduct scheme with different elevation to make balance on the provision of future development along the shoreline and visual impact to the lake. Viaduct option (**Figure 63)** have minimal impact to the existing fisherfolk and vessel transportation.

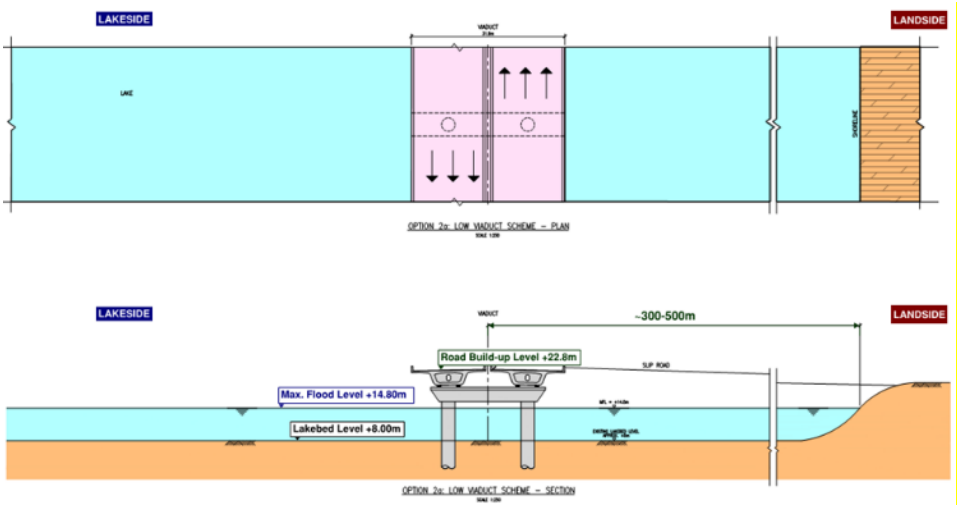


Figure 63 General Layout of Option 2A

Option 5 - Combination Viaduct + Dike Scheme was developed in the Option Selection Workshop which was held on 20th February 2019. In this option, providing a 51km long high-standard expressway comprising of the combination of dike and viaduct along west shore of the Laguna Lake with interchanges from Bicutan/Taguig in Metro Manila through Calamba to Los Baños in Laguna in Phase 1. There were 8 number of interchange identified at Stage I Hagonoy, Sucat, Muntinlupa, San Pedro, Binan-Sta Rosa, Cabuyao, Calamba and Los Baños, each location is subject to further review in Stage II with a safer, reduce travel time and increase economic development along Lower Bicutan to Los Baños.

2.4..1.2 Summary of Alignment Options Recommended

As re-capped in the previous sections, the horizontal alignment for all options are fundamentally the same. The landing points, interchanges, toll plazas and service stations arrangement are therefore the same. Distinctive features of each options are summarized in Table 5.

Table 5 Summary of Key Engineering Parameters of Options

	Option 1: Dike Scheme	**Option 2a: Low Viaduct Scheme**	**Option 2b: Low Viaduct Scheme with Preservation Dike**	**Option 4b: Hybrid Low + High Viaduct with Preservation Dike**	**Option 5: Combination of Viaduct + Dike**
Mainline Vertical Alignment	Top level of highway road surface is +6.022mSL.	Top level of highway road surface is +12.322mSL.	Top level of highway road surface is +12.322mSL. Top level of preservation dike is +6.022mSL.	Top level of highway road surface varies from +12.322mSL to +14.022m. Top level of preservation dike is +6.022mSL.	Top level of highway road surface varies from +12.322mSL to +14.022m.
Dike Structure	Top width of the dike is 40.9m.	NA	Top width of the dike is 8m.	Top width of the dike is 8m.	Top level of preservation dike is +6.022mSL.

	Option 1: Dike Scheme	Option 2a: Low Viaduct Scheme	Option 2b: Low Viaduct Scheme with Preservation Dike	Option 4b: Hybrid Low + High Viaduct with Preservation Dike	Option 5: Combination of Viaduct + Dike
Pump Design	Total 18no. pumping stations, each with 6-12 nos. of vertical axial pumps. Minimum capacity of pump is 40m3/s @ 3.8m	NA	Total 18no. pumping stations, each with 6-12 nos. of vertical axial pumps. Minimum capacity of pump is 40m3/s @ 3.8m	Total 18no. pumping station, each with 6-12 nos. of vertical axial pumps. Minimum capacity of pump is 40m3/s @ 3.8m	NA
Flood Gate Design	Total 18 no. flood gate along LLRN. Each pumping station consisting 16 nos. of sluice gates span across 300m dike opening. The proposed dimension is 18m x 8m (W x H).	NA	Total 18 no. flood gate along LLRN. Each pumping station consisting 16 nos. of sluice gates span across 300m dike opening. The proposed dimension is 18m x 8m (W x H).	Total 18 no. flood gate along LLRN. Each pumping station consisting 16 nos. of sluice gates span across 300m dike opening. The proposed dimension is 18m x 8m (W x H).	NA
Superstructure Design	NA	Continuous bridge with beam and slab or box girder, typical span of 50m.	Continuous bridge with beam and slab or box girder, typical span of 50m	Continuous bridge with beam and slab or box girder, typical span of 50m	Continuous bridge with beam and slab or box girder, typical span of 50m
Substructure Design	NA	Monopile or multiple piles with pile cap	Monopile or multiple piles with pile cap	Monopile or multiple piles with pile cap	Monopile or multiple piles with pile cap

The review on environmental and social key aspects was carried out in Stage I outline the existing conditions and possible constraints in the landing and connecting areas and initially identify the affected areas.

In addition, the environmental considerations will include studies on the effects to the adjacent land and the environment, community impacts and ecologically sensitive areas. The following sections discuss about the laws and regulations for DENR and ADB requirements and the preliminary conditions in environmental and social studies

- Adverse impacts upon the livelihoods of fishery along the Laguna lake shoreline operators and land transport operators.

- Displacement of some community members and organizations as a result of land resumptions.
- Residential communities and businesses are likely to require resettlement, subject to the final road alignment. A Resettlement Action Plan (RAP) and Stakeholder engagement process will be required.

These impacts should be managed appropriately through the provision of appropriate assistance to affected groups, to ensure that the net benefits of the LLRN are distributed equitably.

However, the LLRN project will have significant social and economic benefits for the greater community over time. The distinguishing characteristics of each option in terms of issues and benefits is presented in Table 6 below.

Table 6 Key environmental / social / economics by option

Option	Key environmental / social / economics issues	Key environmental / social / economics benefits
Option 1: Dike Scheme	• Reduced connectivity between the inland channel and lake may reduce lake habitat • Significant dredging which may leading to soil contamination and water quality degradation • Intensive construction leading to noise and air pollution impacts to nearby sensitive receivers, congested traffic area during the construction phase. • Greater impact on fishing activities and other economic activities on the lake	• Flood alleviation
Option 2a: Low Viaduct Scheme	• Minimal contribution to lake preservation	• Allowing access to the lake for fisherfolk and other users. • Minimal footprint within the lake • Lower environmental impact during construction due to less intensive construction methodology and less dredging requirement
Option 2b: Low Viaduct Scheme with Preservation Dike	• Significant dredging which may leading to soil contamination and water quality degradation	• Lower environmental impact during construction due to less intensive construction methodology

Option	Key environmental / social / economics issues	Key environmental / social / economics benefits
	• Reduced connectivity between the inland channel and lake may reduce lake habitat	
Option 4b: Hybrid Low + High Viaduct with Preservation Dike	• Significant dredging which may leading to soil contamination and water quality degradation • Reduced connectivity between the inland channel and lake may reduce lake habitat	• Lower impact to existing urbanization patterns and ecosystems, provided that the increased height remains a passage for ecology and marine traffic. • Limited visual impact
Option 5: Combination of Viaduct + Dike	• Reduced connectivity between the inland channel and lake may reduce lake habitat	• Flood alleviation

As a result of the options selection workshop conducted on 20 February 2019 and the findings of the Stage I Options Study, Option 5 - Combination Viaduct + Dike Scheme was chosen to take forward to Stage II of the Feasibility Study. This option is the most suitable with the best overall balance of positive outcomes, cost, ease of implementation, and minimum negative impact.

2.4..2 The Final Confirmed Alignment

The LLRN is proposed with majority of road along the shoreline of Laguna Lake. The Phase I of this Project will be mainly along the Western coast. Phase II will run around the Northern and Southern coastline of the Lake via Eastern the coast. The total length of Phase I and II could exceed 100km.

The final confirmed alignment of Phase I will start at a roundabout interchange connecting to C6 at Lower Bicutan, north of the existing Lakeshore Hall. The alignment begins eastward into Laguna Lake before turning southward and traverse off-shore along the coastal communities of Muntinlupa City at Sucat, Alabang, then on-shore from Laguna Province at San Pedro, Biñan, Santa Rosa, Cabuyao and end at the coastline of Calamba. There will be a stub end for the connection to Phase II as well as link road to the Calamba central area.

The total length of the final refined mainline from Lower Bicutan to Calamba is 37.6 km. There will be 8 interchanges at the mainline. The interchanges are proposed at Lower Bicutan, Sucat, Alabang, Tunasan, San Pedro/Biñan, Santa Rosa, Cabuyao and Calamba. They are proposed to connect to Municipal Boundaries at the nearest public road. LLRN FS aims to provide the concept for the connection to the centre of communities which is preferred to be at Manila South Road, but details as well as the ROW and negotiation are proposed to be carried out by the LGUs. In 2026 when LLRN starts operation, it is expected that the connection works of all these interchanges would have been implemented except for those at the Tunasan Interchange. Our traffic forecast and economic appraisal have adopted this implementation assumption.

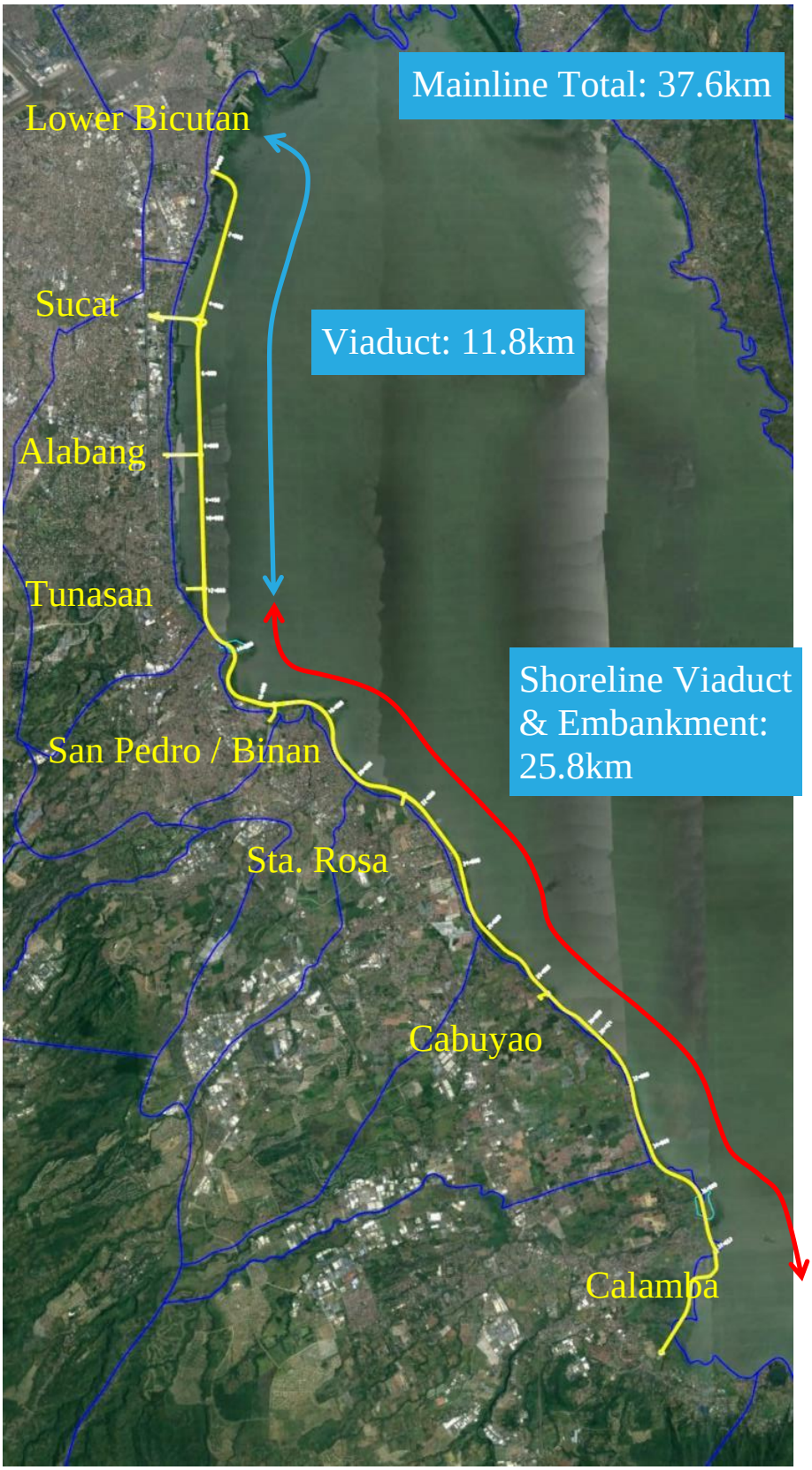


Figure 64 LLRN Phase I Final Confirmed Alignment along the Western coast of Laguna Lake

Summarized Comparison of Environmental Impacts of Each Alternatives

Table 5 is the summarized environmental and social constraints along the alignment, as rapidly assessed during site visits conducted.

Table 7 Summarised Environmental and Social Constraints along the Alignment

Environmental/ Social Aspect	Constraints
Land	Most of the connecting areas are situated in built-up areas, with few trees/vegetation in some areas such as Binan-Sta. Rosa interchanges.
Water	May affect current lake uses e.g. potable water supply, fisheries and aquaculture, flood control projects, etc.
Air	Air and noise pollution are expected to increase during construction phase.
People	Traffic congestion is a concern, since the project is situated in built-up areas. Utilities i.e. high-tension wires are also considered as constraints. Land acquisition will also be critical due to presence of informal settlers. Displacement and resettlement of some residential communities (subject to the final road alignment) Adverse impacts upon the livelihoods of fishery along the Laguna lake shoreline operators and land transport operators

2.5 Process / Technology

Construction Method

Construction methods that the project may employ are discussed in Section 2.7..2 Construction/Development Phase.

Operation and Maintenance

The design of the structures will be in accordance with the Design Standard guidelines of DPWH and other specifications of the project, where necessary. These design standards contain principles and requirements for safety, serviceability and durability. It assumes that maintenance activities are performed during the working life of the bridge structures in order to enable them to fulfil the requirements for reliability.

In order to preserve the intended reliability of the structures there is an absolute requirement for ongoing inspection and maintenance. Replacement or repair of certain components shall be carried out as necessary to ensure that the reliability of the structures is not reduced during the intended service life.

2.6 Project Size

The project is a road network with two lanes on each direction along the mainline except for the section between Sucat and Sta. Rosa with three-lanes on each direction. Each lane is 3.35m wide with 2.5m far side shoulder with 3.5m-wide cycle track and sidewalk on the lakeside for certain sections. The total mainline length is 37.6km which is divided into two sections - Section 1 with a Viaduct of about 11.8km and Section 2 with shoreline viaduct and embankment of about 25.8km. It has a total of eight interchanges - (1) Lower Bicutan, (2) Sucat, (3) Alabang, (4) Tunasan, (5) San Pedro/Biñan, (6) Santa Rosa, (7) Cabuyao, and (8) Calamba. The road network will require a total land area of 210,994.38 m^2 and affect a total fish cage area of 837,400.00 m^2.

2.7 Project Phases

The project components will be implemented according to the Department of Public Works and Highways (DPWH) Standard Specifications, Volume II: Highways, Bridges and Airport (the Blue Book) 2004 edition. This will be supplemented with additional project-specific specifications, where necessary.

2.7..1 Pre-construction/Pre-operational Phase

The pre-construction phase involves planning and conduct of the detailed engineering design for the project components, obtaining ROW and necessary clearances and local permits, pre-qualification of contractors and awarding of contracts, and mobilization for construction.

During the pre-constructional phase, the contractor(s) will mobilize equipment and supplies to the project site, erect temporary facilities for workers and field office, storage sheds and workshops required for the management and supervision of the project. Construction management staff and workers, including local labor, which will include women. Casting yard, which will also serve as a dry dock, will be set up where precast concrete elements such as girders and beams will be casted.

The Road Right-of-Way (ROW) and compensation process will be completed before the start of construction. Affected land and property must be cleared before the start of construction, including properties that should be demolished for the construction of land viaduct, ramps and roundabout junctions. Trees and vegetation areas on the site will be removed at site clearing phase.

Detailed geotechnical and subsurface investigations will be conducted. Ground preparation and earthworks will commence at the pre-construction phase. As the layout of the structure should be already set accurately at this stage, excavation work will begin, where the soil will be removed to a required depth in which the foundation of the structure will be placed. Heavy machineries like boulders, backhoe, shovels, and scooper will be used for earthworks i.e. removing of excessive soil and other material from construction site.

A health and safety management plan will be prepared and implemented to establish protocols and procedures in addressing potential health and safety emergencies (e.g. oil spills).

Construction of temporary facilities will also be built during this stage depending on the number of workers that will be hired and the actual civil works. The acquired land will be utilized for construction of these.

There may be minimal disruption to road users in the vicinity of the project site during the construction phase. Access roads may need to be opened prior to the commencement of construction-related activities. Any required road closures or detours will be clearly marked to ensure that there are no safety risks for road users, and any possible distribution will be minimized.

2.7..2 Construction/Development Phase

Provided below are brief discussion of construction methods that the project may employ. The construction methods presented in the following sections are commonly adopted worldwide. Whilst the local contractors can make reference to them, these methods are subject to changes in accordance with the availability of construction vessels and plants and the construction practice of the local industry.

2.7..2.1 Viaduct

This section is to list out the possible construction methods for the proposed viaduct options.

2.7..2.1.1 Dredging for Barge Access

Dependent on the methodology of embankment, there might be a necessity for navigation of barges for delivery/disposal of material within the lake. Land filling for embankment is a major activity, dredging might be necessary before it, either to expose the silt for taking out the sand or dredging of navigation channel for deeper barges. For the piling activity. There might be barging points or wave breakers for protection of barges.

2.7..2.1.2 Temporary Steel Deck and Piling Platform

General access for construction could be provided by constructing temporary access deck and working platform for piling and delivery of construction materials. Temporary deck could consist of temporary steel piles and prefabricated light steel deck.

2.7..2.1.3 Temporary Dry Working Platform

In this method, temporary dry working platform would be constructed using high-strength fabric tube with sand fill as a reclamation dykes. The dry working platform will be above water level. After completion of temporary dry working platform, land construction plants could be used, and the construction method for piling would be similar to land-based methods. The temporary dry working platform could be removed after the completion of the viaduct. This method would be particularly advantageous with development reclamations as the dry working platform could be integrated with the development reclamation.

2.7..2.1.4 Pile Foundations

The use of reinforced concrete bored pile shall be adopted in the preliminary design for the foundation. Driven piles may also be an economical solution and shall also be considered. Driven piles are easier to construct than bored piles but each pile capacity is less hence more piles are needed for each support. The pile type, size, number and arrangement shall all be finalized in the detailed design phase.

2.7..2.1.5 Pile Bent and Super Structure

For the substructure of the majority of the mainline viaduct, pile bents with bored piles is the proposed option. These types of piles are constructed and extended above water up to the base of crosshead which supports the superstructure. There is no pile cap required for this substructure which eliminates the construction time, cost and environmental impact associated with pile cap construction. This substructure is only suitable up to a certain height as the bored pile/column will become too slender when the road level is high.

2.7..2.1.6 Casting Yard and Works Stations

The proposed LLRN along west shoreline of Laguna Lake is approximately 37km long. It is foreseen that there will be large amount of construction activities during the implementation/construction phase. To minimize the impact to existing road network, whose capacity is about to be exceeded in some location, casting yards along the main line are proposed. Ideally the casting yards could be located at headlands with widening of existing roads. Also, the casting yards could be located at position of future service stations along the proposed highway to avoid waste of reclamation and reduce unnecessary acquisition of land. The selection of casting yard locations should minimize the impact to local residents and environment. The project could be split into a number of packages with covered construction yards for precast element construction. 2 possible casting yard/ works area locations have been identified. Further study would be required at detailed design phase and contractor to further investigate the proposed location.

Table 8 Possible Casting Yard and Works Stations Details

	Total Area (km^2)	**Reclamation (km^2)**	**Un-used Green Land (km^2)**	**Farm Land (km^2)**
Casting Yard 1 At headland near Santo Nino, San Pedro	0.2	0	0.2	0
Casting Yard 2 Between river mouth of San Cristobai River and San Juna River, Calamba	0.28	0	0	0.28

The details of possible casting yards are listed in **Table 8**. The size of casting yards is for reference only, the final size and locations will be studied to suit the construction method and number of contracts. Layout plan for possible casting yards are shown in **Figure 65** and **Figure 66.**

Figure 65 Possible Location of Casting Yard 1

Figure 66 Possible Location of Casting Yard 2

2.7..2.1.7 Dumping Area

There will be many excavation activities such as bored piling and/or pile cap construction for both land and marine viaducts and embankment base layer. It is necessary to identify dumping/storage areas for material which is either suitable or unsuitable for re-use. If the dredged material from the bored piles it is likely to be unsuitable material and cannot be used

for site formation works, these excavated materials might need to be dumped at identified area such as landfill site. This has to be controlled in a suitable manner with minimum impact to the environment. The dumping site would ideally be as close to the project location as possible to reduce the cost of transportation, it needs to be further study in DED phase.

2.7..2.1.8 Haul Road

Haul road(s) to and from the construction sites and in particular the works area(s), barging point(s) and/or casting yards will be required. The capacity of existing roads will need to be checked and upgraded if necessary, to suit the construction activities. This may need to be carried out as advanced works.

2.7..2.1.9 Superstructure Construction

For beam and slab scheme, the proposed construction method of precast beams are erected by back feed launching gantry. In this method, the precast beams would be erected first on temporary bearings on the pier crossheads or portal beams. Then permanent formwork would be installed on the beam for the deck slab, which would then be cast in-situ. To make the individual spans continuous, concrete diaphragm can be cast between the end of two spans.

For deck supported on bearings, the load will be transferred to permanent bearing after in-situ diaphragm and slab gained enough strength, hence the viaduct could reach desired articulation. For viaduct with monolithic connection between deck and substructure, the in-situ diaphragm would be casted monolithically with the crosshead beam to form the joint. For lake viaduct and embankment viaduct, the main steps of superstructure construction method.

2.7..2.2 Embankment

The construction methods presented in the following paragraphs are commonly adopted worldwide. Whilst the local contractors can make reference to them, these methods are subject to changes in accordance with the availability of construction vessels and plants and the construction practice of the local industry.

2.7..2.2.1 Source of Construction Material

Based on the previous material source exploration in PEA 1991 Feasibility Study of the Laguna De Bay Reclamation Project, it was estimated that around 220 million cubic metres of sand and fill materials exist along the identified area, refer to Figure 67 The required total earth fill material for LLRN embankment is around 16 million cubic metres based on current estimation.

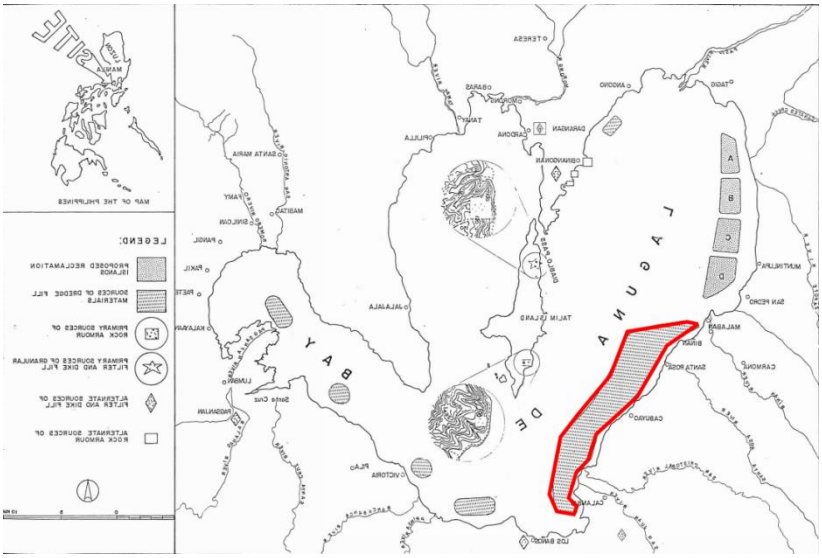


Figure 67 Sources of dredge fill and rockfill materials (PEA Feasibility Study 1991)

Apart from the fill material from the lake, there are other sources from nearby provinces for materials explored in this study, however the impact on land environment and traffic impact during construction have to be considered. At this stage, using material from the lake is recommended.

1. Pampanga is an alternative source for sand that can be used for backfilling the embankment. It is about 113 km via the NLEX.
2. Tuy and Calatagan, Batangas for aggregates (Fine and Coarse) and boulders produced from basalt quarry and crushing plant. It is about 114 km via Santa Rosa-Tagaytay Road.
3. Ternate, Cavite for aggregates (Fine and Coarse) and boulders produced from basalt quarry and crushing plant. It is about 60 km via Dasmarinas-Carmona Road.
4. Antipolo and Teresa Rizal for aggregates (Fine and Coarse) and boulders produced from basalt quarry and crushing plant. It is about 45 km via the C6 Road.
5. Rodriguez, Rizal for aggregates (Fine and Coarse) and boulders produced from basalt quarry and crushing plant. It is about 50 km via C6 Road.
6. Sariaya, Quezon for aggregates, boulders and armour rocks. It is about 100 km via SLEX.

For base course, sub-base materials, and backfilling materials, the above sources can provide the materials. According to the "CY 2019 UPDATED MATERIALS MAP" published by Department of Public Works and Highways LAGUNA I District Engineering Office on 8th May 2019, three different materials sources within the fourth district of Laguna are identified, and all three available sources are Boulders, Gravel, Sand and Ready-Mix Concrete. The sources location and site view are shown as following Figure 68 to Figure 71**.**

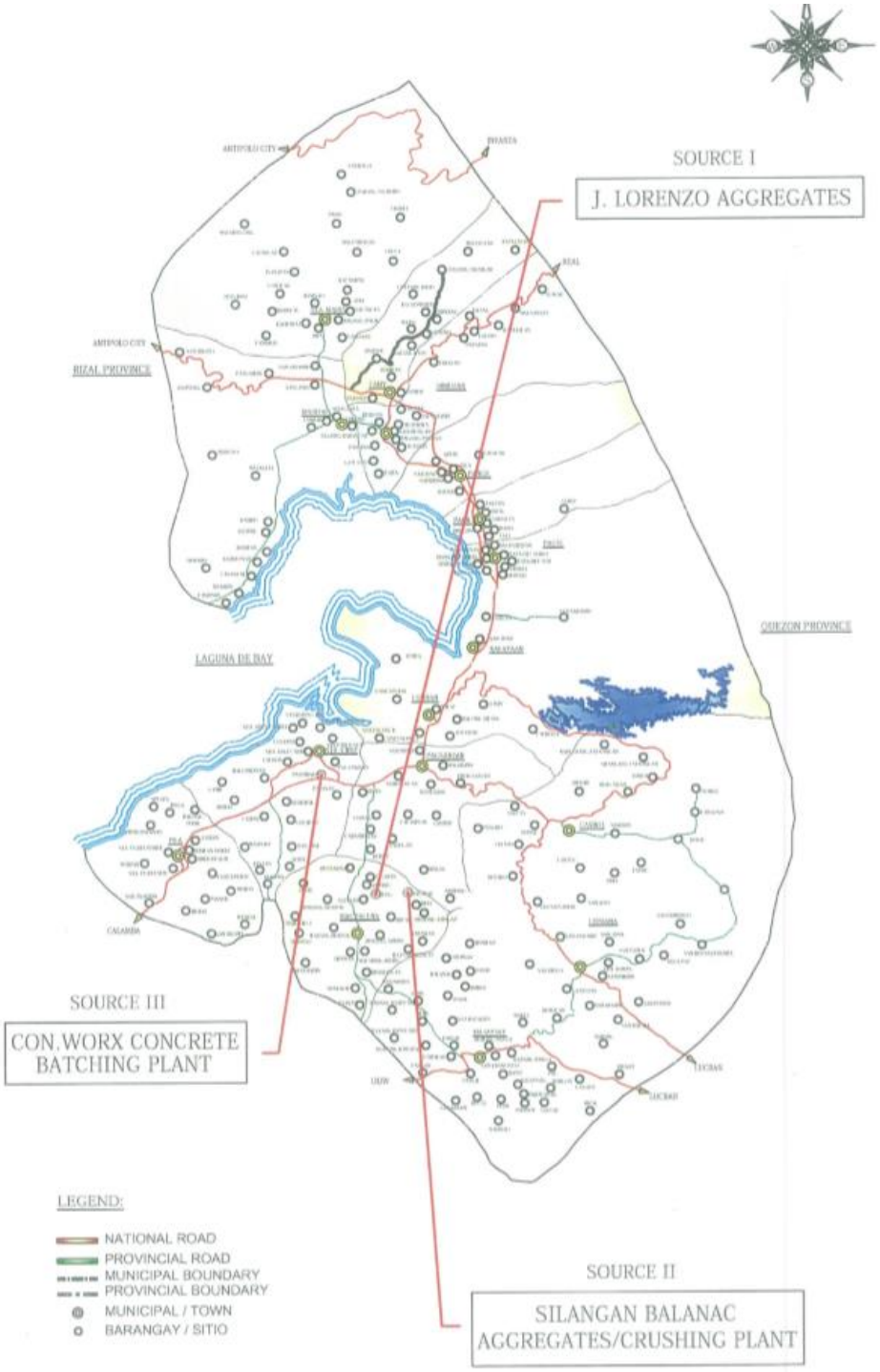


Figure 68 Materials Source Location Map

NAME: J. LORENZO AGGREGATES
Location: Km 89+283 National Road, 4.2Km. Leading to Provincial Road, Right & 2.3 km access road. Brgy. Ilog, Magdalena, Laguna.
Kind of Materials Available: Boulders, Gravel & Sand.
Available: G-1, 20-30 cu.m. /day
3/4, 20-30 cu.m. /day
S-1, 40-50 cu.m. /day
Uses: Borrow Fill, Item 200, 201, 300, 311, 505 & 506

Figure 69 Sources I Site View

NAME: SILANGAN BALANAC AGGREGATES/CRUSHING PLANT
Location: : Km 90+300 National Road, 4.9 Km. leading to Provincial Road, Right & 350m access road. Brgy. Balanac, Magdalena, Laguna.
Kind of Materials Available: Boulders, Gravel & Sand.
Available: G-1, 50-60 cu.m. /day
3/4, 50-60 cu.m. /day
S-1, 40-50 cu.m. /day
Uses: Borrow Fill, Item 200, 201, 300, 311, 505 & 506

Figure 70 Sources II Site View

NAME: CON.WORX CONCRETE BATCHING PLANT
Location: Km 86, National Highway, Brgy. Patimbao, Sta. Cruz, Laguna.
Kind of Materials Available: Ready Mix Concrete
Production Output: 75 cu.m. /day
Source of Raw Materials: Holcim Aggregates
Accreditation: DPWH-BRS Accredited

Figure 71 Sources III Site View

Based on the identified available sources, the embankment fill materials would comply with the embankment design and construction requirement.

2.7..2.2.2 Stone Column Construction

Stone column is proposed to be installed in potential liquefaction zone to mitigate soil liquefaction issue during earthquake events. Stone column can also help increase the bearing capacity and reduce the ground settlement.

The 2m thick loose sandy silt at the top portion of the seabed should be dredged and replaced with qualified rock fill (gravel) blanket prior to install the stone column. The offshore bottom-feed method could be adopted for the stone column installation. A barge or a pontoon is used to serve as a working platform on which a crawler crane of sufficient capacity is mounted to support the custom built vibro string assembly. Positioning of the stone column is often done with the assistance of a global positioning system. Penetration to the required depth below seabed level is assisted by the combined action of vibrations and compressed air. Stone is fed to the vibrator either using a long arm excavator or other stone transport systems.

2.7..2.2.3 Construction of Embankment

On top of the fill blanket, geotextile should be laid prior to building up the embankment. Staged construction should be adopted to raise the embankment. The conventionally compacted thickness for each filling layer is various. The layer thicknesses are dependent on the maximum particle size of the embankment material and the efficiency of the compaction equipment. The next layer should not commence unless the required compaction of existing layer of fill is achieved. In case of raising the embankment on a soft soil, the rate of filling is governed by the stability and degree of consolidation which are usually related to observations of excess pore water pressures in the ground.

In general, fill material should be placed systematically and in uniform layers to the correct width and side-slopes. Care is required to ensure that the material is placed correctly to avoid loose, uncompacted edges, clue either to blading off surplus material, or to the addition of material due to insufficient width.

Geotextile tubes should be used to facilitate the construction of the embankment. By placing them at the toe of the embankment, they can serve as a protection against erosion. The rock armour protection facing shall be built up in layers ahead of each layer of filling.

2.7..2.2.4 Vessel Navigation

Water access is essential for the proposed construction methods and the site location presents several logistical constraints for consideration to make marine-based construction viable. Typical work vessel types for reclamation or embankment construction include:

- Flat-top barge
- Crane barge
- Hopper barge
- Tugs (for unpowered barges)
- Motor Boat / Launch
- Specialised Dredger

Upon tender award, work vessels must be mobilised from supplier storage/berths, likely sourced elsewhere in the Philippines or internationally. External water routes to the site are therefore limited to Pasig River, which runs from Manila Bay to the north-western tip of Laguna Lake. Any marine navigation, self-propelled or towed, through Pasig River presents the first constraint: all transiting vessels must fit through inland waterways and structures and comply with local navigation practices. The vessels' water draft, air draft and beam should have sufficient clearance from the riverbed, bridge deck and piers, respectively.

Within the project site, work vessels should be able to deploy and operate across the many work-fronts. During this stage, vessels may be heavily laden with dredged soils or construction fill materials for transport across the site. Further dredging works may be needed to maintain a navigation channel for these vessels with sufficient depth clearance. Alternatively, the laden draft of vessels may be tightly controlled to avoid the additional dredging.

In view of the constraints for mobilising and operating in Laguna Lake, it is recommended that non-specialised, shallow-drafted or draft-controlled work vessels should be procured to carry out construction of the LLRN. It is possible that specialised plant may be brought via overland routes and then loaded onto general work barges; supporting infrastructure may need to be constructed, such as a temporary causeway. Loaded vessels may also need to limit quantities of cargo in their holds to successfully navigate through un-dredged shallow water areas and maintain stability during construction, particularly with lifting works.

2.7..3 Operational Phase

While the final selection of the maintenance party is subject to the overall resources planning of DPWH at the time of project completion, when applying for funds through the General Appropriation Act for the maintenance activities, two categories of funds may be considered –

a. Preventive Maintenance – this involves implementation of annual preventive maintenance program for the National Road System (NRS) to ensure that the roads under the NRS would remain in good condition. With the funding, the DPWH may undertake the maintenance works by the Central Office or Regional Offices.

b. Long Term Performance Based Maintenance (LTPBM) – this subcomponent aims to test the performance of multi-year contracts including routine, periodic and preventive maintenance activities. Payment under the LTPBM contracts will be based on outcomes such that whatever the contractor is expected to perform must meet the established standard (minimum service level). In this case, a private company will be engaged through contracts to perform the services.

Even though the private sector may demand a larger profit margin as they perform the tasks, it is expected that this increase in costs will be offset by the higher efficiency of the works. The cost implication of the choice of maintenance party is expected to be minimal and our projection therefore do not distinguish the different scenarios. The final arrangement is subject to further coordination and discussion during the DED stage.

2.7..4 Demobilization Phase

The demobilization activities will proceed after the construction phase. This will include demobilization of construction barracks and other temporary facilities structures, and removal of all equipment. Construction areas will be cleared and cleaned of any construction waste or debris. Demobilization and restoration work will comply with the accepted procedures and standards prescribed in the approved civil works contract, per DPWH standards.

Project Schedule

The project schedule is shown in **Figure 72** below. Project preparation and identification started last 2018, while the civil works construction will begin in 2022. The construction is expected to end by the year 2025 as of June 2020 updates.

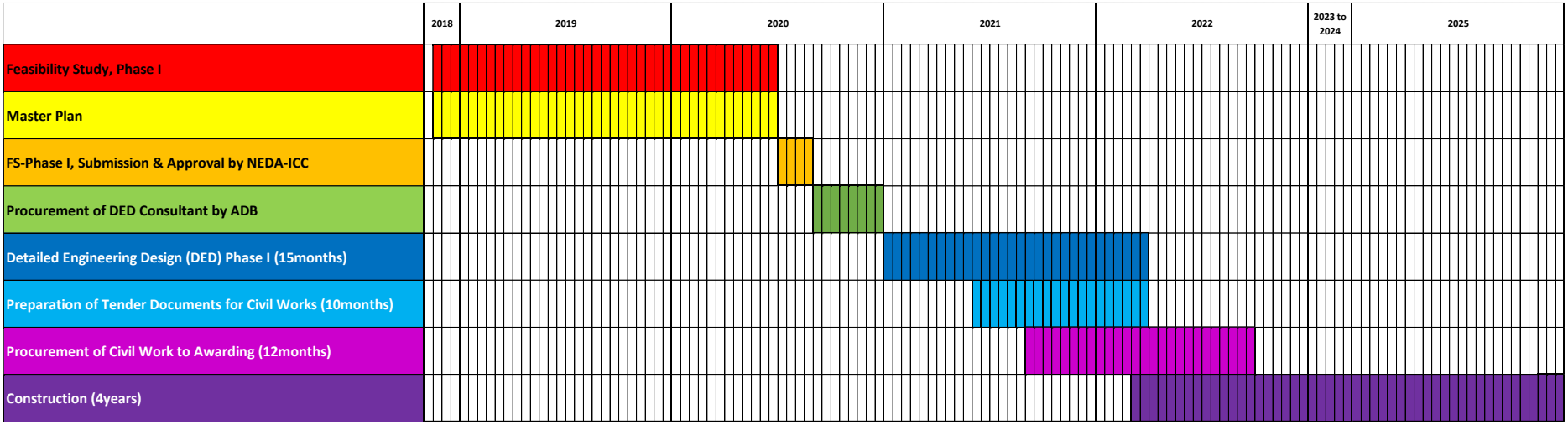


Figure 72 LLRN Project Schedule

2.8 Manpower

Preconstruction Phase

The manpower necessary during pre-construction phase are the project proponents, consultants and sub-consultants of the project. The total estimated manpower for this phase is listed in **Table 9**.

Construction Phase

During construction, the work force will consist skilled and unskilled workers for the construction, where hiring of qualified locals is recommended.

A percentage of the construction manpower will be provided by the contractor; hence DPWH will require the contractor to adopt strict policy requiring to source workforce from qualified locals and to develop scheme of prioritization in local hiring.

Furthermore, DPWH will strictly enforce RA 6685 in the project. This act requires private contractors to whom the project have been undertaken to hire at least 50% of the qualified unskilled and at least 30% of the qualified skilled workers from the host city or municipality of the project.

Moreover, the contractor is required to apply labor standards and equal pay for work of equal value for both men and women. Equal opportunities will be provided for men and women. A target percentage of female workers will be set on the DED stage of the project.

Lastly, it will be part of the policy of DPWH to hire qualified applicants including persons with disability (PWD), members of indigenous communities, senior citizens and those any sexual orientation and gender identities (SOGI). These all will be part of the Terms of References (TOR) of the contractor during construction and operations phase.

Operation Phase

For the operations, there will be lesser people hired as compared to the construction phase of the project. The operation phase will need people who will handle the security and passage of vehicles, as well as the maintenance and repair works of the road. DPWH commits to the implementation of an employment protocol, prioritizing locals as a hiring policy.

Table 9 Summary of Manpower Requirements for the Project

Project Phase	Estimated Manpower Requirements	Tasks to Perform	Skill Requirement/s
Pre-Construction	< 5% of total workers in construction	• Pre-drilling • Surveying • Ground investigation	General site workers, surveyors, crane/heavy machinery operator etc.
Construction	Approx. 4,000 to 5,000 workers at the peak of a 4-year construction	• Site office and precast yard set up • Foundation construction – Lake • Foundation construction – Land • Viaduct construction • Embankment construction • At grade road construction	Earth filling and compaction for embankment, Concreting, formwork/falsework erection, reinforcement fixer, crane/heavy machinery operator, welders, truck/lorry drivers, general site workers, surveyors, precast factory workers etc.
Operation Phase	40-60 worker/officer	• Security • Operation • Maintenance and repair • Inspection	Inspectors, security officer, technicians for repair and maintenance,

Note: Subject to further refinement during DED stage.

2.9 Indicative Project Investment Cost

The civil works of the project will cost approximately PhP 117.168 Billion, while the estimated total cost of the proposed LLRN project is PhP 166.268 Billion. Given that the LLRN is in the early stages of study, a factor of +50% and -20% may be applied to the total project cost.

2.10 Initial Environmental Impact Assessment and Mitigation

Table 10. Initial Environmental Empact Assessment and Mitigation

Project Phase	Environmental Component Likely to be Affected	Potential Impact	Prevention/ Mitigation/Enhancement Measure/s
Pre-construction	Existing utility lines	ROW land acquisition may affect existing utilities (i.e., power cables, water pipes of water utilities)	Utilities need to be relocated to avoid service disruption
	Terrestrial ecology	Removal of vegetation	Compensation for trees and crops with owners
			Tree replacement

	People	Involuntary resettlement	Identify PAPs/PAFs
			Conduct sustained community consultations
			Establish grievance mechanism
			Establish compensation scheme
			Prepare a Resettlement Action Plan (RAP)
Construction	Land	Landscape modification, soil erosion, vegetation clearing	Prepare and implement a material handling program or a site protection and rehabilitation program
			Immediate soil compaction for an all-weather road through a road roller to prevent any splash and soil erosion
	Terrestrial and Aquatic Ecology	Solid waste generation	Determine clean-up, collection, and disposal schedule for construction waste
			Train workers on waste management practices
			Determine ways of recycling excavated materials
		Accidental oil, grease, and fuel spills	Locate motor pool area at least 500 meters away from the waterbody
			Construction equipment and vehicles need to be serviced by accredited service providers with suitable wastewater facilities

			Store oil, grease, and fuel in secure containers with proper labels at designated locations
			Train workers on waste management practices
		Changes in channel beds and disturbance to aquatic life from the demolition, excavation, pile driving, and viaduct structure and construction	Strict observance and implementation of the Site Protection and Rehabilitation Program and materials handling, which provide for soil erosion control measures.
			Observe best practices in proper construction procedures that promote minimal disturbance to the environment.
	Livelihood	Fishing activities of fisherfolks may be affected.	Schedule of activities will be shared with the local government units and posted within the project site to make sure that construction activities will not adversely affect fishing activities in the area.
		Employment opportunities because of the project.	Priority hiring should be given to local qualified applicants. Proponent shall be in coordination with PESOs for the matching of skills and hiring of workers.
	Occupational health and safety	Excavation activities for the viaduct may hit unexploded ordinance.	Studies will be undertaken to determine if there are unexploded ordinance along the project alignment and its nearby areas.
			Conduct regular tool box meetings

		Accidents may befall workers in the project site.	Provide PPE to all workers and strictly require its use.
			Provide training and safety drill to workers
			Record health and safety incidents on site.
			Develop occupational health and safety plans.
			Conduct trainings on risk management and prevention.
	Water	Contamination from domestic waste of the construction base	Provide temporary toilets (portable toilet) and connect to government sewage.
			Wastewater generated by the project needs to be collected and handled by a third-party collector accredited by DENR-EMB.
	Air	Fugitive dust pollution from equipment use and increased traffic	Provision of buffer zones and tree planting sites.
			Water sprinkling over soil; regulated application to avoid erosion issues.
			Use of non-road machinery / construction equipment that follows prescribed emissions standards.
			Monitoring of ambient air quality to ensure emissions are within allowable limits.
		Increased noise level from equipment use and traffic	Heavy equipment should have mufflers and silencers.
			Instruct heavy equipment operators to properly operate

			engines, avoid pumping fuel, and the reckless use of horns.
			Close monitoring of noise to ensure it falls within the permissible limit.
			Schedue construction activities during daytime.
	Community health and safety	Accidents from driving in a high-risk zone	Establishment of clear and appropriate directional and warning signs.
		Increased traffic congestion	Coordinate with LGUs and affected barangays to develop traffic management plans and necessary route diversion schemes.

3 Public Participation

DENR Administrative Order (DAO) No. 2017-15 provides the guidelines on public participation under the Philippine EIS system. In line with this guidelines, initial stakeholder identification and IEC meetings were done.

3.1 Initial Stakeholder Identification

Stakeholders, as defined by DAO 2017-15, are people (natural or juridical) who affect or are affected by the project or undertaking, such as, but not limited to members of the local community, industry, local government units (LGUs), national government agencies (NGAs) and non-government organizations (NGOs) and people's organizations (POs).

A preliminary stakeholder identification and analysis was done to come up with a list of stakeholder groups that have interest in or stand to be affected by the project given its potential impacts. Note that stakeholder mapping is an iterative process that is informed by the conduct of site visits, observations, and validations by the study team.

Based on initial site visits, preliminary interviews, initial IEC meetings, and desk research done, the following were the identified stakeholders for the project:

- Local Government Units
- Owners and operators of commercial sea vessels
- National government bodies
- Transport sector
- Business sector
- Fisherfolk sector
- Senior citizens
- Youth
- Residents/Homeowners

3.2 Initial IEC Meetings

3.2.1 Taguig City

An online IEC meeting was held with the City Government of Taguig in 22 September 2020 at 2 PM. There were 20 participants in said meeting, including key officials and representatives from the City Administrator's Office, City Planning and Development Office, City Environment and Natural Resource Office, City Assessor's Office, City Agriculturist's Office, City Engineer's Office, and City Housing Office.

Among the issues and concerns raised during said meeting were the following:

- Final copy of the alignment
- Viaduct elevation and basis for it
- Viaduct design and its capacity to accommodate bigger sea-borne vehicles
- Recycling of excavated materials and its possible re-use in the embankments
- Traffic congestion and traffic management during construction
- Clear demarcation of LLDA boundary
- Aligning the LLRN project with other national government projects
- Identification of affected barangays
- Compensation for project affected people, especially fish cage operators who stand to be displaced by the project
- Health and safety protocols of the project

Figure 73 show the screenshots of the online IEC meeting with the City Government of Taguig.

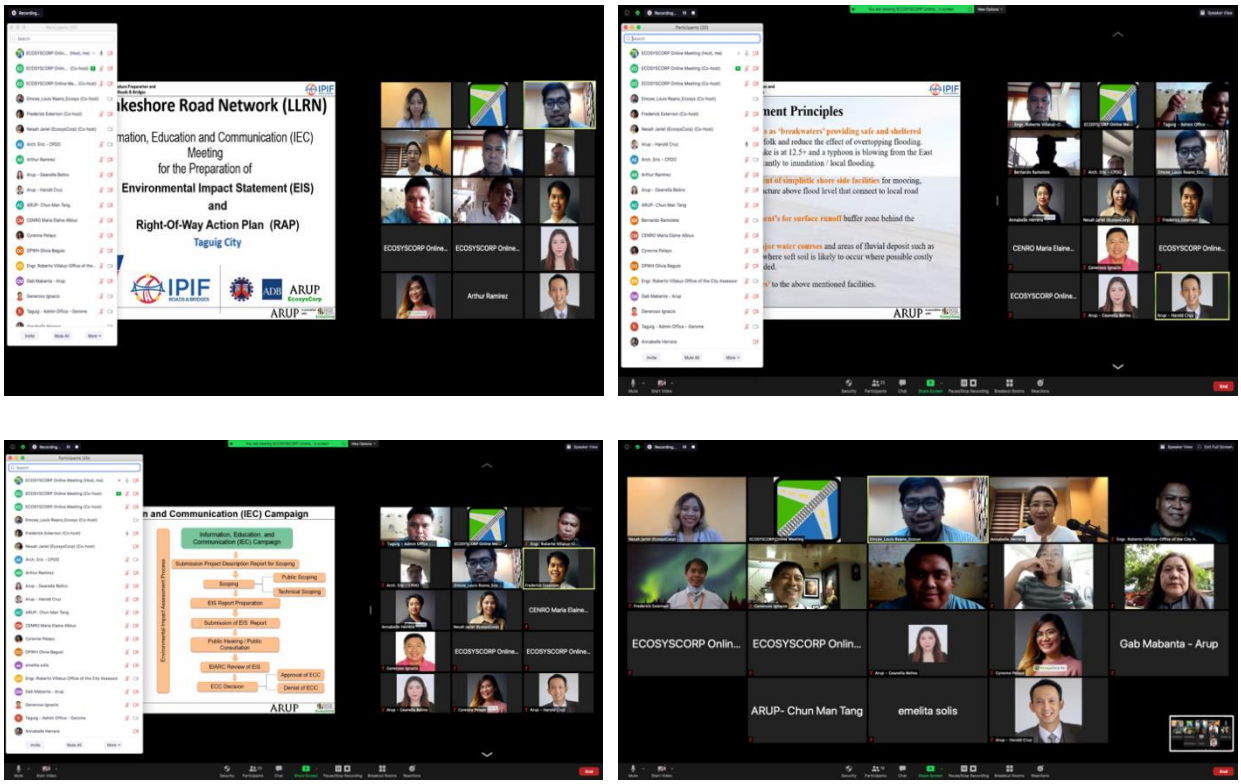


Figure 73. Screenshots of online meeting with the City Government of Taguig

3.2.2 Muntinlupa City

An online IEC meeting was held with the City Government of Muntinlupa in 28 July 2020 at 10 AM. There were 31 participants in said meeting, including key officials and representatives from the City Administrator's Office, City Planning and Development Office, City Environment and Natural Resource Office, City Assessor's Office, City Engineer's Office, Fisheries and Aquatic Resources Management Council, Department of Agriculture, and Lake Management Office. Representatives from the affected barangays of Tunasan, Cupang, Sucat, Poblacion, Putatan, and Bayanan were also present. There were also representatives from the Laguna Lake Development Authority (LLDA) who joined the meeting.

Among the issues and concerns raised during said meeting were the following:

- Placement of the alignment interchange in Susana Heights
- LLRN alignment with other projects, including the Paranaque Spillway Project
- Inclusion of DRRM and climate change in the EIA
- Provision of PPEs to participants to on-site activities

Figure 74 show the screenshots of the online IEC meeting with the City Government of Muntinlupa.

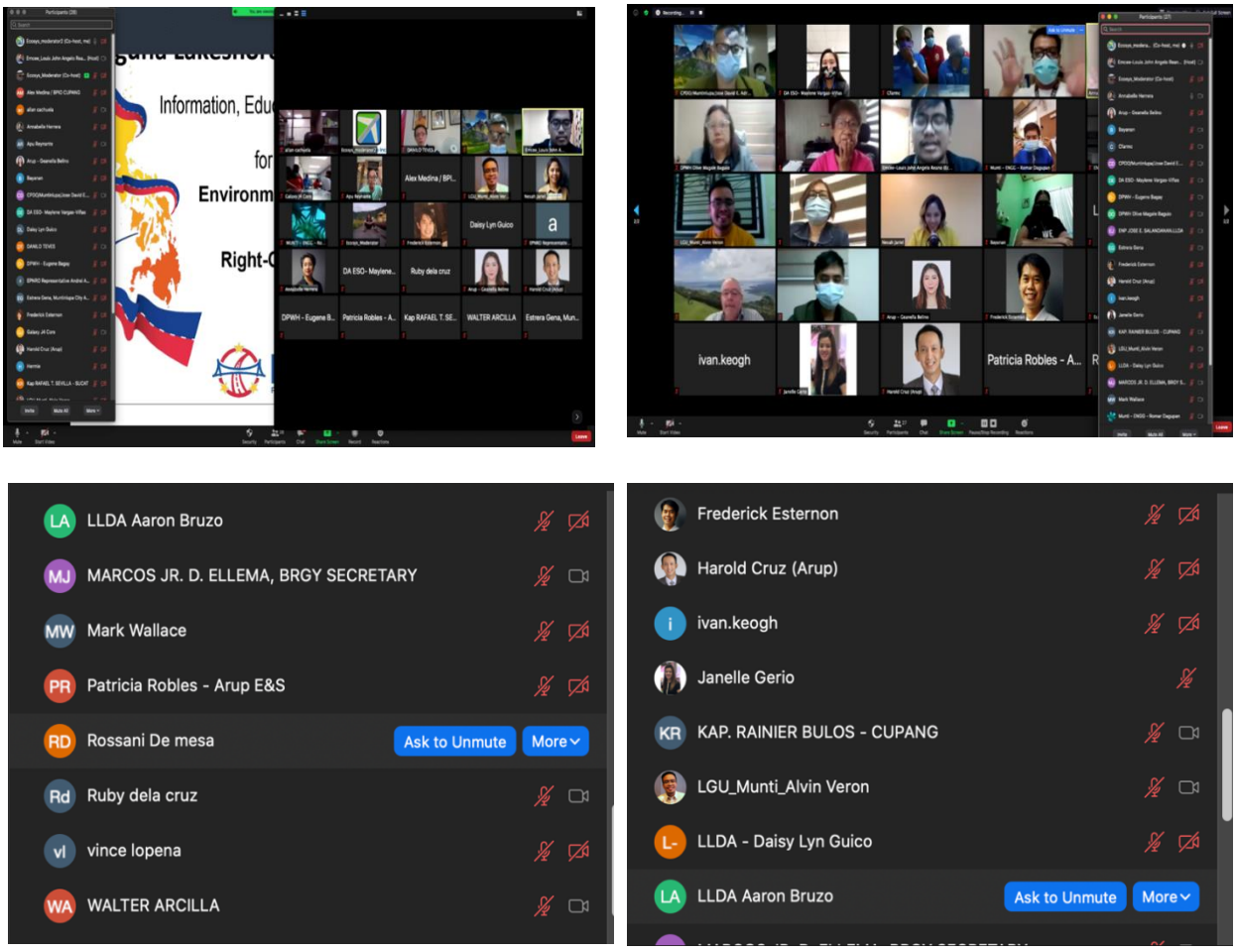


Figure 74. Screenshots of online meeting with the City Government of Muntinlupa

3.2.3 San Pedro City

An online IEC meeting was held with the City Government of San Pedro in 11 August 2020 at 10 AM. There were 22 participants in said meeting, including key officials and representatives from the City Administrator's Office, City Planning and Development Office, City Environment and Natural Resource Office, City Agriculturist's Office, and Urban Development and Housing Office. Representatives from the affected barangays of Cuyab and San Roque were also present.

Among the issues and concerns raised during said meeting were the following:

- Access to the lake as it affects the livelihood of residents
- Technical details of the viaduct and embankments, especially as it relates to reducing adverse impacts to people
- Notifying residents who stand to be displaced by the project
- NEDA acceptance and approval of the project
- Adherence to ADB safeguard policies
- Conduct of IEC at the barangay level

Figure 75 show the screenshots of the online IEC meeting with the City Government of San Pedro.

Figure 75. Screenshots of online meeting with the City Government of San Pedro

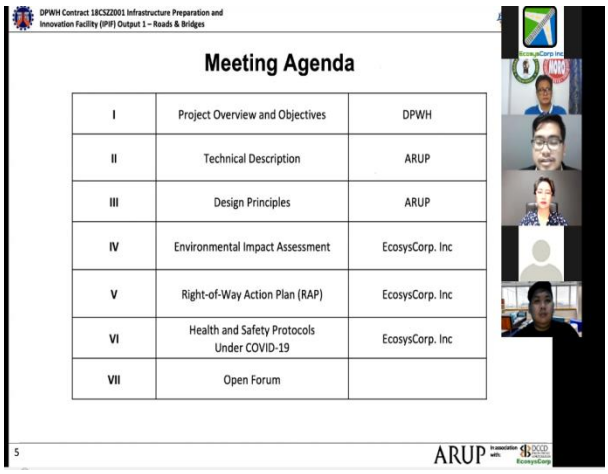
3.2.4 Binan City

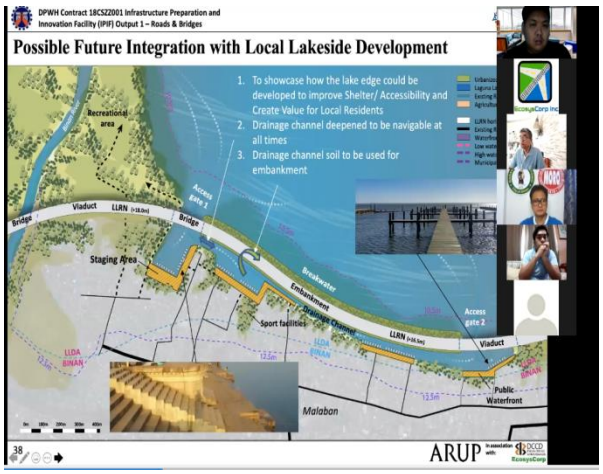
An online IEC meeting was held with the City Government of Binan in 30 June 2020 at 8 AM. There were 21 participants in said meeting, including key officials and representatives from the City Planning and Development Office, City Assessor's Office, and Liga ng mga Barangay. Representatives from the affected barangays of Dela Paz, Malaban, Casile, and San Antonio were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Among the issues and concerns raised during said meeting were the following:

- Displacement of residents who rely on the lake for their livelihood
- Possible adverse impacts of excavation activities in the lake and corresponding mitigating measures
- Sourcing and hauling of construction materials
- Technical details of the viaduct and embankments, especially as it relates to reducing adverse impacts to people
- Placement of entry and exit points in every city
- Placement of interchanges on San Pedro/Binan
- Structures to be affected
- Accuracy of maps shown
- Provision of assistance/compensation to PAPs
- Possible routes of heavy equipment and its impact on the barangay, especially on the integrity of barangay roads
- Maintaining the cleanliness of shorelines
- Grievance redress
- Coordination with affected barangays

Figure 76 show the screenshots of the online IEC meeting with the City Government of Binan.





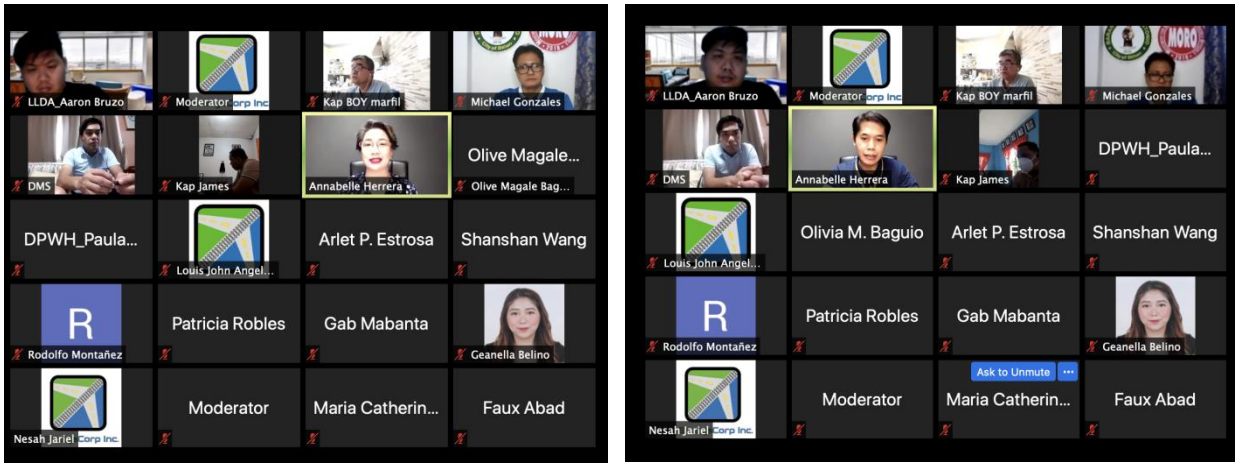


Figure 76. Screenshots of online meeting with the City Government of Binan

3.2.5 Sta Rosa City

An online IEC meeting was held with the City Government of Santa Rosa in 23 July 2020 at 10 AM. There were 25 participants in said meeting, including the City Mayor and key officials and representatives from the City Planning and Development Office, City Environment and Natural Resource Office, City Agriculturist's Office, City Assessor's Office, and Urban Development and Housing Office. Representatives from the affected barangays of Aplaya, Caingin, and Sinalhan were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Among the issues and concerns raised during said meeting were the following:

- Displacement of residents along the shoreline
- Updating of the City's Local Shelter Plan
- Coordination of site activities
- Health and safety protocols before the conduct of on-site activities
- Clarification on the flood mitigation component of LLRN

Figure 77 show the screenshots of the online IEC meeting with the City Government of Santa Rosa.

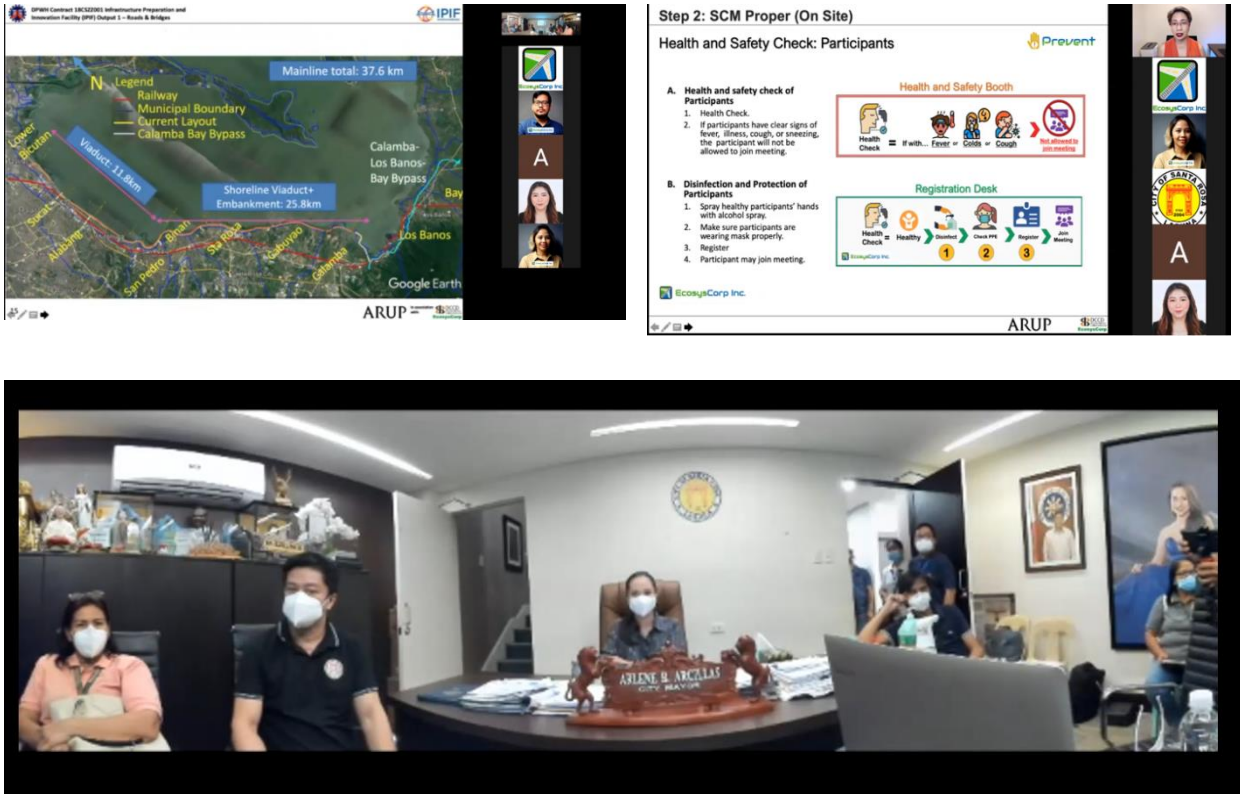


Figure 77. Screenshots of online meeting with the City Government of Santa Rosa

3.2.6 Cabuyao City

An online IEC meeting was held with the City Government of Cabuyao in 01 July 2020 at 10 AM. There were 20 participants in said meeting, including key officials and representative from the City Planning and Development Office, City Assessor's Office, and City Engineer's Office. Representatives from the affected barangays of Butong, Marinig, and Bigaa were also present.

Among the issues and concerns raised during said meeting were the following:

- Survey of PAPs
- Participants to on-site activities
- Distance of the project to the lakeshore
- Project impact on flooding in the area
- Placement of interchange in Cabuyao
- Access of fisherfolks
- Design of the structure
- Timing of conduct of meetings with barangays

Figure 78 show the screenshots of the online IEC meeting with the City Government of Cabuyao.

Figure 78. Screenshots of online meeting with the City Government of Cabuyao

3.2.7 Calamba City

An online IEC meeting was held with the City Government of Calamba in 24 July 2020 at 2 PM. There were 25 participants in said meeting, including key officials and representatives from the City Engineer's Office, Calamba Housing Office, City Agriculturist's Office, and City Assessor's Office. Representatives from the affected barangays of Uwisan, Sampiruhan, Lingga, and Lecheria were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Among the issues and concerns raised during said meeting were the following:

- Project design as it affects residents' source of livelihood and their access to it
- Height of vertical clearance
- Health and safety protocols before the conduct of on-site activities

Figure 79 show the screenshots of the online IEC meeting with the City Government of Calamba.

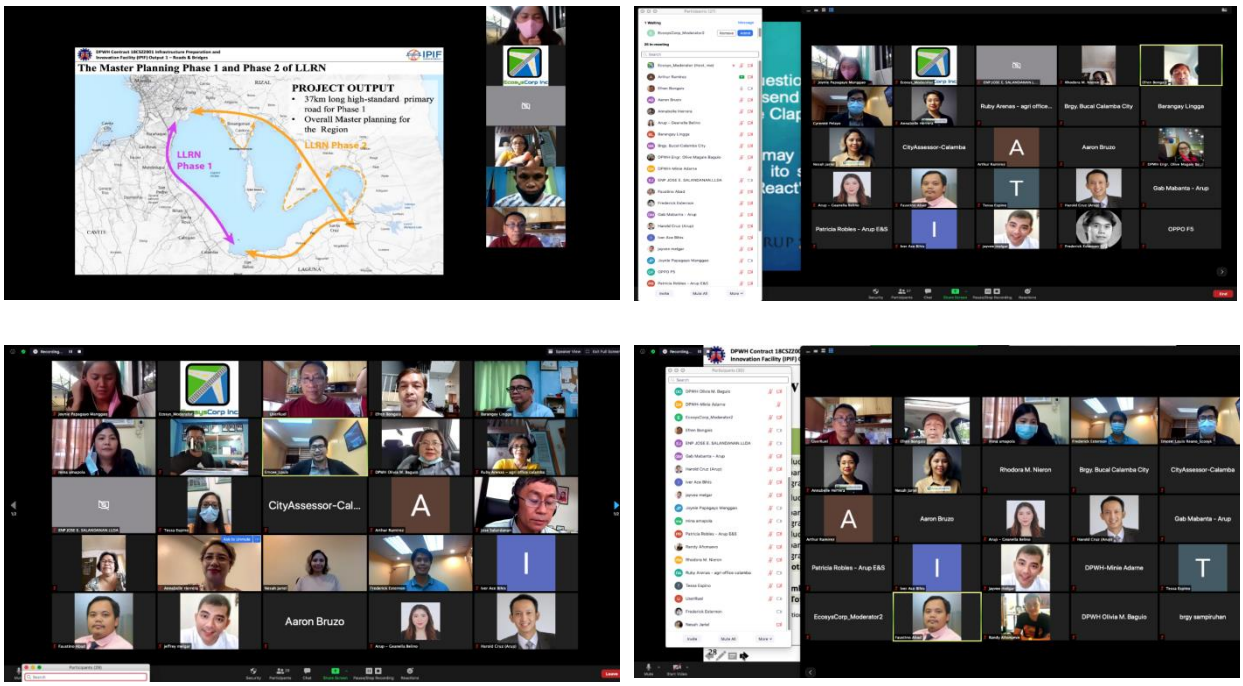


Figure 79. Screenshots of online meeting with the City Government of Calamba

ANNEX A
SAMPLE PPT PRESENTATION FOR THE VIRTUAL (ONLINE) IEC PRESENTATIONS

Laguna Lakeshore Road Network (LLRN)

Information, Education and Communication (IEC) Meeting for the Preparation of

Environmental Impact Statement (EIS)

and

Right-Of-Way Action Plan (RAP)

23 July 2020

IPIF ROADS & BRIDGES

ADB

ARUP

EcosysCorp

ARUP In association with: DCCD ENGINEERING CORPORATION EcosysCorp

EcosysCorp Zoom Meeting Rules and Policies

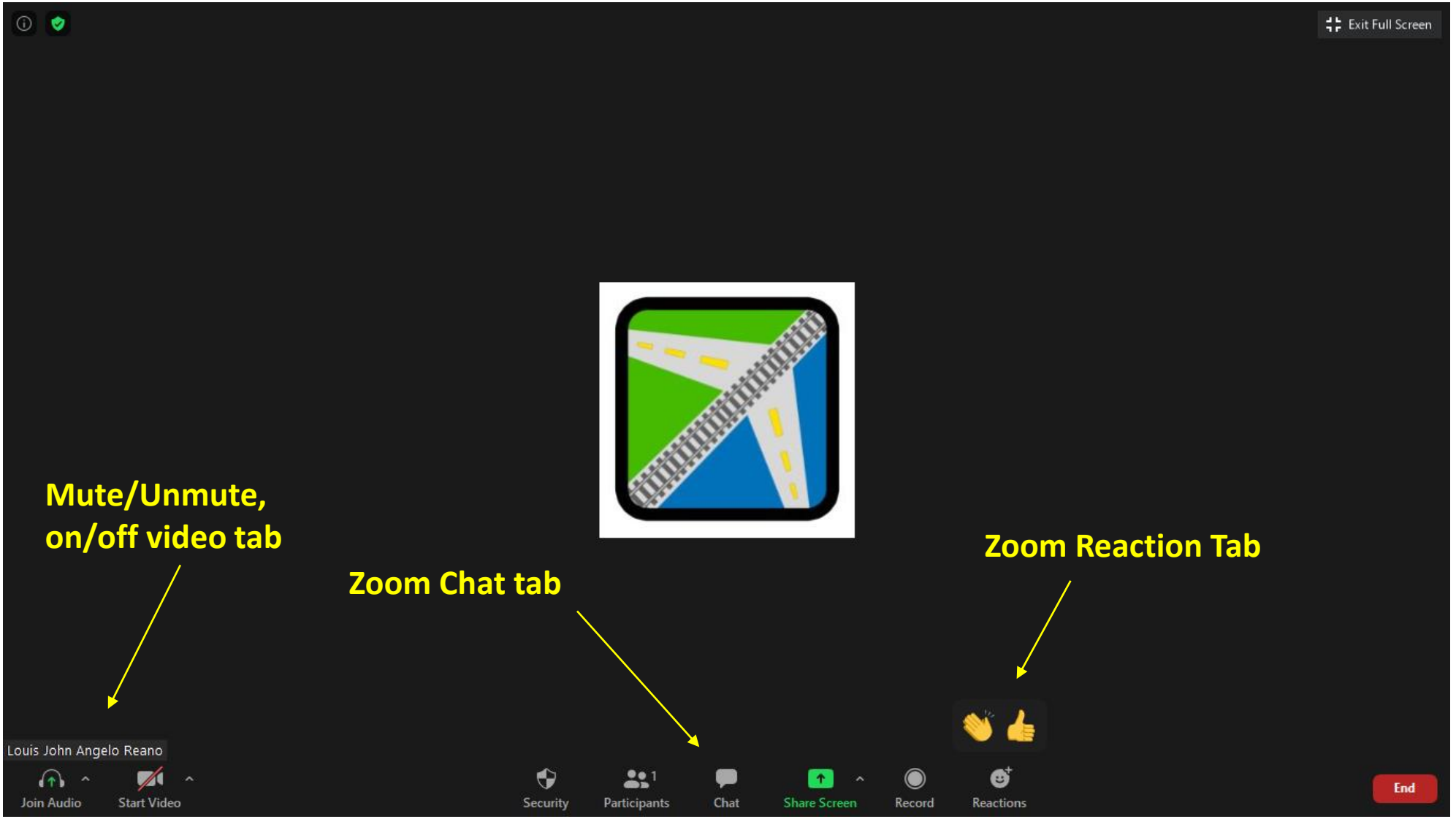
Prior to the Start of the Meeting

1. The Zoom Host shall set the rules and policies to maintain order in the conduct of this online meeting.
2. The Zoom host is in charge of attendance and will inform the Emcee of the current attendance and online status.

During the Presentation

3. Once the meeting has started, all participants will be placed in mute by the Host. Only the Emcee can request for unmute.
4. Participants who have concerns or questions DURING the presentation will have to notify the Emcee through the Zoom Chat or “Clap React” in Zoom meeting.

EcosysCorp Zoom Meeting Rules and Policies



EcosysCorp Zoom Meeting Rules and Policies

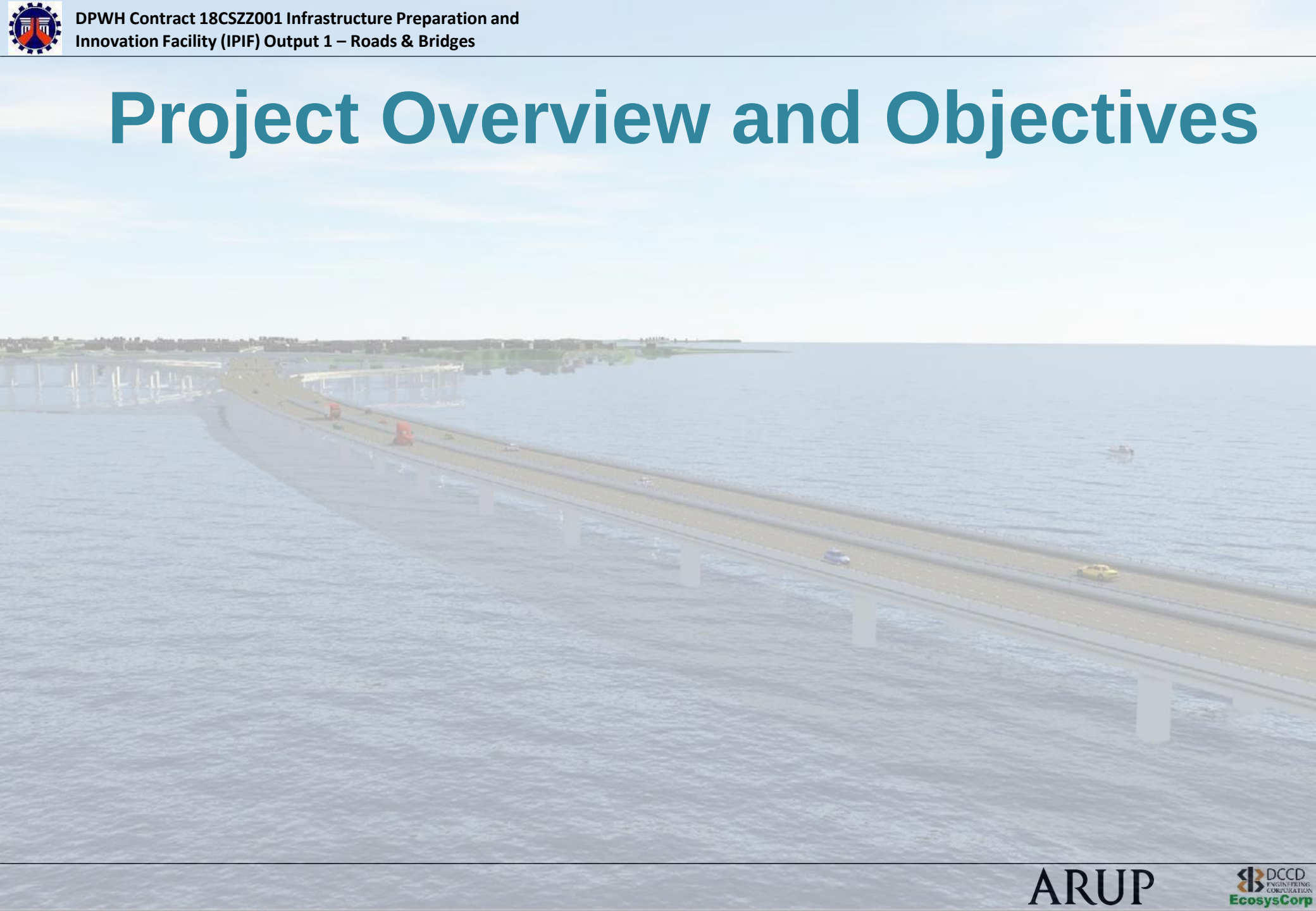
During the Open Forum

5. All questions will be addressed at the end of the presentation.
6. During Open Forum, Participants with questions and the person answering the questions will be removed from mute.
7. Participants with questions may notify the Emcee that they have question by "clap or thumbs up" reacting or by typing in their question at the chat box as previously shown. The Emcee will then document and place those participants/questions in queue.
8. The Emcee will direct the questions to the person who is in authority to answer them.

Meeting Agenda

I	Project Overview and Objectives	DPWH
II	Technical Description	ARUP
III	Design Principles	ARUP
IV	Environmental Impact Assessment	EcosysCorp. Inc
V	Right-of-Way Action Plan (RAP)	EcosysCorp. Inc
VI	Health and Safety Protocols Under COVID-19	EcosysCorp. Inc
VII	Open Forum	

Project Overview and Objectives



Project Overview and Objectives

The Laguna Lakeshore Road Network (LLRN) Project is one of the seven projects under the Infrastructure Preparation and Innovation Facility (IPIF) which aims to support the Department of Public Works and Highways to deliver more effective, efficient and innovative infrastructure projects all over the country. LLRN caters the area in the vicinity of Laguna de Bay, with a road network scheme that is divided into two phases:

Phase I runs along the western coastline of the Lake while Phase II stretches in the Northern to Southern coastline via an eastern route.

Phase I is composed of an 11.8km viaduct from Lower Bicutan to Tunasan and a 25.8km shoreline viaduct-embankment hybrid from Tunasan to Calamba. This totals to a 37.6km of road network servicing the areas of Taguig, Muntinlupa and Laguna.

Phase II which is subjected to further study and assessment given the long-term action plan, will complete the Road Network surrounding the lake and will improve connectivity between Santa Cruz and Bay.

Project Overview and Objectives

The feasibility study (FS) is expected to determine the best concept/approach, alignment and/or the nature of improvements/construction required for the LLRN Project based on technical, economic, environmental and social impacts and the development of suitable and optimal investment programs. The main objectives of the FS are:

1. To reduce transportation constraints on the existing road, induce economic development in the area and nearby provinces and promote the achievement of the development objectives being pursued in the area; and,

2. To provide safer, convenient and faster travel to motorist coming from north and south of the project area to various tourist business destinations in Laguna, Rizal, Quezon and Batangas.

INFRASTRUCTURE PREPARATION AND INNOVATION FACILITY (IPIF) Under ADB TA Loan

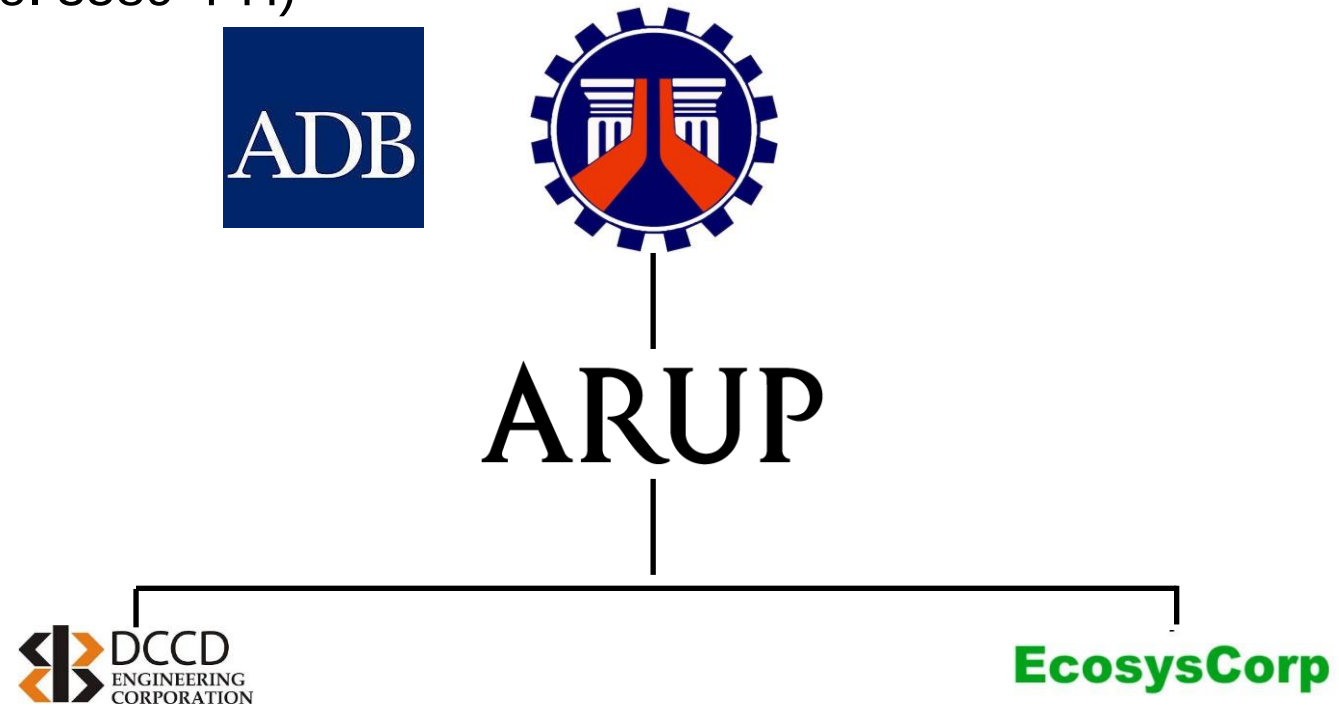
Infrastructure Flagship Project

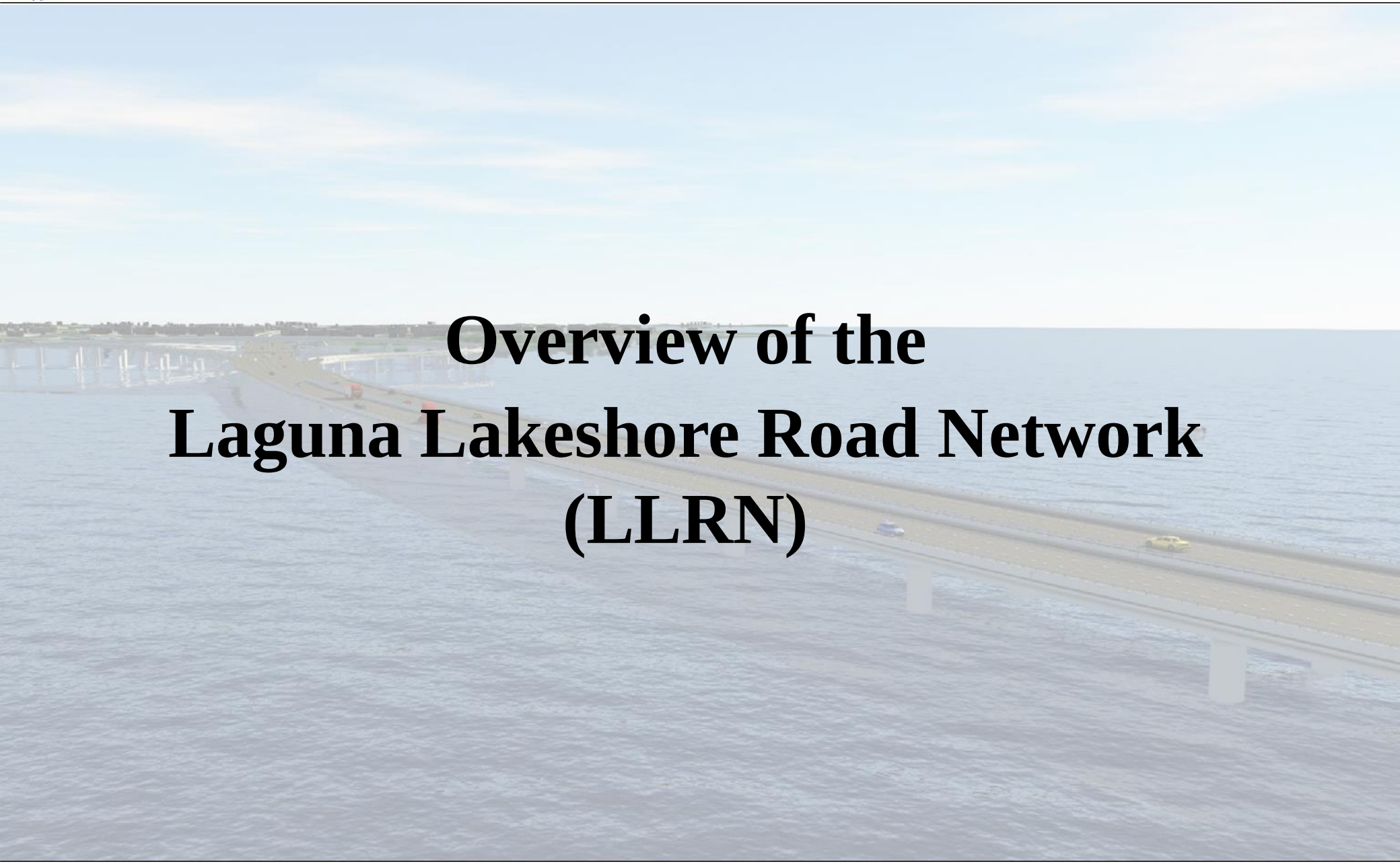
Infrastructure Preparation and Innovation Facility (IPIF) Output 1 – Roads and Bridges

Project Organization Structure

Client: Department of Public Works and Highways (DPWH)

Lending Institution: Asian Development Bank (ADB Technical Assistance Loan No. 3589 PH)



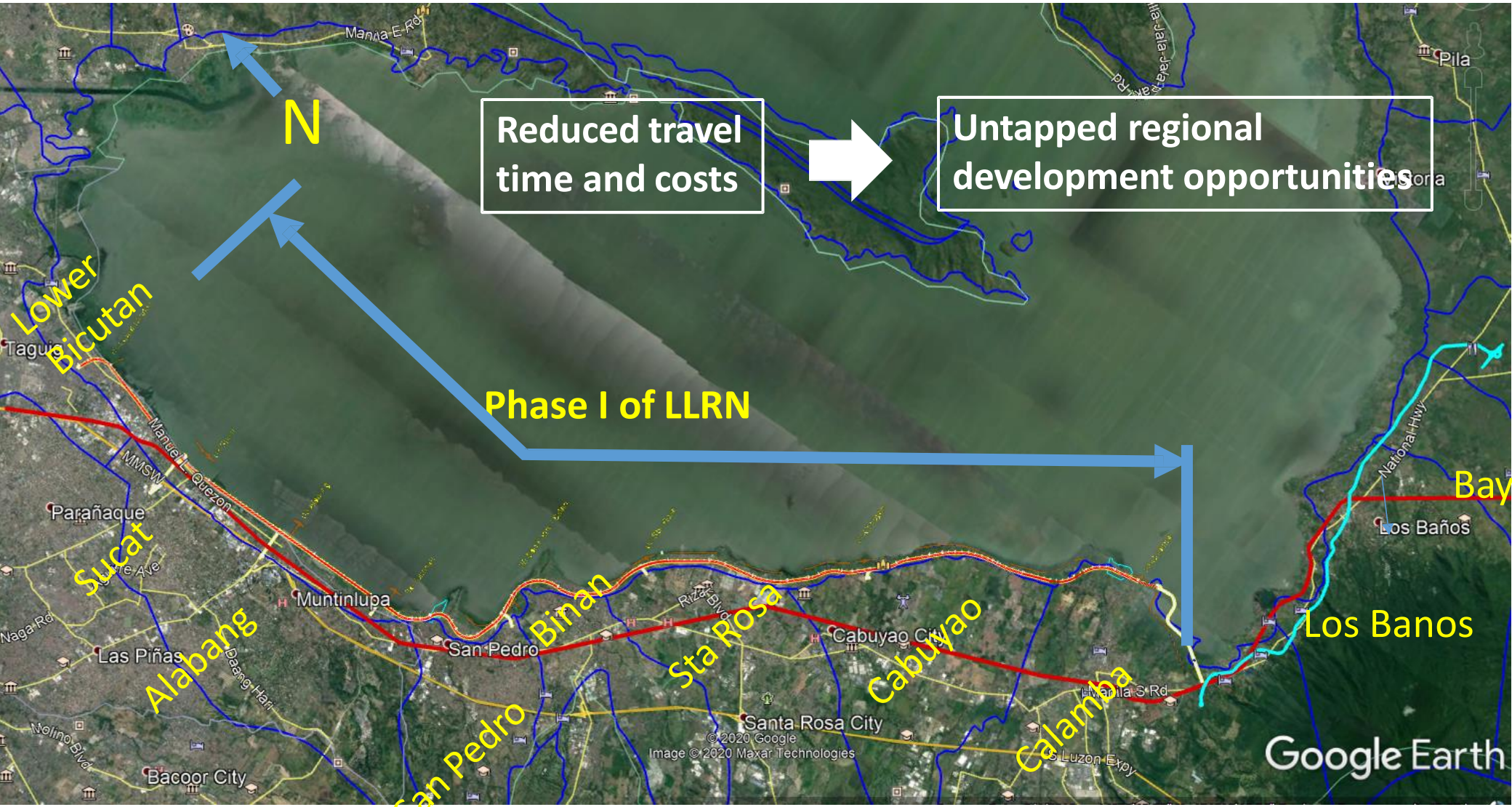


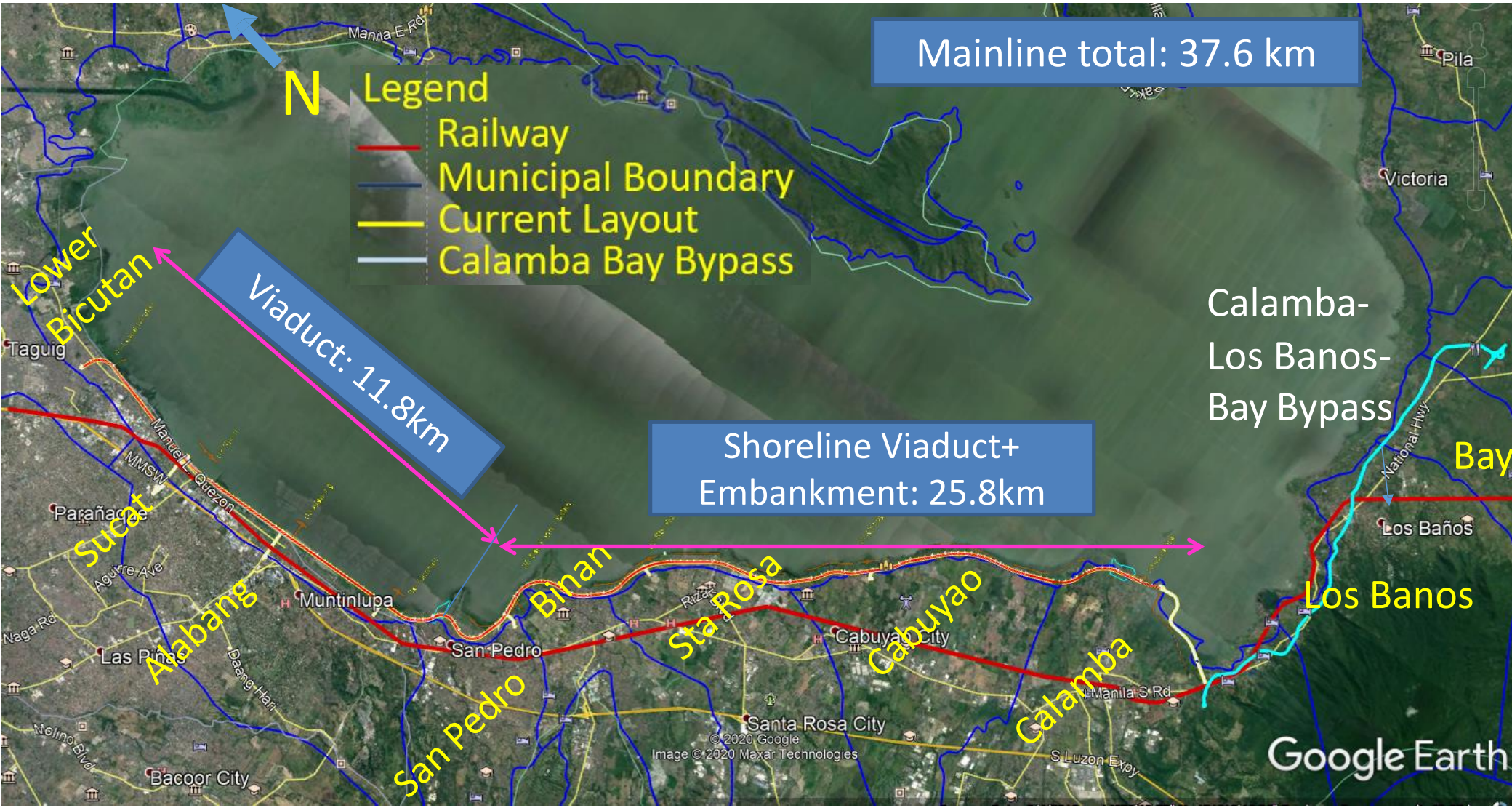
Overview of the Laguna Lakeshore Road Network (LLRN)

The Master Planning Phase 1 and Phase 2 of LLRN

ARUP In association with: DCCD Engineering Corporation EcosysCorp

Project Objective & Outcome




N
Legend
Railway
Municipal Boundary
Current Layout
Calamba Bay Bypass
Mainline total: 37.6 km
Viaduct: 11.8km
Shoreline Viaduct+ Embankment: 25.8km
Lower Bicutan
Sucat
Alabang
Binan
Sta Rosa
Cabuyao
Calamba
San Pedro
Los Banos
Calamba-Los Banos-Bay Bypass
Bay
Taguig
Parañaque
Muntinlupa
Las Piñas
Bacoor City
San Pedro
Santa Rosa City
Cabuyao City
Los Baños
Victoria
Pila
Manila E Rd
Manuel L. Quezon
MMSW
Aguirre Ave
Naga Rd
Daang Hari
Nolino Blvd
Manila S Rd
National Hwy
S Luzon Expy
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Google Earth

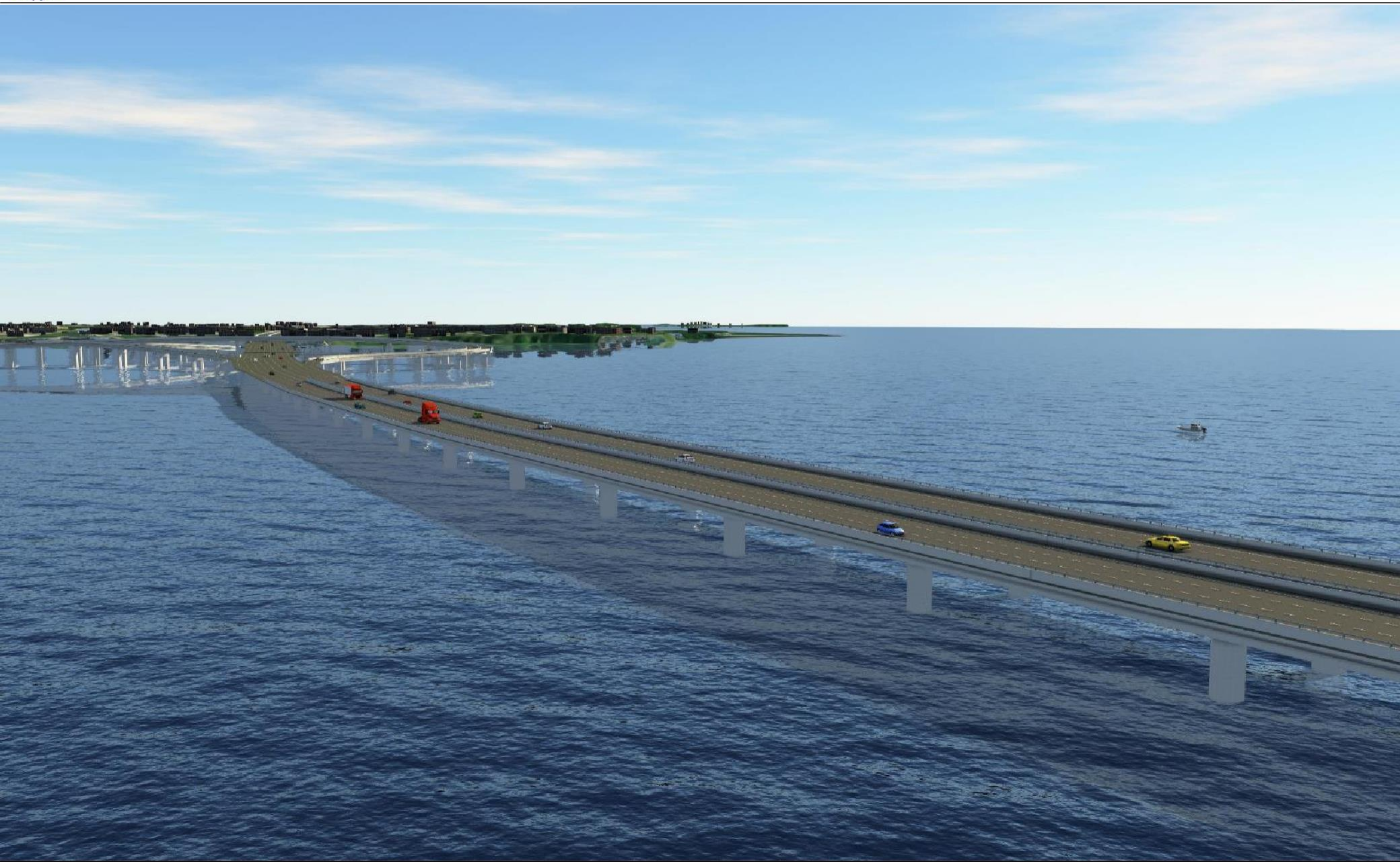
Preliminary Traffic Forecast of LLRN in AM Peak Hour

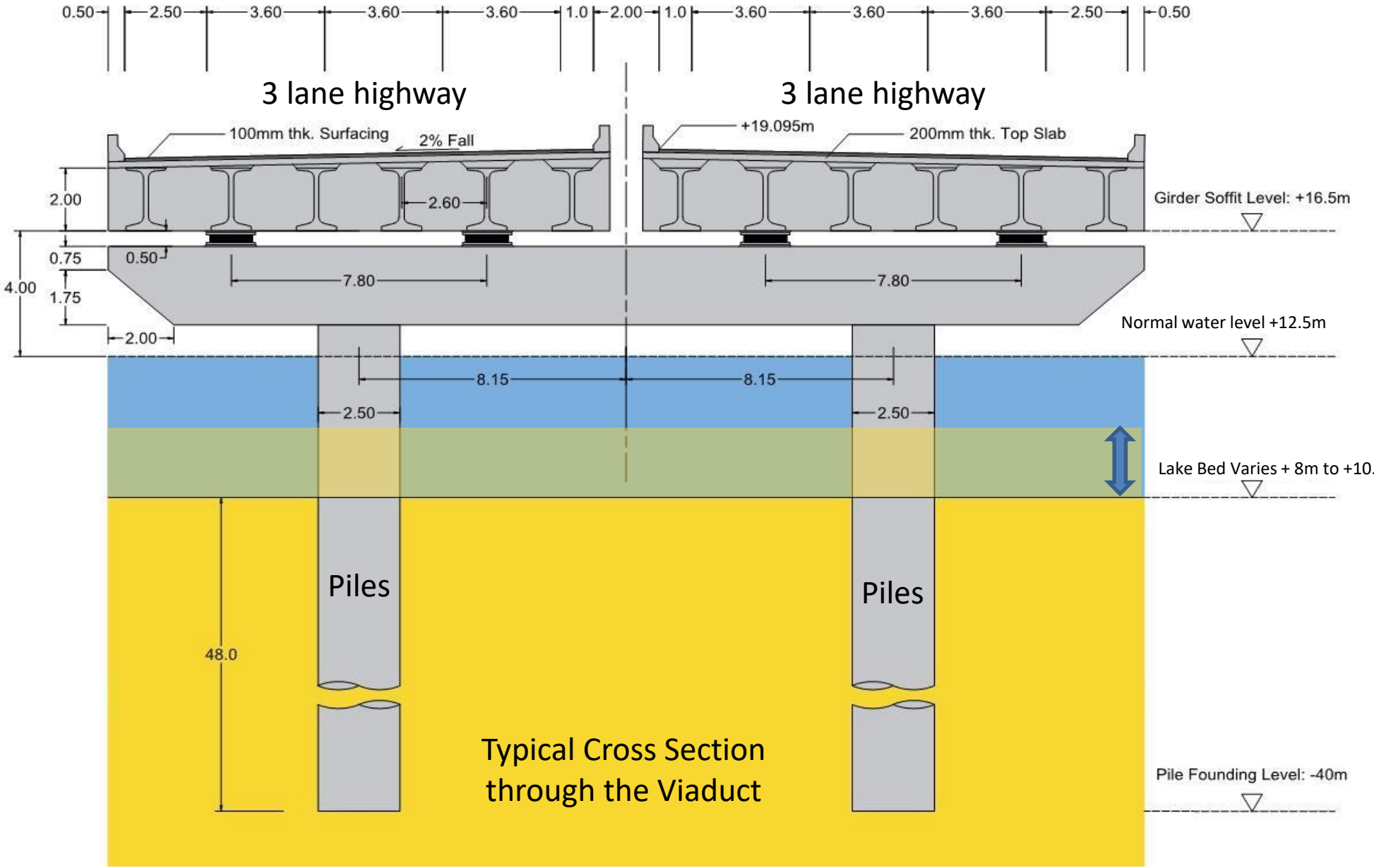
Section	No. of Lanes by Direction	Traffic Flow (PCU/hr)		V/C Ratio	
		2025	2035	2025	2035
Lower Bicutan - Sucat	2	1,500	2,700	0.4	0.7
Sucat - Alabang	3	1,400	3,800	0.2	0.6
Alabang - San Pedro	3	1,100	4,100	0.2	0.7
San Pedro - Santa Rosa	3	1,000	3,300	0.2	0.6
Sta Rosa - Cabuyao	2	900	2,700	0.2	0.7
Cabuyao - Calamba	2	800	2,100	0.2	0.5

Technical Description

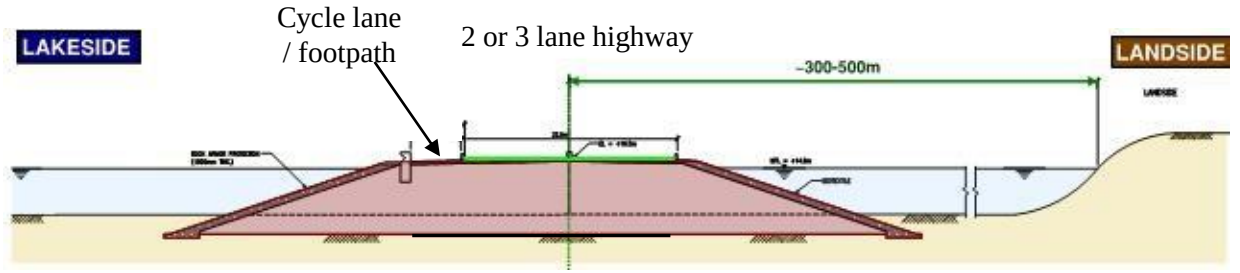
ARUP

DCCD ENGINEERING CORPORATION
EcosysCorp

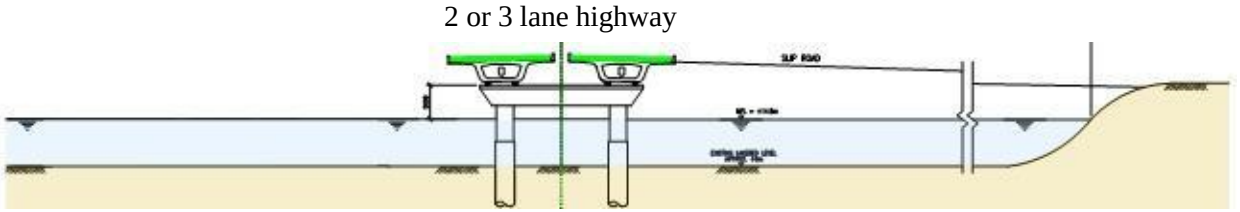



0.50
2.50
3.60
3.60
3.60
1.0
2.00
1.0
3.60
3.60
3.60
2.50
0.50
3 lane highway
3 lane highway
100mm thk. Surfacing
2% Fall
+19.095m
200mm thk. Top Slab
2.00
2.60
Girder Soffit Level: +16.5m
0.75
0.50
4.00
1.75
7.80
7.80
2.00
Normal water level +12.5m
8.15
8.15
2.50
2.50
Lake Bed Varies + 8m to +10.5m
Piles
Piles
48.0
Typical Cross Section through the Viaduct
Pile Founding Level: -40m


Lower Bicutan
Taguig
Viaduct
Sucat
Slip road Viaduct
Muntinlupa
Mainline Embankment
at Interchange
Viaduct for slip roads over
embankment at interchanges
Viaduct



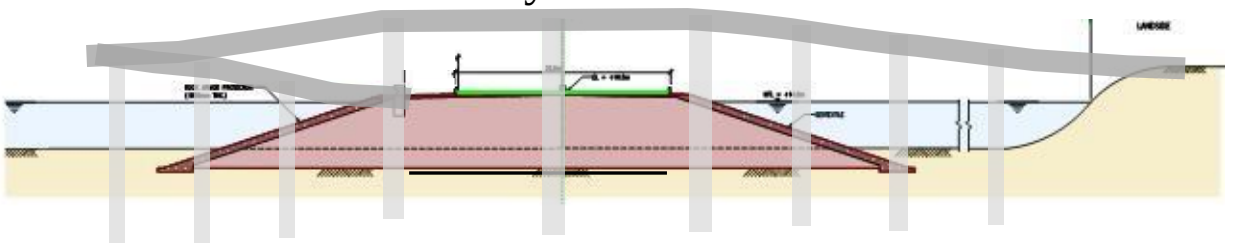
Embankment



Viaduct

Flyover

Slip road Viaduct



Trumpet Interchange

Mainline Cross Section

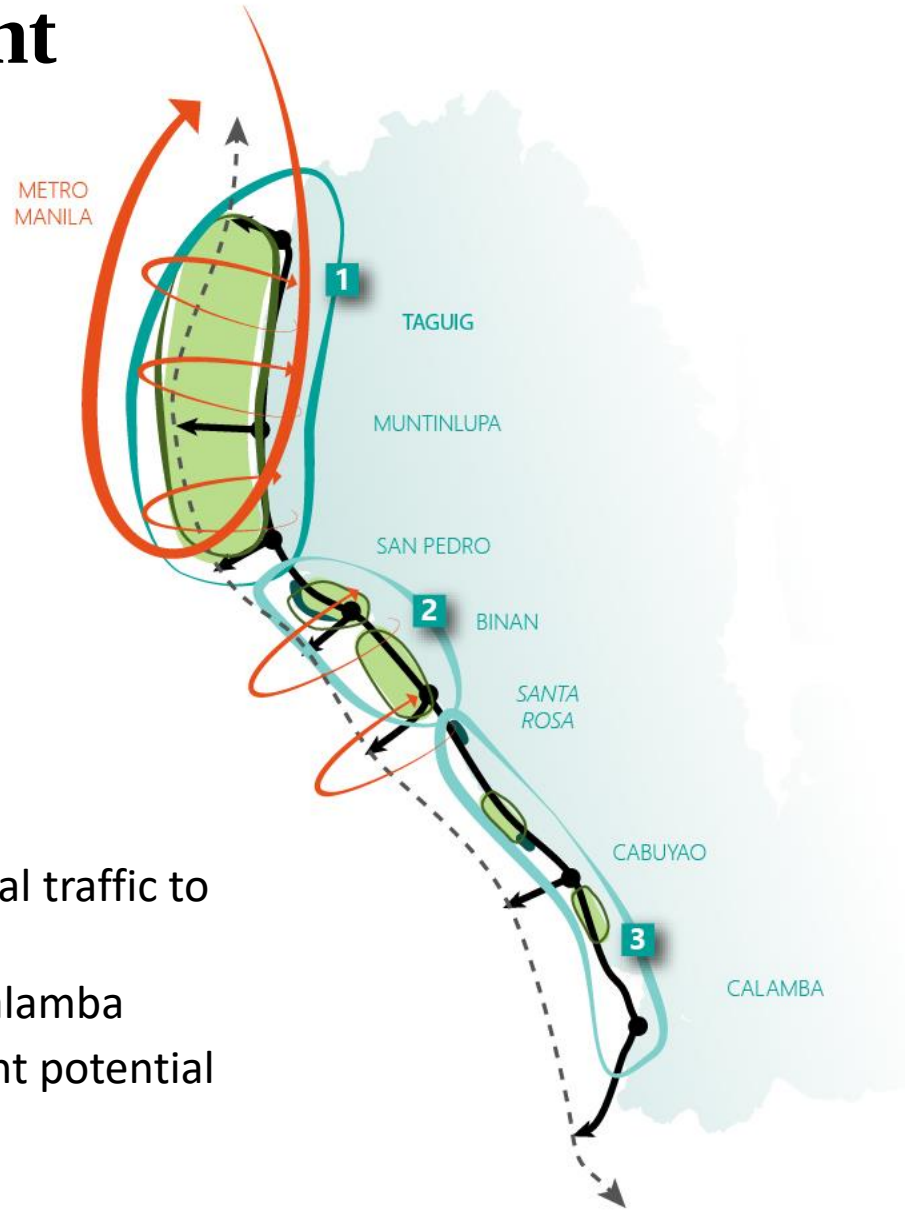
Design Principles

Overall Approach to Waterfront

Section 1 : Lower Bicutan to Tunasan
Character - Highly urbanized, high land value, shoreline development

Section 2: San Pedro & Binan
Character - Urbanized clusters with intermittent waterfront access

Section 3: Santa Rosa & Calamba
Character - Low urbanization, agricultural lands and undeveloped shorelines



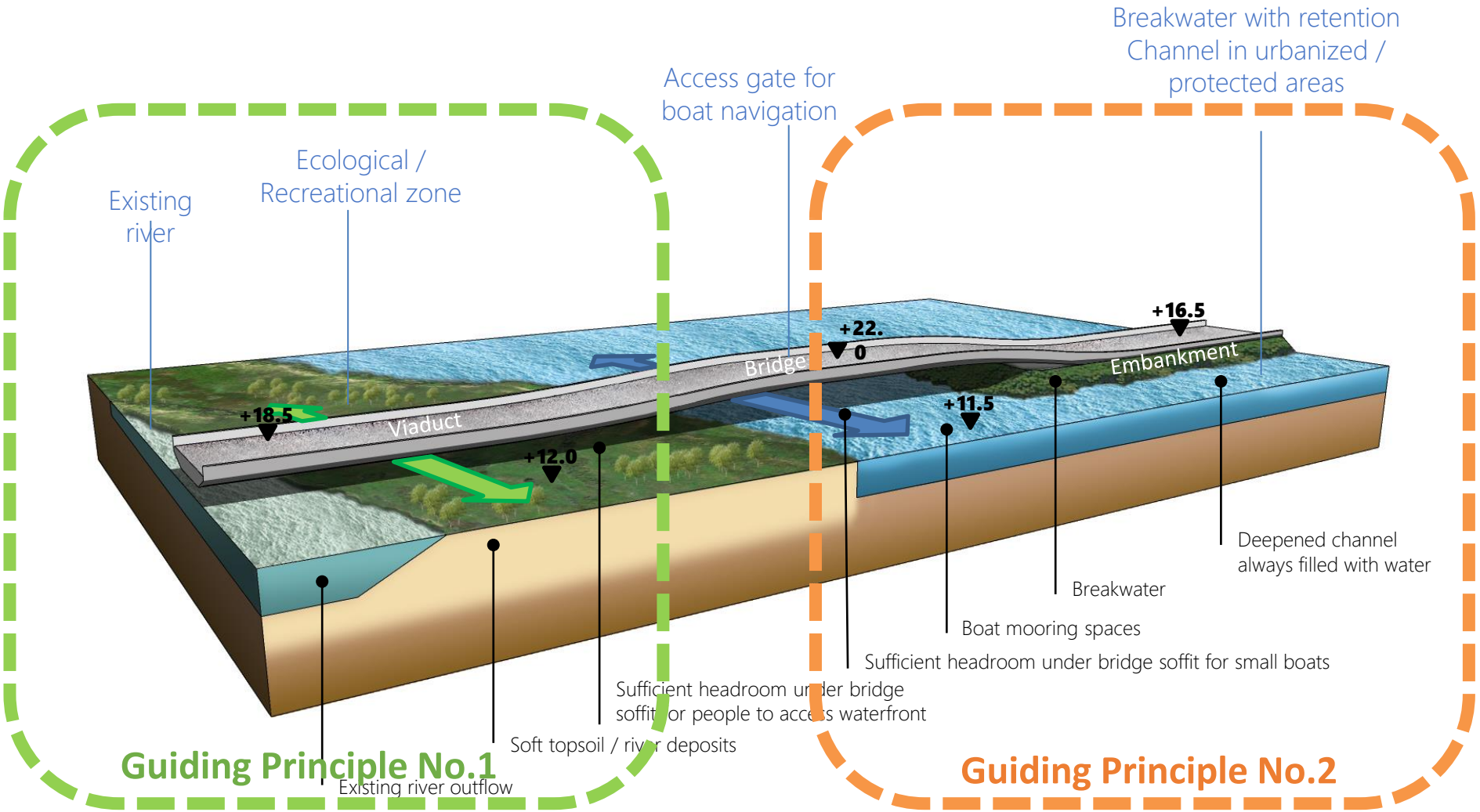
Objective

- Road Connectivity to allow By-Pass Circulation of local traffic to ease congestion on existing roads
- Improve N-S traffic movement to Metro Manila & Calamba
- Improve local livelihoods, resilience and development potential along the lake edge

Viaduct / Embankment Principles

- **Characterize embankments as 'breakwaters' providing safe and sheltered mooring facilities** for fisherfolk and reduce the effect of overtopping flooding. Assumption that when the lake is at 12.5+ and a typhoon is blowing from the East the waves contribute significantly to inundation / local flooding.
- **Possible Future Development of simplistic shore side facilities** for mooring, markets and critical infrastructure above flood level that connect to local road networks.
- **Utilise low areas / embayment's for surface runoff** buffer zone behind the 'breakwater'
- **Bridge / Viaduct across major water courses** and areas of fluvial deposit such as the Binan river promontory where soft soil is likely to occur where possible costly **liquefaction mitigation** needed.
- **Bridge across 'Access Gates'** to the above mentioned facilities.

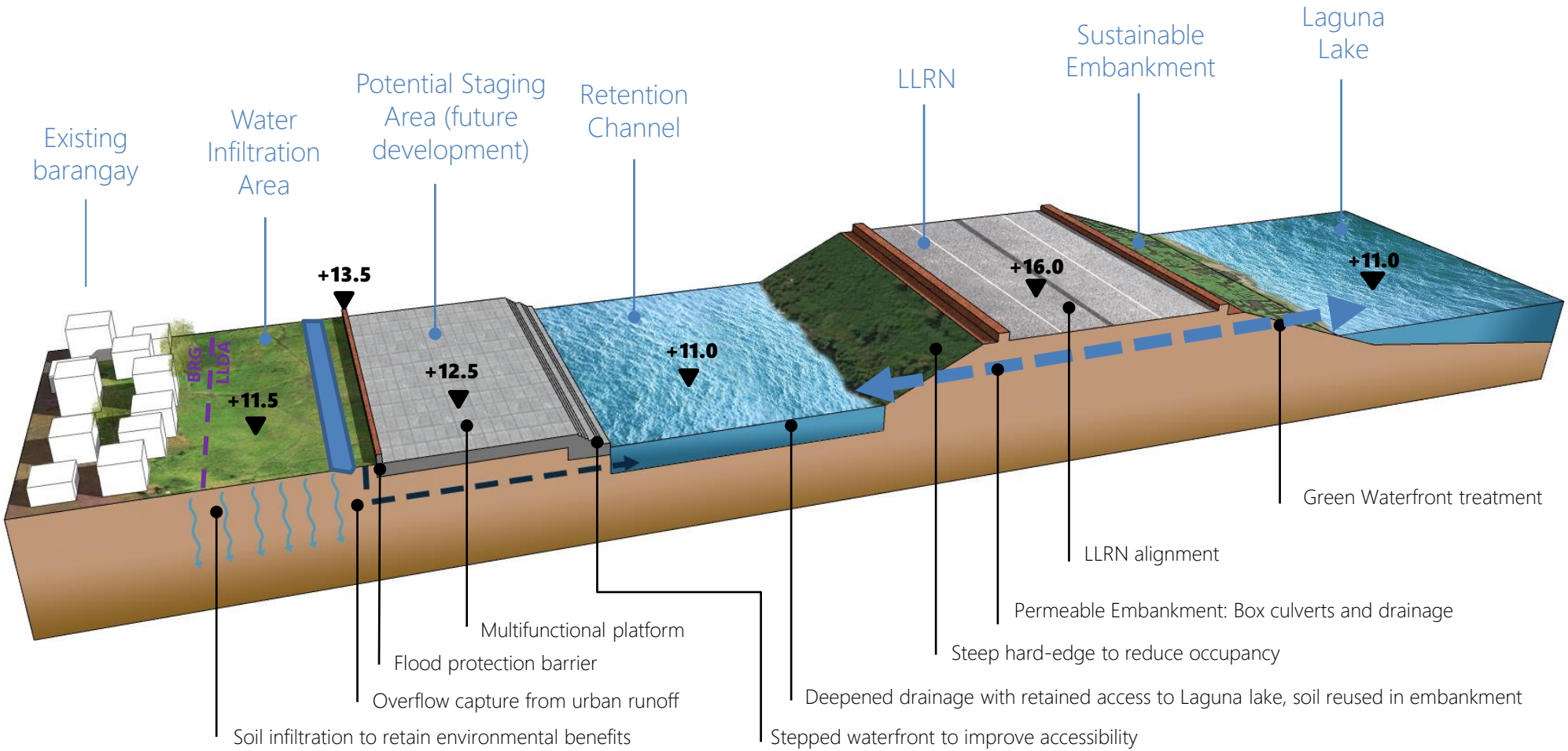
Vertical Road Alignment Principle



Viaduct / Embankment Principles (technical considerations)

- **Embankment porous** with culverts and drainage pipes. Major culvert every 100-120m.
- **Major catch drain** on shoreline side to divert water.
- **No flood protection**.
- **Can be retrofitted later for flood protection.**
- **Needs to be properly maintained and managed**, to ensure no blockage and no informal settlers on the embankment slopes.

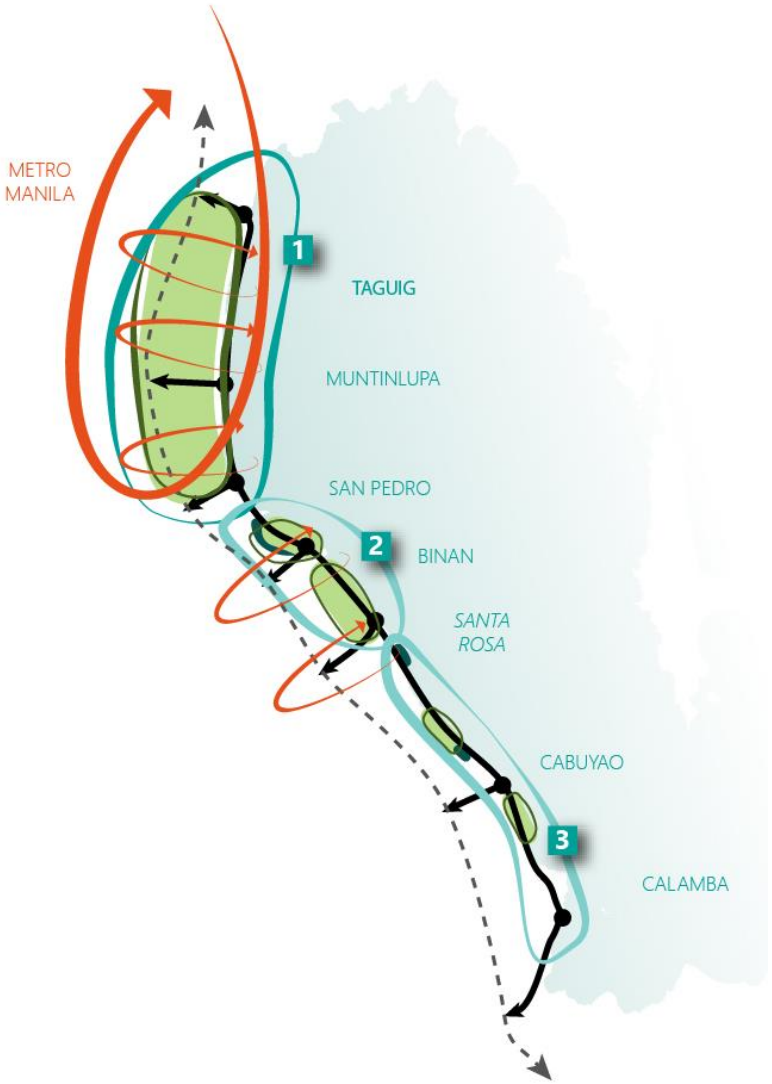
Multi-Purpose (Deepened) Permanently Flooded Retention Channel



Overview of Phase 1 Route Alignment lengths per Section

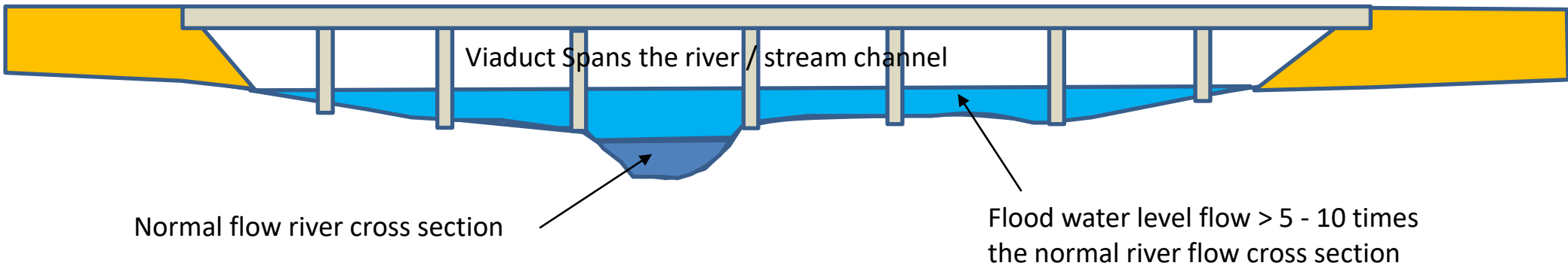
		Length (km)	% within each Section	% of Total Length
Section 1 (Lower Bicutan to Tunasan)	Viaduct	12.9	100%	34%
	Embankment /At grade	0.0	0%	0%
Section 2 (Tunasan / San Pedro to Binan)	Viaduct	3.0	42%	8%
	Embankment /At grade	4.1	58%	11%
Section 3 (Sta. Rosa to Calamba)	Viaduct	6.8	38%	18%
	Embankment /At grade	10.8	62%	29%
	Total Viaduct	**22.70**	**-**	**60%**
	Total Embankment	**14.90**	**-**	**40%**
	Total Length	**37.60**	**-**	**100%**

Note: Exact length distribution to be verified with vertical profile design.

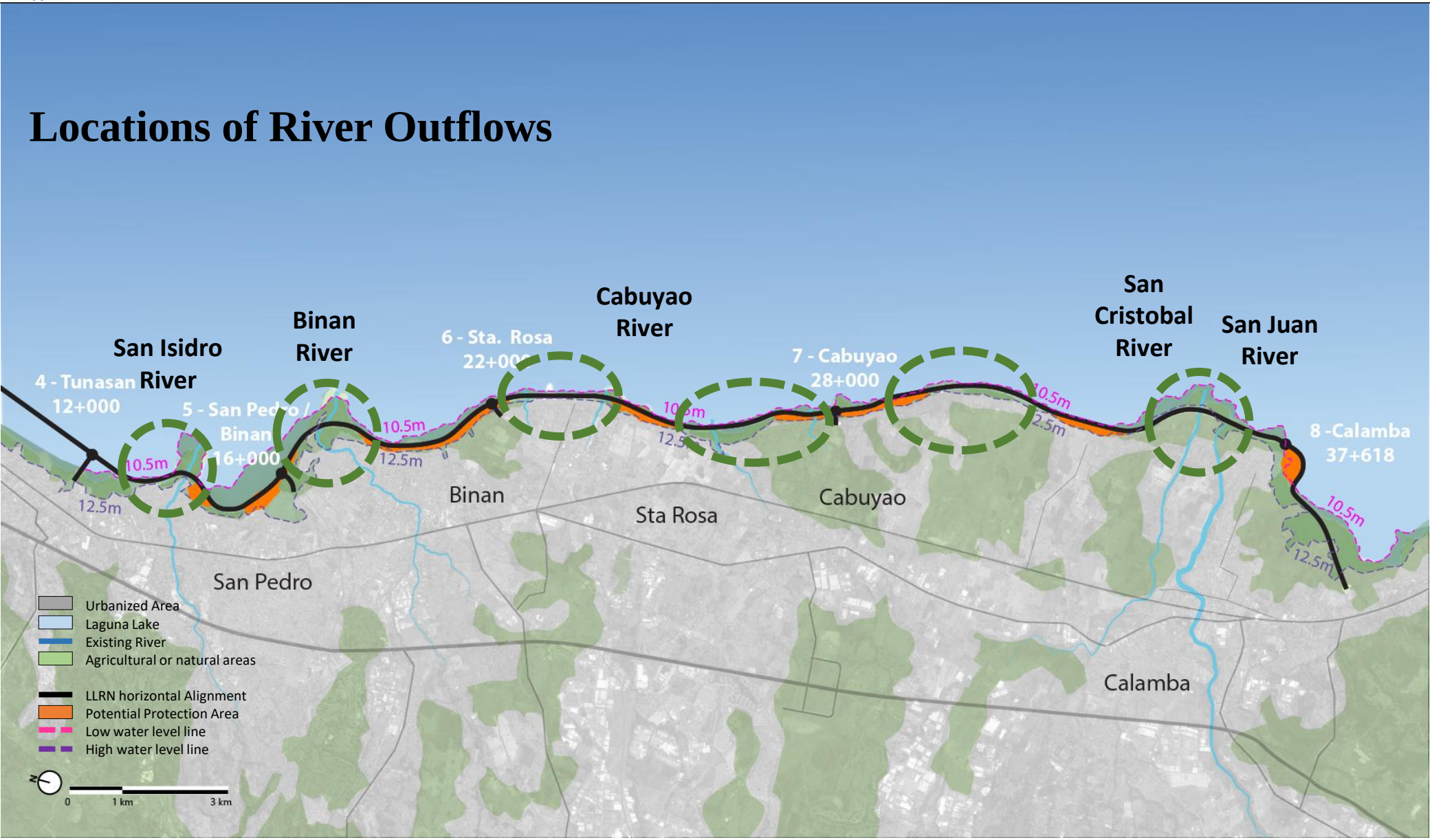


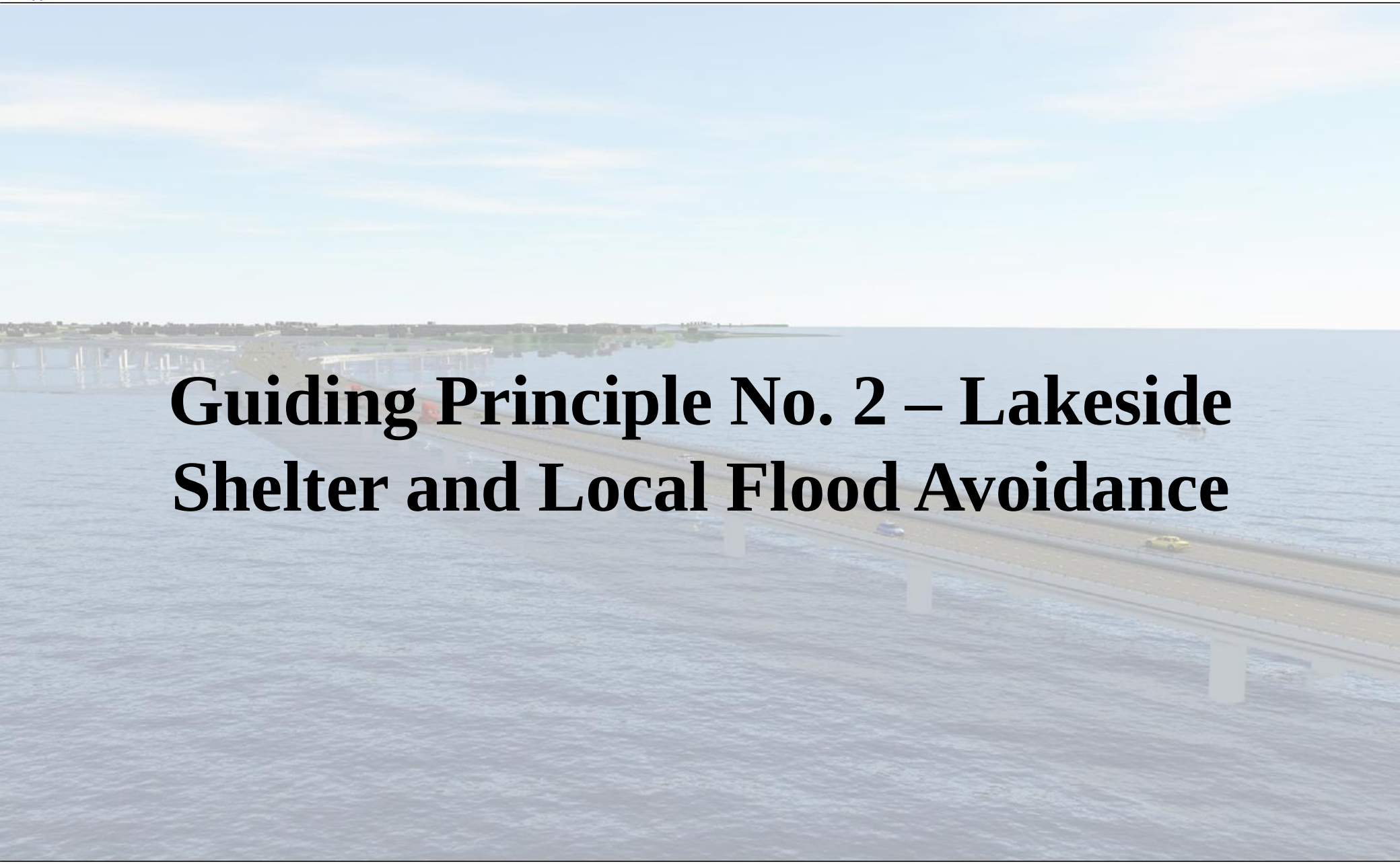
Guiding Principle No.1: River / Stream Crossings

- Cross section of the river checked and at 12.5m elevation of flooding whole cross section of viaduct is = to 10 times the river typical cross section.
- Unimpeded flow to be maintained so viaduct length = 3 to 5 times the width of the river from bank to bank.
- Viaduct to span the soft soil zones to avoid costly ground treatment.



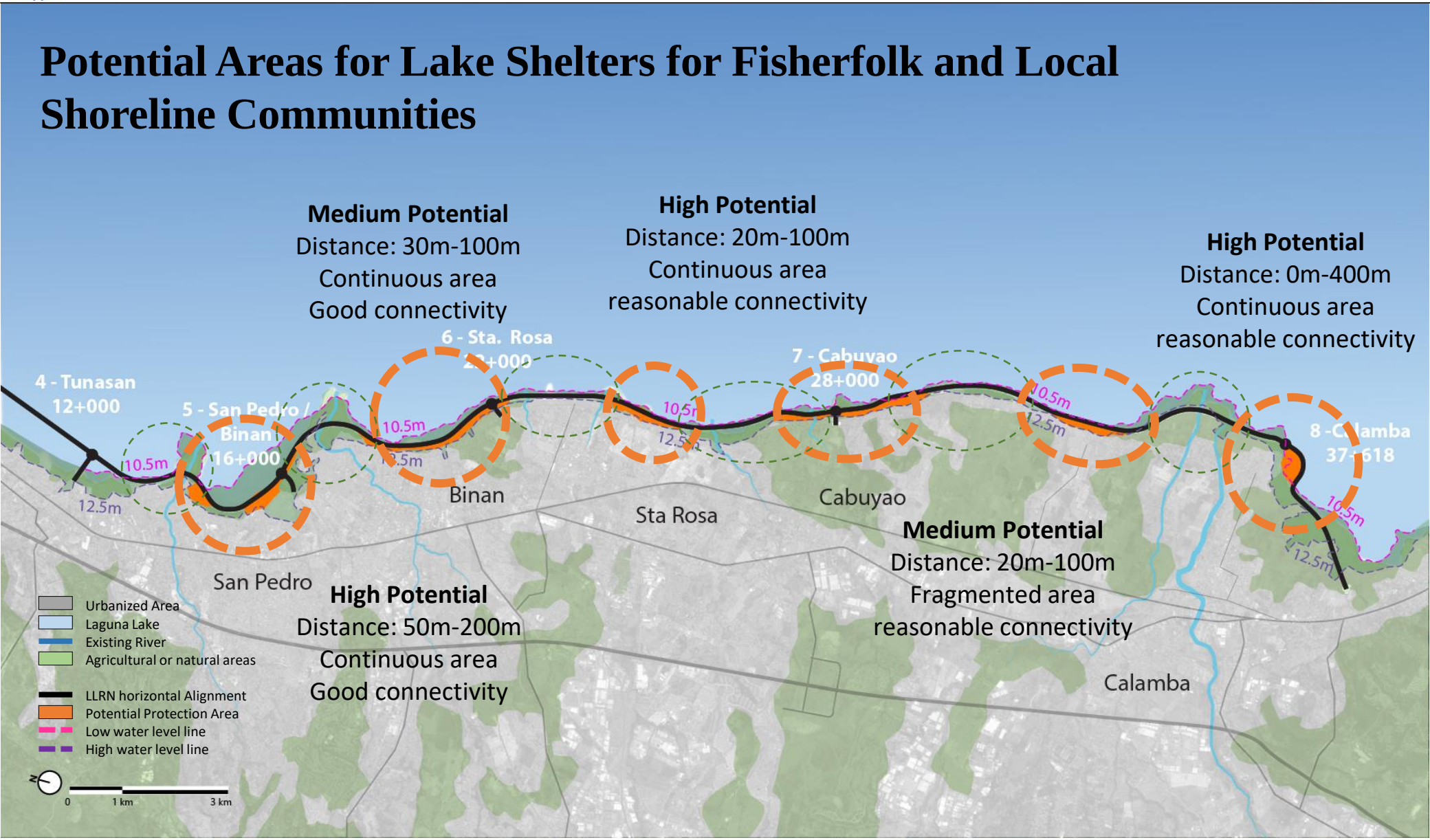
Locations of River Outflows





Guiding Principle No. 2 – Lakeside Shelter and Local Flood Avoidance

Potential Areas for Lake Shelters for Fisherfolk and Local Shoreline Communities

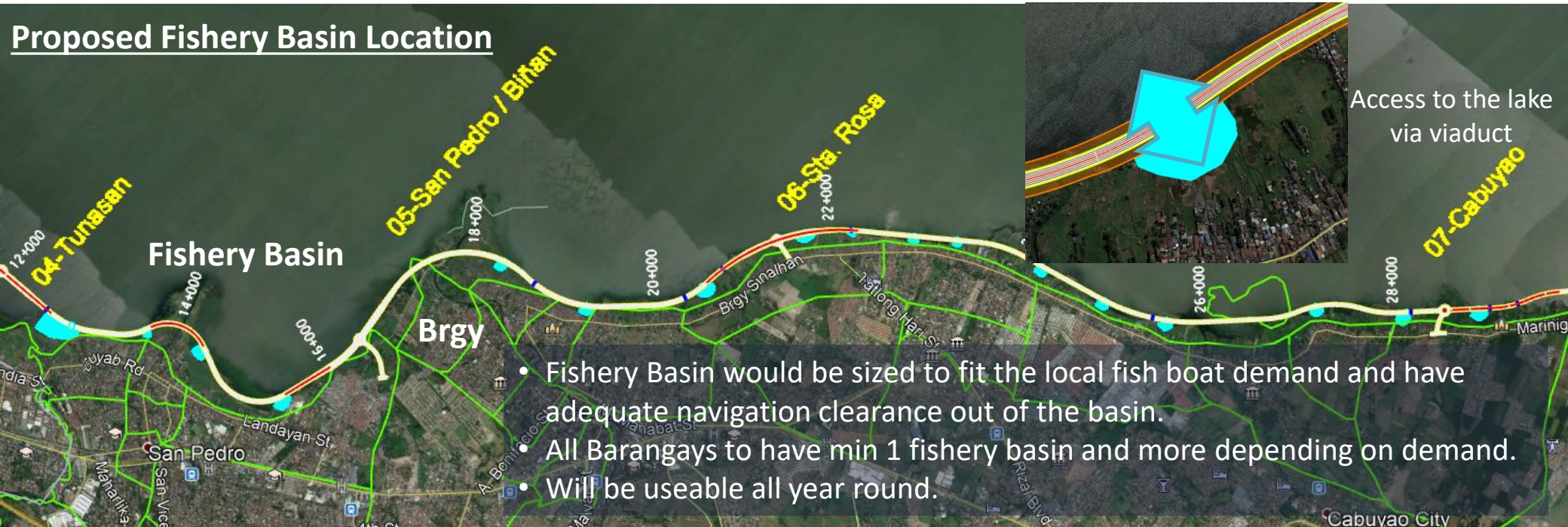


Fishing Boat Density Map and Proposed Fishery Basin

Fishing Boat Density Map

Note: Illustrative distribution of where the fishing boats are generally located in 13 April 2017.

Proposed Fishery Basin Location



Access to the lake via viaduct

- Fishery Basin would be sized to fit the local fish boat demand and have adequate navigation clearance out of the basin.
- All Barangays to have min 1 fishery basin and more depending on demand.
- Will be useable all year round.


06-Sta. Rosa
20+000
22+000
24+000
26+000
Viaduct
Embankment
Fishery Basin
Culverts @ 160m Spc
Brgy Sinalhan
Brgy Aplaya
Mercedes Homes IV
Tatlong Hari St
Dia Leyco Subdivision
Zeramyr Subdivision
Calle Barcelona
F Gomez St
Sutter Ave
Bigaa Rd
Dr Zavalla St
Posiedon Dr
Sparta Dr
Emerald St
Perlas St
Google Earth
1 km

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Road Typology (concept)

Viaduct (Principle No.1)

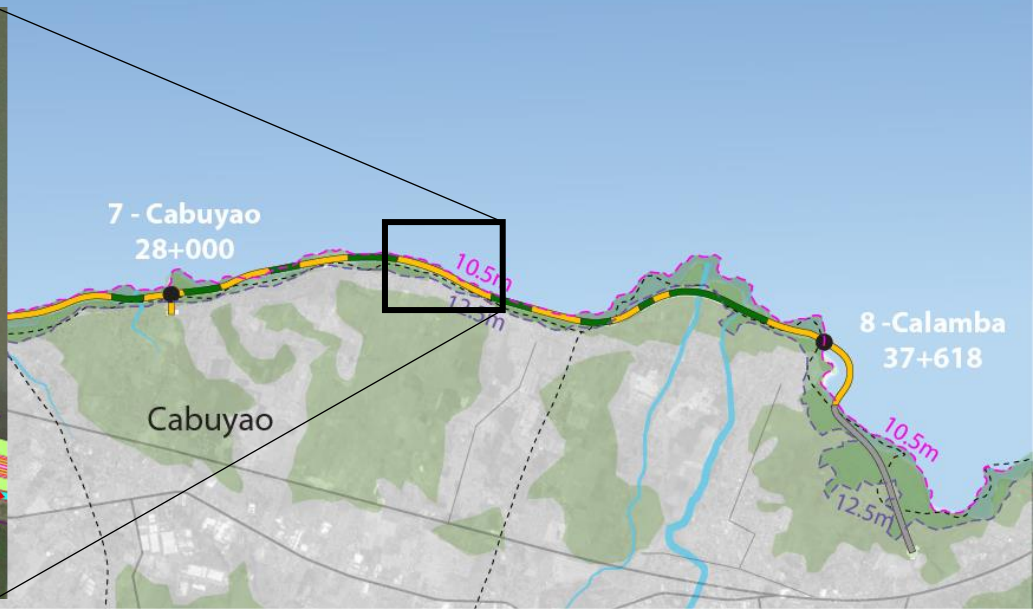
Embankment (Principle No.2)

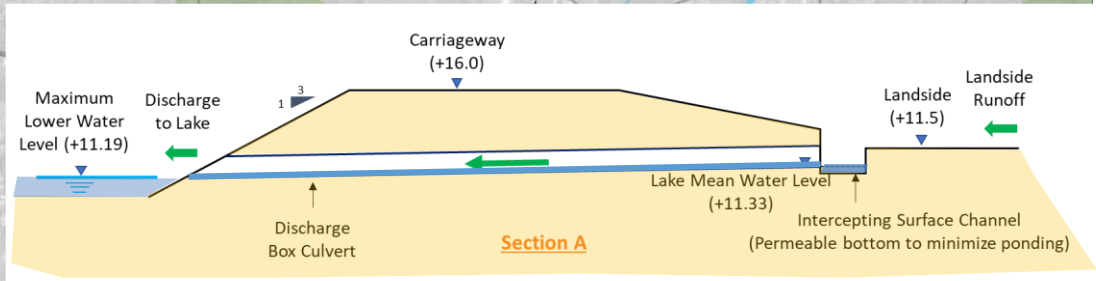
Objective

1. Not to stop the natural increase in water level along the lakeshore edge.
2. Not to impede any surface water coming off the land into the lake.
3. Maintain high porosity and permeability to allow water to travel both ways through the embankment

Road Typology (concept)

Layout Plan of Typical Surface Embankment Drainage / Culverts





Future Proposed Flood Mitigation Projects

DPWH Proposed Flood Mitigation Measures

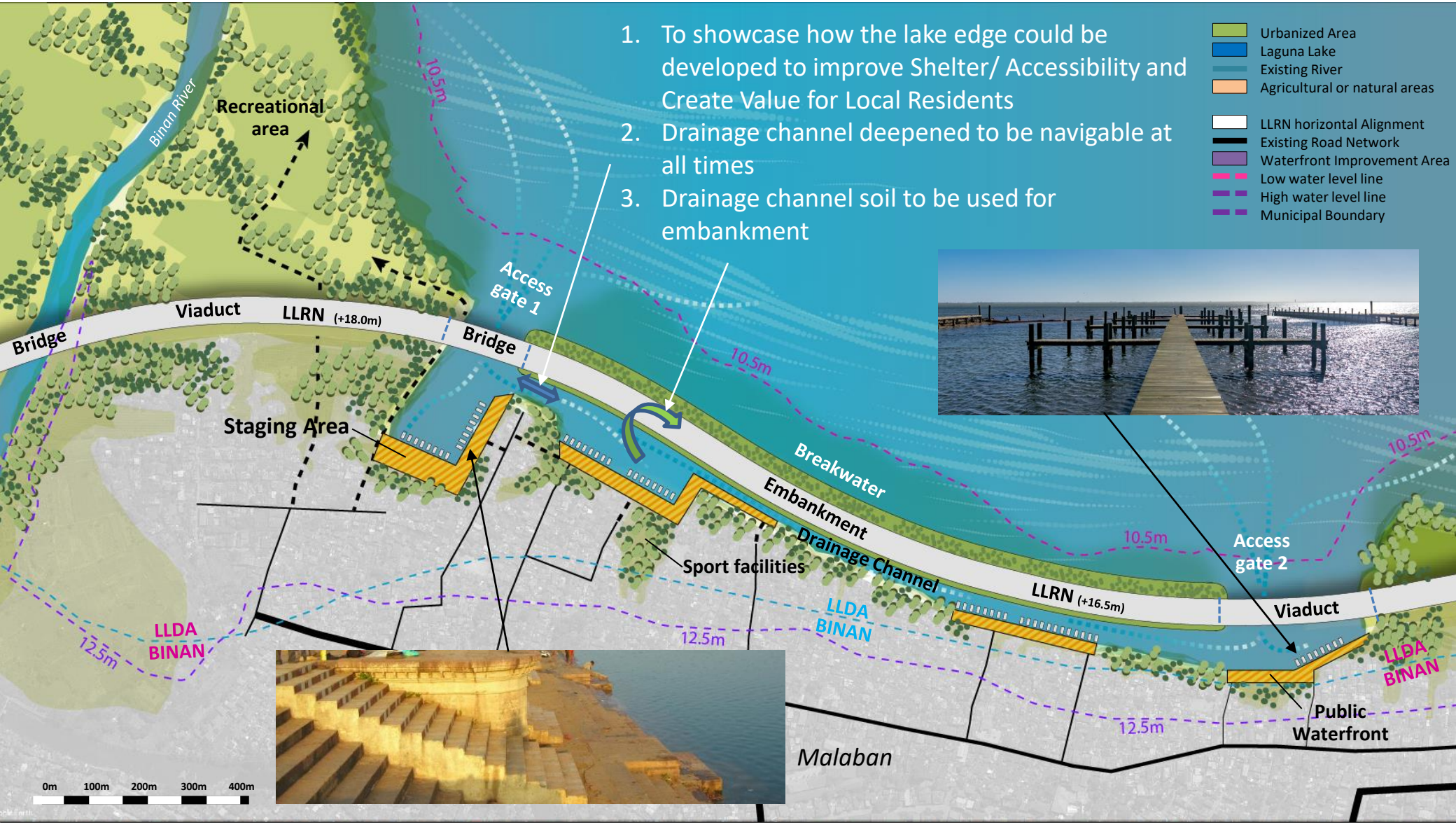
Various flood mitigation measures are being proposed by DPWH to control the lake levels and flood waters in Laguna de Bay

- Paranaque Spillway Project – Funded by JICA to reduce the overall level and duration of flooding incidents by DPWH FCMC
- Various catchment and control studies to manage the runoff into the lake by DPWH FCMC
- Various local flood protection schemes within LGU's to tackle local flooding by DPWH FCMC
- To be agreed by LGU's and LLDA

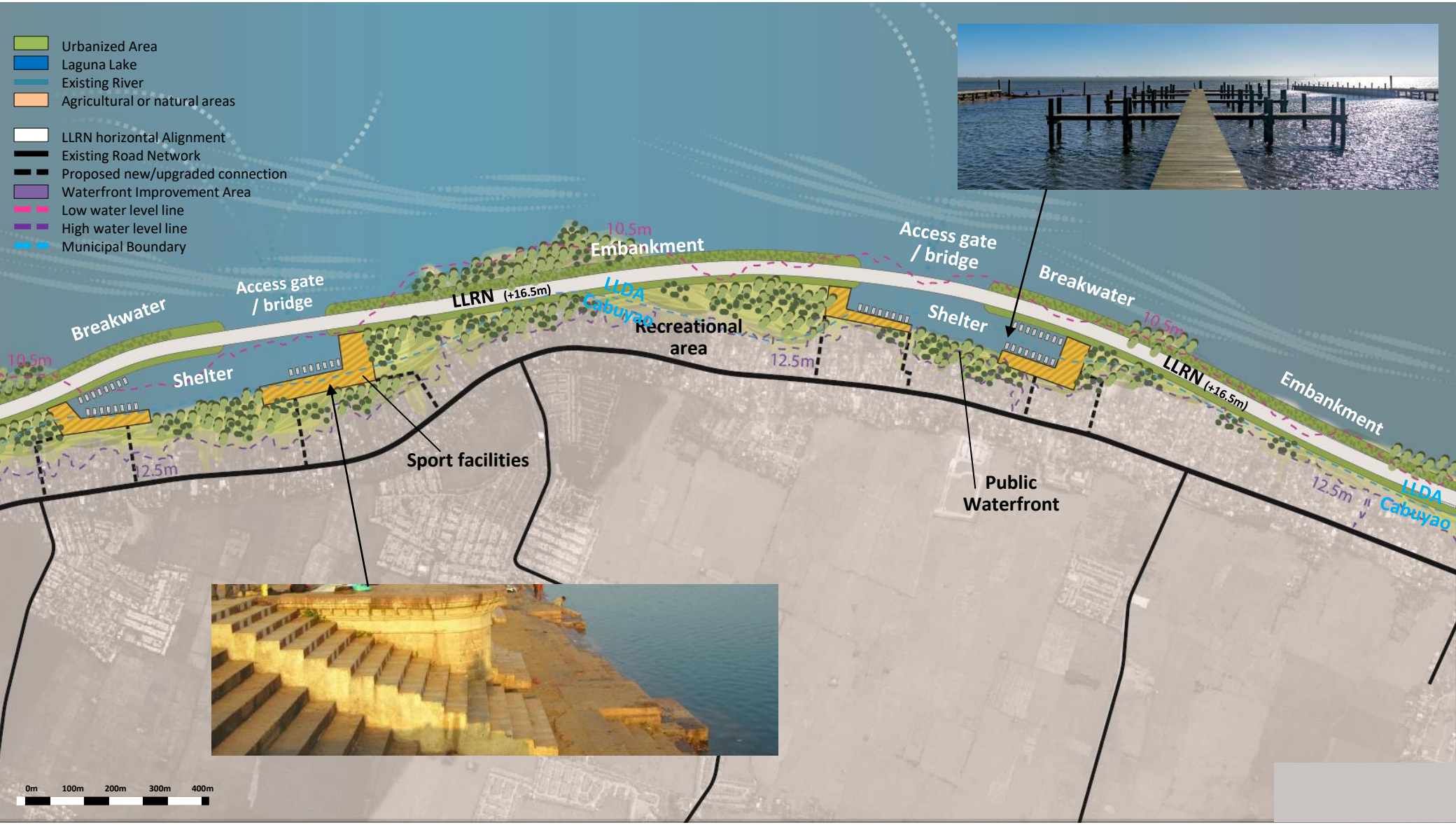
Possible Future Integration with Local Lakeside Development

(Subject to Agreement with LLDA)

Possible Future Integration with Local Lakeside Development



Possible Future Integration with Local Lakeside Development



Shoreline Lake Water Circulation

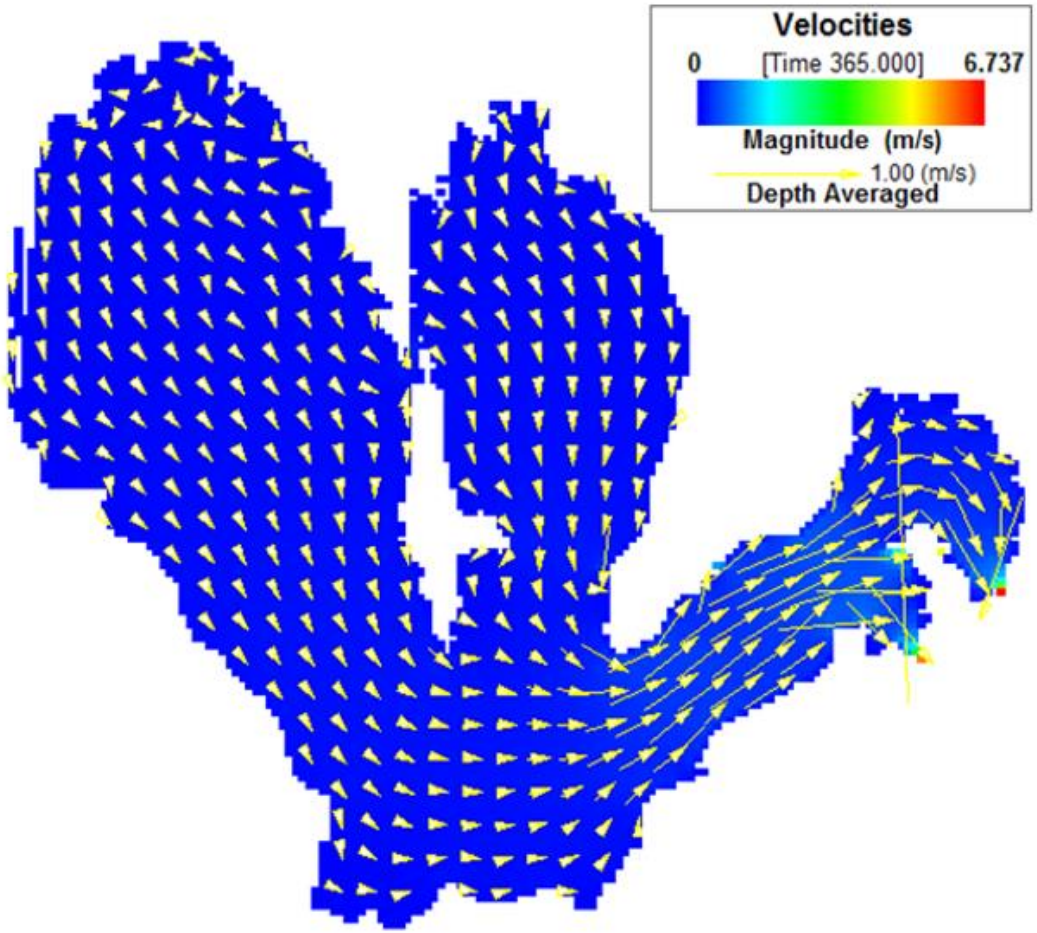
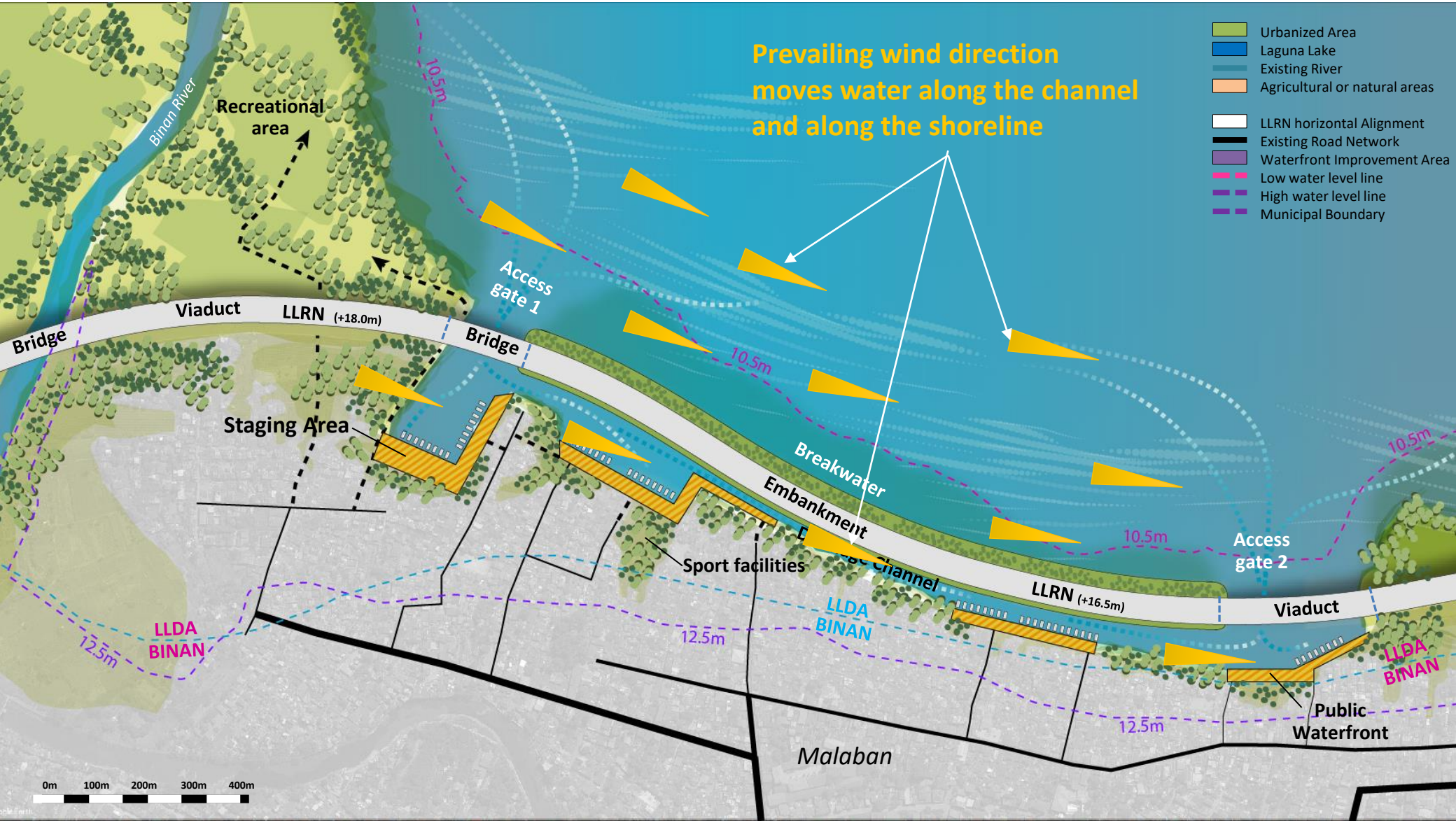


Fig. 2:Wind Circulation Pattern in Laguna Lake Basin with Average wind speed at 2 m/sec^2

"The wind direction is the major contributor for the direction of the flow of water."

International Journal of Scientific & Technology Research Volume 3, Issue 8, August 2014


Prevailing wind direction moves water along the channel and along the shoreline
Urbanized Area
Laguna Lake
Existing River
Agricultural or natural areas
LLRN horizontal Alignment
Existing Road Network
Waterfront Improvement Area
Low water level line
High water level line
Municipal Boundary
Binan River
Recreational area
10.5m
Access gate 1
Viaduct
LLRN (+18.0m)
Bridge
Bridge
Staging Area
Breakwater
Embankment
Channel
Sport facilities
LLRN (+16.5m)
Viaduct
Access gate 2
LLDA BINAN
12.5m
Public Waterfront
Malaban
0m
100m
200m
300m
400m

Overall Planned Project Schedule

Project Schedule – Phase 1 (DED & Construction Package)

- Funding for Detailed Engineering Design (DED) has already been secured from ADB

	2020	2021	2022	2023	2024	2025	2026	2027
Feasibility Study								
Detailed Engineering Design								
Target Construction Stage								
Likely Operation								

- Further definition of the project design and scheme to be undertaken in DED

Environmental Impact Assessment (EIA)

What is Environmental Impact Assessment (EIA)?

EIA is a process that identifies, predicts and evaluates the effects of a development project on the environment and communities.

It also provides proposed mitigating measures for negative impacts and enhancement measures for positive impacts to ensure that the environment and communities are being considered in the project implementation.

Objectives Under the EIA Process

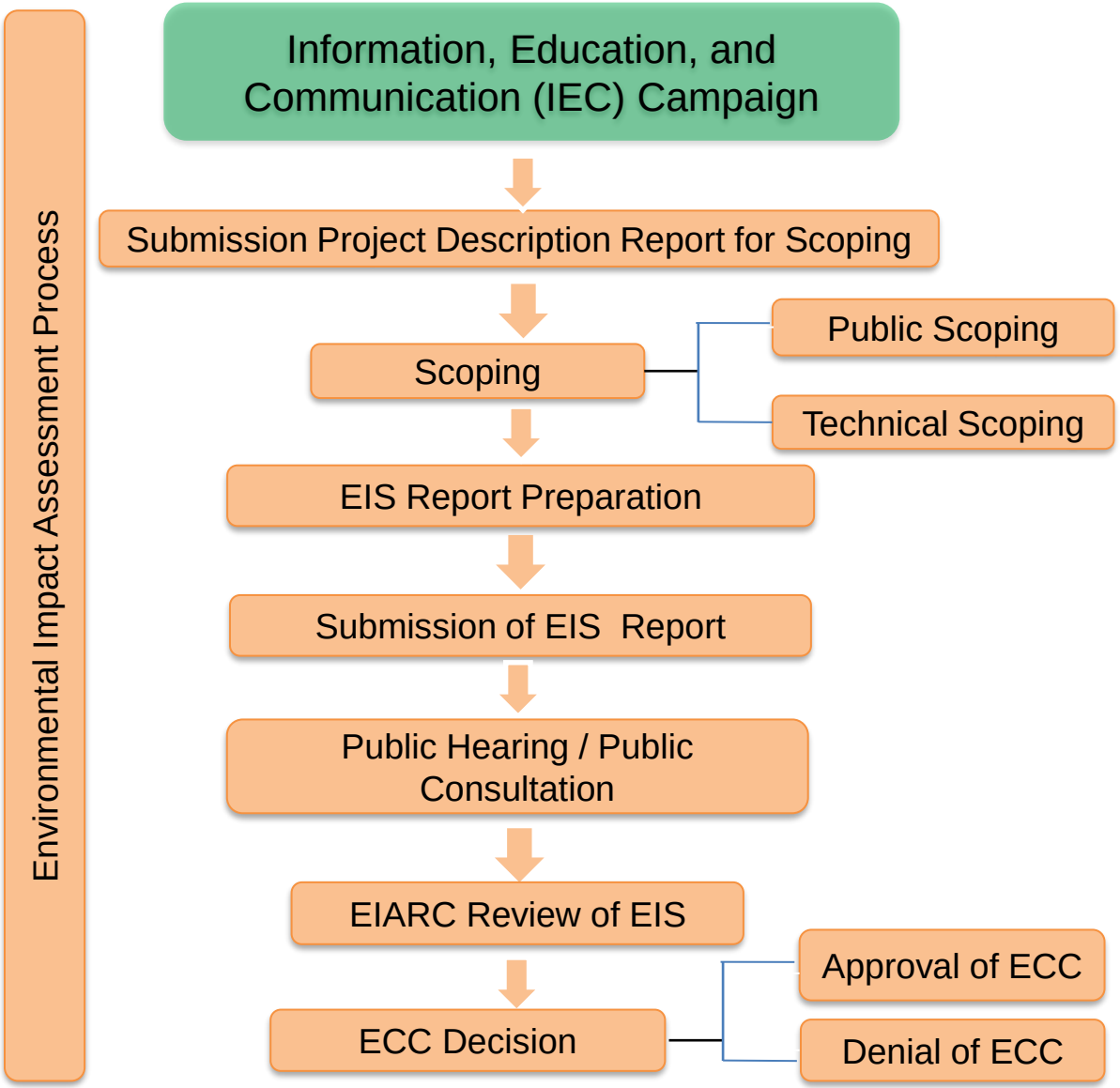
1. To identify preliminary stakeholders of the Project

2. To solicit inputs / suggestions that can be considered in the environmental impact assessment (EIA) study

3. To request information on present and future land use plan from LGUs

Information, Education and Communication (IEC) Campaign

- First step of the EIA process
- Important part of the social preparation process
- Paves the way towards good partnership between the Implementing Agency and the LGUs



Next Step: Stakeholder Meetings at Barangay Level

1. Barangay Council
2. Barangay Health Workers (BHWs)
3. Youth Organization
4. Persons with Disability (PWDs) Organization
5. Senior Citizens' Organization
6. Teacher's Association
7. Religious Groups / Sectors
8. PNP / Barangay Tanods
9. Business Organizations
10. Women's Organizations
11. Indigenous Peoples (IPs) organization, if present in the barangay
12. Fisherfolks / Farmers Organization, if present in the barangay
13. Other concerned organizations in the barangay

Representatives from each organization will be invited to the stakeholder meeting

On-Site EIA Activities

Primary and secondary baseline data gathering

1. Air quality and noise level sampling
2. Water quality sampling
3. Terrestrial and aquatic ecology
   a. Flora
   b. Fauna
4. Social impact assessment

EIA Study Timeline

Project Scoping

- **IEC Meetings** (1st week of July 2020)
- **Barangay Stakeholder Meetings** (4th week of July to 3rd week August 2020)

EIS Preparation

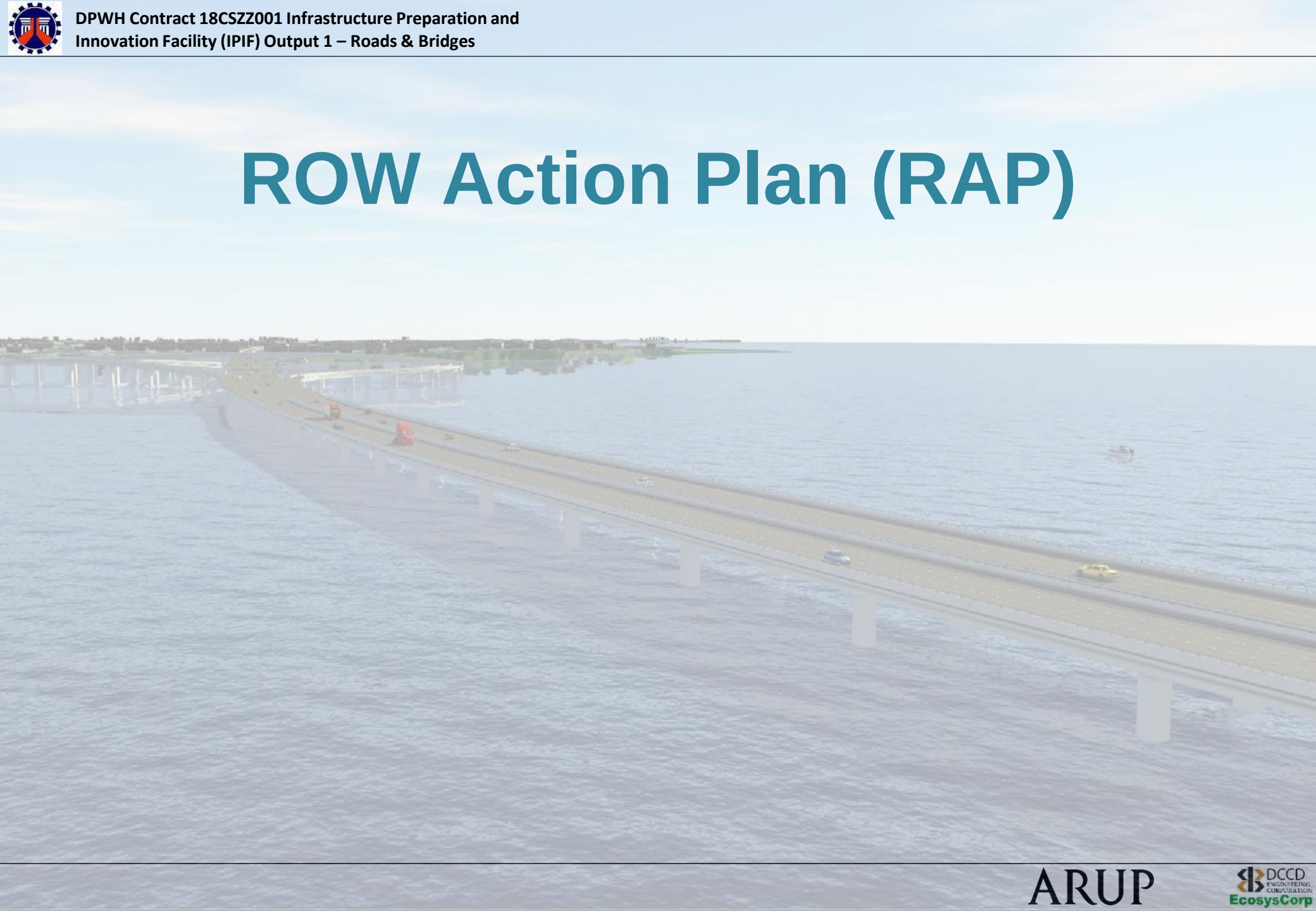
- **Sampling and**
- **Analysis**

(3rd week of August 2020 onwards)

EIS Review

Public Hearing (1st week of January 2021)

ROW Action Plan (RAP)



Project-Affected Barangays

Project-Affected Barangays

RAP Activities

1. IEC Meeting with the Concerned LGUs
2. Holding of the 1st Stakeholder Consultation Meeting (SCM)
3. Census Tagging
4. Socio-Economic Profiling (Households, Businesses, Fish Cage Owners etc.)
5. Inventory of Losses (IOL)
6. Holding of the 2nd Stakeholder Consultation Meeting

Topics:

1. **Description of the Project**

2. **RAP Survey Activities:**
   - Census and Tagging
   - Socioeconomic Survey
   - Inventory of Losses (IOL)

3. **Legal Framework and Project Resettlement Policy for the RAP**

RAP Survey Field Activities

Census and Tagging

- Posting of stickers on structures
- Photograph owner and structure

Socio-Economic Survey

- Survey interview to determine socio-economic status of Affected Persons (APs)

Inventory of Losses

- Structure mapping
- Land and Structure Appraisal

2nd Stakeholder Consultation Meeting

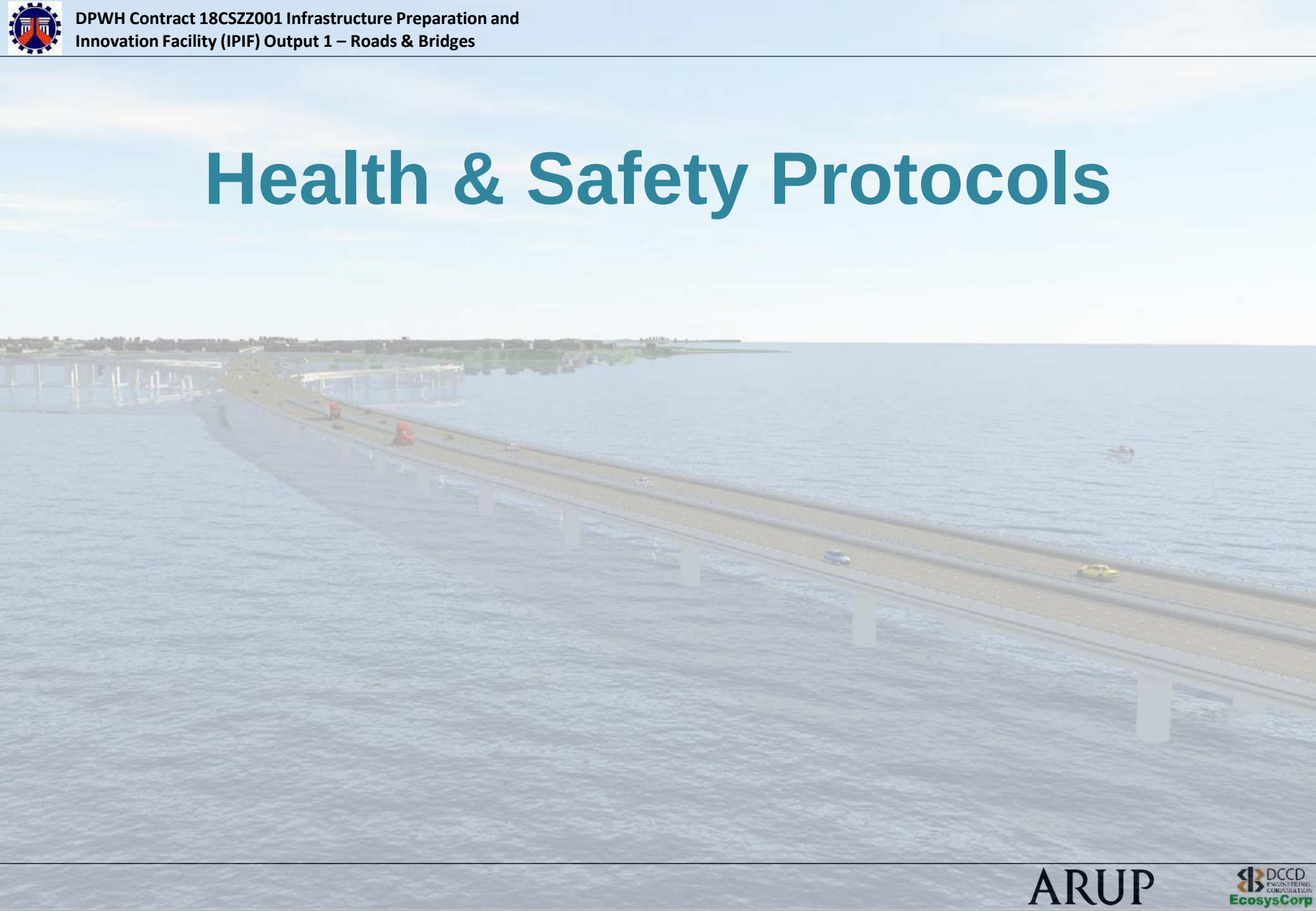
Topics:

1. Results of CAT and SES
2. Relocation Plan for Informal Settlers
3. Livelihood Restoration and Improvement
4. Entitlement Matrix

Documents to be Requested from the LGU

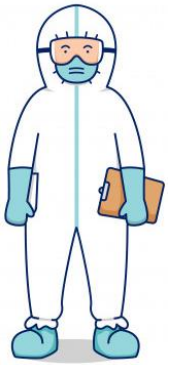
- Names of Declared Owners of Potentially-Affected Properties;
- List of affected fish cage owners/operators
- Information about fisherfolks/fish cage workers
- Tax Maps;
- Updated Municipal Profile;
- Comprehensive Land Use Plan (CLUP);
- Shelter Plan;
- Residential, commercial and agricultural areas with available lots (for legal PAPs); and
- Livelihood, Training, and Employment Programs

Health & Safety Protocols



Step 1: Invite APs

Field Coordinators give SCM Invitation to PAP.



APs

AP chooses option

Online Option

Login to www.EcosysCorp.Ph

Online SCM

Onsite Option

RSVP with EcosysCorp thru Text for Onsite

Onsite SCM

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Dedicated SCM Staff

Disinfect Protect Prevent

Ecosys will assign specific staff members to focus on implementing the **disinfect**, **protect**, and **prevent** protocols.

- Safety Support Staff (SSS)
- Participant Support Staff (PSS)
- Meeting Support Staff (MSS)

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PSS/SSS/MSS H&S Protocols

1. PSS/SSS will be provided with a **disinfection kit** containing hand sanitizer/Alcohol,for proper personal disinfection.

2. PSS/SSS Will be provided with gloves, surgical mask, and **FULL PPE** for proper protection.

3. Conduct **health checks** (signs of illness) prior to meeting

4. MSS will be provided with disinfecting solution/wipes for meeting materials and equipment

Disinfect
Protect
Prevent

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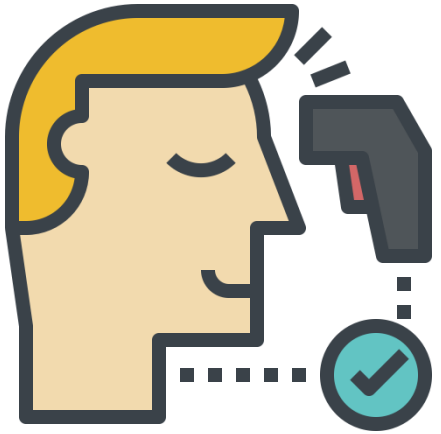
Step 2: SCM Proper (On Site)

Participants' Health and Safety Protocols:

1. Pass thru Health and Safety Booth
2. Health & safety check and proper use of face mask.
3. Provide fresh, new face mask (cannot use own mask)
4. Disinfect hands using alcohol.
5. Use a "**controlled" meeting** area to manage physical distancing.



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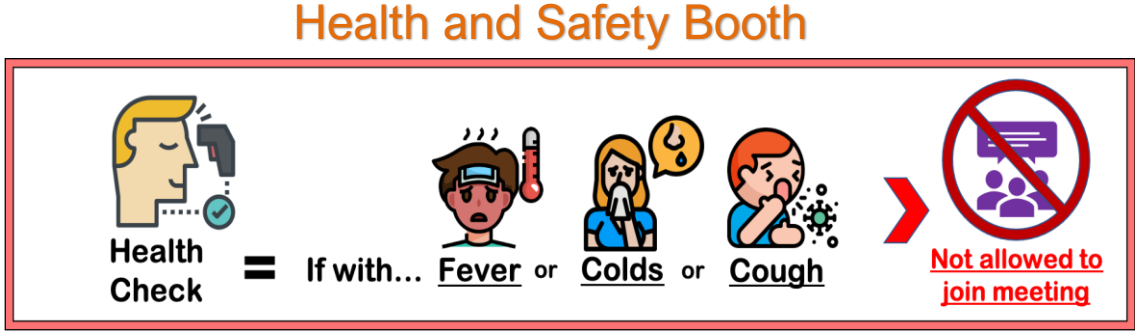
Health and Safety Check: Participants

Prevent

A. Health and safety check of Participants

1. Health Check.
2. If participants have clear signs of fever, illness, cough, or sneezing, the participant will not be allowed to join meeting.



B. Disinfection and Protection of Participants

1. Spray healthy participants' hands with alcohol spray.
2. Make sure participants are wearing mask properly.
3. Register
4. Participant may join meeting.

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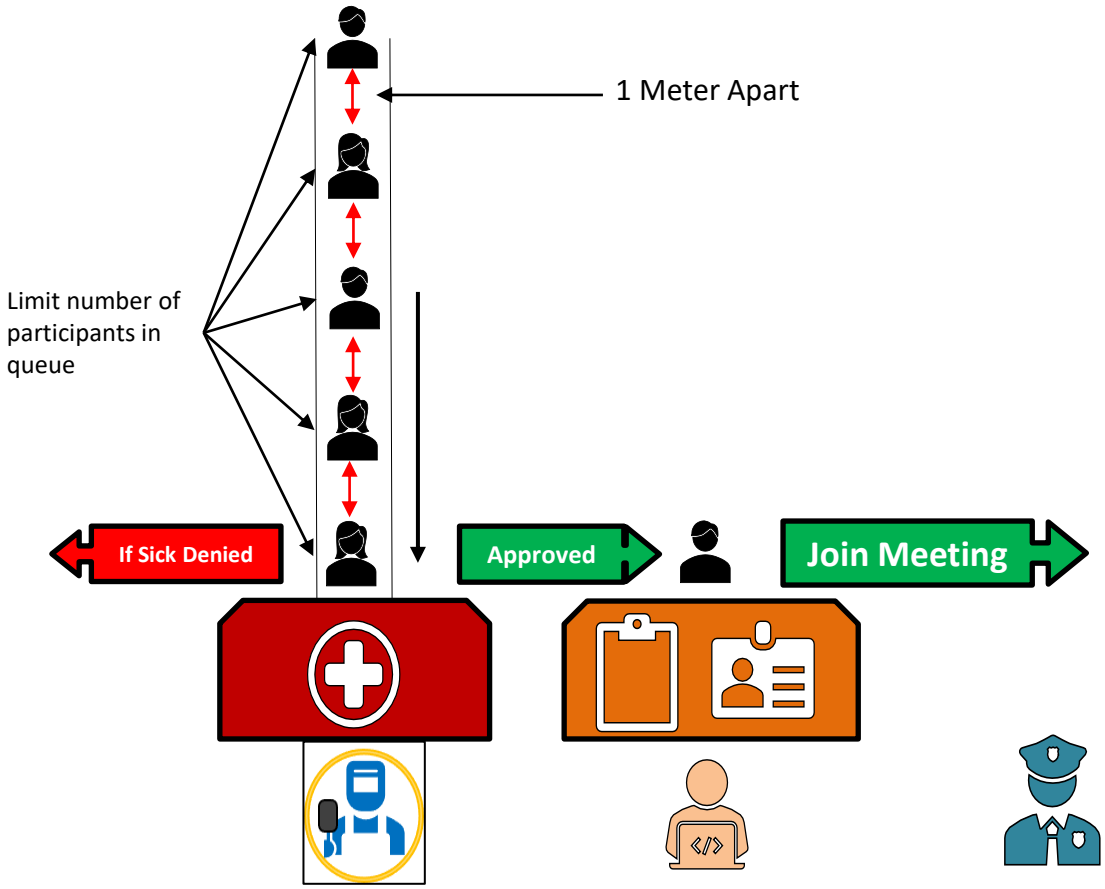
Step 2: SCM Proper (On Site)

Registration: Queue Management

- Participants will be given assigned time/schedule when to attend/check in for registration.
- Only 5-10 participants will be scheduled to be on queue every 5 minutes.
- Participants will be kept at 1 meter distance from front person in queue.

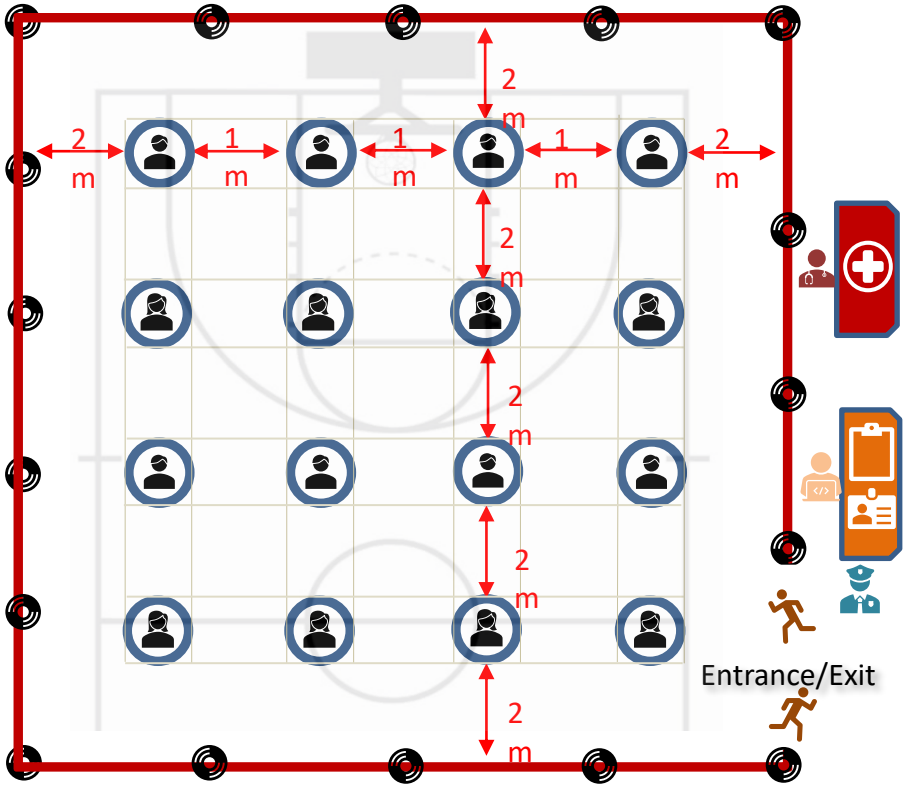


Step 2: SCM Proper (On Site)

Establishment of Controlled Meeting Area

"The GCQ/MGCQ directs stricter physical distancing protocols where people going to public places must observe one-meter distance apart from each other." -

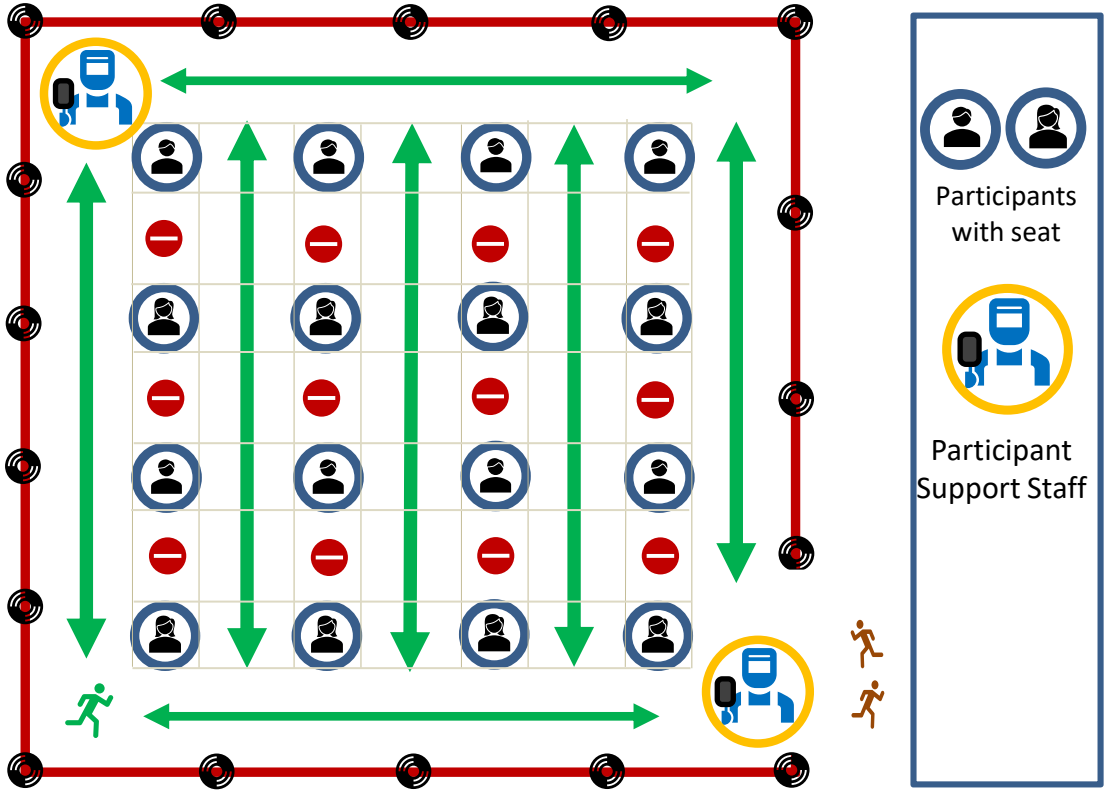
- A "Meeting Area" will be cordoned off and will have pre-defined dimensions based on social distancing protocols.
- The meeting area will be the controlled environment in which all disinfected and protected participants and staff will stay.



Step 2: SCM Proper (On Site)

Movement Inside the Meeting Area

- Two (2) Participant Support Staff (PSS) will be assigned inside meeting area.
- Participants will not be allowed to move from their assigned seats without the assistance of a PSS.
- All concerns, questions, and inquiries by participants will be handled by the PSS.
- PSS will approach any Participant that may have a question
- Numbers will be provided incase there is a queue of questions.



Step 3: Start Post SCM Activities

Field Survey Activities

1. Census and Tagging
2. Socio Economic Survey
3. Inventory of Losses (drone based) with field verification
    a. Structure mapping
    b. Land & structure appraisal

Census and Tagging Team

Disinfect Protect Prevent

Duties and Responsibilities:

Full AP Interaction

1. Communicate with PAP
2. Ask PAP to sign survey documentation
3. Install tagging stickers
4. Takes photograph of PAP for documentation
5. Provide SES Options to PAP

Team Leader:
- ✓ Full PPE
- ✓ Face Shields, surgical masks

Team Members:
- ✓ Face shields, surgical masks

Socio-Economic Survey Options:

Option 1: Online Survey

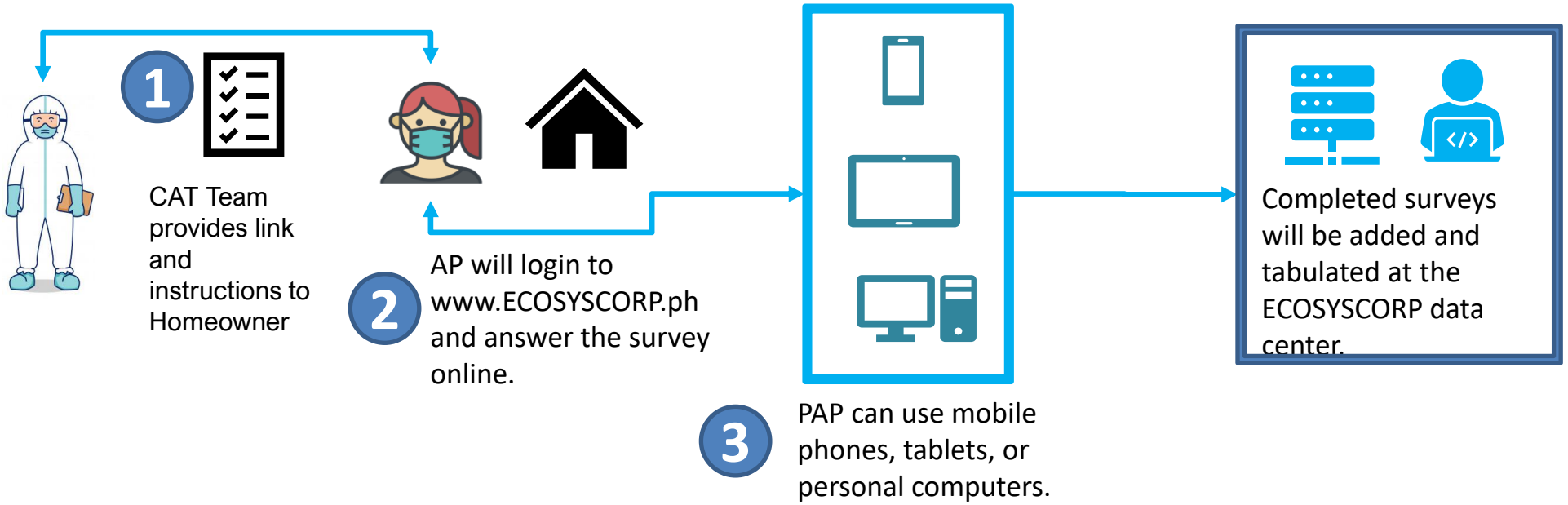
Option 2: Survey thru Ecosys Call Center

Option 3: On Site Survey (Outside the house)

SES Option 1: Online Survey

Disinfect Protect Prevent

www.EcosysCorp.Ph



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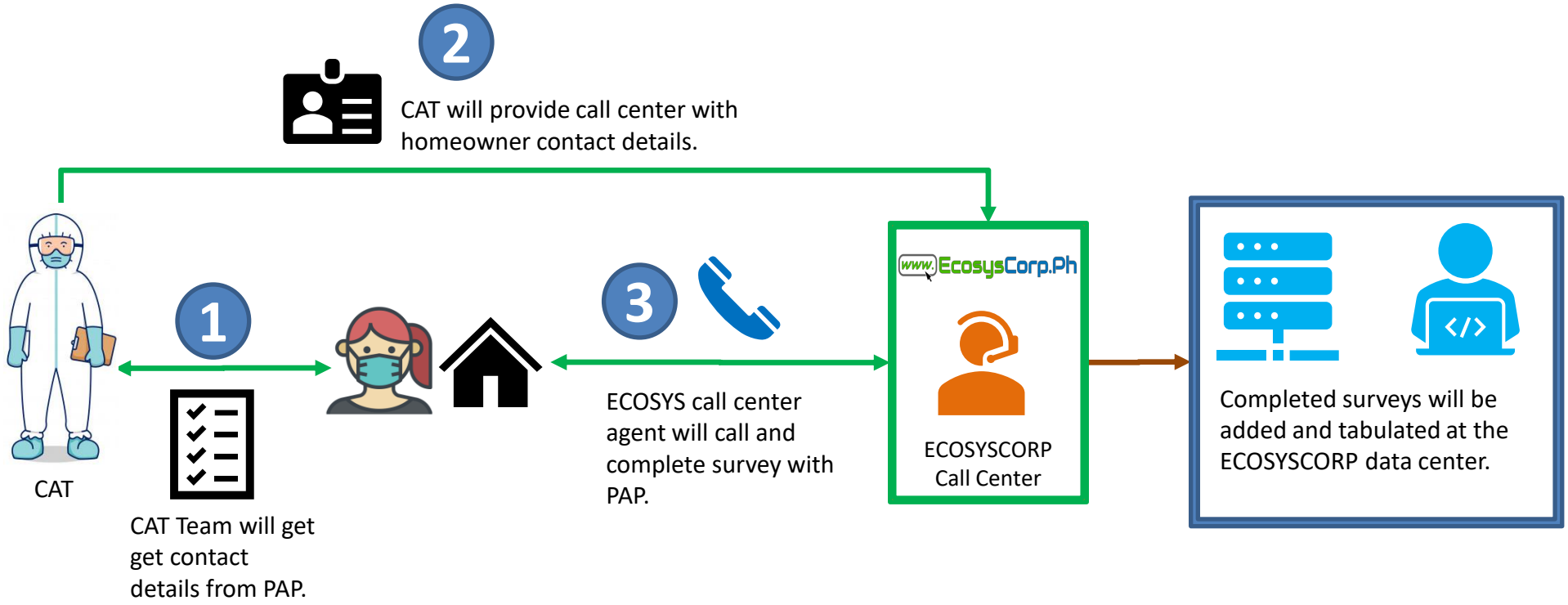
SES Option 2: Call Center Survey

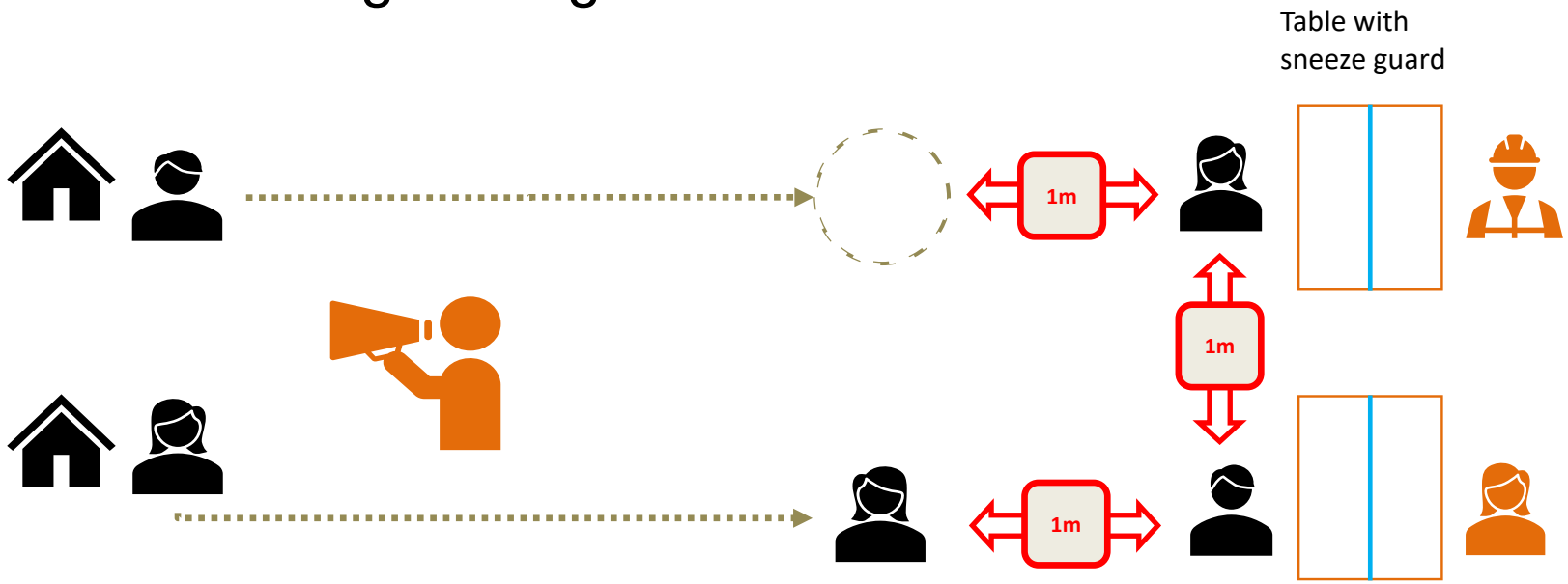


SES Option 3: On-Site Survey

- Onsite SES option will be available for those who don't have phones or access to an Internet connection.
- A pop-up booth will be established to accommodate 3-4 onsite enumerators with table and chairs each protected with a clear plastic barrier.
- The Pop-up booth will be established at the nearest common area available near the PAP residence.

SES Option 3: On-Site Survey

Physical distancing management:



Salamat Po

End of Presentation

OPEN FORUM

ANNEX B
ATTENDANCE AND SCREENSHOTS OF THE VIRTUAL (ONLINE) IEC PRESENTATIONS

PUBLIC PARTICIPATION ACTIVITIES

DENR Administrative Order (DAO) No. 2017-15 provides the guidelines on public participation under the Philippine EIS system. In line with this guidelines, initial stakeholder identification and IEC meetings were done.

1.1. INITIAL STAKEHOLDER IDENTIFICATION

1.2. INITIAL IEC MEETINGS

1.2.1. TAGUIG CITY

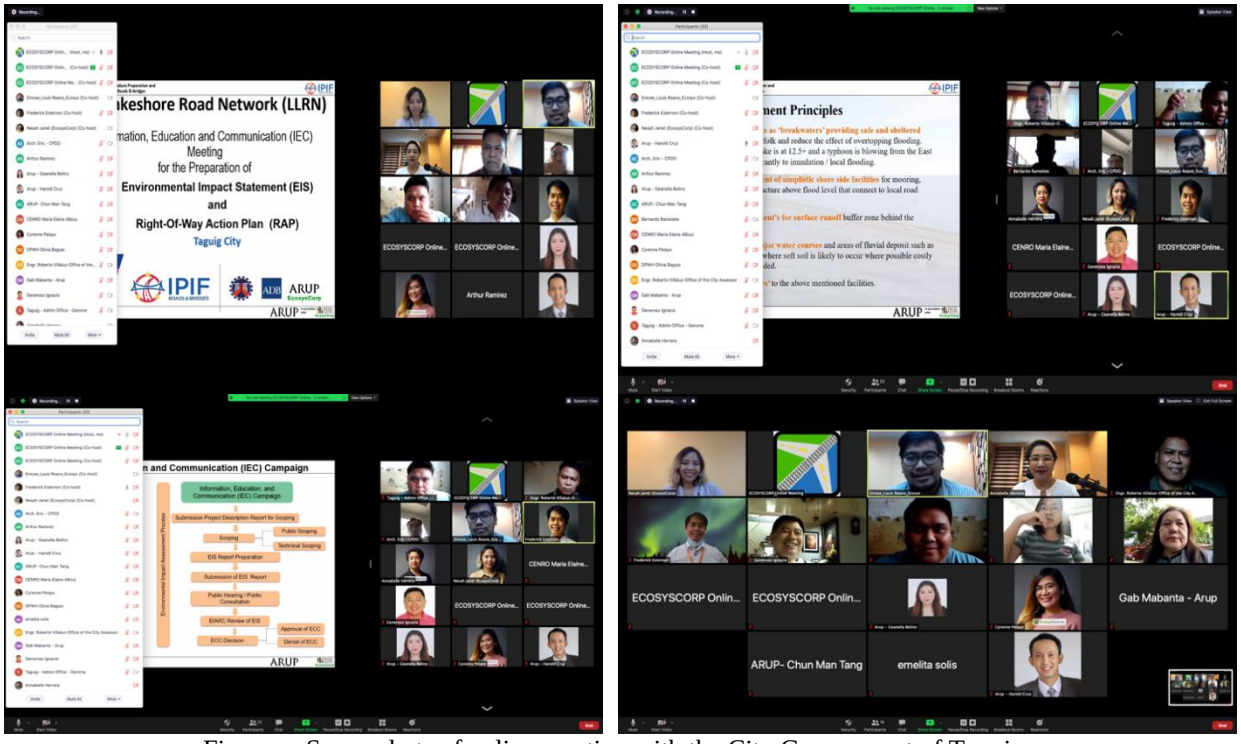


Figure _. Screenshots of online meeting with the City Government of Taguig

1.2.2. MUNTINLUPA CITY

An online IEC meeting was held with the City Government of Muntinlupa in 28 July 2020 at 10 AM. There were 31 participants in said meeting, including key officials and representatives from the City Administrator's Office, City Planning and Development Office, City Environment and Natural Resource Office, City Assessor's Office, City Engineer's Office, Fisheries and Aquatic Resources Management Council, Department of Agriculture, and Lake Management Office.

Figure _ show the screenshots of the online IEC meeting with the City Government of Muntinlupa.

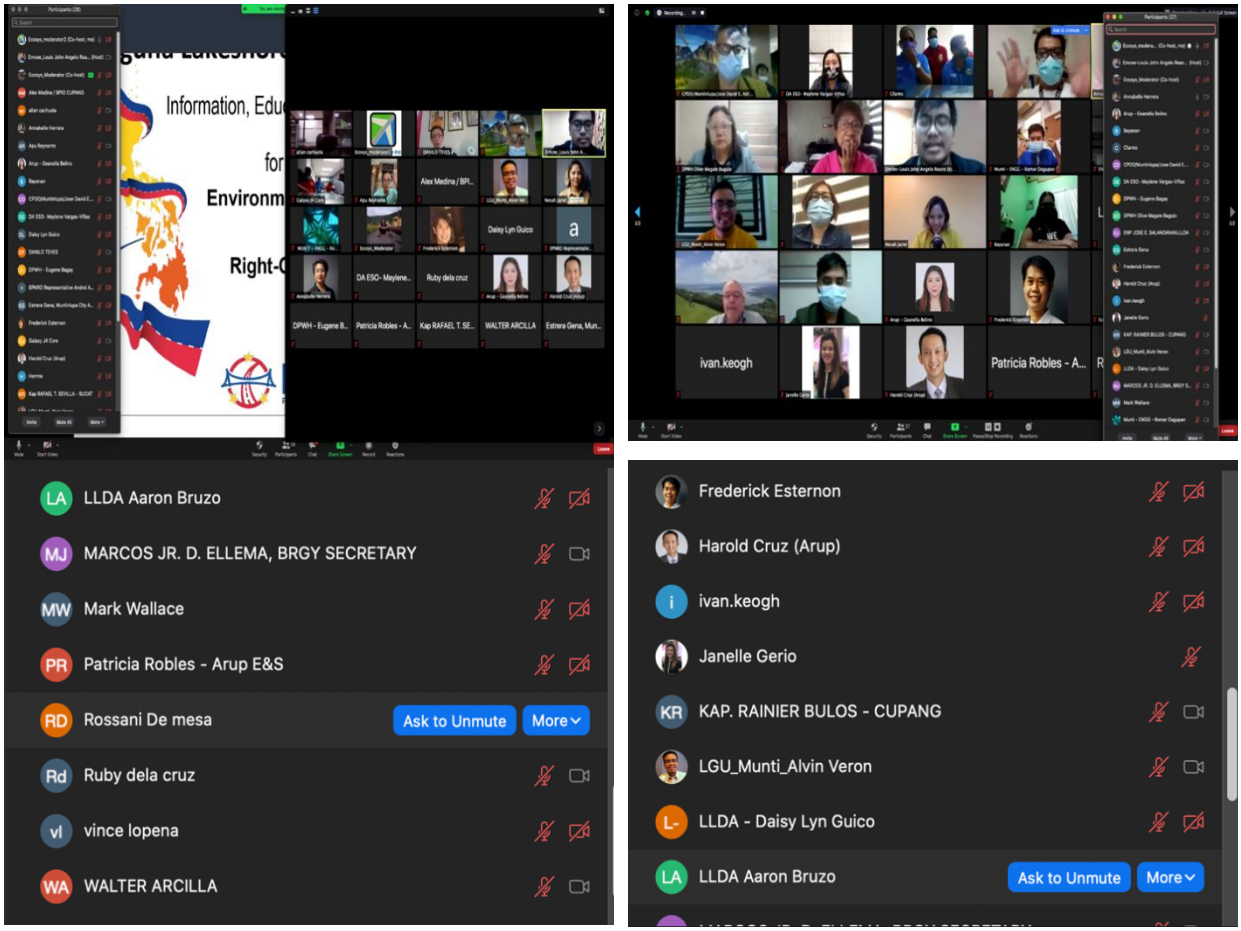


Figure _. Screenshots of online meeting with the City Government of Muntinlupa

1.2.3. CITY OF SAN PEDRO

An online IEC meeting was held with the City Government of San Pedro in 11 August 2020 at 10 AM. There were 22 participants in said meeting, including key officials and representatives from the City Administrator's Office, City Planning and Development Office, City Environment and Natural Resource Office, City Agriculturist's Office, and Urban Development and Housing Office. Representatives from the affected barangays of Cuyab and San Roque were also present.

Figure _ show the screenshots of the online IEC meeting with the City Government of San Pedro.

Figure _. Screenshots of online meeting with the City Government of San Pedro

1.2.4. CITY OF BINAN

An online IEC meeting was held with the City Government of Binan in 30 June 2020 at 8 AM. There were 21 participants in said meeting, including key officials and representatives from the City Planning and Development Office, City Assessor's Office, and Liga ng mga Barangay. Representatives from the affected barangays of Dela Paz, Malaban, Casile, and San Antonio were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Figure _ show the screenshots of the online IEC meeting with the City Government of Binan.

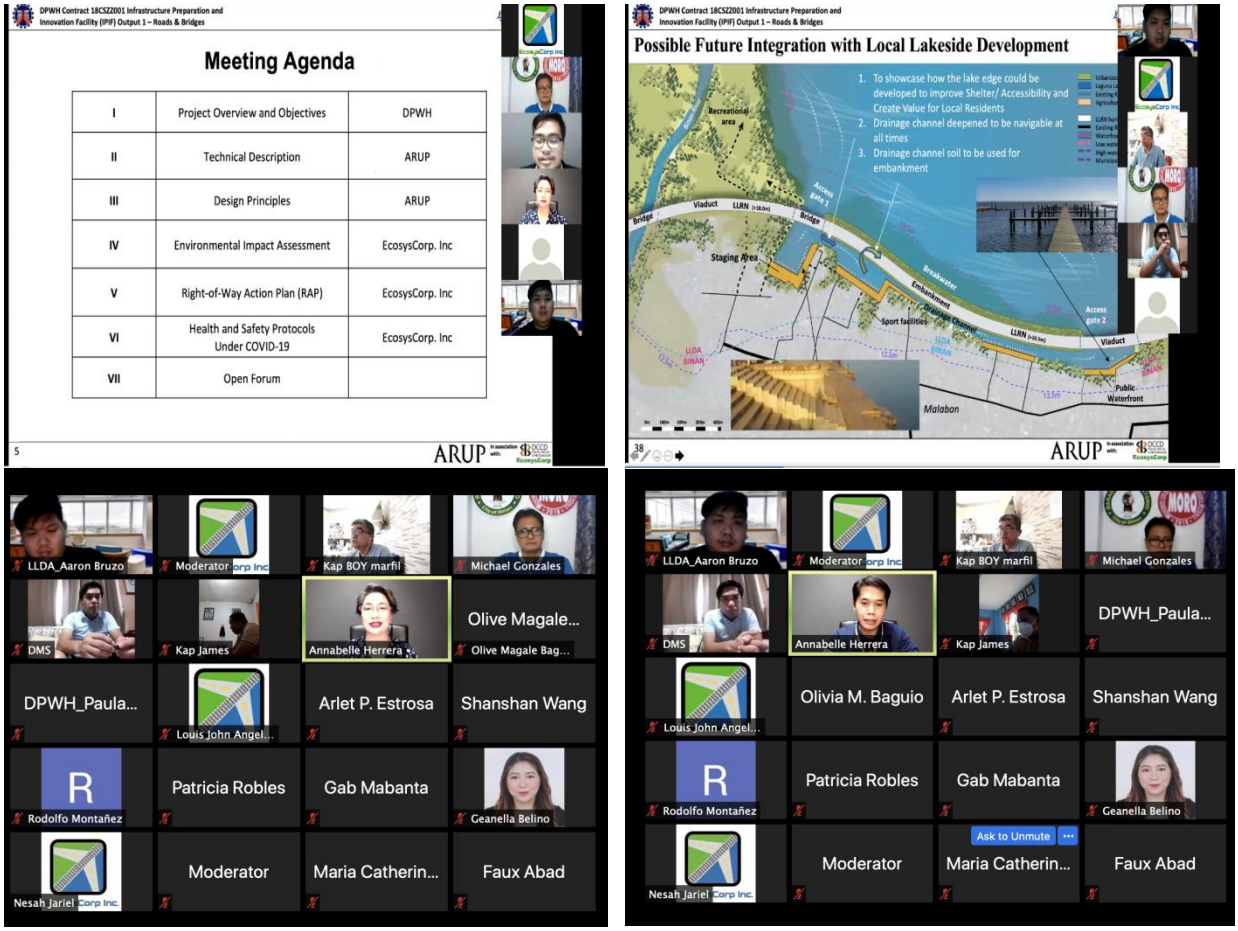


Figure _. Screenshots of online meeting with the City Government of Binan

1.2.5. CITY OF SANTA ROSA

An online IEC meeting was held with the City Government of Santa Rosa in 23 July 2020 at 10 AM. There were 25 participants in said meeting, including the City Mayor and key officials and representatives from the City Planning and Development Office, City Environment and Natural Resource Office, City Agriculturist's Office, City Assessor's Office, and Urban Development and Housing Office. Representatives from the affected barangays of Aplaya, Caingin, and Sinalhan were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Figure _ show the screenshots of the online IEC meeting with the City Government of Santa Rosa.

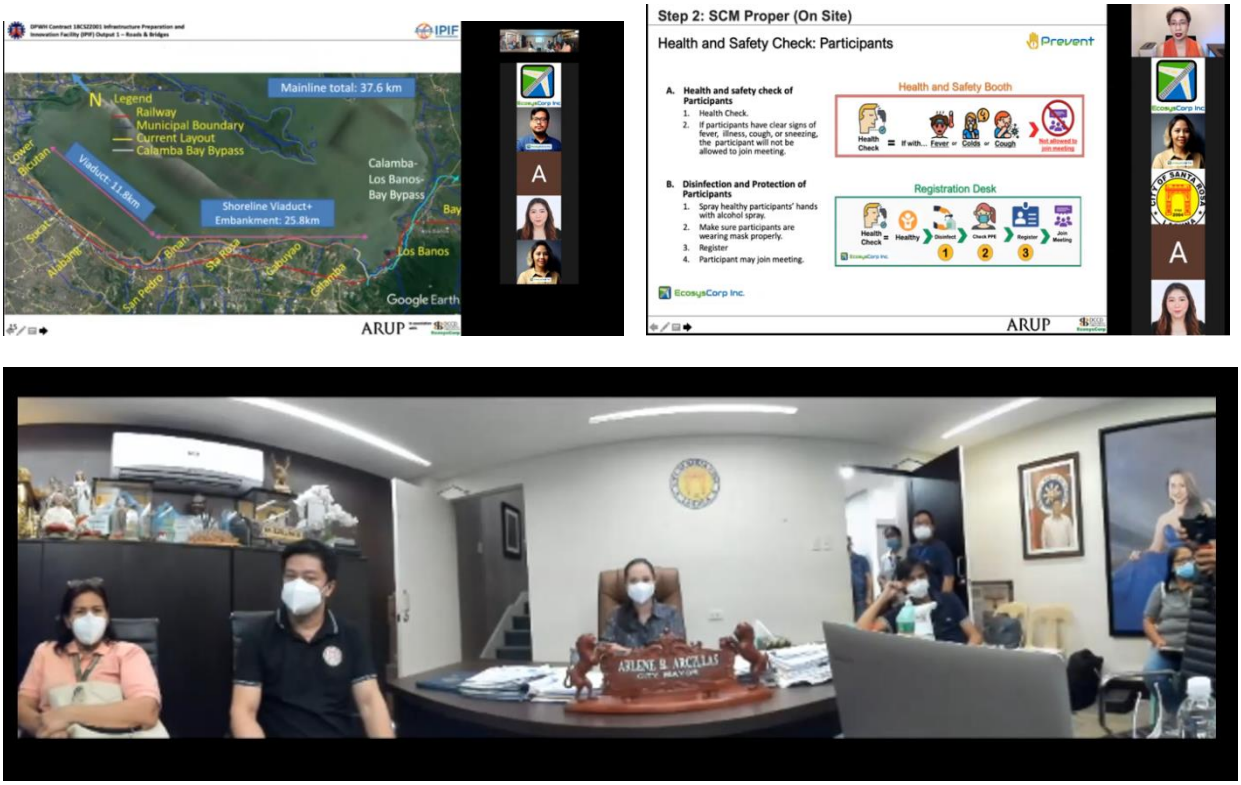


Figure _. Screenshots of online meeting with the City Government of Santa Rosa

1.2.6. CITY OF CABUYAO

An online IEC meeting was held with the City Government of Cabuyao in 01 July 2020 at 10 AM. There were 20 participants in said meeting, including key officials and representative from the City Planning and Development Office, City Assessor's Office, and City Engineer's Office. Representatives from the affected barangays of Butong, Marinig, and Bigaa were also present.

Figure _ show the screenshots of the online IEC meeting with the City Government of Cabuyao.

Figure _. Screenshots of online meeting with the City Government of Cabuyao

1.2.7. CITY OF CALAMBA

An online IEC meeting was held with the City Government of Calamba in 24 July 2020 at 2 PM. There were 25 participants in said meeting, including key officials and representatives from the City Engineer's Office, Calamba Housing Office, City Agriculturist's Office, and City Assessor's Office. Representatives from the affected barangays of Uwisan, Sampiruhan, Lingga, and Lecheria were also present. A representative from the Laguna Lake Development Authority (LLDA) also joined the meeting.

Figure _ show the screenshots of the online IEC meeting with the City Government of Calamba.

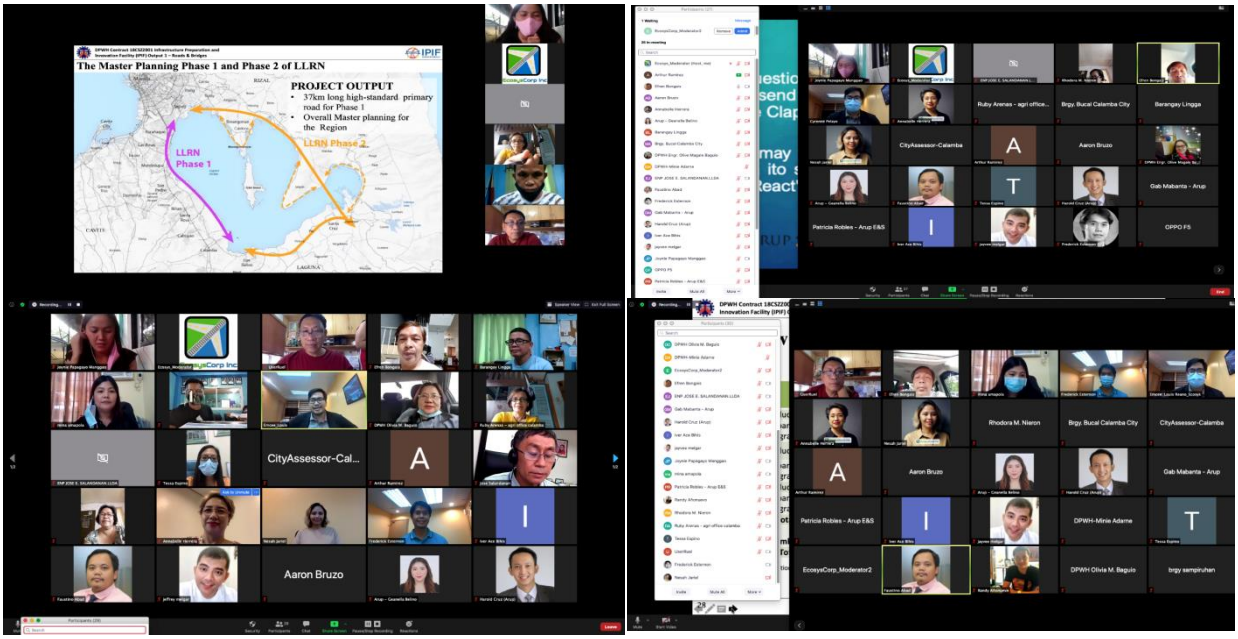


Figure _. Screenshots of online meeting with the City Government of Calamba

ANNEX C
ISSUES RAISED PER CITY DURING THE VIRTUAL (ONLINE) IEC PRESENTATIONS

ISSUES RAISED PER CITY DURING THE VIRTUAL CONSULTATIONS FOR THE LLRN PROJECT

CITY	ISSUES
Taguig City	▪ Final copy of the alignment ▪ Viaduct elevation and basis for it ▪ Viaduct design and its capacity to accommodate bigger sea-borne vehicles ▪ Recycling of excavated materials and its possible re-use in the embankments ▪ Traffic congestion and traffic management during construction ▪ Clear demarcation of LLDA boundary ▪ Aligning the LLRN project with other national government projects ▪ Identification of affected barangays ▪ Compensation for project affected people, especially fish cage operators who stand to be displaced by the project ▪ Health and safety protocols of the project
Muntinlupa City	▪ Placement of the alignment interchange in Susana Heights ▪ LLRN alignment with other projects, including the Paranaque Spillway Project ▪ Inclusion of DRRM and climate change in the EIA ▪ Provision of PPEs to participants to on-site activities
City of San Pedro	▪ Access to the lake as it affects the livelihood of residents ▪ Technical details of the viaduct and embankments, especially as it relates to reducing adverse impacts to people ▪ Notifying residents who stand to be displaced by the project ▪ NEDA acceptance and approval of the project ▪ Adherence to ADB safeguard policies ▪ Conduct of IEC at the barangay level
City of Binan	▪ Displacement of residents who rely on the lake for their livelihood ▪ Possible adverse impacts of excavation activities in the lake and corresponding mitigating measures ▪ Sourcing and hauling of construction materials ▪ Technical details of the viaduct and embankments, especially as it relates to reducing adverse impacts to people ▪ Placement of entry and exit points in every city ▪ Placement of interchanges on San Pedro/Binan

	▪ Structures to be affected ▪ Accuracy of maps shown ▪ Provision of assistance/compensation to PAPs ▪ Possible routes of heavy equipment and its impact on the barangay, especially on the integrity of barangay roads ▪ Maintaining the cleanliness of shorelines ▪ Grievance redress ▪ Coordination with affected barangays
City of Santa Rosa	▪ Displacement of residents along the shoreline ▪ Updating of the City's Local Shelter Plan ▪ Coordination of site activities ▪ Health and safety protocols before the conduct of on-site activities ▪ Clarification on the flood mitigation component of LLRN
City of Cabuyao	▪ Survey of PAPs ▪ Participants to on-site activities ▪ Distance of the project to the lakeshore ▪ Project impact on flooding in the area ▪ Placement of interchange in Cabuyao ▪ Access of fisherfolks ▪ Design of the structure ▪ Timing of conduct of meetings with barangays
City of Calamba	▪ Project design as it affects residents' source of livelihood and their access to it ▪ Height of vertical clearance ▪ Health and safety protocols before the conduct of on-site activities