Chapter 4

FUTURE ENVIRONMENTAL CONDITION WITHOUT PROJECT

The future environmental condition presents the likely scenario in the project area *without the project.* This could serve as a basis for determining the significance or non-significance of the predicted impacts on the quality of the environment *with* or *without* the project.

Under a no project scenario, the potential economic development that will be realized with the improved and increased access of Cavite and Laguna may not be totally achieved.

The geodynamic processes such as erosion and siltation will persist even if the project is not implemented. The extent and degree of these processes will depend on the other project developments which may come about in the area. Though the foundation characteristics of the rocks will remain the same, these developments could result in the partial exposure of previously vegetated areas to the weathering and erosion elements thereby locally increasing the generation of sediments available for siltation of waterways or dispersal as dust. Construction works which will entail large cuts and excavations could locally increase slopes and increase potential for mass movement or failure.

Locally, the soils which mantle most of the project area will likewise be subjected to partial or total removal depending on the developments which will take place. Considering the continuing boom in real estate development in Cavite and Laguna, a large portion of the idle agricultural lands including portions of the proposed road corridors, could be converted for residential or commercial usage. In the process, the vegetation cover could be removed or modified. This will contribute to the already declining agricultural production of the 2 provinces.

The terrestrial ecology within the project, which basically corresponds to a degraded agricultural system, will persist but the aerial coverage will decline over time in response to the continuing landuse conversion.

The quality of the surface waters which are intersected by the proposed roadways will continue to decline as local inhabitants continue to utilize them as dumping grounds for both solid and liquid wastes. This condition will persist unless the available laws on solid waste and water quality are effectively and sustainably implemented. Accordingly, the already limited fishing activity at the rivers traversing the 2 provinces will continue to decline.

The seaward flow of the natural waterways to the Manila Bay will continue. The volume of flow could decline over time due to the changes in the landuse of their respective catchments. These changes could also lead to the modification or increase in the peak flows at the designated bridge crossings.

Groundwater levels will continue to fluctuate with the seasonal changes. The continuing increase in pumpage due to the rise in the population of the water users could bring about the local lowering of the water levels.

The population of the LGUs within the project area will increase as more lands are converted for residential development projects. These will translate to increased waste generation and contribute to congested traffic at and along existing major intersections and thoroughfares. Over time, traffic conditions will worsen as the number of commuters and vehicle owner's increase. This will translate into the worsening of the quality of air along the existing thoroughfares in the project area.

Chapter 5
IMPACT ASSESSMENT AND MITIGATION MEASURES

5.1 GENERAL IMPACT IDENTIFICATION AND ASSESSMENT METHODOLOGY

The CALA project impacts were classified into three (3) major categories under the physical, biological and socio-economic environment modules. These were further classified according to the three (3) phases of project development: pre-construction/construction, operation and maintenance phases.

The issues and impacts identified during the study were evaluated in terms of their nature, their duration (time-scale), areal extent, reversibility or permanency and cumulative effects. Collectively, these serve to establish the over-all degree or magnitude of the impact, which is described as follows:

- Significant (S)
- Moderately Significant (MS)
- Non-Significant (NS)

5.2 IMPACT ASSESSMENT AND MITIGATION/ENHANCEMENT MEASURES

Table 5.1 summarizes the over-all project impacts (negative and positive) and their corresponding mitigation and enhancement measures by development phase and by environmental module: physical, biological and socio-economic. These are described and discussed in detail in the succeeding sections.

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
1. Preconstruction/Construction Phase					
A. Physical Environment					
Land					
▪ Detailed engineering design; clearing within ROW area; site grading, excavation, backfilling bored piling at bridge areas, hauling/stockpiling of excavated and construction materials	Terrain modification, soil and weathered rock displacement Erosion, siltation of local waterways particularly at bridge crossings	S, P (negative) S, T (negative)	▪ Within designated disposal site	▪ Terrain modification permanent, erosion, siltation during construction period	▪ Clearing and excavation works to be planned during dry season where practicable and scheduled so as to allow speedy concreting/backfilling of excavated sections ▪ Use of temporary siltation ponds[1] ▪ Excavated materials be placed on appropriate dumpsites or spoils area at some distance from structure sites and provided with adequate containment; re-use soil spoils for backfilling ▪ Stockpiles of sand and gravel be fenced or so located to reduce transport of sediments during heavy rains including reducing storage time in work areas ▪ Observance of proper materials handling and heavy equipment operations for transport, hauling and moving earth spoils to minimize spills into rivers and nearby waterways[2] ▪ Immediate revegetation of exposed areas which will no be occupied by road structures ▪ Strict observance of proper cut and fill procedures and materials balance to minimize wastage of excavated materials from work areas ▪ Restoration or dredging of silted waterways upon completion of construction activities ▪ Use of temporary sumps for detention of bentonite used in drilling bored piles ▪ Use of tarpaulins or equivalent to cover exposed stockpiles of excavated and construction materials ▪ Monitor river quarrying for construction materials within the project area. Sources of construction materials for the project will be identified and approved for quarrying by the Mines and Geosciences Bureau and/or the concerned LGU ▪ Monitoring of earthmoving activities by a qualified geotechnical engineer or

[1] *Sitation ponds* correspond to sumps which temporary detain water pumped out of excavations. Detention will facilitate the settlement of sediments from the water prior to eventual release into the nearby waterway.
[2] This refers to the observance of caution in moving loaders and trucks laden with loose materials so as to minimize spillage and likely siltation while crossing waterways.

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
					engineering geologist
	Slope destabilization at new cuts	MS, T (negative)	▪ Sloping section of disposal site, access road	▪ During construction period	▪ Undertake slope stability analysis supported by adequate geologic mapping, field tests and laboratory analysis for sections which will involve large cuts. Drilling accompanied by appropriate laboratory test may be undertaken. This is an option to be taken by the contractor should his designer require subsurface data for the proposed slope stabilization measure. ▪ Install as necessary slope protection measures such as shotcreting, rock bolts or soil nails. A soil nail anchors soil like materials which are likely to fail into more stable strata located farther into the slope.
	Degradation of national and provincial roads used for hauling construction materials and for movement of heavy equipment	MS, T (negative)	▪ Main roads used for hauling	▪ During construction period	▪ Regular road maintenance, restoration of roads original conditions after construction activities. As practiced, the roads used by the contractors that are degraded by the passage of heavy equipment are restored or repaired at the end of the project or upon completion of construction activities in the particular area.
	Increased generation of solid wastes	NS, T (negative)	▪ Active construction areas	▪ During construction period	▪ Provision of waste bins in various strategic points within the construction area for the workers to dispose their wastes. Wastes from these containers will be collected (dump truck of the contractor) regularly to be disposed at a designated waste disposal site. ▪ Re-use and recycling of scrap materials and containers such as bottles, cans, boxes and plastics as much as practicable or selling them to scrap buyers. ▪ Conduct of a thorough orientation of workers on proper waste disposal practices. ▪ Re-use construction spoils as aggregate or filling materials where practicable. ▪ Regular hauling of construction debris to the designated disposal area to prevent their accumulation on-site resulting to negative effects on the landscape. ▪ Conduct of equipment/vehicle cleanup and maintenance in only one designated area located as far away as possible from waterways. Spent and used oil should be collected and placed in sealed containers and disposed of properly to prevent draining into waterways or sold to used oil recyclers/buyers. ▪ Efficient housekeeping practices including the use of covered receptacles for refuse generated by workers and construction scrap/debris will ensure the proper

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
					handling and disposal of solid wastes. ▪ In order to minimize the need to dispose of earth materials, the contractor shall make use of excavated materials as much as possible for filling and as part of construction materials. For non-suitable materials, these are placed in low areas where the possibility of erosion is limited.
Air					
	Increase in particulates and gaseous emissions and noise levels	MS, T (negative)	▪ Immediate construction areas	▪ During construction period	▪ Sprinkle water in exposed areas on regular basis especially during dry and windy periods ▪ Speed of vehicles used for construction should be regulated to minimize stirring up of loose materials sinks for dusts/spoils ▪ Proper handling and storage of spoil materials ▪ Proper maintenance of engines for efficient fuel burning to lessen gaseous emissions ▪ Schedule construction activities during daytime ▪ Installation of silencers or mufflers for as many vehicle engines and heavy equipments as possible
	Increased traffic at road intersections leading to construction areas	MS, T (negative)	▪ Road intersections leading to construction areas	▪ During construction period	▪ Contractor to assign traffic aides at key road sections to assist in traffic management
Water					
	Changes in river water quality	S, T (negative)	▪ Areas immediately downstream of bridge crossings	▪ During construction period	▪ Refer to mitigation measures on soil displacement, erosion and siltation of waterways ▪ Locate gravel crushing, screening areas and concrete batching operations as far away as possible from waterways ▪ Undertake regular monitoring of water quality focusing on DO, BOD, TSS and TDS ▪ Provide adequate temporary sanitary facilities with proper drainage to prevent leaching and wash water from reaching water courses, use of portalets ▪ Contractors to prepare and implement a materials handling program for

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
					construction spoils and solid waste management ▪ Contractor to observe proper equipment maintenance and operation to minimize spillage of oil and grease into waterways
B. Biological Environment					
Terrestrial					
▪ Vegetation clearing, excavation and grading and other construction activities	Loss, disturbance and damage to existing vegetation	MS, T (negative)	▪ Proposed roadway and ROW	▪ During construction period	▪ Immediate replanting of critical areas (open/exposed soil) prone to erosion ▪ For every tree cut, the required replacements must be made[3] ▪ Secure necessary permit from DENR for tree cutting ▪ Implement tree balling where practicable
Freshwater					
	Local aquatic habitat alteration and temporary displacement of species	NS, T (negative)	▪ Proposed roadway and ROW	▪ During construction period	▪ Same mitigation for the control of soil erosion and sedimentation
C. Socio-economic Environment					
▪ Detailed engineering design; clearing within ROW area; site grading, excavation, backfilling bored piling at bridge areas, hauling/stockpiling of excavated and construction materials including ROW acquisition	Total or partial loss of land/farm area, properties and crops, dislocation and loss of income due to ROW acquisition	S, P (negative)	▪ Proposed roadway and ROW	▪ During construction period	▪ Negotiate with PAFs/PAPs for an acceptable compromise on valuation and compensation ▪ Finalize the LARP incorporating therein the agreements reached during public consultations
	Increase in employment	MS, T (positive)	▪ NA	▪ During construction	▪ Require contractors to source workforce from qualified locals

[3] Cutting of trees is generally guided by the provisions of PD 705 – Revised Forestry Code of the Philippines (Section 23). In the case of trees located in private lands, guidelines for cutting are embodied in DAO-21 which refers to the Revised Guidelines in the issuance of Private Land Timber Permit/Special Private Land Timber Permit (PLTP/SPLTP). A 100% tree inventory is required and this must be undertaken by a registered forester or by the local DENR office.

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
	opportunities			period	▪ Contractors to orient workers on desirable working relationship especially if there are non-resident workers
	Increase in livelihood and business opportunities	MS, T (positive)	▪ NA	▪ During construction period	▪ Priority to be give to local subcontractors ▪ Priority to be given to local suppliers of construction materials and equipment ▪ Supply of food and catering to be preferentially awarded to local suppliers
	Potential health, sanitation and safety problems	NS, T (negative)	▪ Active construction areas	▪ During construction period	▪ Contractor to provide temporary housing facilities for workers equipped with adequate water and sanitation facilities ▪ Contractors to implement proper solid waste management in the work site, workers will be oriented to observe proper hygiene and sanitation practices and provided with appropriate protection gears while working ▪ Construction areas to be enclosed as necessary and provided with appropriate signage to avoid accidents
D. Land Use					
Land Use and Zoning					
	Change in land value	S, P (positive)	▪ Properties traversed by or close to road alignment	▪ From construction period onward	▪ Property appraisal by the local government unit before construction
2. Operation and Maintenance Period					
A. Physical Environment					
Land					
	Erosion at major discharge points of the road's storm drains	NS, T (negative)	▪ Immediate major discharge areas of storm drains	▪ During heavy rains/storms	▪ Installation of dissipators at major discharge points of the roads' storm drains
Air					
▪ Operation and maintenance of roads	Increase in particulates and gaseous	MS, P (negative)	▪ Along completed	▪ During operation period	▪ IEC to road users on the proper maintenance of engines for efficient fuel burning and minimization of gaseous emissions

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
	emissions		road ways		▪ Tree planting along the roads ▪ Regular road cleaning activity such as regular
	Increase in noise levels	MS, P (negative)	▪ Along completed road ways	▪ During operation period	▪ Traffic controls (e.g. speed limits and traffic-volume restrictions) and Vehicle controls along the highway (e.g., truck bans) ▪ Tree planting along the roads ▪ Sound barrier panel should be installed along the roads
B. Socio-economic Environment					
▪ Operation and maintenance of roads	Lessened traffic congestion and improved access to public utilities and services	MS, P (positive)	▪ Along completed road ways and current roadways	▪ During operation period	▪ Enhance the accessibility by providing appropriate signage to guide traveling public to use shortest and most convenient route to reach the interior places from the highway via the existing access roads and vice versa
	Increased livelihood and business opportunities, and revenues for LGUs	MS, P (positive)	▪ NA	▪ During operation period	▪ Encourage LGUs to use part of the increase revenues for promoting conducive for expanding business operation and establishing new livelihood activities, by maintaining peace and order and improving basic services and infrastructure and utilities
	Increased migration and population	MS, P (negative)	▪ NA	▪ During operation period	▪ Concerned LGUs (barangay and municipal/city) to regulate encroachment in watershed areas (forest-land) through proper zoning and enforcement ▪ LGUs to adequately plan/provide for social services and infrastructures including health services, waste management and facilities and road network ▪ Encourage the LGUs to regulate or prevent the establishment of squatter colonies by strictly enforcing RA 7279 or the "Urban Development Housing Act (UDHA)"
	Regional serverance	S, P (negative)	▪ Along completed road ways	▪ During operation period	▪ In order not to disturb human flow between communities, measures for crossing the road should be installed such as flyover, underpass, at grade intersection, service road.
	Increased accidents	MS, T (negative)	▪ Along completed road ways	▪ During operation period	▪ Intersection signal and sign board instllation
	Damage of	MS ,P	▪ Along	▪ During operation	▪ Revegetation of the exposed areas

Table 5.1 Summary of Environmental Impacts and their Corresponding Mitigation/Enhancement Measures

Project Activities	Predicted Envt'l. Impacts	Degree /Type of Impact	Extent	Duration	Mitigation/Enhancement Measure
	landscape	(negative)	completed road ways	period	▪ Tree planting along the roads
C. Land Use					
Land Use and Zoning					
	Change in land value	S, P (positive)	▪ Properties traversed by or close to road alignment	▪ From operation onward	▪ Regular property appraisal by the local government

Note: S - Significant impact, MS - Moderately significant impact, NS - Not significant impact
T - Temporary impact, P - Permanent impact
negative - negative impact, positive - positive impact

5.2.1 Impacts During Pre-Construction/Construction Phase

(1) Physical Environment

1) Terrain Modification, Soil and Weathered Rock Displacement and Erosion, Siltation of Local Waterways

Pre-construction activities would include surveys, foundation/geotechnical exploration and detailed engineering design for project structures. These would generally entail minimal clearing and removal of vegetation cover and will not result in any significant terrain alteration.

The first part of construction phase will entail the clearing and removal of structures within the designated right of way (ROW) of the road. Thereafter, stripping and excavation will be carried out through most of the hilly to gently sloping sections of the route while backfilling and construction of embankments shall be made at low and flat areas, respectively. Piles will be bored at the proposed bridge crossings and the drilling will use bentonite which may be accidentally discharged into the nearby waterways. Excavated materials will accumulate at construction site and stockpiles of construction materials will be developed. Drainage canals will be constructed alongside the roads to divert runoff. New access roads will be built to facilitate hauling of construction materials, spoils, personnel and equipment. All these activities will result in the modification of the existing landforms along the proposed route.

Table 5.2 presents the current erosion status at the various segments of the proposed road alignments which will be affected during construction

Table 5.2 Analysis Result of Soil Erosion

Erosion Category	Road Sections (in km)		
	East-West	North-South	CALA Expressway
Slight Erosion	11.36	13.37	-
Moderate Erosion	-	-	-
Severe Erosion	-	7.26	17.88
No Apparent Erosion	-	-	5.68
Total	**11.36**	**20.63**	**23.56**

All earthmoving activities will generate loose materials and expose additional areas to erosion. Stockpiles of loosened excavated materials if left unprotected and not properly managed could be eroded especially during rains and may contribute to the siltation of nearby waterways. This condition is expected to prevail and persist over the period of construction at the location of the proposed bridge crossings. Stockpiles of sand and gravel brought in from sources outside the project area could also be susceptible to erosion.

The time scale for the erosion of exposed surfaces and material stockpiles is considered short-term as this process would likely take place only during the rainy season of the construction period. The impacts would be irreversible but the magnitude will vary from moderate to significant depending on the extent of exposed sections, the number of and size of stockpiles and the ability of the contractor to mitigate erosion.

Mitigating Measures

The main construction contractor and its sub contractors will be required to submit and implement appropriate materials handling program or a site protection and rehabilitation program that will be monitored regularly by DPWH. The erosion potential of the newly exposed areas and the loosened materials generated during the construction stage could be heightened during rainy season. The program must contain the following measures whose consistent implementation must be monitored by the DPWH:

- Programming of clearing and excavation works during the drier months where practicable; schedule must be such as to facilitate the speedy concreting or backfilling of excavated sections or the installation of the proposed road structures.
- Construction of appropriate siltation ponds to temporarily detain silted waters generated by earthmoving/dewatering and the drilling of holes for bored piles
- Placing of excavated or graded materials on appropriate dumpsites or spoils area and provided with adequate containment (i.e. barrier nets or tarpaulins). Effort must be exerted to facilitate the use of the same materials for backfilling.
- Stockpiles of sand and gravel must be fenced, covered with tarpaulin or so located to reduce remobilization or erosion of sediments during heavy rains including their reducing storage time in the work areas.
- Care to be observed in the operation of heavy equipment for transporting, hauling and moving earth spoils from one area to another so as to avoid spills into the rivers or nearby waterways.
- Immediate revegetation of the exposed areas, which fall outside of the proposed road structures, must be undertaken.
- Strict observation of materials balance and proper cut and fill procedures to avoid or minimize any wastage or removal of excavated materials from the work areas.
- Restoration or dredging of silted waterways upon completion of construction activities. This must be conscientiously observed by the contractor to improve stream drainage and water quality.
- Inclusion of a geotechnical engineer or engineering geologist in the workforce to monitor all earthmoving activities

2) Slope Destabilization at New Cuts

Earthmoving or excavation along the road route, whether mechanically undertaken or aided by blasting, could initiate down slope movement. This could also take place at the abutments of the proposed bridges. Based on the observed nature of the volcanic rocks in the project area, the probability of this event taking place is deemed slight to moderate. This is supported by the generally low to moderate slopes in the project areas as indicated in Table 5.3.

Table 5.3 Analysis of Slope

Slope Category	Road Sections (in km)		
	East-West	North-South	CALA Expressway
0-3%	6.36	3.06	1.26
3-8%	5	10.63	2.1
8-18%	-	6.94	15.19
18-30%	-	-	5.01
30-50%	-	-	-
> 50%	-	-	-
Total	**11.36**	**20.63**	**23.56**

Mitigating Measures

Once the final alignment is established and the design of the embankments, cuts and bridges finalized, the immediate vicinity of these structures must be subjected to engineering geological assessment to determine likelihood of slope failure during construction. Where necessary, drilling accompanied by appropriate laboratory tests must be undertaken to establish the parameters for possible institution of slope protection measures such as shotcreting and installation of rock bolts and soil nail, among others. Monitoring of slope cuts at structure sites must be done by an engineering geologist.

3) Degradation of National and Provincial Roads

Regular use of the national and provincial roads by heavy trucks and equipment will contribute to their deterioration.

Mitigating Measures

The contractor must regularly maintain the roads used during construction and make sure that these are restored to their original conditions immediately after the project has been completed.

4) Deterioration of River Water Quality

Aside from siltation of waterways brought about by erosion, river beds are disturbed in relation to foundation preparation of bridges. These will bring about increased total suspended solids and consequently a decline in dissolved oxygen (DO) levels. A decline in water quality can also be brought about by accidental spill of oil and grease from equipment used in construction. A change in river water quality may also come from unsanitary practices of the construction workers that may use the rivers as toilet area and waste disposal area for both construction and domestic wastes. These impacts though short term in nature are deemed to be moderately significant. (Table 5.4)

Mitigation Measures

In addition to the measures provided earlier, solid waste and sewage generated within the work area should be properly managed. It would be best to locate gravel crushing, screening areas and concrete batching operations as far away as practicable from waterways to avoid accidental spillage into the rivers/creeks. Fuel and oil storage areas should also be located well away from any watercourse. Most importantly, there must be provision for adequate temporary sanitary facilities in construction campsites with proper drainage and sewage system to prevent leaching of untreated sewage or wash water into the groundwater and surface water.

Regular monitoring of water quality should be undertaken during the construction phase to determine the extent of changes and adequacy of control measures.

5) Increase in Suspended Particulates and Gaseous Emissions

The concentration of suspended particulates can increase at the construction sites during site preparation and construction as a consequence of excavation activities and vehicle movement. The stockpile of loosened earth materials can become re-suspended get

airborne during windy days. The removal of vegetation could also expose the soil and render them susceptible to wind suspension and transport. In general, expected increase in TSP concentration may be confined to construction sites which could exceed the DENR limits of 300 μg/Ncm at some periods. This condition will be temporary though and intermittent that will last until the construction period.

Local and short term increase in gaseous emissions may occur at particular road sections under construction where heavy equipment is being used. *Table 5.5* shows the uncontrolled emission factors of construction equipment during project construction.

Table 5.4 River Crossings and other Features along Proposed Three Routes

Section	Crossing Points (1	Name of River	Name of Tributary	Municipality	Drainage Area (km^2)	Proposed Structure (Tentative)	Notable Existing Conditions
North-South Road (NS)							
NS-1	Sta.0+000	-	-	Bacoor	-	Interchange	Coastal Road
NS-1	Sta.1+100 Sta.1+401	-	-	Bacoor	-	Overpass	Aguinaldo Highway cor. Molino Blvd.
NS-2	Sta.3+500	-	-	Bacoor	-	-	small creek
NS-3	Sta.7+380	-	-	Imus	4.9	Bridge	
NS-3	Sta.8+500	Imus	-	Imus	9.9	Bridge	near new bridge already constructed, land reclamation is on-going for expansion of Citta Italia estate
NS-3	Sta.10+800	Imus	-	Imus	1.8	Bridge	
NS-3,4	Sta.12+280	-	-	Imus	-		Daang Hari Crossing
NS-4	Sta.12+550	Imus	Baluctot	Imus	20.9	Bridge	moderately deep
NS-4	Sta.14+320	Imus	-	Imus	34.7	Bridge	near suspention pedestrian bridge
NS-4	Sta.15+100	-	-	Imus	-	Overpass	Salitran Road
NS-4	Sta.17+060	Imus	-	Dasmariñas	3.0	Bridge	near existing irrigation weir
NS-4,5	Sta.19+000	-	-	Dasmariñas	-	Overpass	Auguinaldo Highway
NS-5	Sta.21+100	San Juan	Dasmariñas	Dasmariñas	11.8	Bridge	near Bucal Bridge under construction of widening
NS-5	Sta.21+300	-	-	Dasmariñas	-	Overpass	Governors Drive
NS-5	Sta.25+450	San Juan	Ylang Ylang	Silang	2.9	Bridge	
NS-5	Sta.26+666			Silang		Interchange	CALA Expressway
Daang Hari (DH)							
DH-1	Sta.0+000	-		Muntinlupa City	-	-	Boundary of Muntinlupa City and Municipality of Imus
DH-1	Sta.3+200	-	-	Muntinlupa City / Imus	-	-	the corner of Daang Hari
DH-3	Sta.3+420	-	-	Imus	3.4	Bridge	
DH-3	Sta.6+100	Zapote	Don Cella	Imus	10.9	Bridge	
DH-3	Sta.7+100	Zapote	-	Imus	4.6	Bridge	
DH-3	Sta.8+100	-	-	Imus	1.3	Bridge	
DH-3	Sta.9+300	Imus	-	Imus	7.7	Bridge	
DH-3	Sta.12+050	Imus	-	Imus	54.6	Bridge	near new bridge under construction
DH-3,4	Sta.12+300	-	-	Imus	-		North-South Crossing
DH-4	Sta.13+640	Imus	-	Imus	8.7	Bridge	
DH-4	Sta.15+220	San Juan	-	Imus	52.0	Bridge	
DH-4	Sta.17+300	San Juan	Pasong Cama Chi	General Trias	11.4	Bridge	
DH-4	Sta.17+400	San Juan	Rio Grande	General Trias	51.1	Bridge	near existing suspension bridge
DH-4	Sta.18+960	Cañas	Cañas	General Trias	95.8	Bridge	
DH-4	Sta.24+268			Tanza			Coastal Road
CALA Expressway (CE)							
CE-1	Sta.0+000	-		Santa Rosa		Interchange	SLEX
CE-1,2	Sta.5+150	-	-	Silang	-	Overpass	Sta.Rosa-Tagaytay Road Crossing
CE-2	Sta.5+820	Banava	-	Silang	12.3	Bridge	
CE-2	Sta.7+200	Banava	-	Silang	1.6	Bridge	moderately deep
CE-2	Sta.7+720	Banava	-	Silang	4.5	Bridge	moderately deep
CE-2	Sta.8+500	Banava	-	Silang	2.2	Bridge	
CE-2	Sta.9+200	Biñan	-	Silang	1.4	Bridge	
CE-2	Sta.9+600	-	-	Silang	-	-	Westgrove Heights
CE-2	Sta.10+840	Biñan	-	Silang	8.8	Bridge	
CE-2	Sta.13+250	San Pedro	-	Silang	12.7	Bridge	Downstream of confluence, deep valley with thick vegetation
CE-2	Sta.15+320	Imus	-	Silang	13.2	Bridge	deep valley
CE-2,3	Sta.14+650	-	-	Silang	-	Overpass	Aguinaldo Highway
CE-3	Sta.16+800	Dasmariñas	-	Silang	4.9	Bridge	
CE-3	Sta.17+200	-	-	Silang	-	Interchange	End of North-South
CE-3	Sta.19+300	San Juan	Ylang Ylang	Silang	8.8	Bridge	
CE-4	Sta.22+881			Silang			Governors Drive

Note: (1, Tentative figures to be further veirfied through finalization of alingment in the feasibility study

Figure 5.1 Photos Showing Particular Issues in the North-South Road

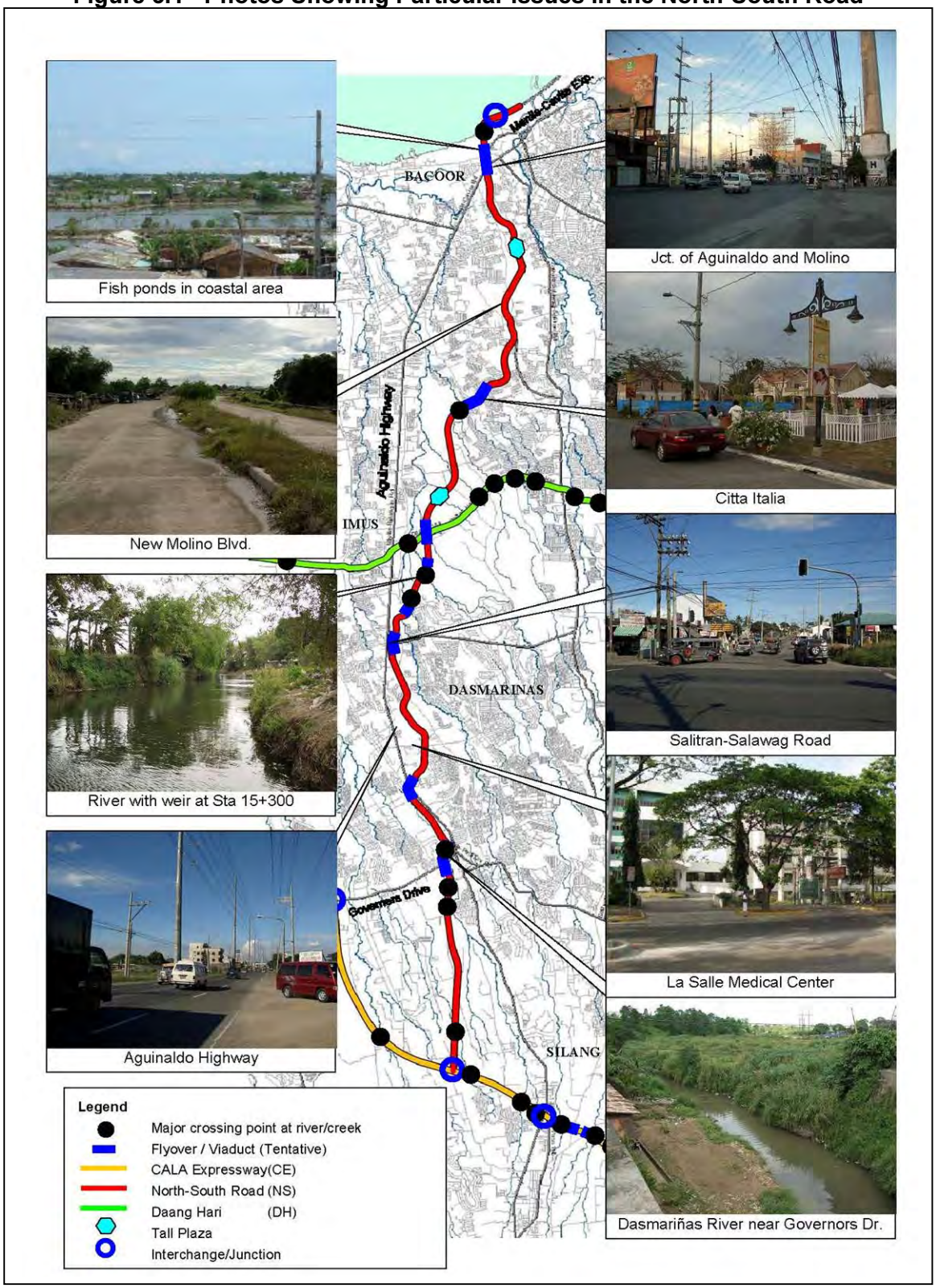


Figure 5.2 Photos Showing Particular Issues in Daang Hari

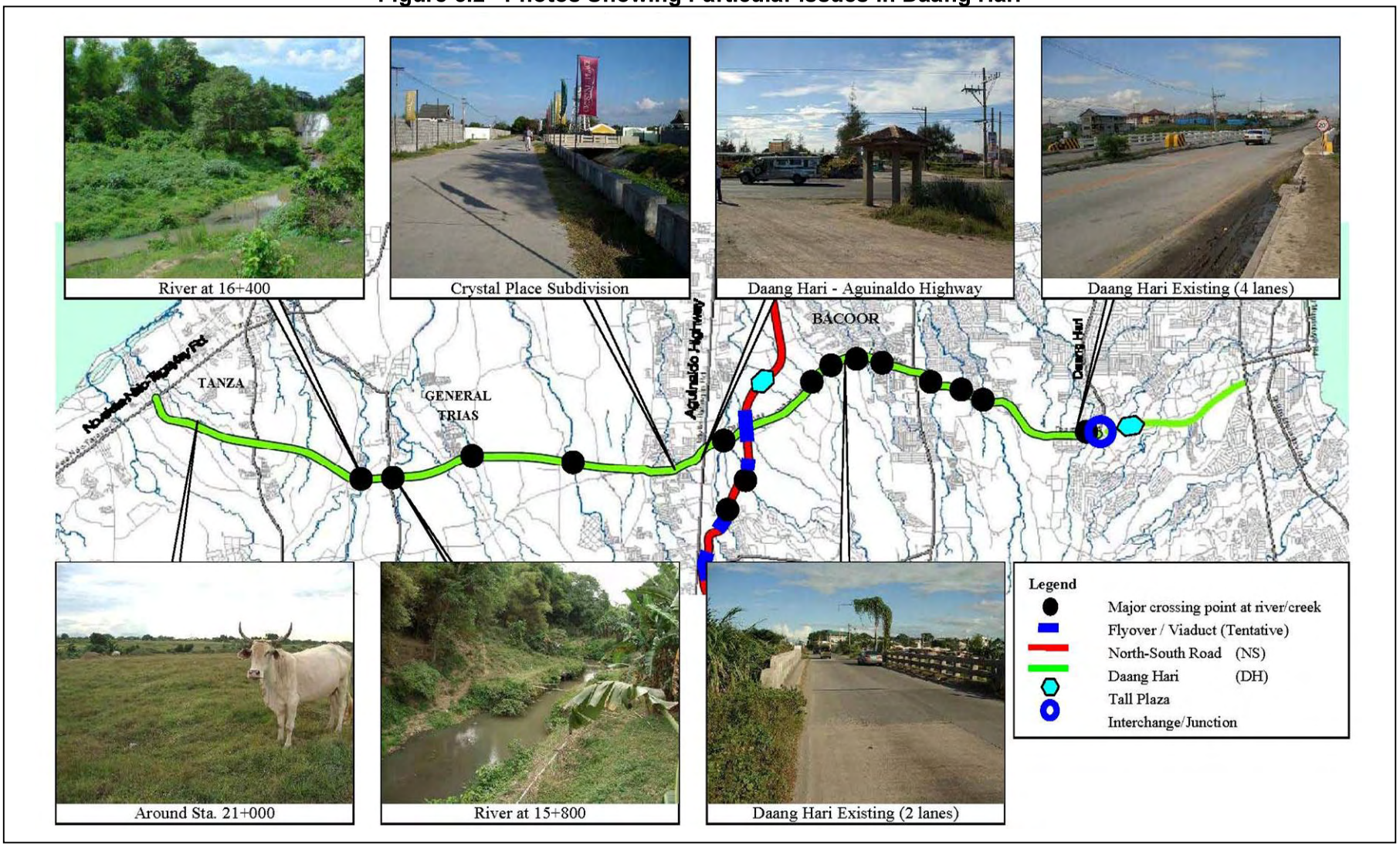


Figure 5.3 Photos Showing Particular Issues in the CALA Expressway

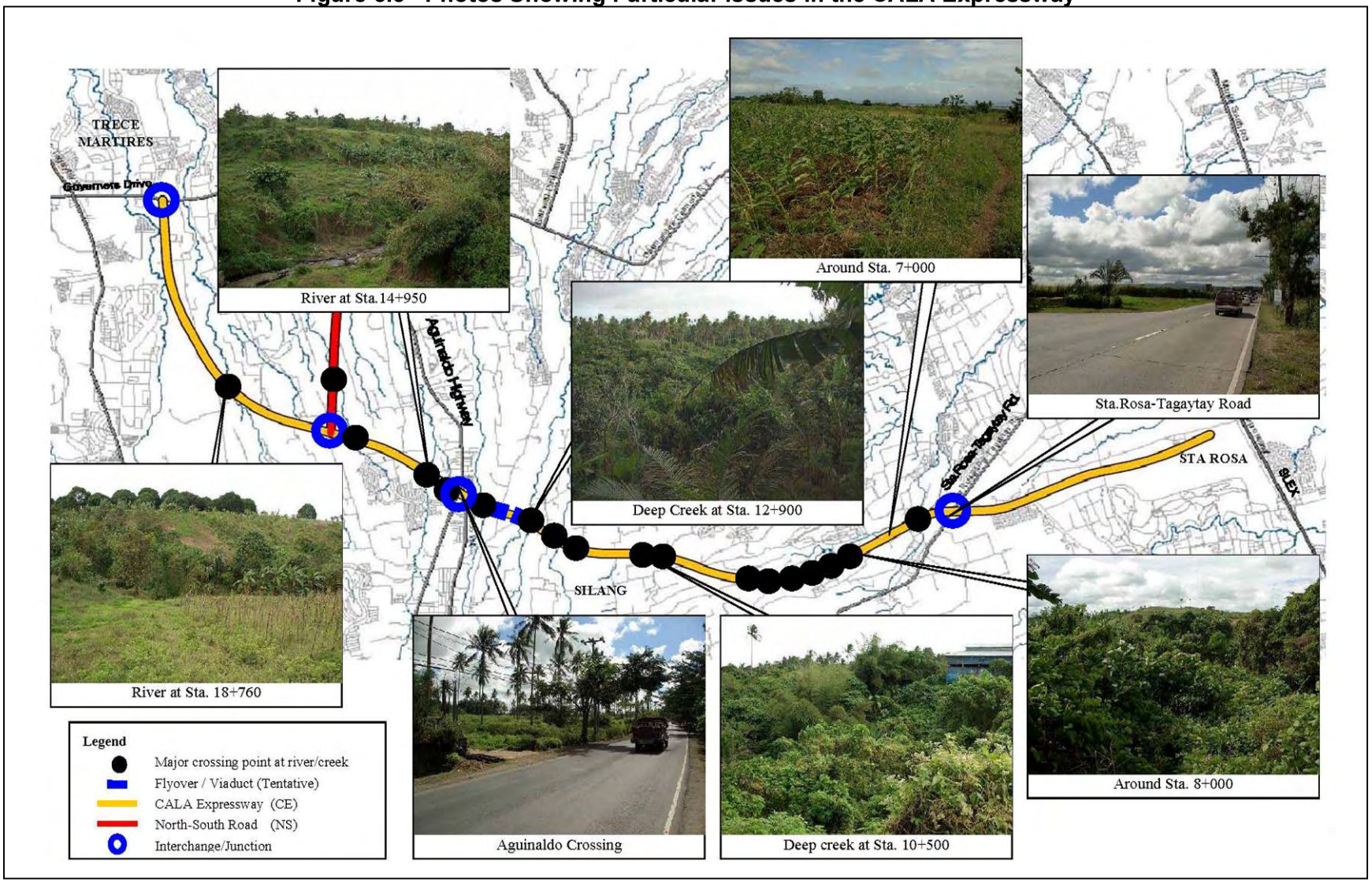


Table 5.5 Emission Factors for Typical Construction Equipment

	Emission Factors (g/hp-hr)					
Equipment Type	**THC**	**Aldehyde**	**NOx**	**SOx**	**CO**	**PM**
Diesel						
Track-type Tractor	0.75	0.17	11.00	0.85	2.15	0.69
Wheeled Tractor	1.76	0.28	11.00	0.85	7.34	1.27
Wheeled Dozer	0.37	0.16	11.00	0.87	2.28	0.41
Scraper	0.55	0.28	11.00	0.90	2.45	0.79
Motor Grader	0.36	0.12	11.00	0.87	1.54	0.63
Wheeled Loader	0.97	0.20	11.00	0.86	2.71	0.81
Track type Loader	1.11	0.10	11.00	0.85	2.26	0.66
Off-Highway Truck	0.37	0.22	11.00	0.89	2.28	0.50
Roller	0.97	0.20	11.00	1.00	6.03	0.78
Miscellaneous	1.01	0.20	11.00	0.93	4.60	0.90
GASOLINE						
Gasoline Misc.	6.49	0.22	4.79	0.26	198.00	0.30
Fugitive Dust						10.91 lb/acre-hr

Source: www.sbcapcd.org

Data in Table 5.5 shows that the air pollution load is dependent on the horsepower rating and usage duration of the particular equipment.

Mitigation Measures:

Regular water sprinkling should be done especially during dry and windy days to minimize increase in TSP. The speed of vehicles traversing the construction areas should be regulated to about 20 km/h or less. Proper handling and storage of spoil materials should also be observed.

For gaseous contaminants, proper maintenance of the engines will lead to proper burning of fuel which will help lessen gaseous emission.

6) Increase in Noise Levels

Use of heavy equipment during construction activities will lead to noise increase at the various construction sites and along access roads. Operation of different construction equipment generates noise that could vary in intensity. The expected noise sources during the construction of the project are the earthworks equipment such as jackhammers, bulldozers, graders, pay loaders, generators, compressors and heavy trucks. The expected noise levels at various distances from the equipment are shown in Table 5.6

Noise increases are temporary and short-term in nature and will only affect the immediate vicinity of the project site. Noise levels will be intermittent and are not expected to interfere with the daily activities of people living nearby. It is expected that noise will have a minimal impact to the human settlement in the area.

Personnel involved in the transfer and delivery of concrete products must be provided with mask and goggles.

Table 5.6 Noise Levels of Construction Equipment at Varying Distance

Equipment	Distance (m)				
	15	30	60	120	240
Earthmoving equipment					
Front loaders	75	69	63	57	51
Backhoes	85	79	73	67	61
Graders	88	82	76	70	64
Trucks	91	85	79	73	67
Materials Handling					
Concrete mixers	82	79	73	67	61
Cranes	83	77	71	65	59
Stationary sources					
Generators	78	72	66	60	54
Compressors	81	75	69	63	57
Pumps	76	70	64	58	52
Impact Equipment					
Pile drivers	101	95	89	83	77
Jackhammers	88	82	76	70	64

The data in Table 5.6 shows that the sound levels exceed the standards set in Sec. 78 of P.D. 984 for Categories A to D at morning, daytime, and nighttime at 30 m. The effect will worsen if the workers are nearer to the equipment (less than 30 m) and exposed for long periods of time, e.g., operators of heavy mechanized equipment. Effects would include anxiety, hearing changes, interference with speech communications, annoyance, etc.

Mitigation Measures:

An appropriate speed limit of about 20 km/h should be maintained for construction related equipment when passing through populated areas. Vehicle engines and heavy equipment shall be required to install silencers or mufflers and properly maintain the vehicles to minimize noise emissions. Construction activities should be scheduled during daytime to minimize impacts to the population nearby.

Implementation of noisy construction activities or noise generating activities must be scheduled during daytime especially in commercial and residential areas

Workers directly exposed to noisy equipment must be provided with of ear mufflers.

7) Increase in Solid Waste Generation

Construction will generate various waste materials such as rock/soil debris, steel cables, concrete slugs, broken hollow blocks, excess or scrap materials from the supply stock, sand and gravel, concrete nails, packaging material like empty cement bags, cardboard boxes, among others. Oil and grease from heavy equipment may also contaminate the soils in the area if these are not disposed properly. Additional domestic wastes may come from the construction workers. Collectively, these could contribute to the existing municipal solid wastes being generated in the area.

Mitigation Measures:

The DPWH must require its contractors to implement a waste management program consistent with the provisions of RA 9003. This must include the regular collection and disposal of wastes to a suitable disposal facility site to be designated by the concerned LGU. The program would observe the following waste management practices:

- Provision of waste bins in various strategic points within the construction area for the workers to dispose their wastes. Wastes from these containers will be collected (dump truck of the contractor) regularly to be disposed at a designated waste disposal site.
- Re-use and recycling of scrap materials and containers such as bottles, cans, boxes and plastics as much as practicable or selling them to scrap buyers.
- Conduct of a thorough orientation of workers on proper waste disposal practices.
- Re-use construction spoils as aggregate or filling materials where practicable.
- Regular hauling of construction debris to the designated disposal area to prevent their accumulation on-site resulting to negative effects on the landscape.
- Conduct of equipment/vehicle cleanup and maintenance in only one designated area located as far away as possible from waterways. Spent and used oil should be collected and placed in sealed containers and disposed of properly to prevent draining into waterways or sold to used oil recyclers/buyers.
- Efficient housekeeping practices including the use of covered receptacles for refuse generated by workers and construction scrap/debris will ensure the proper handling and disposal of solid wastes.

(2) Biological Environment

1) Loss and Disturbance/Damage to Existing Vegetation

The proposed road will lead to the permanent removal of the existing vegetation cover within the established right of way. Ecologically, this will have insignificant impact as the area to be affected corresponds to a grassed over agricultural area.

Mitigation Measures:

On critical areas (e.g., exposed soil/land on sloping terrain prone to wind and water erosion; waterways and drainages leading to aquatic habitat) immediate vegetative plantings must be pursued.

A tree inventory must be undertaken within the proposed road corridor. Normally, the proponent requests the regional DENR office to undertake the inventory. The trees to be cut must be replaced by a corresponding number of trees as specified by the DENR. Where possible, tree balling must be undertaken. Permit to cut trees must be secured from the local DENR.

2) Aquatic Habitat Alteration and Temporary Displacement of Species

Bridge construction will result in the unavoidable movement of excavated and construction materials into the local waterways. This will result in the local and short term alteration of the aquatic habitat and the temporary displacement local fish species. Considering the degraded status of most of the rivers to be traversed by the road alignment, the impacts are deemed insignificant.

Mitigation Measures:

In order to minimize the degradation of the local aquatic ecosystem, the mitigation measures for the reduction of siltation and contamination from heavy equipment must be implemented. These measures include among others the observance of proper materials handling for trucks and vehicles laden with loose materials which cross waterways, the provision of covers for the said vehicles and slower speed to minimize the probability of spillage. Waterways should not be used as areas for washing or cleaning of heavy equipment.

(3) Socio-economic Environment

1) Loss of land, house and other assets

Acquisition of right-or-way (ROW) for the three proposed road alignments will directly affect a total of 605 households residing in 19 barangays all in the seven (7) municipalities of Cavite province. Most (69.9%) of these households are located in the North-South Road alignment, mostly residents of Bacoor and Dasmariñas municipalities (see Table 5.7).

Table 5.7 No. of Directly Affected HHs and Corresponding No. of Barangays

City/Municipality	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments		
	Bgy	HH	Bgy	HH	Bgy	HH	Bgy	HH	%
Bacoor	6	344					6	344	56.9
Dasmarinas	3	65					3	65	10.7
Gen. Trias			3	13			3	13	2.1
Imus	2	14	2	44			4	58	9.6
Silang					1	10	1	10	1.7
Tanza			1	3			1	3	0.5
Muntinlupa City			1	112			1	112	18.5
Total	**11**	**423**	**7**	**172**	**1**	**10**	**19**	**605**	**100.0**
% of Total Bgy	57.9	-	36.8	-	5.3	-	100.0	-	-
% of Total HH	-	69.9	-	28.4	-	1.7	-	100.0	-

Source: Household Invrentry Surey and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project

There will be no affected HH in NS5 section of the proposed north-south alignment which is in Dasmarinas and Silang.

Out of the 605 affected HHs, 91.9% claimed they own the house that they are residing, about 18.5% of whom also own the land that they occupy while the others merely own the house and rent the land. The rest of the affected HHs is either illegal occupants of the land or whose tenure over the land has yet to be ascertained.

On the other hand, the land occupied by more than half (55.7% of the HHs are actually public land, and only about one third of them are occupying privately-owned land. The status of the land occupied by the rest of the HHs has yet to be ascertained. See Table 5.8.

Table 5.8 No. of Directly Affected HHs by Tenure and Status of Land

Tenure Over Land & House	City/Municipality							Total	
	Bacoor	Dasmarinas	Gen Trias	Imus	Silang	Tanza	Muntinlupa City	No.	%
Own land and house	15	39	7	32	10	0	0	103	17.0
Rent land and own house	86	0	0	0	0	1	0	87	14.4
Rent land and house	25	5	0	4	0	0	0	34	5.6
Illegal occupancy of land and own house	146	6	0	6	0	0	0	158	26.1
With permission to use land and own house	70	7	6	9	0	0	111	203	33.6
No Answer	2	8	0	7	0	2	1	20	3.3
Total	**344**	**65**	**13**	**58**	**10**	**3**	**112**	605	100.0
Land Status									
Privately-owned	76	54	13	28	10	0	1	182	30.1
Public land	224	5	0	3	0	0	105	337	55.7
No Answer	44	6	0	27	0	3	6	86	14.2
Total	**344**	**65**	**13**	**58**	**10**	**3**	**112**	605	100.0

Source: Household Inventory Survey and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project

Majority of the HHs have monthly income P10,000 and below. Less than 1% has monthly income of more than P70,000. See Table 5.9.

Table 5.9 No. of Directly Affected HHs by Monthly HH Income

Monthly HH Income (PhP)	City/Municipality							Total	
	Bacoor	Dasmarinas	Gen Trias	Imus	Silang	Tanza	Muntinlupa City	No.	%
Below PhP 5,000	110	21	5	25	0	0	16	177	29.3
5,001 - 10,000	134	20	2	7	0	0	18	181	29.9
10,001 - 15,000	44	8	2	6	2	0	16	78	12.9
15,001 - 20,000	19	2	2	2	6	0	15	46	7.6
20,001 - 25,000	9	2	2	4	0	0	6	23	3.8
25,001 - 30,000	1	0	0	4	0	0	7	12	2.0
30,001 - 35,000	3	2	0	2	1	0	6	14	2.3
35,001 - 40,000	1	2	0	0	1	0	1	5	0.8
40,001 - 45,000	0	0	0	0	0	0	4	4	0.7
45,001 - 50,000	1	1	0	1	0	0	1	4	0.7
50,001 - 55,000	1	0	0	0	0	0	2	3	0.5
55,001 - 60,000	0	0	0	0	0	0	0	0	0.0
60,001 - 65,000	0	0	0	1	0	0	0	1	0.2
65,001 - 70,000	0	0	0	0	0	0	0	0	0.0
70,001 - 75,000	2	0	0	1	0	0	1	4	0.7
75,001 - 80,000	1	0	0	0	0	0	0	1	0.2
80,001 - 85,000	0	0	0	0	0	0	0	0	0.0
85,001 - 90,000	1	0	0	0	0	0	0	1	0.2
90,001 - 95,000	0	0	0	0	0	0	1	1	0.2
95,001 - 100,000	0	0	0	0	0	0	1	1	0.2
Over PhP 100,000	0	0	0	0	0	0	0	0	0.0
No Answer	17	7	0	5	0	3	17	49	8.1
Total	344	65	13	58	10	3	112	605	100.0

Source: Household Inventory Survey and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project

Sixty-nine percent (69.1%) of the HHs have houses with floor area below 50 m^2, and 52.1% have home lots with less than 100 m^2. See Tables 5.10 and 5.11.

Table 5.10 No. of Affected HHs by Floor Area of House

Floor Area (sq.m.)	City/Municipality							Total	
	Bacoor	Dasma-rinas	Gen Trias	Imus	Silang	Tanza	Muntinlupa City	No.	%
50 & Below	253	28	10	26	2	3	96	418	69.1
51 - 100	70	17	3	17	8	0	14	129	21.3
101 - 150	7	13	0	7	0	0	1	28	4.6
151 - 200	6	6	0	8	0	0	0	20	3.3
201 - 250	2	1	0	0	0	0	0	3	0.5
251 - 300	2	0	0	0	0	0	0	2	0.3
Above 300	2	0	0	0	0	0	0	2	0.3
No Answer	2	0	0	0	0	0	1	3	0.5
Total	**344**	**65**	**13**	**58**	**10**	**3**	**112**	**605**	**100.0**

Source: Based on the Household Inventory Survey and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project

Table 5.11 No. of Affected HH by Size of Home Lot

Size of Home Lot (sq.m.)	City/Municipality							Total	
	Bacoor	Dasma-rinas	Gen Trias	Imus	Silang	Tanza	Muntinlupa City	No.	%
100 & Below	234	23	7	11	6	0	34	315	52.1
101 - 200	13	17	0	9	4	0	23	66	10.9
201 - 300	7	4	1	2	0	3	16	33	5.5
301 - 400	3	0	1	0	0	0	2	6	1.0
401 - 500	3	0	1	0	0	0	10	14	2.3
501 - 600	3	0	0	0	0	0	10	13	2.1
601 - 700	0	0	0	0	0	0	1	1	0.2
701 - 800	0	1	0	0	0	0	7	8	1.3
801 - 900	0	1	0	0	0	0	0	1	0.2
901 - 1000	1	3	0	1	0	0	3	8	1.3
Above 1000	2	1	1	1	0	0	1	6	1.0
No Answer	78	15	2	34	0	0	5	134	22.1
Total	**344**	**65**	**13**	**58**	**10**	**3**	**112**	**605**	**100.0**

Source: Based on the Household nventory Survey and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project

Almost half (46.1%) of the affected households have single-detached one-storey type of houses. A few of these houses are relatively large and made of expensive materials belonging to well-off families, such as those in Bacoor and Silang. See Table 5.12.

Table 5.12 No. of Affected HH by Type of Houses

Type of House	City/Municipality							Total	
	Bacoor	Dasma-rinas	Gen Trias	Imus	Silang	Tanza	Muntinlupa City	No.	%
SD 1-storey	106	35	13	44	6	3	72	279	46.1
SD 2-storey	80	9	0	10	4	0	17	120	19.8
Apartment	17	5	0	2	0	0	1	25	4.1
Duplex	1	2	0	0	0	0	7	10	1.7
Shanties	140	14	0	2	0	0	15	171	28.3
Total	**344**	**65**	**13**	**58**	**10**	**3**	**112**	**605**	**100.0**

Note: SD – Single-Detached
Source: Household Inventory Surve and Perception Survey conducted under the Feasibility Study and Implementation Support on the CALA East-West National Road Project.

The other properties that will be affected include perennial and seasonal crops, such as mangoes, coconut, coffee, cacao, pineapple, papaya and vegetables. The actual extent of these losses will be determined during the detailed engineering phase of the project.

Mitigation measures:

The land to be acquired for the ROW requirement of the project and the properties thereon, including houses, crops and other structures, will be compensated based on a compensation scheme to be established by DPWH in consultation with the project affected families or persons (PAFs/PAPs) and concurred by the foreign-funding agency that provide financial assistance to the project in accordance with the Project Agreement entered into by the Philippine Government and the said funding agency.

Compensation for privately-owned land will be given to the rightful owner or legitimate heir. Occupied public land has no replacement value and as such, is not subject to compensation. However, the project will acquire it in accordance with law and make it a property of the DPWH in behalf of the government. Tenants tilling an affected land will be entitled to compensation in accordance with the adopted compensation scheme.

The replacement cost of structures other than the house, and the standing crops, be these in privately-owned or public land, will be determined taking into consideration the assessed value as established by the municipal and provincial assessor's office or the Department of Environment and Natural Resources (DENR), and the fair market value. Payment will be given to the rightful owner of these improvements, be it landowner, tenant, or informal settler. Compensation for the other losses that have yet to be identified will be determined in accordance with the adopted compensation scheme.

To ensure compliance to these mitigation measures, a Land Acquisition and Resettlement Plan (LARP) will be prepared and finalized by the DPWH in consultation with the PAFs/PAPs subject to the concurrence of the foreign-funding agency. The LARP will provide the mechanism for redress of grievances and settlement of disputes between and among PAFs/PAPs and the Project, especially those related to ROW acquisition entitlement, valuation and compensation.

The DPWH will implement the LARP in coordination and with the assistance of the respective LGUs, and concerned national government agencies such as the National Housing Authority (NHA), DENR, DAR and the Philippine National Police.

It is clear from the results of the household and perception surveys and FGDs conducted in all the affected barangays that only a small percentage of the directly affected households fully accept resettlement as an alternative measure to mitigate their losses. More information campaign and consultations will thus be undertaken to further enlighten the affected communities. Their views and suggestions will be considered in finalizing LARP to thus enhance social acceptability of the project, particularly the measures to mitigate its adverse impacts on the PAFs/PAPs.

2) Employment opportunities and influx of migrant workers

Numerous employment opportunities will be generated by the project during the construction phase. The project will hire worker for the duration o the construction period and need both skilled and unskilled workers.

Considering the large percentage of unemployed labor force in the project area keen competition for the job opening is expected to ensue between and among residents and those from neighboring communities, which could create social tension and potential peace and order problem in the area. This situation will be aggravated by the entry of migrant workers that might be brought in from other places by the project contractors.

Aside from reducing the number of jobs available to the residents, the migrant workers might bring along their families that will only add to the health and sanitation problem, and eventually settle as squatters in the project area.

Mitigation measures:

To minimize or altogether prevent these problems from happening and, instead, promote harmonious social relationship in the area, appropriate measures will be instituted so that the generated employment opportunities will be enjoyed by the community and that the entry of migrant workers would not heighten competition nor create social problems in the area.

The DPWH will adopt a system of screening and hiring of labor force in consultation with the LGUs and implement the system in coordination and with the assistance of the latter. The system will provide the following:

- Conduct of orientation for all recruited labor force and technical staff prior to actual construction work. The orientation will include desirable working relationship, especially between locals and migrant workers. No one will be admitted to work without undergoing the orientation;
- All registered household members will have the opportunity to work in various civil works depending on skills;
- A scheme of prioritizing the labor force will be adopted based on a selection and hiring criteria to be established by DPWH in consultation with the LGUs and the affected HHs; and
- Priority hiring will be given to the PAFs/PAPs, depending on available job and skill of applicants.

3) Livelihood and business opportunities

Opportunities for additional livelihood activities and expanded business operation are also expected to be generated during the construction of the project. Small livelihood activities like sari-sari stores, food catering, laundry and other related services will be in demand

especially so if many of the construction workers are residents from places far away from the construction site or are migrant workers hired from outside the municipality or province. Local business will be enhanced if much of the construction materials and services as well as domestic needs of workers are sourced locally.

Increase in livelihood activities and business operation will enhance the income of residents and local enterprises. This will redound to increase in revenues to the LGUs, in the form of taxes, and hence additional source of funds to improve the delivery of basic LGU services to the community.

Enhancement measures:

To enable the local residents and businesses to enjoy the generated opportunities, the project will adopt a policy that the procurement of construction materials and other supply requirements should, as much as possible, be done within the municipality or city; or within the province or region where these municipalities are located.

4) Potential health, sanitation and safety problems

Health and sanitation problems are expected if many of the workers hired by the project have o stay at the construction, which especially applies to migrant workers, due to the solid waste and sewage that they will generate daily at the site. Moreover, the people living near the construction site and the laborers will be exposed to construction hazards that could lead to accidents unless appropriate safety measures are put in place.

Mitigation measures:

Construction contractors of the project will be required to provide temporary housing for their workers with provision for adequate water and toilet facilities. They will also be required to implement proper solid waste management and disposal. Construction workers will be instructed to strictly observe proper hygiene and sanitation practices at the site.

To ensure safety within or near the work areas, appropriate safety gears will be required of worker. Appropriate enclosures and signage will be also put in place where necessary, especially in excavated areas and road corners to avoid accidents.

5) Change in land value

The areas traversed by or located near the new roadways will change in value. Improved access will increase the value of lots while unfavorable partition will contribute to possible decline in assessment. The rise in value will translate to higher real estate taxes for the concerned LGU. In the case of lot owners, the increase in land value can only be realized if their properties are sold or leased.

Enhancement measures:

The local government units must undertake an assessment of properties within its jurisdiction to provide local residents, establishments and institutions an updated appraisal of the value of the land in the area prior to construction.

5.2.2 Impacts during the Operation and Maintenance Phase

(1) Physical Environment

1) Erosion of at the discharge points of the road storm drains

The roadway shall be provided with a drainage system which will collect storm water and discharge them at specific points within the ROW. If these discharge points remain unprotected, the concentrated impact of the water could bring about erosion which could affect the slopes or embankments of the roadway.

Mitigation Measure:

Dissipators must be placed at the major discharge points of the storm drains of the proposed road alignment.

2) Increased Air Pollution

a) CO, NO_x, SO_2, PM, Pb

Air emission during the completion and usage of the NS Road, EW Road, and CALA Expressway will come from motor vehicles and the pavement (for particulates). Gaseous emissions like CO, NOx, and SOx will be emitted by motor vehicles while particulates will mostly come from the road pavement. In estimating the pollution load of the proposed project, the following data was used:

- Traffic projection data provided by DPWH; and
- Vehicle emission factors from Table 5.15, Appendix 4 of the World Bank URBAIR Metro Manila Report (1997).

Table 5.13 Traffic Forecast (2010-2030)

Project Component		Length (km)	Capacity (1,000 PCU/day)	Volume (1,000 PCU)				Volume Capacity Ratio (VCR)			
				2010	2015	2020	2030	2010	2015	2020	2030
NS	NS-1	1.39	102.7	105.2	106.9	107.5	119.3	1.02	1.04	1.05	1.16
	NS-2	4.75	102.7	115.1	123.4	129.6	131.8	1.12	1.20	1.26	1.28
	NS-3	6.21	102.7	70.1	104.7	116.7	140.7	0.68	1.02	1.14	1.37
	NS-4	6.75	102.7	-	112.1	116.3	134.1	-	1.09	1.13	1.31
	NS-5	7.56	102.7	-	103.1	89.3	107.5	-	1.00	0.87	1.05
	Total	**26.66**	**102.7**	**99.5**	**111.1**	**111.9**	**127.0**	**0.97**	**1.08**	**1.09**	**1.24**
EW	EW-2	3.36	49.5	68.7	70.2	88.0	144.8	1.39	1.42	1.78	2.93
	EW-3	9.21	49.5	-	69.3	66.1	89.5	-	1.40	1.34	1.81
	EW-4	11.81	49.5	-	55.7	61.2	77.9	-	1.13	1.24	1.57
	Total	**24.38**	**49.5**	**82.8**	**65.1**	**69.8**	**93.2**	**1.67**	**1.32**	**1.41**	**1.88**
CE	CE-1	3.24	98.0	-	115.9	152.8	187.6	-	1.18	1.56	1.91
	CE-2	6.80	98.0	-	106.7	134.9	181.7	-	1.09	1.38	1.85
	CE-3	7.03	98.0	-	112.1	156.4	209.2	-	1.14	1.60	2.13
	CE-4	2.59	98.0	-	55.3	101.7	139.7	-	0.56	1.04	1.43
	Total	**19.66**	**98.0**	**-**	**94.8**	**130.5**	**174.3**	**-**	**0.97**	**1.33**	**1.78**

The VCR is one indicator of the level or degree of congestion in a road section. The actual traffic volume is taken from the survey conducted while the road carrying capacity is estimated based on conditions of the road. The congestion ratio is expressed as the Level of Service (LOS) criteria of a road section shown in Table 5.14.

Table 5.14 Level of Service (LOS) Criteria

V/C Ratio	Level of Service (LOS)	Description
Less than 0.2	A	Free flow traffic
0.21 to 0.50	B	Free flow traffic
0.51 to 0.70	C	Moderate traffic
0.71 to 0.85	D	Moderate/ heavy traffic
0.86 to 1.00	E	Heavy traffic
Greater than 1.0	F	Forced flow; stop & go

Data shown in Table 5.13 indicate the projected total VCRs are approaching or greater than 1.0. Based on the LOS criteria in Table 5.14, these VCRs depict a forced flow, stop-and-go condition. This implies that emissions will not only come from moving motor vehicles (free-flowing, highway conditions) but also from queuing during stop-and-go conditions.

The worst case scenario for the pollution load from a road network based on the available data was estimated using vehicle free-flow emissions factors of the World Bank URBAIR-Metro Manila Report (1997). Although the traffic projection VCRs in Table 5.13 showed forced flow conditions prevailing, it is difficult to determine the actual road conditions, i.e., what sections of the road are free-flowing, duration of free flow, sections where vehicle will queue, etc. Estimation of air pollutants will be done assuming a free-flowing condition for the entire length of road.

Table 5.15 Emission Factor for Free-flowing Conditions

(Unit: g/veh-km)

Air Residual	Car	Jeepney	Bus	Truck
CO	49.5	2.5	12.4	12.4
NOx	2.7	1.4	12.5	12.5
SO_2	0.011	0.121	0.374	0.374
Pb	0.073	-	-	-
TSP	0.1	0.9	1.5	1.5

Source: WB URBAIR Metro Manila Report, 1997

Further, since the traffic projection was only in terms of PCUs (no vehicle mix analysis), the highest emission factor was used in calculating the loads for the worse case scenario. Table 5.16 shows the pollutant estimates for the free-flow condition.

Table 5.16 Pollutant Estimates for Free-flow Conditions (2010-2030)

(Unit: million ton)

Pollutant	Road Component											
	NS				EW				CE			
	2010	2015	2020	2030	2010	2015	2020	2030	2010	2015	2020	2030
CO	131	147	148	168	100	79	84	112	0	92	127	170
NOx	33	37	37	42	25	20	21	28	0	23	32	43
SO_2	1	1	1	1	1	1	1	1	0	1	1	1
PM	4	4	4	5	3	2	3	3	0	3	4	5
Pb	0.19	0.22	0.22	0.25	0.15	0.12	0.12	0.17	0.00	0.14	0.19	0.25

To estimate of the equivalent concentrations of these pollutants in the light of limited data for detailed modeling, a box model was applied. The “box model” is simple atmospheric

dispersion model used to calculate ground-level concentrations of specific air pollutants of concern emitted from a project activity. It is usually used in the absence of detailed meteorological data needed by other models, e.g., ISCST3, CALINE, etc.

A box model is based on the assumption that pollutants emitted to the atmosphere are uniformly mixed in a volume, or "box," of air (Canter, 1985). The most critical aspect of the usage of the box model is to establish, with rationale, the downwind, crosswind, and vertical dimensions of the box. In addition, the time period over which pollutant emissions will be considered must be established: a typical time period is one (1) hour. The time and physical dimension considerations are based on the assumption of steady state conditions, i.e. it is supposed that the emissions, wind speed, and characteristics of air available for dilution will not vary over time (Ortolano, 1985). A box model is also based on the assumption that discharges mix completely and instantaneously with the air available for dilution and the released material is chemically stable and remains in the air.

The box model can be used for single-point, multiple-point, area, or line, or "hybrid-type" sources of air pollutants. The basic box model used in the CALA project EIS is depicted in Figure 5.4 and mathematically expressed as follows (Ortolano, 1985; Canter, 1985):

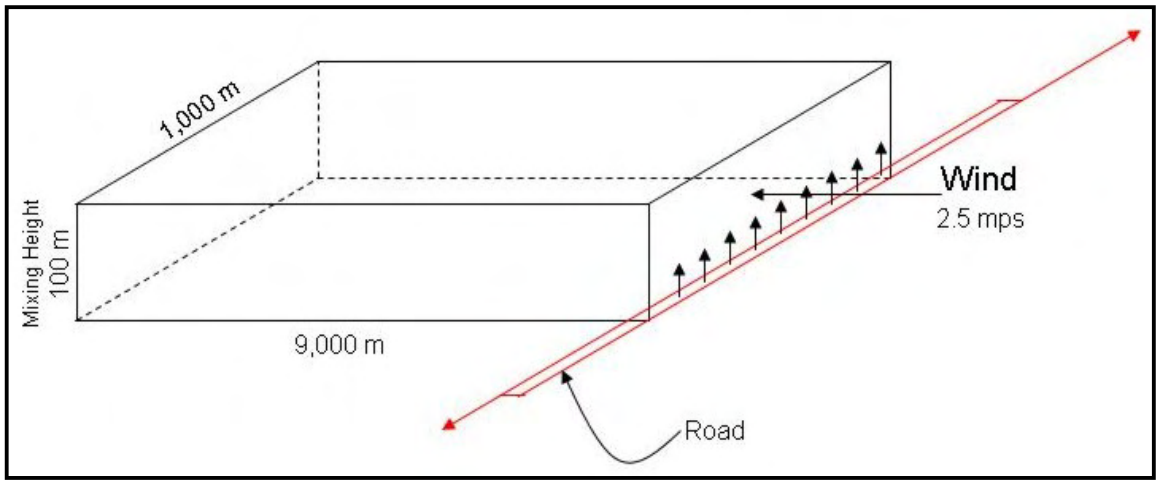
where C = average concentration of gas or particulate, throughout box, including at ground level ($\mu g/m^3$)
Q = release rate of gas, or particulates from source type (g/sec)
t = time period over which assumption of uniform mixing in box holds valid (3600 sec)
x = downwind dimension of box (m)
y = crosswind dimension of box (m)
z = vertical dimension of box (m)

The following assumptions were used:

a) The box model covers 1 km of each road network;
b) Wind is blowing perpendicular to the road network (PAGASA data shows annual wind direction is east);
c) Wind speed used is 2.5 m/s (PAGASA annual data);
d) Mixing height is 100 m (to give worse-case results);
e) Distance downwind after 1 hour is 9,000 m at a wind speed of 2.5 m/s;
f) Vehicle emissions are uniformly mixed inside the “box model”;
g) Emissions, wind speed, and characteristics of available air for dilution are constant with time;
h) Complete and instantaneous mixing of emissions.

Figure 5.4 shows the box model schematic figure.

Figure 5.4 Box Model



Results of the box model are shown in Table 5.17.

Table 5.17 Box Model Results

Road Component	NS				EW				CE			
YEAR	2010	2015	2020	2030	2010	2015	2020	2030	2010	2015	2020	2030
Pollutant	μ g/m3				μ g/m3				μ g/m3			
CO	16.7	18.6	18.7	21.3	12.7	10.0	10.7	14.3	0.0	11.7	16.1	21.5
NOx	4.2	4.7	4.7	5.4	3.2	2.5	2.7	3.6	0.0	3.0	4.1	5.4
SO_2	0.126	0.141	0.142	0.161	0.096	0.075	0.081	0.108	0.000	0.088	0.122	0.163
PM	0.505	0.564	0.568	0.644	0.384	0.302	0.324	0.432	0.000	0.355	0.488	0.652
Pb	0.025	0.027	0.028	0.031	0.019	0.015	0.016	0.021	0.000	0.017	0.024	0.032

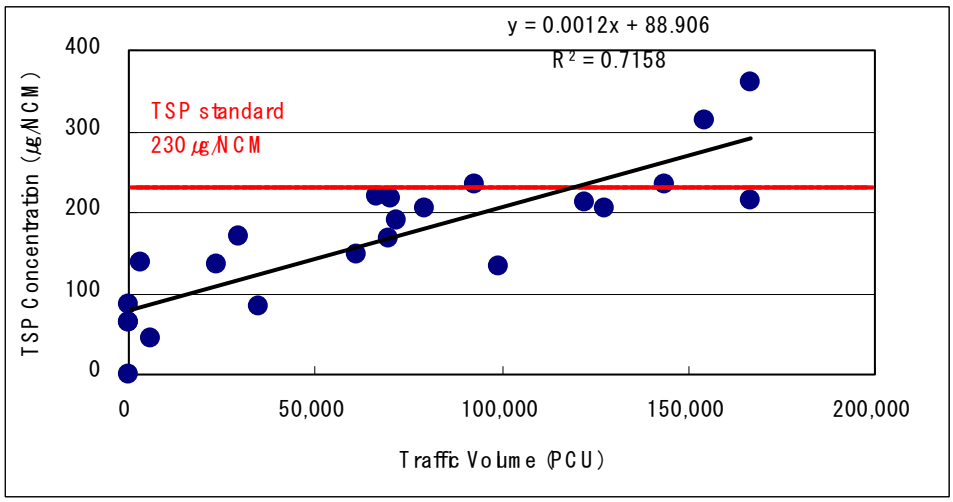
In the highways and roads, the primary pollutant of concern is carbon monoxide. The results showed that it is within the CAA one-hour standards despite the generality of the data and assumptions used. Results shows that predicted ambient concentrations of other residuals per km of the project used conform to the CAA one-hour standards. The low values for SO_2 indicate the low sulfur content of the fuels being used currently.

b) TSP

In theory, TSP level along roads is positively correlated with the traffic volume. Therefore, TSP levels of both baseline survey in CALA area and EMB monitoring in Manila area were determined the strength of a correlation with the traffic volume. Regarding the traffic volume, the result of field survey was converted into PCU.

The result of analysis showed positive correlation between TSP level and traffic volume. Its fitted curve was as following and R2 factor was 0.7158 (Figure 5.6).

Figure 5.6 Correlation Chart between Traffic Volume and TSP Concentration



Y= 0.0012 X +88.906
Y: TSP Concentration (μ g/NCM)
X: Traffic Volume (PCU)

Source: 2004 Philippine Statistical Yearbook and JICA study Team, 2006

Future TSP level was predicted based on future traffic volume by using the above model. The traffic volume was estimated as shown in Table 5.20 based on the implementation schedule and toll setting.

Table 5.20 Estimated Future Traffic Volume (000PCU)/day

Road Section		2010	2015	2020	2030
NS	NS-1	105.2	106.9	107.5	119.3
	NS-2	115.1	123.4	129.6	131.8
	NS-3	70.1	104.7	116.7	140.7
	NS-4	-	112.1	116.3	134.1
	NS-5	-	103.1	89.3	107.5
	Total	99.5	111.1	111.9	127
DH	DH-2	68.7	70.2	88	144.8
	DH-3	-	69.3	66.1	89.5
	DH-4	-	55.7	61.2	77.9
	Total	82.8	65.1	69.8	93.2
CE	CE-1	-	115.9	152.8	187.6
	CE-2	-	106.7	134.9	181.7
	CE-3	-	112.1	156.4	209.2
	CE-4	-	55.3	101.7	139.7
	Total	-	94.8	130.5	174.3

Note) -: the section is not constructed.

TSP level was calculated by using the above model based on the estimated traffic volume as shown in Table 5.21. The result of calculation showed that TSP levels of some sections exceed national standards (230 μ g/NCM) in 2015 (Colored values exceed national standard). Moreover, most of sections exceed it in 2030.

Table 5.21 Estimated TSP Level (μg/NCM)

Road Section		2010	2015	2020	2030
NS	NS-1	215.1	217.2	217.9	232.1
	NS-2	227.0	237.0	244.4	247.1
	NS-3	173.0	214.5	228.9	257.7
	NS-4	-	223.4	228.5	249.8
	NS-5	-	212.6	196.1	217.9
	Total	208.3	222.2	223.2	241.3
DH	DH-2	171.3	173.1	194.5	262.7
	DH-3	-	172.1	168.2	196.3
	DH-4	-	155.7	162.3	182.4
	Total	188.3	167.0	172.7	200.7
CE	CE-1	-	228.0	272.3	314.0
	CE-2	-	216.9	250.8	306.9
	CE-3	-	223.4	276.6	339.9
	CE-4	-	155.3	210.9	256.5
	Total	-	202.7	245.5	298.1

Note) -: the section is not constructed.

Mitigation Measures

Traffic controls, such as speed limits, traffic-volume restrictions will provide moderate emission reductions. Adjustments of intersection signal cycle may also reduce the accumulation of pollutants due to idling vehicles. Movement of certain vehicles such as heavy trucks, which have high emission rates, may be regulated through truck bans.

Regular road cleaning activity such as regular water sprinkling can also contribute to improvement of particulate level caused by construction of the project and regular traffic flow.

As a mitigation measure to be installed on the road, tree planting should be conducted along the roads, especially where pass htrough the built-up area.

3) Increased Noise Level

Noise impacts will be generated by the passing motor vehicles. The degree of sound level perception is dependent on the following factors:

a) Position of receptor;
b) Presence of barriers, e.g. trees, buildings, etc;
c) Motor vehicle speed; and
d) Meteorological conditions.

One major observation in perceiving traffic noise is that during daytime, this is considered part of the ambient noise levels that people tend to disregard. However, the same sound levels maybe perceived as nuisance at night. This shows that interpretation of whether a certain sound level is perceived as noise or not is subjective and dependent on various factors. The following table shows sound levels of some common motor vehicles when moving along a road or highway.

Table 5.22 Sound Levels of Some Common Motor Vehicles, dB(A)

Trade Name	Type		Fuel Type	Sound level in dB(A) at 7.5 m
NISSAN	200SX - S14 Series	2.0 Turbo Coupes	Petrol	66.2
NISSAN	QX - A32 Series	3.0 V6 Saloon	Petrol	66.7
NISSAN	QX - A32 Series	2.0 V6 Saloon	Petrol	66.7
MITSUBISHI	Space Wagon	2.4 GDI GLX	Petrol	67
MITSUBISHI	Space Wagon	2.4 GDI GLS	Petrol	67
MERCEDES-BENZ	C-Class Saloon (W202) Diesel	C 220 CDI Esprit Saloon	Diesel	67
VOLVO	S/V70 Model Year 2000	2.4T	Petrol	67
MAZDA	626	1.8i	Petrol	68
MAZDA	626	2.0 100kW (136ps)	Petrol	68
PROTON	Persona	1800 Coup0 1.0L EFi	Petrol	68.9
HONDA	Accord 4 Door (2000 YM)	1.8i VTEC SE	Petrol	69
HONDA	Prelude (1999 YM)	2.2i VTI	Petrol	69
DAIHATSU	Charade	Charade G200 Hatchback, 1.3L EFi	Petrol	69
LEXUS		IS200	Petrol	69
HYUNDAI	Accent	1.5 SOHC (2000MY)	Petrol	69
PROTON	Persona	1500 Saloon	Petrol	69.1
TOYOTA	Camry	2.2 Saloon Auto	Petrol	70
BMW	New 3 Series	318 Ci Coup	Petrol	70
MITSUBISHI	Galant - Saloon	2.4 GDI	Petrol	70
MITSUBISHI	Space Wagon	2.4 GDI GLX	Petrol	70
KIA	Sedona	2.5 V6 S/SX/GSX/Executive	Petrol	70
SUZUKI	Grand Vitara	2.0 TD Estate	Diesel	70.2
CHRYSLER JEEP	Jeep Grand Cherokee (00 Model Year)	4.0L	Petrol	71
TOYOTA	Landcruiser	4.7 Auto	Petrol	71
TOYOTA	RAV4	2.0 Auto	Petrol	71
HONDA	CR-V (2000 YM)	2.0i LS	Petrol	71.4

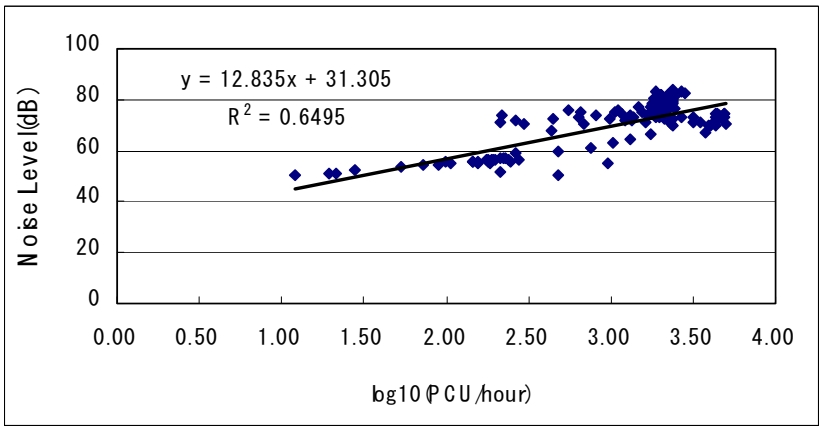
Source: http://www.xs4all.nl

It can be seen that the sound levels of motor vehicles listed in the preceding table exceeded the standards for Class AA, Class A, and Class B in all diurnal categories.

In theory, noise level along roads is positively correlated with logarithm of traffic volume. Therefore, noise level of baseline survey in CALA area was determined the strength of a correlation with logarithm of traffic volume. Regarding to traffic volume, the hourly data of field survey was converted into PCU/hour.

The result of analysis showed positive correlation between noise level and logarithm of traffic volume. Its fitted curve was as following and R2 factor was 0.6495 (Figure 5.5).

Figure 5.5 Correlation Chart between Logarithm of Traffic Volume and Noise Level



Y= 12.835 X +31.305
Y: Noise Level (dB)
X: Log 10 (Traffic Volume (PCU/hour))
Source: JICA study Team, 2006

Future noise level was calculated by using the above model based on the estimated traffic volume as shown in Table 5.23. The results of calculation showed that noise level of all sections exceed the national standards.

Table 5.23 Predicted Noise Level

Section	Morning	Daytime	Evening	Nighttime	Morning	Daytime	Evening	Nighttime
	2010				2015			
NS-1	79.4	79.5	79.0	77.3	79.4	79.6	79.1	77.4
NS-2	79.9	80.0	79.5	77.8	80.2	80.4	79.9	78.2
NS-3	77.1	77.3	76.7	75.1	79.3	79.5	78.9	77.3
NS-4	-	-	-	-	79.7	79.9	79.3	77.7
NS-5	-	-	-	-	79.2	79.4	78.9	77.2
DH-2	78.2	78.2	77.2	72.0	78.3	78.3	77.4	72.1
DH-3	-	-	-	-	78.2	78.2	77.3	72.0
DH-4	-	-	-	-	77.0	77.0	76.1	70.8
CE-1	-	-	-	-	81.1	81.1	80.1	74.9
CE-2	-	-	-	-	80.7	80.7	79.7	74.4
CE-3	-	-	-	-	80.9	80.9	80.0	74.7
CE-4	-	-	-	-	77.0	77.0	76.0	70.8
Section	**2020**				**2030**			
NS-1	79.5	79.7	79.1	77.5	80.1	80.2	79.7	78.0
NS-2	80.5	80.7	80.1	78.5	80.6	80.8	80.2	78.6
NS-3	79.9	80.1	79.5	77.9	81.0	81.2	80.6	79.0
NS-4	79.9	80.1	79.5	77.9	80.7	80.9	80.3	78.7
NS-5	79.2	79.4	78.9	77.2	79.5	79.7	79.1	77.5
DH-2	79.6	79.6	78.6	73.3	82.4	82.4	81.4	76.1
DH-3	78.0	78.0	77.0	71.8	79.7	79.7	78.7	73.4
DH-4	77.6	77.6	76.6	71.3	78.9	78.9	77.9	72.7
CE-1	82.7	82.7	81.7	76.4	83.8	83.8	82.8	77.6
CE-2	82.0	82.0	81.0	75.7	83.6	83.6	82.7	77.4
CE-3	82.8	82.8	81.8	76.6	84.4	84.4	83.4	78.2
CE-4	80.4	80.4	79.4	74.2	82.2	82.2	81.2	75.9

DENR Allowable Standard (dB)				
Class AA Category	45	50	45	40
Class A Category	40	55	40	45
Class B Category	60	65	60	55
Class C Category	65	70	65	60
Class D Category	70	75	70	65

Note: Classes for noise standard are categorized into the followings
Class AA: Area 100m from school, hospitals, playground etc.
Class A: residential purpose
Class B: commercial areas
Class C: light industrial areas
Class D: heavy industrial areas

Mitigation Measure:

Road operation and maintenance will bring about increased air pollution and noise levels as more vehicles begin to use the new roadways. These can be mitigated by tree planting to be located at the center of and/or along the proposed roads, noise barriers to be installed at the specific locations with socially sensitive facilities along the proposed roads such as hospital and school, and flyover structure at the specific locations where the roads pass through or aside the lower-storey residential area to disperse air and noise to the sky as well as regular air and noise monitoring and strict implementation of speed limits. An example of the mitigation measures for Section 1 of the North-South Road is shown in Figure 5.6. The figures of the mitigation measures for all road sections are

shown in Annex 5.1. Expected noise reduction effects of the proposed measures are shown in the following table.

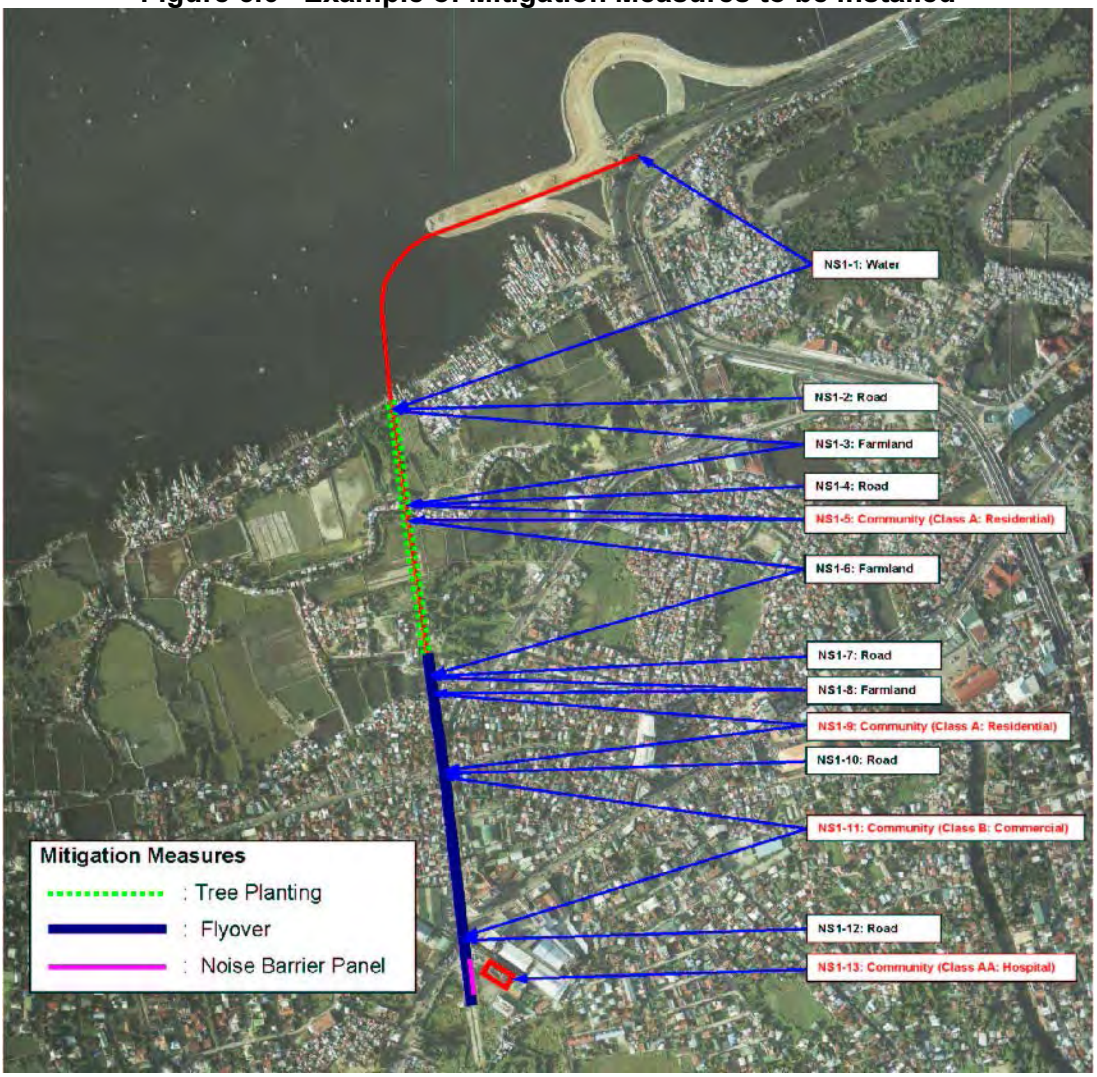
Table 5.24 Expected Noise Reduction Effects of the Proposed Measures

Mitigation Measures	Noise Reduction Range	Remarks
Flyover	3.7 - 4.7 dB[1)]	Height of flyover: 7 - 9 m
Flyover + Noise barrier	4.5 - 6.3 dB[1)]	Height of flyover: 7 - 9 m Height of noise barrier: 3 m
Tree Planting	0.4 - 0.6 dB[2)]	Tree planting zone: height 1.5m X breadth 0.4 - 1.0m

Note: [1)] - Estimated by JICA Study Team

[2)] - The values are based on experimental measurements in Japan under the Study on effect by planting belts on noise attenuation (5th Report) – Road traffic noise attenuation-, 1989

Figure 5.6 Example of Mitigation Measures to be Installed



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(2) Socio-economic Environment

1) Improved access to public utilities/services

The proposed project is expected to improve the access of local residents to public utilities/services located at the town centers or in Metro Manila. This will greatly benefit the employees of government and private firms, especially those with offices in Metro Manila, or those employed in large industrial estates and economic zones in Cavite and Laguna. It will also benefit college students whose schools are mostly located in Metro Manila; and housewives who prefer to purchase grocery items and other household needs at large shopping malls located likewise in Metro Manila and in major population centers in Cavite and Laguna provinces.

Improved access to services, such as tertiary health services and higher education, will benefit the people as a whole in the project area.

Enhancement measures:

To enable the people in the project area to fully enjoy the benefits arising from improved access to public utilities/services, the project will coordinate with the LGUs in putting into place signage to guide the commuters to the shortest and most convenient route to reach the interior destinations via the existing access roads (provincial, municipal, or barangay) from the project-constructed road and vice versa. These will be complemented by an information campaign (IEC) to be undertaken to enhance social acceptability and people's cooperation for the proper maintenance of the constructed road.

2) Increased economic opportunities and revenues for the LGUs

The improved accessibility and traveling convenience as a result of the project will inevitably attract more economic activities in term of more livelihood undertakings and expanded business operation. This will further improve the revenues of the LGUs that are initiated during the construction phase. The new economic activities are expected to especially develop along the constructed road as well as at strategic points and junctions that link it to the interior places via existing access roads in the project area, which will ultimately redound to increased household incomes and people's quality of life.

Enhancement measures:

To boost the increasing economic activities in the project area during the operation and maintenance phase of the project, the LGUs will be encouraged to use part of the accrued revenues to further promote an atmosphere conducive to these activities. The LGUs can achieve this by means of improving the delivery of basic LGU services and maintaining the access roads and other infrastructure/utilities in the municipality/city such as water and power supply, and disposal of household and municipal wastes.

3) Increased migration and rapid population growth

The improved accessibility, travel convenience, and presence of numerous economic activities will likewise promote migration to the project area and increase the already high population growth rates in the respective municipalities. More residential areas or subdivisions will be developed and serve as destination points for these migrants who aspire to live in suburban communities. But other areas, especially along the highway and

town centers, will become destination points for informal setters and soon develop into congested squatter colonies, unless preventive measures are implemented.

It is expected that the development of more subdivisions for suburban type of residents will augur well for the overall economic progress in the area. In contrast, if the establishment of squatter colonies is left unregulated, it will unavoidably give rise to various types of social problems in the community.

Mitigation/enhancement measures:

The development of suburban subdivisions should be promoted; while that of squatter colonies should be prevented or strictly regulated in a manner that does not violate the constitutional rights of abode and other human rights of those involved, otherwise known as “informal settlers.” This will be achieved by encouraging the LGUs to implement strictly Republic Act 7279 or the Urban Development and Housing Act (UDHA), and to update their respective Comprehensive Land Use Plan (CLUP) and zoning ordinance.

4) Increased traffic accidents

Incrase of traffic accidents will be expected especially at intersection due to increasing traffic volume.

Mitigation/enhancement measures:

In order to prevent occurrence of traffic accidents at intersection, intersection signals should be installed. In addition, sign board can also contribute to prevention of traffic accidents.

5) Damege of landscape

Landscape will be changed after road constrcution. Especially exposed areas generated by cutting slope will damage landscape value.

Mitigation/enhancement measures:

In order to mitigate the damage of landscape, revegetation of the exposed area or tree planting alonf the roads should be implemented.

6) Change in land value

The areas traversed by or located near the new roadways will change in value. Improved access will increase the value of lots while unfavorable partition will contribute to possible decline in assessment. The rise in value will translate to higher real estate taxes for the concerned LGU. In the case of lot owners, the increase in land value can only be realized if their properties are sold or leased.

Enhancement measures

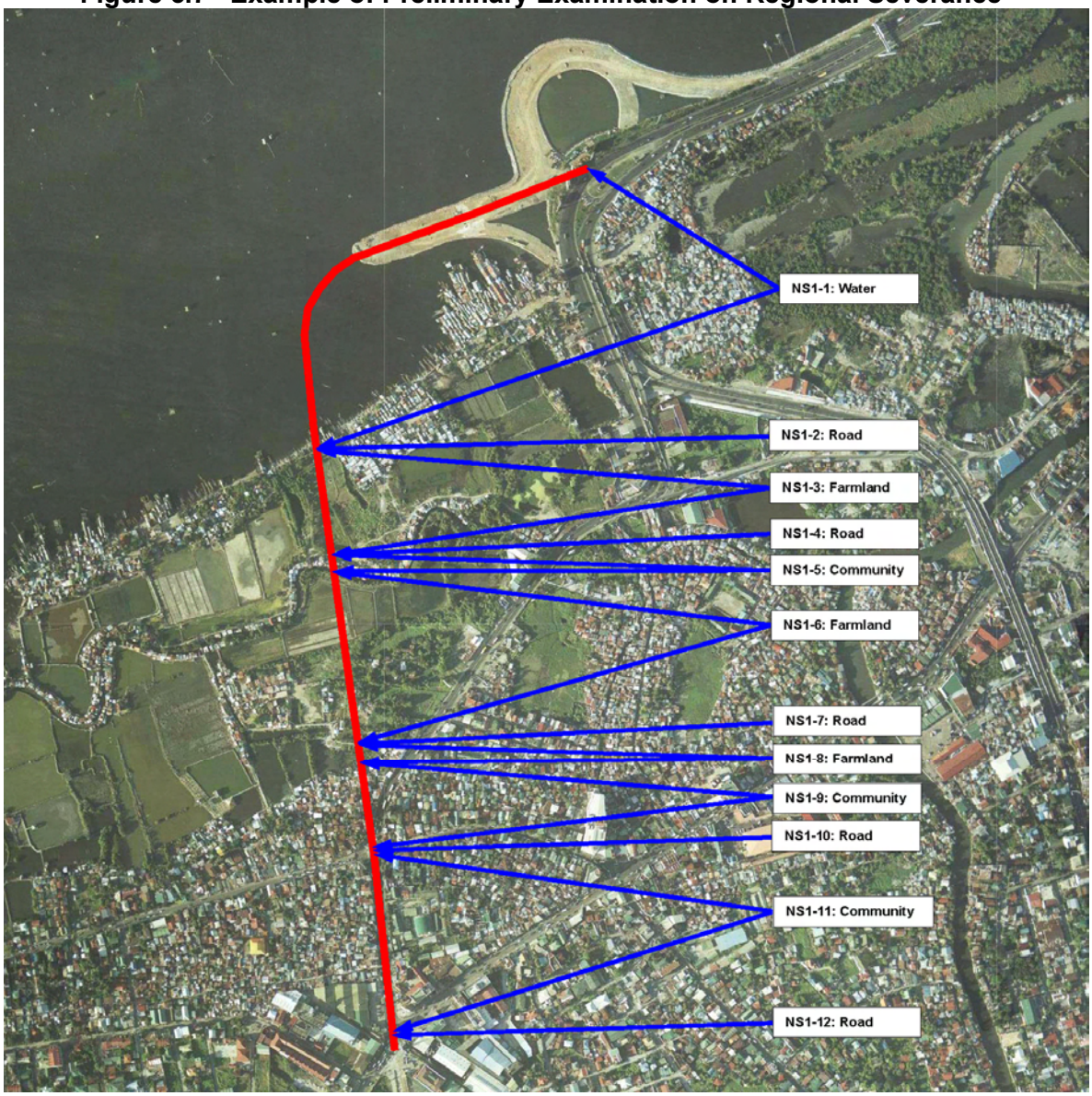
The local government units must undertake an assessment of properties within its jurisdiction to provide local residents, establishments and institutions an updated appraisal of the value of the land in the area after the construction period.

7) Regional severance

Regional severance or movement interruption to be potentially caused by the proposed projects was examined as a social impact of the proposed projects. Specific sites and areas, where the proposed road may interrupt movement of people/vehicle from one to another sides along the proposed road by the proposed road traversing the sites, were identified by means of aerial photograph with proposed road alignment as well as field reconnaissance. In the project area along the proposed roads, the following type of the interruption were mainly considered; i) Division of a community such as dense residential area and subdivision, ii) Division of the existing road that the proposed road intersects, iii) Division of the farm land, and iv) other types of interruption.

An example of the preliminary examination on regional severance for Section 1 of the North-South Road is shown in the following figure. The figures of the examination for all road sections are shown in Annex 5.1.

Figure 5.7 Example of Preliminary Examination on Regional Severance



As results of the examination, potential interruptions were identified for the proposed three roads; 69 for North-South Road, 42 for Daang Hari Road, and 44 for CALA Expressway, respectively as summarized in the following table.

Table 5.25 Identified Interruptions by Type of Interruption

Type of Interruption	North-South Road	Daang Hari Road	CALA Expressway
(1) Community/open space	9	3	3
(2) Road	32	24	24
(3) Farmland	27	15	17
(4) Others	1	0	0
Total	69	42	44

Mitigation Measure:

Based on the identified locations of interruption, social impacts at the location were examined and measures to alleviate the impacts were proposed as shown in the following table. Provision of the pedestrian bridge should be considered, especially at the site for bus stop, in the further study stage.

Table 5.26 Proposed Measures for the Interruption

Type of Measure	North-South Road	Daang Hari Road	CALA Expressway
(1) At-grade intersection	7	13	1
(2) Multi-level intersection	1	0	0
(3) Flyover[1)]	16	2	2
(4) Viaduct[1)]	1	0	0
(5) Underpass[2)]	2	0	3
(6) Overpass[2)]	0	0	4
(7) Other way	7	4	24
(8) No measure is required.	35	23	10
Total	69	42	44

Note: [1)] Flyover (or viaduct) structure for the proposed road has to be provided at the site of interruption.
[2)] Underpass/culvert (or overpass) has to be provided under the proposed road at the site of interruption.

The results of preliminary examination on regional severance by location of interruption are shown in the following tables.

Table 5.27 Preliminary Examination on Regional Severance (North-South Road)

Serial No.	Type of Interruption	Proposed Measure
NS1-1	Farmland (aqua farm)	Proposed coastal road should have bridge to allow outrigger/banca fishing boat to access the shore or there should be a breakwater connecting to the R1 with a service road.
NS1-2	Road	Underpass is required. (Box-culvert type underpass (vehicle type and volume to be checked in the further stage.))
NS1-3	Farmland	No measure is required
NS1-4	Road	Underpass is required.
NS1-5	Community/open space	No measure is required.
NS1-6	Farmland	No measure is required
NS1-7	Road	No measure is required. (use under flyover)
NS1-8	Farmland	Flyover is required.
NS1-9	Community/open space	Flyover is required.
NS1-10	Road	Flyover is required.

Serial No.	Type of Interruption	Proposed Measure
NS1-11	Community/open space	Flyover is required.
NS1-12	Road	Flyover is required.
NS2-1	Farmland	At-grade intersection is required.(no intersection for Niog and NS, no flyover to Mambog but at grade intersection with traffic signal)
NS2-2	Road	Service road between Niog and Mambog on both side of NS
NS3-1	Farmland	No measure is required. (use under flyover)
NS3-2	Road	No measure is required.
NS3-3	Farmland	No measure is required
NS3-4	Road	At-grade intersection is required.
NS3-5	Farmland	No measure is required
NS3-6	Road	No measure is required
NS3-7	Farmland	No measure is required
NS3-8	Road	No measure is required
NS3-9	Farmland	No measure is required
NS3-10	Road	At-grade intersection is required.
NS3-11	Community/open space	Flyover is required.
NS3-12	Road	Flyover is required.
NS3-13	Community/open space	Flyover is required.
NS3-14	Road	Flyover is required.
NS3-15	Farmland	No measure is required. One Asia Property
NS3-16	Road	No measure is required. One Asia Property
NS3-17	Farmland	No measure is required. One Asia Property
NS3-18	Road	No measure is required. One Asia Property
NS3-19	Farmland	No measure is required. One Asia Property
NS3-20	Road	No measure is required. One Asia Property
NS3-21	Farmland	No measure is required. One Asia Property (service road should be provided)
NS3-22	Road	At grade intersection is required and flyover.
NS4-1	Road	At grade intersection is required and flyover.
NS4-2	Farmland	No measure is required. One Asia Property
NS4-3	Road	No measure is required. One Asia Property
NS4-4	Farmland	No measure is required. One Asia Property
NS4-5	Road	Flyover is required.
NS4-6	Farmland	No measure is required.
NS4-7	Road	Flyover is required.
NS4-8	Farmland	No measure is required
NS4-9	Community/open space	No measure is required
NS4-10	Road	Flyover is required.
NS4-11	Community/open space	No measure is required
NS4-12	Road	Closed and another access road to be provided.
NS4-13	Farmland	No measure is required.
NS4-14	Road	No measure is required. start of 2-lane service road.
NS4-15	Farmland	Service road is requird at the right side of NS Road
NS4-16	Road	No measure is required
NS4-17	Farmland	Service road on right side (connecting 16&18)
NS4-18	Road	2-lane service road.
NS4-19	Farmland	No measure is required
NS4-20	Road	No measure is required.
NS4-21	Farmland	No measure is required.
NS4-22	Road	At grade intersection is required
NS4-23	Farmland	No measure is required
NS4-24	Community/open space	No measure is required
NS4-25	Road	At-grade intersection with traffic managegent (signalized)
NS4-26	Farmland	No measure is required.
NS4-27	Road	Flyover is required.
NS5-1	Road	Flyover is required.
NS5-2	Community/open space	Flyover is required.
NS5-3	Road	Flyover is required.
NS5-4	Farmland	Viaduct is required.
NS5-5	Road	Flyover and interchange.
NS5-6	Farmland	3 bridges (240m, 60m, 100m)

Note: Type of interruption

1: Community = Division of a community/subdivision such as residential area and subdivision

2: Road = Division of the existing road by intersection of the proposed road

3: Farmland = Division of the farmland

Table 5.28 Preliminary Examination on Regional Severance (Daang Hari Road)

Serial No.	Type of Interruption	Proposed Measure
DH2-1	Road	Service road is provided.
DH2-2	Farmland	No measure is required.
DH2-3	Road	Flyover is required.
DH2-4	Farmland	No measure is required.
DH2-5	Road	No measure is required.
DH2-6	Road	Service road is provided.
DH2-7	Road	Flyover is required.
DH2-8	Road	No measure is required.
DH2-9	Road	Service road is provided.
DH2-10	Road	Service road is provided.
DH3-1	Road	No measure is required.
DH3-2	Community/open space	No measure is required.
DH3-3	Road	No measure is required.
DH3-4	Farmland	No measure is required.
DH3-5	Road	No measure is required.
DH3-6	Community/open space	No measure is required.
DH4-1	Road	At-grade intersection.
DH4-2	Farmland	No measure is required.
DH4-3	Road	At-grade intersection.
DH4-4	Farmland	No measure is required.
DH4-5	Road	At-grade intersection.
DH4-6	Farmland	No measure is required.
DH4-7	Road	At-grade intersection.
DH4-8	Farmland	No measure is required.
DH4-9	Road	At-grade intersection.
DH4-10	Farmland	No measure is required.
DH4-11	Road	At-grade intersection with traffic signal.
DH4-12	Community/open space	No measure is required.
DH4-13	Road	At-grade intersection with traffic signal.
DH4-14	Farmland	No measure is required.
DH4-15	Road	At-grade intersection.
DH4-16	Farmland	No measure is required.
DH4-17	Road	At-grade intersection.
DH4-18	Farmland	No measure is required.
DH4-19	Road	At-grade intersection.
DH4-20	Farmland	No measure is required.
DH4-21	Road	At-grade intersection.
DH4-22	Farmland	No measure is required.
DH4-23	Farmland	No measure is required.
DH4-24	Road	At-grade intersection with traffic signal.
DH4-25	Farmland	No measure is required.
DH4-26	Road	At-grade intersection with traffic signal.

Note: Type of interruption
1: Community = Division of a community/subdivision such as residential area and subdivision
2: Road = Division of the existing road by intersection of the proposed road
3: Farmland = Division of the farmland

Table 5.29 Preliminary Examination on Regional Severance (CALA Expressway)

Serial No.	Type of Interruption	Proposed Measure
CE1-1	Road	To be determined
CE1-2	Farmland	To be determined
CE1-3	Road	To be determined
CE1-4	Community/open space	To be determined
CE1-5	Road	To be determined
CE1-6	Community/open space	To be determined
CE1-7	Road	To be determined
CE1-8	Farmland	To be determined
CE1-9	Road	To be determined
CE1-10	Farmland	To be determined
CE1-11	Road	Roundabout
CE2-1	Road	Roundabout
CE2-2	Farmland	At-grade intersection is required. (4 nos. of two grade intersection for

Serial No.	Type of Interruption	Proposed Measure
		existing roads will be provided.)
CE2-3	Road	Overpass is required with service road.
CE2-4	Farmland	No measure is required.
CE2-5	Road	Overpass is required.
CE2-6	Farmland	No measure is required
CE2-7	Road	Overpass is required.
CE2-8	Farmland	No measure is required
CE2-9	Road	Interchange is required: flyover, exit
CE2-10	Community/open space	Interchange is required: flyover, exit
CE2-11	Road	Interchange is required: flyover, exit
CE3-1	Road	Interchange is required: flyover, exit
CE3-2	Farmland	No measure is required.
CE3-3	Road	No measure is required. (use underpass at 15+501)
CE3-4	Farmland	Underpass is required at 15+500.
CE3-5	Road	Interchange is required: flyover, exit
CE4-1	Road	Interchange is required: flyover, exit
CE4-2	Farmland	No measure is required.
CE4-3	Road	Flyover is required at 17+120.
CE4-4	Farmland	No measure is required.
CE4-5	Road	Underpass is required.
CE4-6	Farmland	Culvert is required every 500 meters
CE4-7	Road	Flyover is required with service road
CE4-8	Farmland	Service road is required for both side of the road
CE4-9	Road	Overpass is required.
CE4-10	Farmland	Service road is required for both side of the road
CE4-11	Road	No measure is required.
CE4-12	Farmland	No measure is required.
CE4-13	Road	No measure is required.
CE4-14	Farmland	To be determined (san miguel property)
CE4-15	Road	To be determined (san miguel property)
CE4-16	Farmland	To be determined (san miguel property)
CE4-17	Road	Interchange is required.

Note: Type of interruption

1: Community = Division of a community/subdivision such as residential area and subdivision
2: Road = Division of the existing road by intersection of the proposed road
3: Farmland = Division of the farmland