Thereafter, the road alignment will successively pass through an area mapped as rice paddies but are now deemed as grasslands which alternate with unclassified, built up and agro industrial lands. Within these collective segments, the road will go through the barangay halls of Buhay na Tubig (Imus) and Salitran II (Dasmariñas), Day Care Center (Buhay na Tubig), and MTC Academy (along La Salle road). Commercial establishments that the road will go through are located in Brgy. Buhay na Tubig (Bacoor) and establishments that are adjacent MTC Academy (Brgy. Burol Main).

CALA expressway's final alternative route (ALT-2) will pass through agro industrial, non-agricultural and built-up areas. The expressway will pass through a residential area in Brgy. Sabutan, Silang, Cavite. A portion of a poultry farm in Brgy. Tibig (Silang) and a resort along the Silang Bypass road are some of the commercial areas the CALA expressway will go over.

3.2.4 Meteorology and Air / Noise Quality

(1) Methodology

Climatological data from the PAGASA synoptic station at the NAIA Station (1971-2000) were used to describe the meteorological conditions of the project area. Climatological parameters include rainfall, relative humidity, temperature, wind speed and direction, cloud cover, and typhoon frequency.

Ambient air quality measurements were conducted at eight selected stations on November 12-13, 26-28, 2005 and December 1-2, 2005. The stations were selected because of accessibility and access to a power source. Hourly samples were collected for Ozone and 24-hour samples for TSP, SO_2, NO_2, CO, NO, Pb, SPM and O_3 at each station.

Methods for sampling and analysis conform to prescribed methods in Sec. 1(b) Rule VII Part II of the Implementing Rules and Regulations of the Philippine Clean Air Act of 1999.

Noise levels were measured at the same stations used for the air quality monitoring. Measurements at each station were conducted for 24 hours at 10 minutes continuous measurement per hour. The noise levels at the determined sampling stations were measured using an Extech Digital Sound Level Meter.

Vibration level measurement survey was also conducted to measure the extent of disturbance (surface vibration) caused by ongoing construction (civil works), plant of factory operation and/or existing road traffic in particular locations inside the study area. The locations of the surveyed stations coincided with the positions of the previously conducted air quality and noise level measurement surveys.

The survey was conducted during weekdays from May 17 – 25, 2006 with the aid of a RION Vibration Level Meter Model VM-52. The unit of measurement is in decibels (dB). The equipment was set at 100 dB for x, y, z axes of the 3-dimensional vibration. Measurement duration is 500 seconds for every hour with an assigned measurement pitch of 5s. The instrument gathers 100 data entries and generates the following analytical values:

Leq - Energy based average value
Lmax - Maximum value
L5 - Top 5% of all the value
L10 - Top 10% of all the value
L50 - Top 50% of all the value
L90 - Top 90% of all the value
L95 - Top 95% of all the value

These measurements are taken and recorded every hour on the hour for 24 hours. The sensor or probe of this equipment is highly sensitive that it should not be dropped or soak in water.

(2) Climate

Laguna Province belongs to Type I climate under the modified Coronas Climate Classification. This type is characterized by two pronounced seasons, dry from November to April and wet during the rest of the year. Heavy rainfall occurs during the months of June, July, August and September. The presence of numerous hills and prominent mountains protect the province from typhoons.

The Province of Cavite also belongs to the same climate type. The most significant factors controlling rainfall over Cavite Province is the southwest monsoon, which normally caused most of the rains during the months of June to November. Little rain falls on Cavite during the periods of northeast and east west winds. Rainfall is least during the months of December to May. This is because the eastern portions of the Philippine Mountainous areas catch most of the wind-carried moisture before it can move further west or southwest. (Figure 3.16)

In the absence of in-situ data, climatological normals from the synoptic station of PAGASA at the NAIA were used to describe the meteorological conditions at the project area (Table 3.4).

1) Rainfall

The annual average rainfall is 2,161.2 mm with an annual average of 134 rainy days. The dry months are from December to April while the rainy months are from June to October. The wettest months are July to October. August is the peak of the rainy season with an average of 22 rainy days per month.

2) Temperature

In the project area, the average maximum temperature is 31.6°C while the mean minimum is 23.8°C. April is the warmest month with a mean maximum temperature of 34.2°C and January is the coolest with a mean minimum temperature of 21.8°C. The annual mean temperature in the area is 27.8°C.

Table 3.5 Climatological Normals, NAIA Station, Pasay City (1971-2000)

Month	Rainfall	Rainy days	Temperature (° C)			Rel. Hum.	Wind (mps)		Clouds	Days with	
	(mm)		Max.	Min.	Mean	(%)	Dir.	Speed	(Okta)	TSTM	LTNG
Jan	10.6	4	30.1	21.8	26.0	74	E	2	4	0	0
Feb	6.5	2	31.1	22.1	26.6	70	E	2	4	0	0
Mar	14.2	2	32.6	23.1	27.9	67	E	3	3	0	1
Apr	23.4	3	34.2	24.7	29.5	66	E	3	3	1	4
May	144.6	10	33.9	25.4	29.7	71	E	3	5	7	16
Jun	263.4	16	32.5	25.1	28.8	77	W	3	6	11	16
Jul	427.0	20	31.3	24.7	28.0	81	W	3	6	12	16
Aug	473.3	22	30.8	24.5	27.7	82	W	3	7	9	10
Sept	323.9	19	31.1	24.5	27.8	82	W	2	7	11	15
Oct	272.7	16	31.1	24.2	27.7	80	E	2	6	6	10
Nov	134.5	12	31.0	23.5	27.3	78	E	2	5	2	3
Dec	69.1	8	30.1	22.5	26.3	77	E	2	5	0	1
Annual	**2161.2**	**134**	**31.6**	**23.8**	**27.8**	**75**	**E**	**2.5**	**5**	**59**	**92**

Note: TSTM -- thunderstorm, LTNG – lightning (Source: Climate Date Section of PAGASA)

3) Relative Humidity

Relative humidity is expressed as percentage of water vapor in air. In the project area, the mean monthly relative humidity varies from a low of 66% in April to a high of 82% in August and September. The annual average relative humidity is 75%.

4) Prevailing Wind

Cavite is exposed to both monsoons. The mountainous terrain modifies the Northeast monsoon into an easterly direction and the Southwest Monsoon is deflected to a westerly direction. The annual average wind speed is 2.5 m/s with a mean monthly values varying from 2 to 3 m/s. Maximum monthly wind speed of 3 m/s occurs in March to August while minimum wind speed prevails in September to February.

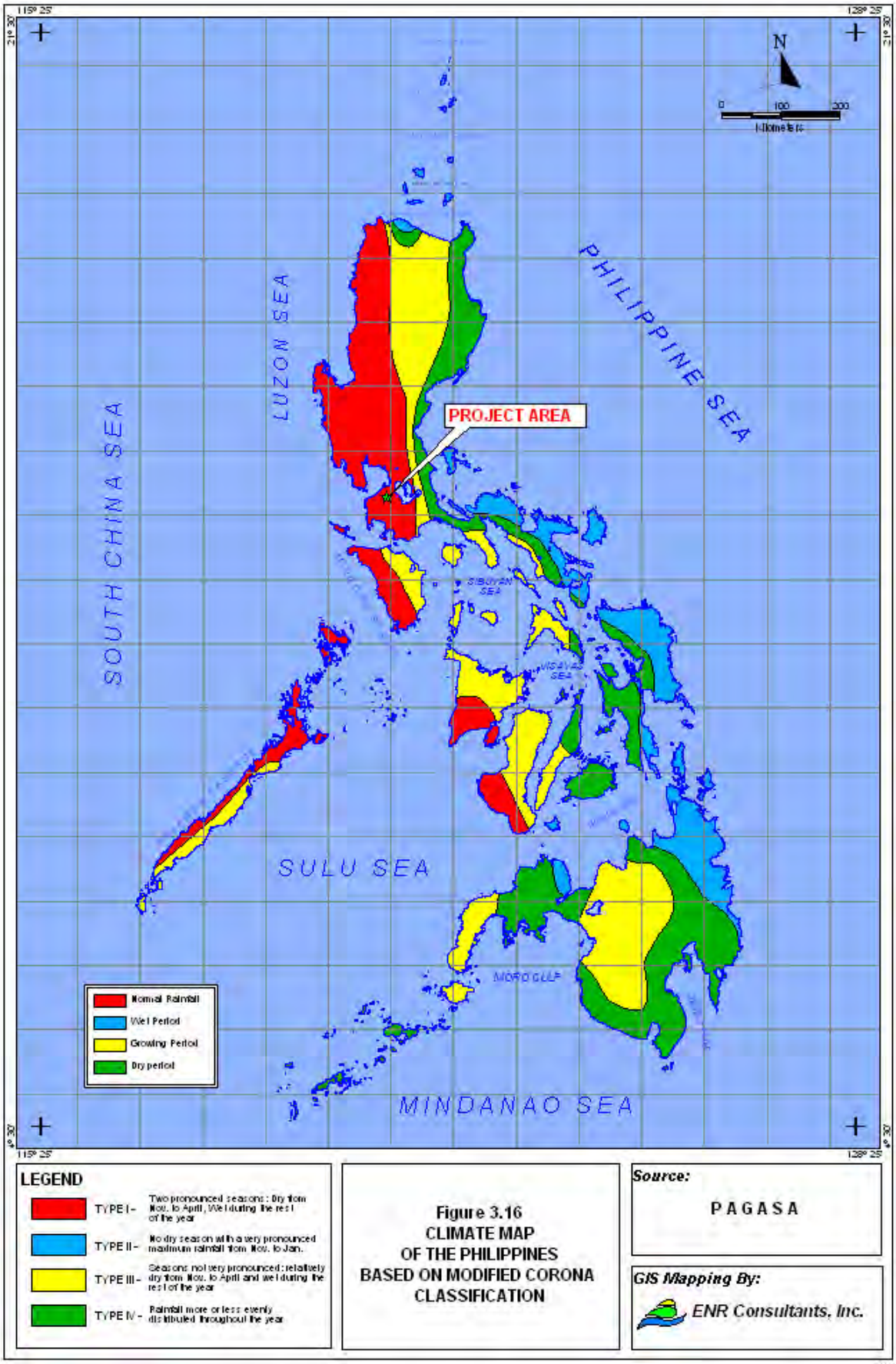
5) Tropical Cyclone Frequency

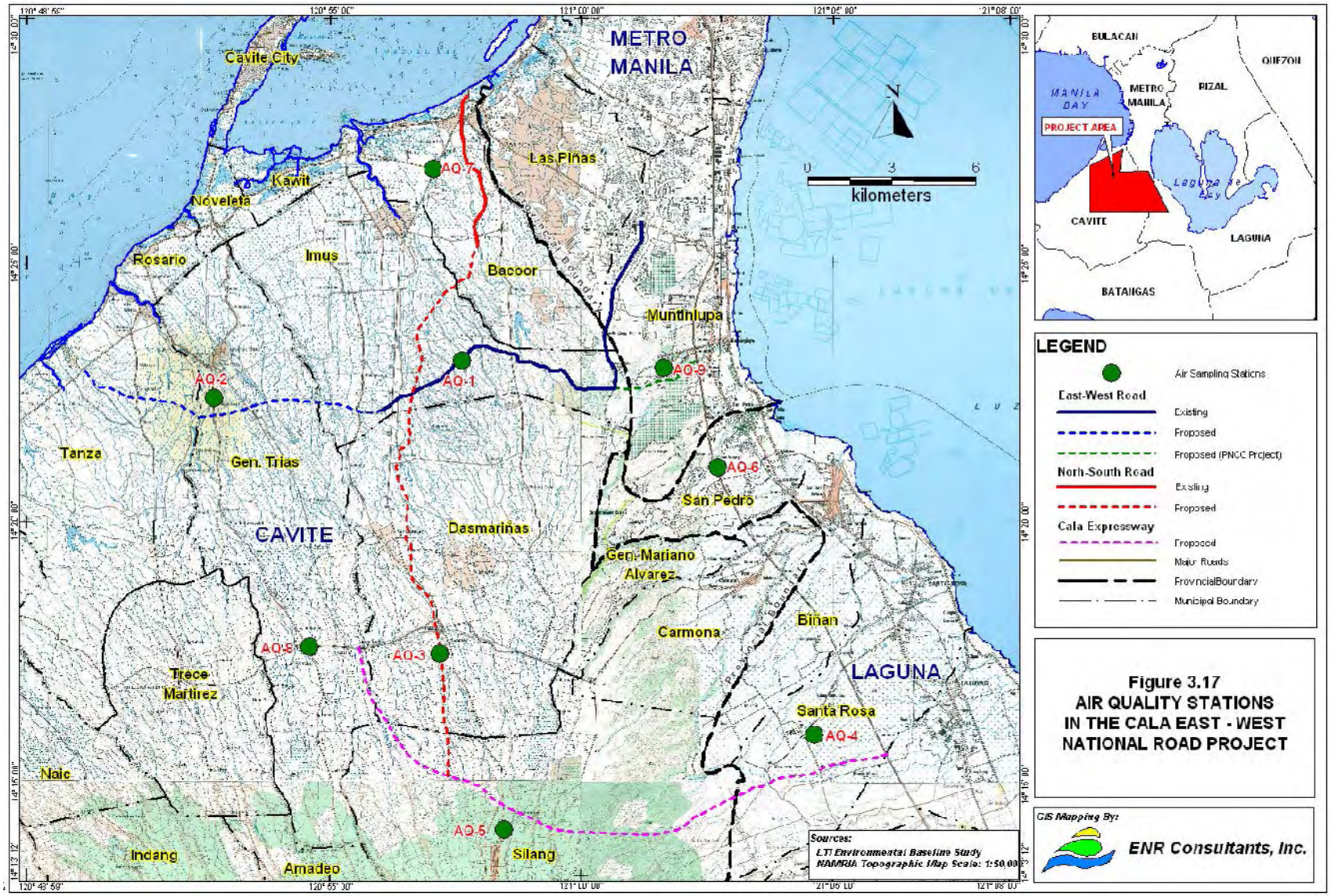
The Philippines, in general, is located in one of the most tropical cyclone-prone regions of the world. The proposed project area is located within an area with an average tropical cyclone frequency passage of 2 and 3 cyclones every five years.

(3) Air Quality

Figure 3.17 shows the location of ambient air quality stations while Table 3.5 provides the identification and description.

The TSP concentrations, except at Stations AQ6, AQ7 and AQ8, are within the standard limit prescribed by the Clean Air Act (CAA). The three (3) stations where the TSP concentrations exceeded the standards are located near the road and are within highly urbanized areas. The high concentrations could also be attributed to the relatively high traffic volume in the areas. Aside from industrial sources, the common sources of TSP include vehicular emissions. Table 3.6 summarizes the results.


N
0
100
200
Kilometers
PHILIPPINE SEA
LUZON SEA
SOUTH CHINA SEA
PROJECT AREA
SIBUYAN SEA
VISAYAN SEA
SULU SEA
MORO GULF
MINDANAO SEA
Normal Rainfall
Wet Period
Growing Period
Dry period
LEGEND
TYPE I - Two pronounced seasons : Dry from Nov. to April, Wet during the rest of the year
TYPE II - No dry season with a very pronounced maximum rainfall from Nov. to Jan.
TYPE III - Seasons not very pronounced; relatively dry from Nov. to April and wet during the rest of the year
TYPE IV - Rainfall more or less evenly distributed throughout the year
Figure 3.16
CLIMATE MAP
OF THE PHILIPPINES
BASED ON MODIFIED CORONA
CLASSIFICATION
Source:
PAGASA
GIS Mapping By:
ENR Consultants, Inc.


METRO MANILA
Cavite City
Las Piñas
Kawit
Noveleta
Rosario
Imus
Bacoor
Muntinlupa
Tanza
Gen. Trias
CAVITE
Dasmariñas
San Pedro
Gen. Mariano Alvarez
Carmona
Biñan
LAGUNA
Santa Rosa
Trece Martirez
Naic
Indang
Amadeo
Silang
AQ-1
AQ-2
AQ-3
AQ-4
AQ-5
AQ-6
AQ-7
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kilometers
BULACAN
QUEZON
RIZAL
METRO MANILA
MANILA BAY
PROJECT AREA
CAVITE
LAGUNA
BATANGAS
LEGEND
Air Sampling Stations
East-West Road
Existing
Proposed
Proposed (PNCC Project)
North-South Road
Existing
Proposed
Cala Expressway
Proposed
Major Roads
ProvincialBoundary
Municipal Boundary
Figure 3.17
AIR QUALITY STATIONS
IN THE CALA EAST - WEST
NATIONAL ROAD PROJECT
GIS Mapping By:
ENR Consultants, Inc.
Sources:
LTI Environmental Baseline Study
NAMRIA Topographic Map Scale: 1:50,000

Table 3.5 Location and Description of Air Sampling Stations

Station ID	Description	Weather Condition	Wind Direction
AQ1	Barangay Buwaya Uno, Daang Hari, Imus Cavite. A residential area (N14° 23' 07" and E120° 57' 37"). Station near the residence of the Barangay Captain.	Cloudy with intermittent rainshowers	East going West
AQ2	Barangay Tapia. 1.5 km away from town proper of Gen Trias, Cavite (N14° 21' 21" and E120° 52' 53"). A residential area. Witnessed by a Barangay Kagawad and the Barangay Captain.	Cloudy	East going West
AQ3	Morzon Subdivision, Barangay Burol Main, Dasmariñas Cavite (N14° 19' 53.2" and E120° 56' 40.6"). A residential area.	Sunny and partly cloudy with rainshowers	East going West
AQ4	R.C. Sta Rosa Centro, Sta Rosa Laguna. Right side of Brittany Subdivision, about 10 m away from the roadside (N14° 14' 37.8" and E121° 03' 24.6').	Sunny with intermittent rain showers in the afternoon	East going West
AQ5	Barangay Biga I, Silang Cavite (N14°.14' 53.8" and E120° 58' 26.5"). Along Emilio Aguinaldo Highway, left side approximately 6 m away from the gate of WB resort.	Sunny	East to West
AQ6	Barangay San Antonio, San Pedro, Laguna (N14° 22' 02.2" and E121° 02' 28"). Approximately 10 m away from Nibagan Bridge across the Car Wash station. Located in Roadside area.	Sunny partly cloudy with rainshowers	East going West
AQ7	Barangay Panapanaan 5, intersection of Tirona-Aguinaldo Highway, Bacoor, Cavite (N14° 26' 43" and E120° 15' 11").	Sunny	East going West
AQ8	Annex Municipal Hall. Barangay Mangahan, Gen Trias, Cavite (N14° 17' 27" and E120° 54' 39"). Located in the roadside area.	Sunny	East going West
AQ9 (NBP)	Sitio Makabuhay Dulo, New Bilibid Prison Compound, Muntinlupa City (N 14°22'43.8" and E 121°01'41.2"). Near the residence of Mr & Mrs. Eric Elegante.	Cloudy	East going West

Table 3.6 Result of Air Quality Analysis

Parameters	DENR Standards	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	AQ9
TSP	230 μg/Ncm	87	65	63	44	139	252	364	329	95
SO_2	180 μg/Ncm	37	42	22	22	56	77	105	83	28
NO_2	150 μg/Ncm	44	56	31	31	28	22	38	41	37
CO	35 μg/Ncm	ND	ND	ND	ND	ND	ND	ND	1.0	ND
Ozone	140 μg/Ncm	55	22	88	5	18	87	55	32	22
Pb	1.5 μg/Ncm	0.022	0.043	0.009	0.021	0.161	0.387	0.433	0.322	0.054
SPM	-	35	29	31	19	113	212	289	267	73
NO	-	29	34	17	21	17	14	23	26	21

Note: ND – Not Detected

The following describes the physical conditions and discusses the result of the air quality of each station.

Station AQ1 is located within a residential area in Barangay Buwaya Uno, Daang Hari, Imus, Cavite (N14° 23' 07" and E120° 57' 37"). The weather condition at the time of sampling was cloudy with intermittent rain showers. The air sample for this station showed a TSP, SO_2, and NO_2 concentrations of 87 μg/Ncm, 37 μg/Ncm and 44 μg/Ncm respectively. Ozone and lead have also low concentrations. All parameters are within the National Ambient Air Quality Guideline Values of the Clean Air Act.

Station AQ2 is located in a residential area at Barangay Tapia (N14° 21' 21" and E120° 52' 53") and about 1.5 km away from town proper of Gen Trias, Cavite. The weather condition at the time of sampling was cloudy. TSP result for this station was recorded at 65 μg/Ncm. The result was way below the DENR Standard. SO_2 result and NO_2 results were recorded at 42 and 56 μg/Ncm respectively are also below the DENR limit. Ozone and Lead was recorded at 22 and 0.043 μg/Ncm, respectively. The results are also below the DENR limit.

Station AQ3 is located inside a subdivision (Morzon Subdivision) at Barangay Burol Main, Dasmariñas, Cavite (N14° 19' 53.2" and E120° 56' 40.6"). The weather condition at the time of sampling was sunny and partially cloudy with intermittent rain showers. A relatively low TSP concentration at 63 μg/Ncm. Since it is located inside a residential area it is not surprising that concentration of SO_2 and NO_2 are low. The readings were recorded at 22 μg/Ncm and 31 μg/Ncm respectively. Ozone reading was at 88 μg/Ncm and Lead 0.009 μg/Ncm. Both did not exceed the DENR standard.

Station AQ4 is located in R.C. Sta Rosa Centro, Sta Rosa Laguna and at the right side of Brittany Subdivision (N 14° 14' 37.8" and E 121° 03' 24.6"). Approximately 10 m away from the roadside. Weather condition at the time of sampling is sunny with intermittent rain showers in the afternoon. The average TSP concentration in the area is relatively low at 44 μg/Ncm. The low 24-hour concentration for both SO_2 and NO_2, 22 μg/Ncm and 31 μg/Ncm respectively were recorded. Ozone reading was 5 μg/Ncm and lead at 0.021 μg/Ncm for this station. Both did not exceed the DENR limit. CO in this station was not detected.

Station AQ5 is located at barangay Biga I, Silang Cavite along Emilio Aguinaldo Highway and approximately 6 m away from the gate of WB resort located in the road side area (N 14° 14' 53.8" and E 120° 58' 26.5"). Weather condition at the time of sampling was sunny. The result of the 24-hour sampling for TSP showed that the concentration 139 μg/Ncm did not exceed the DENR limit. This station is located near a main highway. Likewise, SO_2 and NO_2 concentration are also relatively low, 56 μg/Ncm for SO_2 and 28 μg/Ncm for NO_2 considering that the station is located near the Aguinaldo Highway. Ozone and Lead readings are low at 18 μg/Ncm and 0.161 μg/Ncm respectively. CO in this station was not detected.

Station AQ6 is located **i**n Barangay San Antonio, San Pedro, Laguna. The station is approximately 10 m away from Nibagan Bridge, across a car wash station (N 14° 22' 02.2" and E 121° 02' 28"). It is adjacent to a road. Weather condition at the time of sampling was sunny but partly cloudy with rainshowers. The concentration for TSP was recorded at 252 μg/Ncm and exceeded the DENR standard (230 μg/Ncm). The SO_2 and NO_2 gave relatively low concentrations, 77 μg/Ncm and 22 μg/Ncm for SO_2 and NO_2

respectively. Ozone and lead concentrations gave low readings at 87 μg/Ncm and 0.387 μg/Ncm. CO in this station was not detected.

Station AQ7 is located in Barangay Panapanaan 5 at the intersection of Tirona-Aguinaldo Highway, Bacoor (N 14° 26' 43" and E 120° 15' 11"). This is located at the road side area. Weather condition at the time of sampling was sunny. TSP readings for this station gave the highest concentration of 364 μg/Ncm that exceeded the DENR limit. The measured concentration of SO_2 is 105 μg/Ncm which is higher than that of NO_2 which was measured at 38 μg/Ncm. Ozone and lead reading are still low at 55 μg/Ncm and 0.433 μg/Ncm respectively. CO in this station was not detected.

Station AQ8 is located near the Annex of the Municipal Hall, Barangay Mangahan, Gen Trias, Cavite (N 14° 17' 27" and E 120° 54' 39"). The station is located in the road side area. Weather condition at the time of sampling was sunny. TSP concentration in this area exceeded the DENR limit at 329 μg/Ncm. SO_2 and NO_2 concentrations are surprisingly low although the sampling point is located at the center of commercial area and business zone. The readings were recorded at 83 μg/Ncm and 41 μg/Ncm for SO_2 and NO_2, respectively. Also, ozone and lead concentrations are low, 32 μg/Ncm for ozone and 0.322 μg/Ncm for lead. This is the only station where CO was detected a 1.0 μg/Ncm which is within the DENR standard of 35μg/Ncm for CO.

Station AQ9 is located in Brgy. Makabuhay Dulo, National Bilibid Compound, Muntinlupa City (N 14°22'43.8" and E 121°01'41.2"). The station is situated in a residential area.

(4) Noise

Noise levels were measured at the same stations used for air quality monitoring. Measurements at each station were conducted for 24 hours at 10 minutes continuous measurement per hour. The noise levels at the determined sampling stations were measured using an Extech Digital Sound Level Meter. The ambient noise standards as well as the classification of areas with maximum noise levels are shown in Table 3.7 and the results of the measurements are summarized in Table 3.8.

Table 3.7 Standards for Noise

(Unit: dB(A))

AREA CLASSIFICATION (based on dominant land-use)	Daytime (0901 to 1800H)	Morning (0501 to 0900H) and Evening (1801 to 2200H)	Nighttime (2201 to 0500H)
Class AA (Areas 100 m from schools, hospitals, playground etc.)	50	45	40
Class A (residential purposes)	55	50	45
Class B (commercial areas)	65	60	55
Class C (light industrial areas)	70	65	60
Class D (heavy industrial areas)	75	70	65

Source: 1978 NPCC Rules and Regulations Implementing PD 984

Table 3.8 Results of Noise Level Monitoring

Station*	Average Noise Level (dB)**			
	Morning	Daytime	Evening	Nighttime
NL1	56.9	64.6	55.7	49.8
NL2	52.9	56.4	56.2	50.2
NL3	59.8	57.4	53.4	52.2
NL4	52.5	52.9	52.6	51.5
NL5	56.0	56.9	56.8	54.2
NL6	73.8	74.0	74.3	68.3
NL7	76.1	77.9	70.9	69.1
NL8	77.5	82.4	85.1	72.9

Note: * Sampling stations for noise level are the same for air quality
** Average noise level means the maximum value in each time classification

(5) Traffic

Traffic surveys were simultaneously conducted at the established air quality sampling stations along selected road sections in the project area. Two of these stations were located at the intersection of Aguinaldo Highway and Tirona Highway at Barangay Panapaan, Bacoor and at the intersection of Governor's Drive and Tanza-Amadeo Road in Barangay Manggahan in General Trias and three (3) stations were located along Aguinaldo Highway at Biga 1, Silang, Sta. Rosa – Tagaytay Road and Brgy. San Antonio-San Pedro Road respectively. Figure 3.18 shows the location of these traffic count stations.

The manual traffic classification count survey at said locations were conducted simultaneously on December 1-2, 2005, November 26-27, 2005 and November 27-28, 2005 respectively for 24 hours from 10:00 am to 10:00 am of the next day. The survey recorded 10-minute volume of all vehicles, which were classified into seven (7) vehicle types namely; 1-Car/Taxi/Jeep; 2-Passenger Jeepney; 3-Cargo Jeepney/Pick-up/Van; 4-uses; 5-Trucks, 6-Tricycles; and 7-Motorcycles.

The survey considered all traffic flows in the 4-legged intersections. Tables 3.9 and 3.10 present the direction of each traffic flow in these stations.

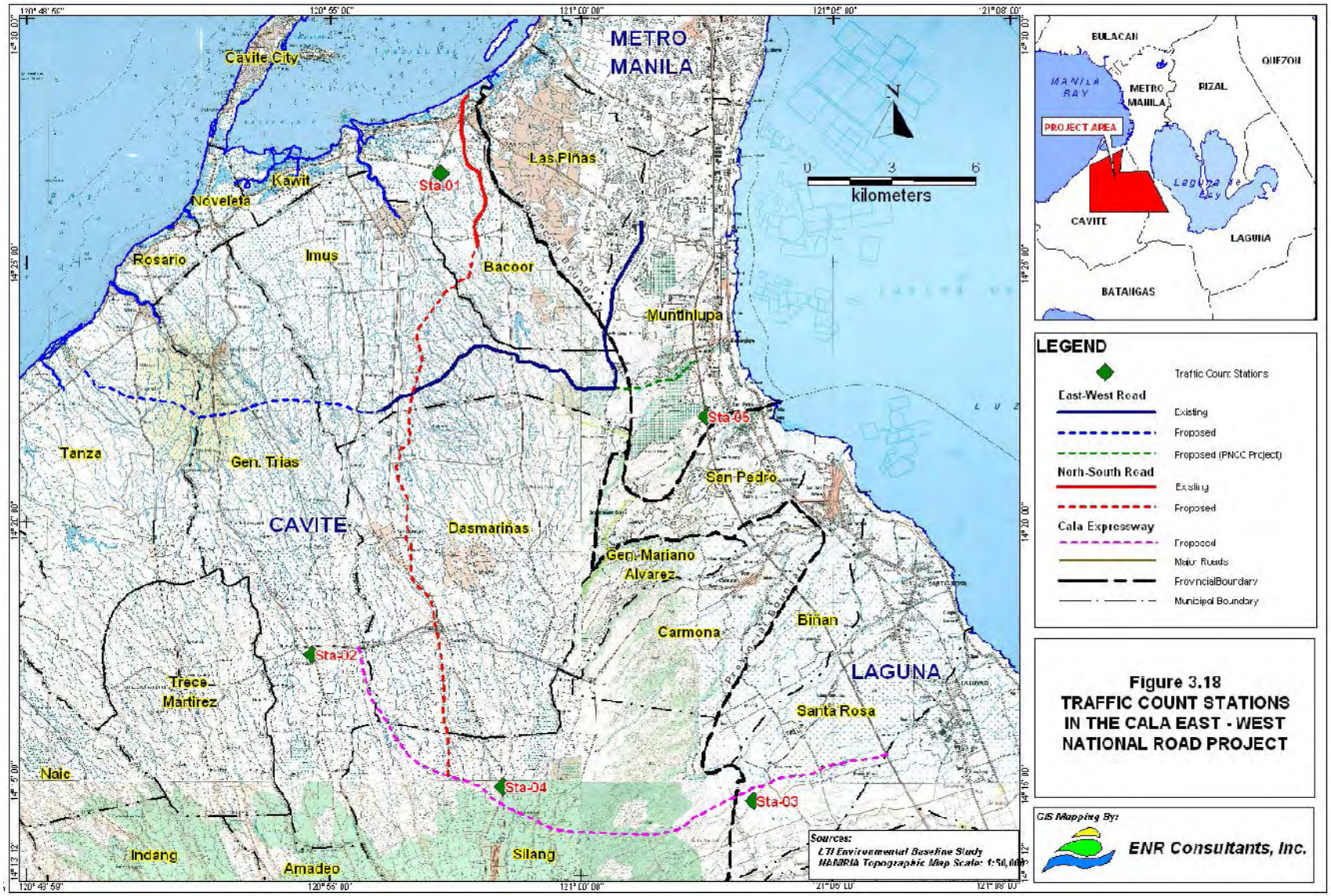


Figure 3.18
TRAFFIC COUNT STATIONS IN THE CALA EAST - WEST NATIONAL ROAD PROJECT

Table 3.9 Station 01: Traffic Flow at the Intersection of Aguinaldo Highway / Tirona Highway, Bacoor

Leg	Flow	From	To
1	1	Imus	Kawit
	2	Imus	Manila
	3	Imus	Andrea Village
2	4	Andrea Village	Imus
	5	Andrea Village	Kawit
	6	Andrea Village	Manila
3	7	Manila	Andrea Village
	8	Manila	Imus
	9	Manila	Kawit
4	10	Kawit	Manila
	11	Kawit	Andrea Village
	12	Kawit	Imus

Table 3.10 Station 02: Traffic Flow at the Intersection of Governor's Drive /Tanza-Amadeo Road, Gen Trias

Leg	Flow	From	To
1	1	Amadeo	Naic
	2	Amadeo	Tanza
	3	Amadeo	Carmona
2	4	Carmona	Amadeo
	5	Carmona	Naic
	6	Carmona	Tanza
3	7	Tanza	Carmona
	8	Tanza	Amadeo
	9	Tanza	Naic
4	10	Naic	Tanza
	11	Naic	Carmona
	12	Naic	Amadeo

Survey Results

The results of the manual traffic classification count in the intersection of Aguinaldo Highway/Tirona Highway in Bacoor and in the intersection of Governor's Drive/Tanza-Amadeo Road in General Trias, along Aguinaldo Highway, Biga, Silang, Sta. Rosa-Tagaytay Road and San Antonio, San Pedro Road are summarized in the Tables 3.11 to 15. Figures 3.19 and 3.20 show the counts at traffic intersection 01 and 02, respectively.

Details of these counts are presented in the *Environmental Baseline Study of LTI (Attachment 3).*

Table 3.11 Station 01: Traffic Classification at the Intersection of Aguinaldo Highway/ Tirona Highway, Bacoor

Leg	Flow	Vehicle Type							Total
		C/T/J	Jeepney	Pick-up/ Van	Buses	Trucks	Tricycle	Motor-cycle	
1	1	2,301	1,652	734	760	1,045	343	396	7,231
	2	7,741	3,639	3,702	1,515	1,290	535	684	19,106
	3	138	9	139	2	11	23	59	381
2	4	146	6	113	0	2	13	43	323
	5	125	10	73	1	3	32	17	261
	6	192	7	113	3	2	24	60	401
3	7	166	8	54	1	6	10	38	283
	8	6,901	3,047	2,724	1,203	1,382	162	1,673	17,092
	9	2,964	625	879	1,903	1,036	151	750	8,308
4	10	4,104	797	1,008	2,211	1,003	184	604	9,911
	11	144	29	131	4	4	14	69	395
	12	1,066	816	426	36	171	123	321	2,959
Total		**25,988**	**10,645**	**10,096**	**7,639**	**5,955**	**1,614**	**4,714**	**66,651**

Table 3.12 Station 02: Traffic Classification Count at the Intersection of Governor's Drive/Tanza-Amadeo Road, General Trias

Leg	Flow	Vehicle Type							Total
		C/T/J	Jeepney	Pick-up/ Van	Buses	Trucks	Tricycle	Motor-cycle	
1	1	555	310	236	84	73	588	191	2,037
	2	418	162	275	26	156	823	242	2,102
	3	1,015	337	669	186	424	353	233	3,217
2	4	1,913	547	1,090	340	491	437	520	5,338
	5	2,655	2,071	1,364	313	417	229	559	7,608
	6	488	142	337	10	130	389	182	1,678
3	7	465	98	147	22	245	283	151	1,411
	8	846	243	307	50	232	1,073	294	3,045
	9	593	175	319	16	40	1,109	254	2,506
4	10	323	192	323	3	56	885	157	1,939
	11	1,871	1,816	1,645	352	651	181	710	7,226
	12	553	665	429	20	99	812	204	2,782
Total		**11,695**	**6,758**	**7,141**	**1,422**	**3,014**	**7,162**	**3,697**	**40,889**

Table 3.13 Station 03: Traffic Classification Count along Aguinaldo Highway, Silang, Cavite

Flow	Vehicle Type							Total
	C/T/J	Jeepney	Pick-up/ Van	Buses	Trucks	Tricycle	Motor-cycle	
1	1,113	1,124	296	447	557	528	541	4,606

Table 3.14 Station 04: Traffic Classification Count along Sta. Rosa-Tagaytay Road, Sta. Rosa, Laguna

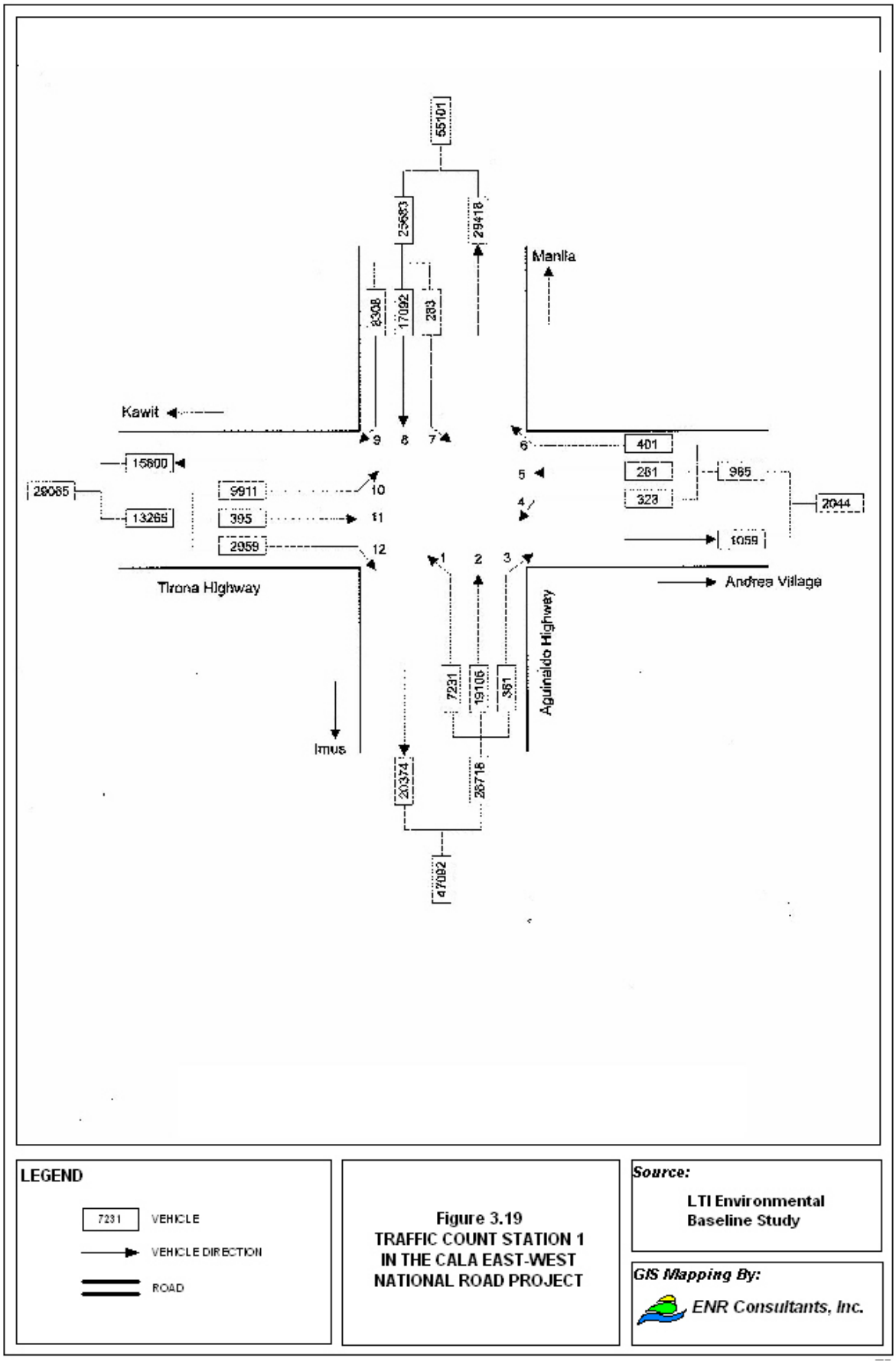
Flow	Vehicle Type							Total
	C/T/J	Jeepney	Pick-up/ Van	Buses	Trucks	Tricycle	Motor-cycle	
1	885	704	278	171	257	310	268	2,873

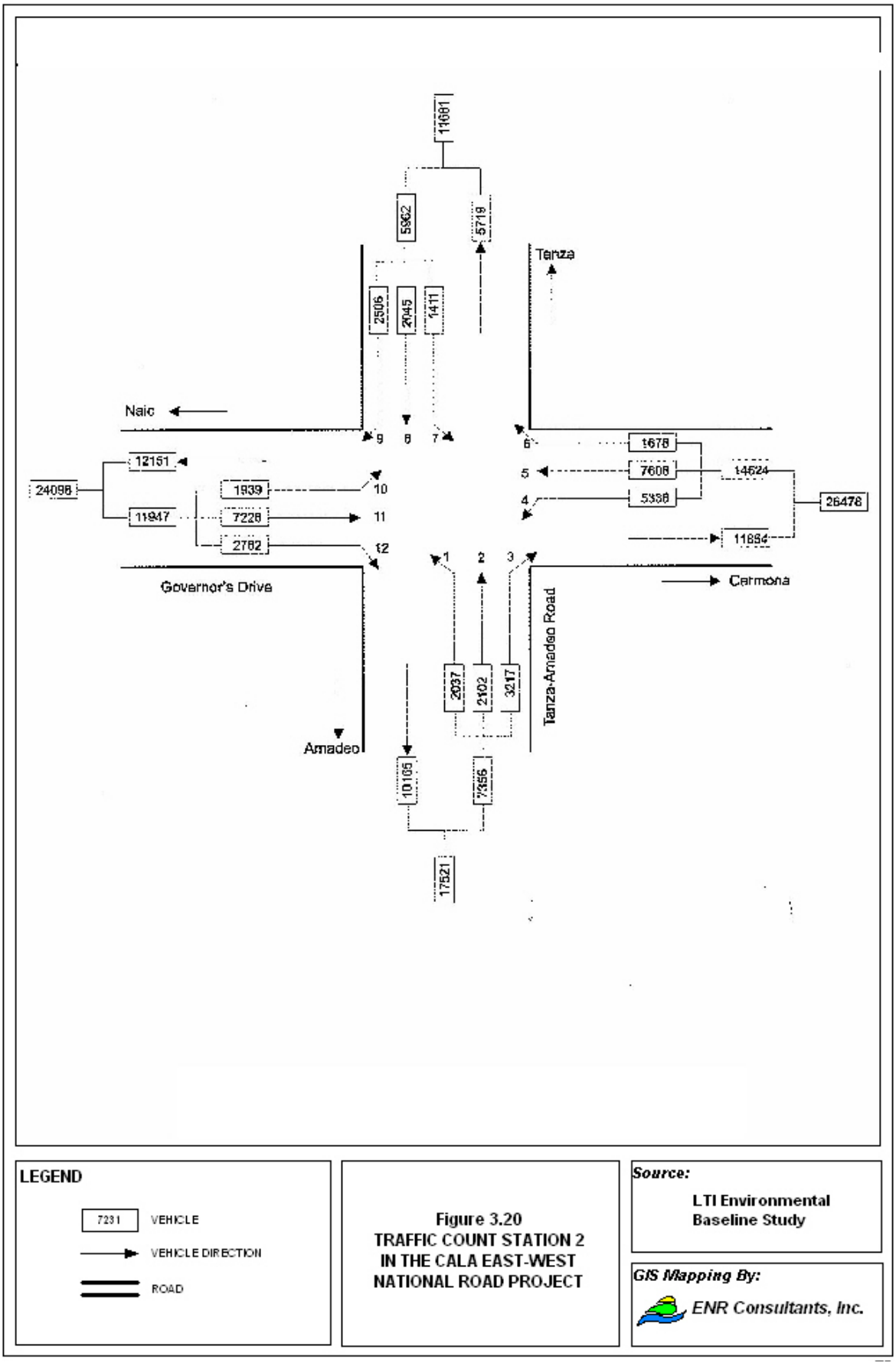
Table 3.15 Station 05: Traffic Classification Count at San Pedro Road Brgy. San Antonio, San Pedro, Laguna

Flow	Vehicle Type							Total
	C/T/J	Jeepney	Pick-up/ Van	Buses	Trucks	Tricycle	Motor-cycle	
1	903	615	580	104	262	942	549	3,955

Table 3.16 Manual Traffic Count at San Pedro Exit SLEX

Flow	Vehicle Type				Total
	Car/Taxi/Jeep	Pick-up/Van	Buses	Trucks	
North	31,099	16,833	3,938	6,475	58,345
South	25,976	16,213	3,696	6,787	52,672
Total	57,075	33,046	7,634	13,262	111,017


55101
25683
29418
Manila
8308
17092
283
Kawit
9
8
7
6
401
15800
5
261
985
28085
9911
10
4
323
2944
13266
395
11
1059
2959
12
1
2
3
Tirona Highway
Andrea Village
Aguinaldo Highway
7231
19106
361
Imus
20374
26716
47092
LEGEND
7231 VEHICLE
VEHICLE DIRECTION
ROAD
Figure 3.19
TRAFFIC COUNT STATION 1
IN THE CALA EAST-WEST
NATIONAL ROAD PROJECT
Source:
LTI Environmental
Baseline Study
GIS Mapping By:
ENR Consultants, Inc.


11681
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14624
24098
1939
10
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5338
26478
11947
7228
11
11884
2762
12
1
2
3
Governor's Drive
Carmona
Tanza-Amadeo Road
2037
2102
3217
Amadeo
10105
7355
17521
LEGEND
7231
VEHICLE
VEHICLE DIRECTION
ROAD
Figure 3.20
TRAFFIC COUNT STATION 2
IN THE CALA EAST-WEST
NATIONAL ROAD PROJECT
Source:
LTI Environmental
Baseline Study
GIS Mapping By:
ENR Consultants, Inc.

(6) Vibration Survey

Results of the survey indicates that vibration levels in all stations are under Japan's vibration standard with an average reading of 45.0 dB both for day and night periods. The summary of the results are shown in the table below. Detailed results for each station are found in the succeeding pages.

Table 3.17 Results of Vibration Measurements at the Different Stations

Station No.	Location	Date	Area Type	Vibration Level Measurement - L10 (dB)	
				Day	Night
NL1	Daang Hari, Brgy. Pasong Buaya I, Imus, Cavite	May 19-20, 2006	Residential	47.2	45.0
NL5	Aguinaldo Highway, Brgy. Biga I, Silang, Cavite	May 22-23, 2006	Commercial	45.0	45.0
NL6	San Pedro Exit, South Luzon Expressway	May 24-25, 2006	Industrial	45.0	45.0
NL7	Intersection Aguinaldo/Tirona Highway, Bacoor, Cavite	May 18-19, 2006	Commercial	45.0	45.0
NL8	Intersection Governor's Drive & Gen Trias-Indang Road, Gen. Trias, Cavite	May 23-24, 2006	Commercial	45.0	45.0

3.2.5 Hydrology

(1) Objectives and Work Flow

Taking account of the goals of the recommended project, the objectives of the hydrological and hydraulic studies are set as follows:

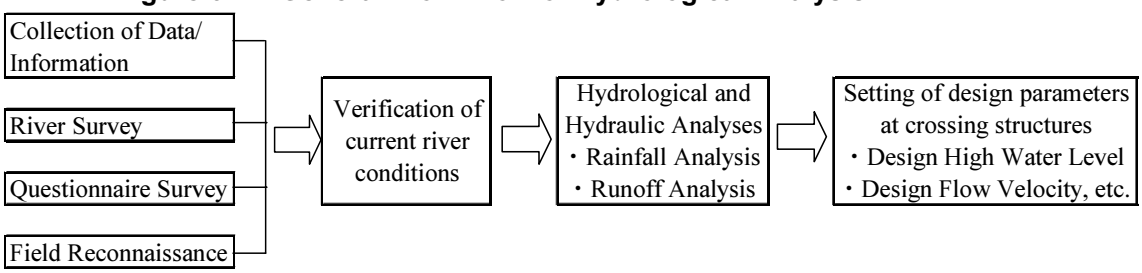
(i) To clarify the current conditions of river channel and riparian areas, which are subject to proposed road network

(ii) To estimate the flood discharges of the rivers in various return periods through statistical approach at crossings along proposed road alignment

(iii) To recommend betterment of drainage system along the proposed alignment, where deterioration of present drainage conditions due to implementation of the project is predicted, if any

In order to accomplish the objectives above mentioned, the work flow of sectoral studies has been set up as follows:

Figure 3.21 General Work Flow of Hydrological Analysis



(2) Available Data, Maps and Documents

1) Topographic Maps

Topographic maps of the Study Area were obtained from NAMRIA Map Sales Office in Fort Bonifacio, Manila. These maps of scale 1:50,000 and 1:10,000 were utilized to confirm the watershed boundaries of river basins and road crossings, which are concerned to the road/bridge design of three routes, i.e. CALA Expressway, North-South Road and Daang Hari Extension.

On the other hand, the cross sections with 50 m intervals and plan along the proposed road alignment with 100 m wide became available exclusively for the present study together with the aerial photographs. Consistency of river cross sections at bridges sites and topographic conditions in the vicinity was duly checked by means of the new survey outcome.

2) Rainfall Record

Daily rainfall records at total six gauging stations (Sangley Point, Ambulong, Amadeo, Bacoor, San Pedro and Tagaytay) in and around the Study Area were collected at the Climate Data Center of PAGASA, Quezon City. The longest duration of daily record is available from 1951 to date at Ambulong, Laguna. The location of gauging stations is shown in Figure 3.22.

3) Discharge Record

Mean daily discharge records at total ten gauging stations in and around the Study Area were collected from Hydrological Division, Bureau of Research and Standards, DPWH. The records are divided into two categories, i.e. old and new coding system. The available data of the old and new systems cover the period from 40's to 1979 and from 1983 to date, respectively, since there was a suspension of discharge measurement by DPWH between 1979 and 1983. Two gauging stations have been operated in the Study Area namely at Alapan in Ilang-Ilang River and at Palubluban in Panaysayan River (Pasong Camachile River, a tributary of Ilang-Ilang River). However, those were all closed and stopped measurement in 1979 and 1984 respectively. The location of water level gauging stations is marked also on Figure 3.22.

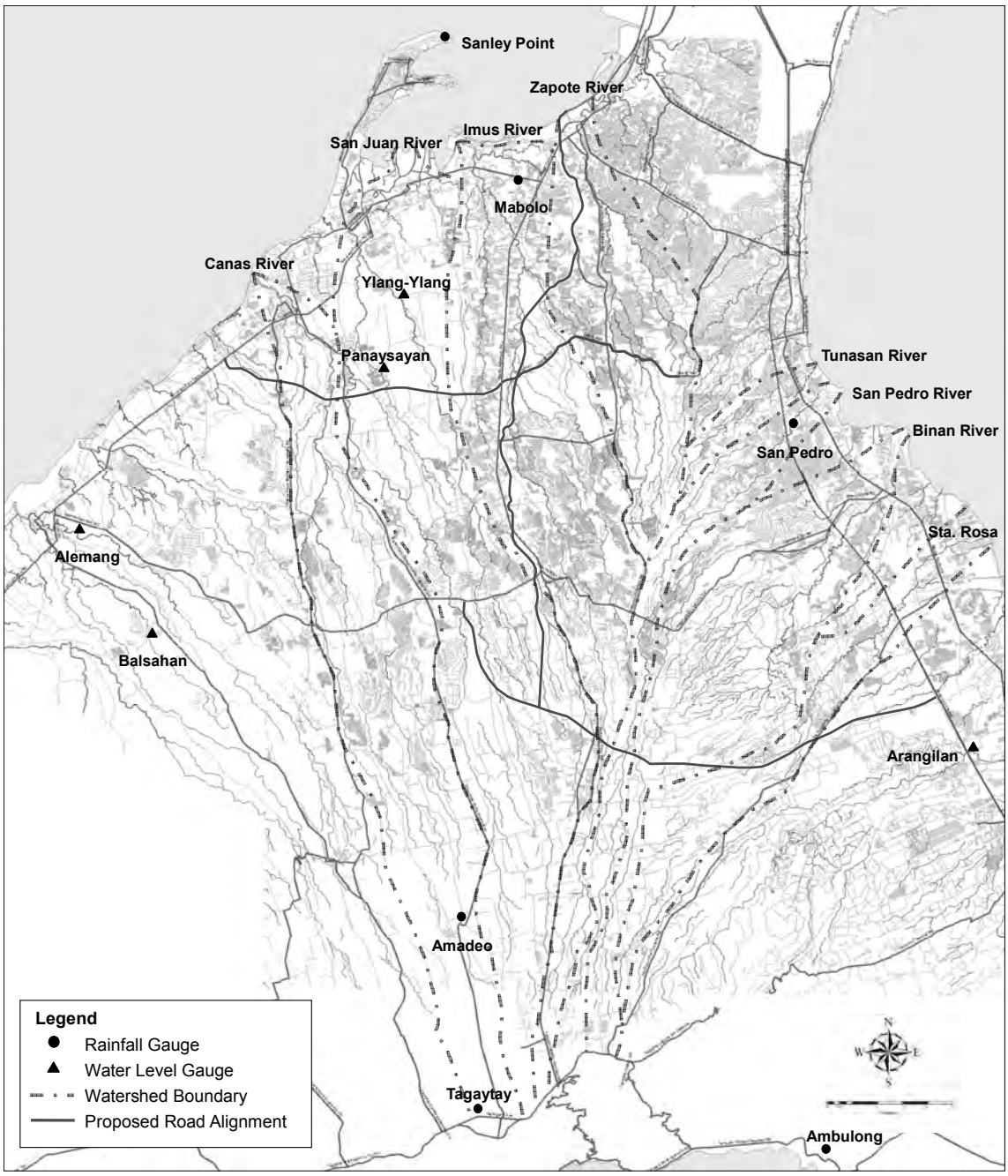
(d) Land Use Maps

The future land use pattern is required to estimate flood peak discharge at arbitrary points of crossing structures such as bridge, viaduct and culvert. As for the flood runoff analysis, which is scheduled to be carried out in the subsequent feasibility study period, the land use map created on GIS format prepared though the present study is available.

4) Satellite Imagery

Geographical information of the Study Area can be extracted at free-access web site of Google Earth. A satellite imagery taken in 2005 can provide the latest information of ground cover in the Study Area. The imagery was utilized to examine relationship between proposed road alignment and river channels concerned.

Figure 3.22 Watershed Boundaries with Rainfall and Water Level Gauging Stations



5) Related Study Reports and Guidelines

Among the related reports, documents and guidelines related to the hydrology, hydraulics and river engineering issues, in particular, following are to be referred for the Study:

(i) The Feasibility Study of the Proposed Cavite Busway System, JICA, November 2002

Among the volumes of the Final Report of the Feasibility Study, Appendix

A – Natural Conditions involves useful information for hydrological analysis. Since the study of Busway System covers same target area of the present Study, the methodology shall be referred.

(ii) Specific Discharge Curve Rainfall Intensity Duration Curve Isohyet of Probable 1-day Rainfall, JICA, March 2003

This Report was prepared under the Project for the Enhancement of Capabilities on Flood Control and Sabo Engineering of DPWH, a Project Type Technical Cooperation from JICA. Specific discharge curves and rainfall intensity curves in short and long duration curves at synoptic stations of PAGASA are available in the Report.

(iii) Design Guidelines, Criteria and Standards for Public Works and Highways, Volume II (Part 2- Hydraulic Design, Part 3-Hgihway Design, Part 4-Bridge Design), DPWH (to be hereinafter referred as to "DPWH Design Guideline")

Design procedure and key factors for hydraulic design are presented with miscellaneous design data and standard drawings.

(iv) Technical Guidelines of River and Sabo Engineering (Draft), Ministry of Infrastructure and Transport, Japan

Details on methodology of rainfall and flood runoff analyses are included with key design parameters such as runoff coefficient by deferent land cover and traveling time of flood flow, etc.

(3) River Cross Section Survey

In order to obtain the sectional data at rover crossing points along the proposed three routes, river cross section survey was carried out from February to May 2006. The survey works were sublet to RASA Surveying, Quezon City, through procurement procedure as specified by JICA. Total 22 sites, where the proposed routes cross over major rivers, were selected as follows:

Proposed Road	Number of Site
(i) CALA Expressway	9 sites
(ii) North-South Road	6 sites
(iii) East-West Road	7 sites
Total	22 sites

The location of major crossing points is shown in Figure 3.23 as well as the sites for river cross section survey. Related information at each crossing point is tabulated in Table 3.18.

Figure 3.23 Location Map of Crossing with River along Proposed Roads

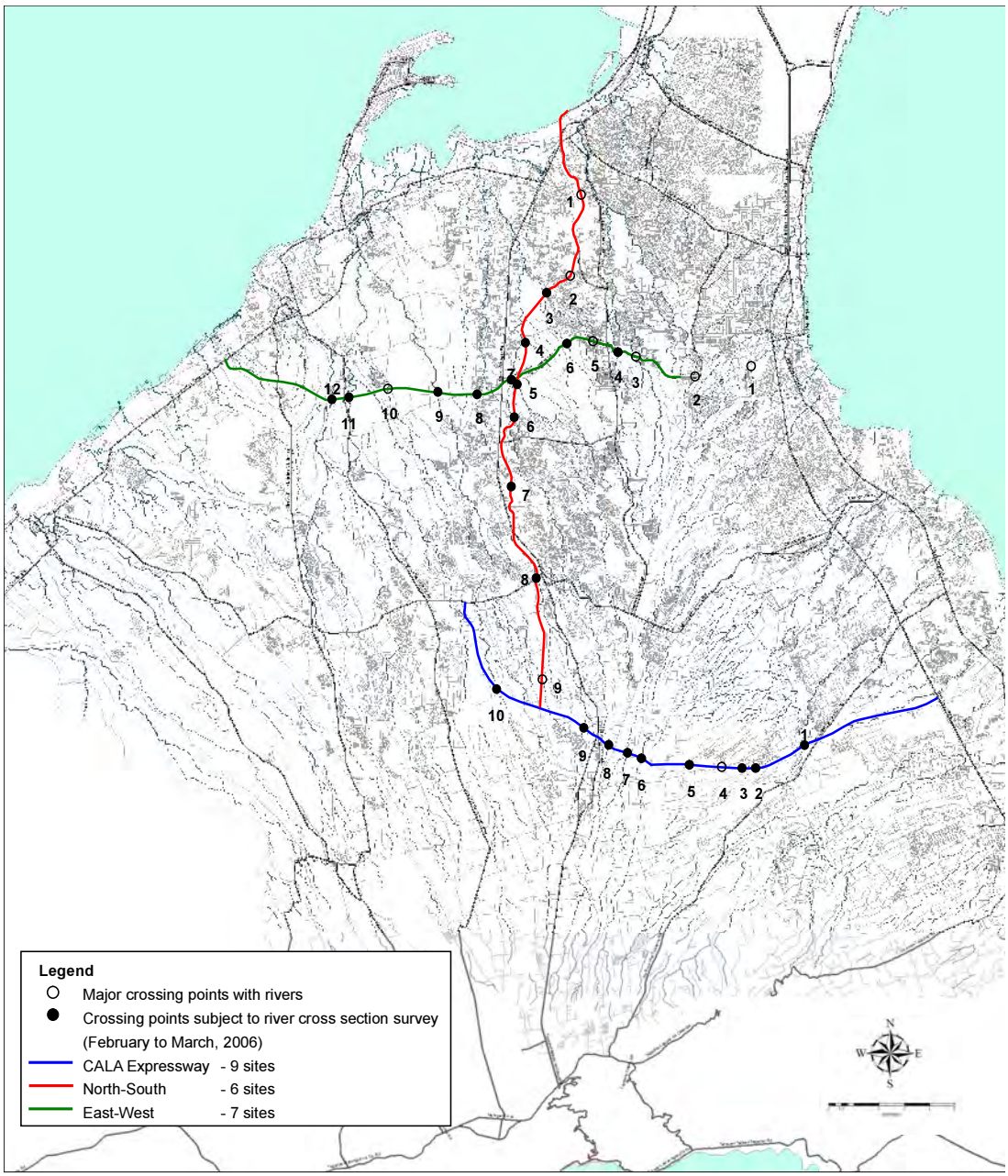


Table 3.18 River Crossings along Proposed Three Routes

Ref. No.	Crossing Points (1	Name of River	Name of Tributary	Municipality	Drainage Area (km2)	Proposed Structure (Tentative)	Notable Existing Conditions	Cross section survey
I.	**CALA Expressway (CE)**							
Start	Sta.0+000			Santa Rosa			SLEX	
CALA1	Sta.5+820	Banava	-	Silang	12.3	Bridge		CE-R1
CALA2	Sta.7+200	Banava	-	Silang	1.6	Bridge	moderately deep	CE-R2
CALA3	Sta.7+720	Banava	-	Silang	4.5	Bridge	moderately deep	-
CALA4	Sta.8+500	Banava	-	Silang	2.2	Bridge		CE-R3
CALA5	Sta.9+200	Biñan	-	Silang	1.4	Bridge		CE-R4
CALA6	Sta.10+840	Biñan	-	Silang	8.8	Bridge		CE-R5
CALA7	Sta.13+250	San Pedro	-	Silang	12.7	Bridge	Downstream of confluence, deep valley with thick vegetation	CE-R6
CALA8	Sta.15+320	Imus	-	Silang	13.2	Bridge	deep valley	CE-R7
CALA9	Sta.16+800	Dasmariñas	-	Silang	4.9	Bridge		CE-R8
CALA10	Sta.19+300	San Juan	Ylang Ylang	Silang	8.8	Bridge		CE-R9
End	Sta.22+881			Silang			Dasmarinas - Naic Road	
								9 sites
II.	**Daang Hari Extension (DH)**							
Start	Sta.0+000			Muntinlupa City	-	-	Boundary of Muntinlupa City and Municipality of Imus	
EW1	Sta.3+200	-	-	Muntinlupa City	-	Bridge	moderately deep valley	-
EW2	Sta.3+420	-	-	Imus	3.4	Bridge		-
EW3	Sta.6+100	Zapote	Don Cella	Imus	10.9	Bridge		-
EW4	Sta.7+100	Zapote	-	Imus	4.6	Bridge		DH-R1
EW5	Sta.8+100	-	-	Imus	1.3	Bridge		-
EW6	Sta.9+300	Imus	-	Imus	7.7	Bridge		DH-R2
EW7	Sta.12+050	Imus	-	Imus	54.6	Bridge	near new bridge under construction	DH-R3
EW8	Sta.13+640	Imus	-	Imus	8.7	Bridge		DH-R4
EW9	Sta.15+220	San Juan	-	Imus	52.0	Bridge		DH-R5
EW10	Sta.17+300	San Juan	Pasong Cama Chili	General Trias	11.4	Bridge		-
EW11	Sta.17+400	San Juan	Rio Grande	General Trias	51.1	Bridge	near existing suspension bridge	DH-R6
EW12	Sta.18+960	Cañas	Cañas	General Trias	95.8	Bridge		DH-R7
End	Sta.24+268			Tanza			Coastal Road	
								7 sites
III.	**North-South Road (NS)**							
Start	Sta.0+000			Imus			Coastal Road	
NS1	Sta.4+150	-	-	Imus	-	-	small creek	-
NS2	Sta.7+950	-	-	Imus	4.9	Bridge		-
NS3	Sta.8+750	Imus	-	Imus	9.9	Bridge	near new bridge already constructed, land reclamation is on-going for expansion of Citta Italia estate	NS-R1
NS4	Sta.11+300	Imus	-	Imus	1.8	Bridge		NS-R2
NS5	Sta.12+900	Imus	Baluctot	Imus	20.9	Bridge	moderately deep	NS-R3
NS6	Sta.14+000	Imus	-	Imus	34.7	Bridge	near suspention bridge	NS-R4
NS7	Sta.17+250	Imus	-	Dasmariñas	3.0	Bridge	near existing irrigation weir	NS-R5
NS8	Sta.21+500	San Juan	Dasmariñas	Dasmariñas	11.8	Bridge	near Bucal Bridge under construction of widening	NS-R6
NS9	Sta.25+500	San Juan	Ylang Ylang	Silang	2.9	Bridge		-
End	Sta.26+700			Silang			Proposed CALA Expressway	
								6 sites

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

Source: JICA Study Team

(4) Current Conditions of River Channels along Proposed Road Network

The Study Area is located at south of Tagaytay mountain ridge, where situated at perimeter of Lake Taal at south, in Provinces of Cavite and Laguna. In terms of watershed areas related to the road network, the Study Area falls in 40 km from north to

south and 25 km from east to west, namely, in around 1,000 km^2. The altitude of the watershed varies from EL 680 m at Tagaytay City to the sea level at the coastal area facing to Manila Bay.

The watershed area is characterized by a number of rivers originating at Tagaytay Ridge and running in parallel, which flows into Manila Bay and Laguna de Bay with feeding valuable water resources in the area. Relatively narrow strips of watershed from south to north (Manila Bay) and to northeast (Laguna de Bay) forms such unique topography. The major river basins emptying toward Manila Bay are Zapote, Imus, San Juan and Canas (from east to west), and those toward Laguna de Bay are Tunasan, San Pedro, Binan and Santa Rosa (from north to south) as shown in Figure 3.22. The size of catchment areas approximately varies between 20 to 120 km^2. The length of river course is around 50 km for the longest. The longitudinal profiles of major nine rivers such as Santa Rosa, Binan, San Pedro, Imus, Dasmariñas, Ilang-Ilang, Baluctot, Rio Grande and Canas Rivers, in which the proposed road alignment traverses.

It is noted that in the Study Area, more than 70 small scale ponds/reservoirs with under 10 m high dams are located. Most of them were constructed by National Irrigation Administration (NIA) or Local Government Units (LGUs) for irrigation purposes. In accordance with the interview to the local people, most of them were constructed 20 to 40 years ago and its function has been deteriorated due to lack of proper maintenance and appropriate repair of gate facilities. As urbanization progressed in Cavite, the necessity of the pond has been declined due to drastic decrease of irrigation water demand. In fact, agricultural land is rapidly changing to residential areas in the Study Area. The approximate location of the pond can be confirmed on the General Layout that was obtained at the "Cavite Friar Lands Irrigation System Office" (Branch of NIA regional office), Naic.

Further detailed conditions on the rivers running through the Study Area are presented dividing into three routes in the subsequent sub-sections. Principal feature of the crossings along the proposed routes is summarized in Table 3.18.

(5) Questionnaire Survey on Flooding Conditions

In order to confirm the flooding conditions such as flood prone area, information on severe floods, notable inundation damage and river improvement plans/on-going works, etc., questionnaire survey to 15 municipalities (11 in Cavite and 4 in Laguna Provinces) was conducted in February 2006. The questionnaire sheets were distributed to Engineering Department of each municipality and were retrieved after filled up. The questionnaire is divided into five sections, namely, (I) General Information, (II) Record of Flood Event, (III) Existing Water Impounding Pond, (IV) Discharge Measurement Record and (V) River Improvement Plans. Some important issues confirmed through the survey are described as follows:

<u>Section I: General Information</u>

(1-1) In the coastal area facing to Manila Bay, in particular, Bacoor, Imus, Kawit, Noveleta, and in lakeshore municipalities of Carmona, San Pedro and Biñan, flood prone area is identified in the low lying Barangays. Extraordinary high tide in addition to the insufficient inland drainage system is major reason of flood occurrence.

(1-2) A total of 974 ha (approximately 10 km^2) flood prone area in Bacoor, Imus, Kawit and Noveleta was identified with some particular barangays suffering from frequent inundation, where are the most susceptible zone to heavy storm in monsoon seasons. Among those, the largest area of 801 ha (82%) falls in Kawit. Nonexistence of major river outlet in Kawit might be one of the main reasons.

Section II: Record of Flood Event

(2-1) Severest flood in each municipality is summarized as below:

Nov. 1995	: Carmona
Nov.1998	: Bacoor
Jun.1999	: Silang
Sep.1999	: Gen. Mariano Alvarez
Oct.-Nov.2000	: Imus, Kawit, Noveleta, General Trias
Nov.2001	: Naic, Biñan
Oct.-Nov.2002	: San Pedro

(Rosario, Tanza, Dasmariñas and Trece Martires answered “None” or blank)

(2-2) According to the answers, due to the flood in Nov. 2000, relatively wide area was inundated at Imus, Kawit and Noveleta, in particular, Manila Bay coastal area. The inundation depth reached about 1.0 m above the ground surface and inundation lasted 4 hours (Noveleta) to 3 days (Imus), which caused serious damage to houses, other properties and livestock. No description regarding inundation is found in the questionnaire sheets from Bacoor. Since the origin of the North-South Road will be located in Bacoor, careful treatment of flood water in Bacoor is required.

Section III: Existing Water Impounding Pond

(3-1) Three municipalities of Dasmariñas, Trece Martires and Carmona reported information on impounding ponds. Dasmariñas described information on five dams with 6 m to 10 m high. Agriculture is predominant function of small scale reservoirs in the Study Area. Most of them were constructed in 40 to 20 years ago.

Section IV: Discharge Measurement Records

(4-1) Among 15 municipalities, only Gen. Mariano Alvarez answered “Yes”, but no technical document is available fort the records.

Section V: River Improvement Plan

(5-1) Only four municipalities of Bacoor, General Trias, Carmona and Biñan responded that they have river improvement plans. For instance, Bacoor has a plan to dredge the NIA’s Creek (L=3.4 km) near Molino Highway for enhancement of cultivation. In other municipalities there is no river improvement plan/activities.

(6) Methodology of Hydrological Analysis

In order to set appropriate methodology of hydrological analysis to determine the probable flood discharge and other design parameters at arbitrary crossings where structures are to be designed, following factors were examined:

(i) Basin parameters: size of catchments, channel length, riverbed gradient (traveling time of discharge)

Relatively small catchments (> 200 km^2), short river length (> 50 km) and 1/80 to 1/100 of average riverbed gradient

(ii) Existing structures for flood control

No major control structures, which can retard and store flood discharge and no inter-basin connection or floodways

(iii) Availability of rainfall and discharge record

Fairly reliable daily rainfall records (sufficient duration and coverage of area) but no flood discharge measurement record in the subject river basin (no measured hydrograph)

(iv) Requirement for design parameters of structure (bridge, culvert, revetment and embankment, etc.)

Flood peak discharge can be converted to the flood water level based on the channel geometry by means of appropriate runoff model.

(v) Future flood control/drainage improvement plan
No major flood control/drainage improvement plan to be taken account to estimate flood discharges is not identified in DPWH except minor channel improvement managed by LGUs

As the result of examination, flood runoff analysis by rational formula and uniform flow theory will be applied to estimate probable peak discharges and associated water levels at arbitrary locations in the Study Area.

(7) Hydrological Analysis

1) Characteristics of Rainfall Pattern

Monthly rainfall amount at six stations is illustrated in Figure 3.24. It is distinct that August and July are predominant rainy period and January to April is very dry in the Study Area. Although the monthly pattern is similar among six stations, the rainfall amount at Amadeo is rather high compared with others. According to the record from PAGASA, in fact, annual rainfall in most of years are extraordinary high, which shows equal or more than 2.5 to 2.8 times of the amount at Sangley Point and Bacoor.

Because the reliability of the daily rainfall record at Amadeo seemed low, the Study Team wrote a letter to confirm the issue to the Chief of Climate Data Division, PAGASA, before starting hydrological analysis. As the results of the consultation, PAGASA informed the Study Team by their letter dated on February 28, 2006 that the records at Amadeo should not be included in any analysis. PAGASA recognized that it was entirely their mistake on

data processing. Therefore, the records at Amadeo were omitted in the subsequent analysis in the present Study. A chronological annual rainfall fluctuation is shown in Figure 3.25.

Figure 3.24 Monthly Variation of Rainfall

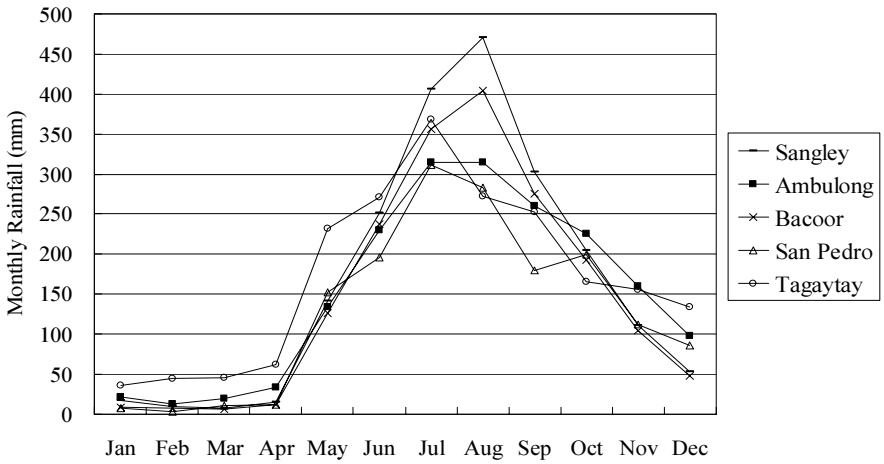
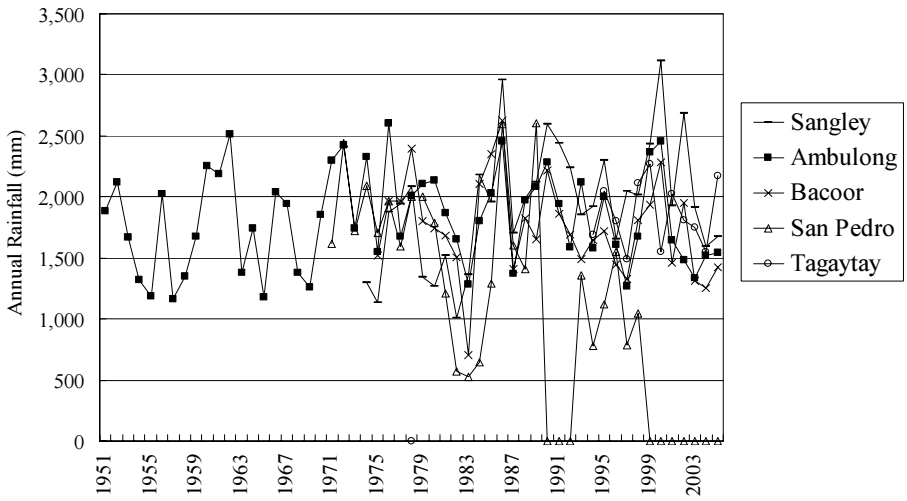


Figure 3.25 Chronological Annual Rainfall Pattern



2) Probable Rainfall

Based on the series of records, probable 1-day rainfall was estimated by Gumbel Method and as summarized in Table 3.19.

Table 3.19 Probable 1-day Rainfall (point rainfall)

(Unit: mm)

Return Period (Year)	Sangley Point	Ambulong	Bacoor	San Pedro
1.01	41.6	38.8	24.4	11.5
2	147.8	138.8	144.4	105.5
5	211.3	198.6	215.4	161.7
10	253.3	238.2	262.8	198.9
25	305.3	287.1	321.3	244.9
50	345.8	325.3	366.9	280.8
100	385.0	362.1	411.0	315.4
200	423.9	398.8	454.8	349.8
Years of data available	32	55	31	25

Source: Analyzed based on the rainfall record from PAGASA

The significant rainfall (193.2 mm at Sangley Point and 214.5 mm at Bacoor) was recorded on October 28, 2000, which caused serious inundation along the coastal area. The municipalities at coastal area answered to the questionnaire that most serous flooding has occurred in November 2000. Although no available direct measurement record of flood discharges is available, the magnitude of the flood of November 2000 might be approximately 10-year recurrence 1-day rainfall probability based on the probable rainfall tabulated above.

3) Runoff Analysis

(i) Runoff Record

Based on the available daily discharge records, annual peak discharges at eight gauging stations are summarized. In the Study Area at Alapan (CA=60 km^2: Ylang-Ylang River) and Palubluban (CA=29 km^2: Panaysayan River), maximum value of annual peak discharge is 346.5 m^3/s and 227.7 m^3/s respectively. In terms of specific discharge, both are 5.8 $m^3/s/km^2$ and 7.9 $m^3/s/km^2$. Since the reliability of the records could not be justified based on the actual discharge measurement and/or rating curves, etc. at gauging stations concerned, statistical analysis to estimate probable discharges was not conducted based on the discharge data. Therefore, those were handled as a guide of magnitude of flood peak discharges.

(ii) Probable Flood Peak Discharge

The flood peak discharge was calculated by means of Rational Formula. The formula of the theory is represented as follows:

Q = * C * I * A

where,

- Q: Peak discharge (m^3/s)
- I : Intensity of rainfall for a duration equal to the time of concentration (mm/hr)
- A: Drainage area or catchment contributing to storm flow (km^2)
- C: Runoff coefficient depending on catchment characteristics

Runoff coefficient

Runoff coefficient (C) shall be decided taking account of land cover, vegetation, shape of catchment and land development, etc. Different figures recommended in guidelines commonly applied in sewerage design and land development are introduced in the Technical Guidelines of River and Sabo Engineering, Ministry of Infrastructure and Transport, Japan.

On the other hand, future land use plan targeted in year 2020 was prepared in the current Study. Based on the presumed built-up conditions in the Study Area versus the criteria as above, 0.6 was applied to estimate the peak discharges at crossing points.

Time of concentration

Time of Concentration in the Rational Formula is usually defined as required time for reaching of the flow in the channel from the most remote point to the outlet of the catchment concerned. Three methodologies by Kraven's formula, Rziha's formula and Ven Ti Chows formula were tested. The one developed by Ven Ti Chow is recommended to apply in the Design Guidelines, Criteria and Standards for Public Works and Highways Volume II, DPWH (Page 696). Those formulas cited above are described as follows:

1. Kraven's formula

T = L/W

I	I > 1/100	1/100 < I <1/200	I< 1/200
W	3.5 m/s	3.0 m/s	2.1 m/s

where, I: Slope of channel, W: Flow velocity (m/s)
L: Length of channel, T: Time of concentration

2. Rziha's formula

T= L/W

$W= 20 (h/L)^{0.6}$

where, W: Flow velocity (m/s), h: Elevation gap (m)
L: Channel length (m) T: Time of concentration (s)

3. Ven Ti Chow (DPWH's Guideline)

$$Tc = \frac{L^{1.15}}{51H^{0.385}}$$

where, Tc: Time of concentration (min)
L: Length of watershed along the mainstream (m)
H: Difference in elevation between the most distant ridges in the watershed and point under review (m)

As the results of examination, Ven Ti Chow's formula was applied to estimate the time of concentration, because that tends to give moderate figures between other two methods. Especially as for the small catchments with short channel length, Kraven and Rziha formula return comparatively short time concentration, which would cause too large rainfall intensity and overestimate of flood discharge.

Rainfall intensity

In order to decide the rainfall intensity applying to the rational formula, analyzed data of rainfall (intensity-duration-frequency) in short duration at Sangley Point in Cavite was collected from Hydrometeorological Investigations and Special Studies Section, Flood Forecasting Branch, PAGASA.

On the other hand, probable annual maximum 1-day rainfall at Sangley Point was estimated based on 32-year records till 2005. However, since the probable values were estimated in the basis of 1-day rainfall not 24-hour data, an adjustment to 24-hour by adding 5% was conducted.

Probable Flood Peak Discharge

All data required for estimate of the flood peak discharge at 22 sites, where cross sections are available, have been set up to the above item (c).

(iii) Flood Water Level

Based on the flood peak discharge at 22 sites, flood water levels were estimated by uniform flow theory with Manning's Formula as shown below:

$$Q = V \times A$$

$$V = \frac{1}{n} I^{1/2} R^{2/3}$$

where, V: Flow velocity (m/s), Q: Discharge (m^3/s)
n: Roughness coefficient, I : Slope of channel bed
R: Hydraulic radius (m)

The roughness coefficient of 0.040 for "n" was applied to entire perimeter of all cross sections considering the current channel conditions.

In accordance with the DPWH Design Guideline (Page 697), design storm frequency is specified for different type of structures as below:

Kind of Structure	Design Storm Frequency
Bridges	1 in 50 years
Box Culverts	1 in 25 years
Pipe Culverts	1 in 10 years
Embankments	1 in 10 years
Ditches and Road Surface	1 in 2 years

Source: DPWH Design Guideline (Page 697)

(iv) Evaluation of Results

In the Feasibility Study of the Cavite Busway System carried out by JICA in 2002, runoff analysis to estimate flood peak discharges at 12 crossing point along the proposed busway. The proposed busway route corresponds with the North-South road in the present Study. The specific discharge for 50-year return period varies between 2.7 and 14.9 $m^3/s/km^2$. On the other hand, those estimated by the current study fall into between 9 to 36 $m^3/s/km^2$. Therefore, it is noted that the current study resulted larger values in terms of specific discharges compared with those estimated by Busway System Study.

On the other hand, Specific Discharge Curves in different return periods are available in the Report of "Specific Discharge Curve, Rainfall Intensity Duration Curve, Isohyet of Probable 1-day Rainfall", which was prepared in the Project for the Enhancement of Capabilities in Flood Control and Sabo Engineering of the DPWH under JICA in March

2003. The distributed range of the specific discharges becomes closer to the envelope curve of Luzon.

Therefore, it is proven that the result of runoff analysis was preliminarily justified in the feasibility study level. However, further verification and updating of the design discharges and flood water levels should be conducted during the detailed design stage.

(8) Particular Issues on River Engineering related to the Proposed Alignment

1) CALA Expressway from Sta.1+000 to Sta.1+500

The alignment of CALA Expressway near connection with the SLEX near Santa Rosa will cross the small creek of the Santa Rosa River. Since the proposed alignment will run along the creek, appropriate alignment will be required so as not to deteriorate the local drainage conditions considering the drainage system in the new residential estates, which are still developing in the vicinity.

Although flood discharge will not make influence to the vertical design of the proposed expressway, it is recommended that existing outlet connected with the creek should be further investigated in the feasibility design stage.

2) North-South Road from Sta.14 +000 to Sta. 15+000

Near the starting point in Bacoor of the North-South Road, interchange is planned on the ground level. In order to decide appropriate elevation of land reclamation and required related structures in the coastal area considering high tide (storm serge) of Manila Bay, probable maximum tide levels were studied.

In Manila Bay, tide levels are observed at Pier No.7 of Manila South Harbor (14°37′N, 120°58′) by the Coast and Geodetic Survey Department, National Mapping and Resource Information Authority (NAMRIA), DENR. Based on the historical records, probable maximum high tide of 50-year return period was estimated at EL.2.42 m by Gumbel Method. In order to protect the structure from extraordinary high tide, it is recommended that this tide level should be considered in structural design of road facilities.

3) Daang Hari Extension from Sta.0+000 to Sta.3+000

Along the proposed alignment of Daang Hari Extension in Citta Italia estates in Municipality of Imus, NIA's irrigation canal is running in parallel. Considering the availability of the limited space of right-of-way, encasing is one of the possible solutions to keep the required width of the road design.

The Study Team wrote an official letter to confirm the opinion to NIA. Discussion with the Chief Engineer of the NIA's Operation Office in Municipality of Naic as well as joint field inspection was made on May 30, 2006.

As the result of the discussion with NIA, they basically accepted to encase (or to cover) the irrigation canal, since it has been already abandoned due to decrease of irrigation water demand in their command area. In fact, it seems no maintenance of the canal is currently provided and this is confirmed with the water stagnation in the canal. However,

the NIA staff requested to retain the flow space, because presently the canal has a function of drainage in the neighboring area of the subdivisions/residential areas.

Based on the findings and recognition by NIA, in order to fit the road alignment within the right-of-way, it is recommended to encase the canal to tentatively keep present flow area. In the detailed design stage, appropriate drainage network should be studied.

4) North-South Road from Sta.21+000 to Sta.21+500

Proposed alignment of NS-Road will cross the Dasmariñas River at around 100 m to 200 m upstream of Bucal Bridge, where construction of widening span is progressed. A river cross section (NS-R6) is available at this section. Based on the runoff analysis, the 50-year probable flood water level will reach a little higher than the right bank. It is recommended that proper protection for the side slope of embankment at bridge pier be required. In particular, due care should be given to the vertical formation of the proposed alignment crossing this point.

(9) Bank Erosion

No serious erosion or local scour of river bed and/or river bank may be realized under the current conditions at the crossing site along the proposed alignment of the three routes. However, appropriate treatment to stabilize the slope of river bank in association with construction of bridge and other crossing structures will be required.

Sediment deposition along the channel is rather small considering steep river bed gradient and relatively thick vegetation cover of the watershed. Further, the river bed and foot of bank slopes are formed with hard rock and thus these are less susceptible to erosion by strong current under the current conditions.

However, specific consideration of countermeasures at crossing points shall be made if present channel geometry is remarkably changed due to construction works of new road and related structures.

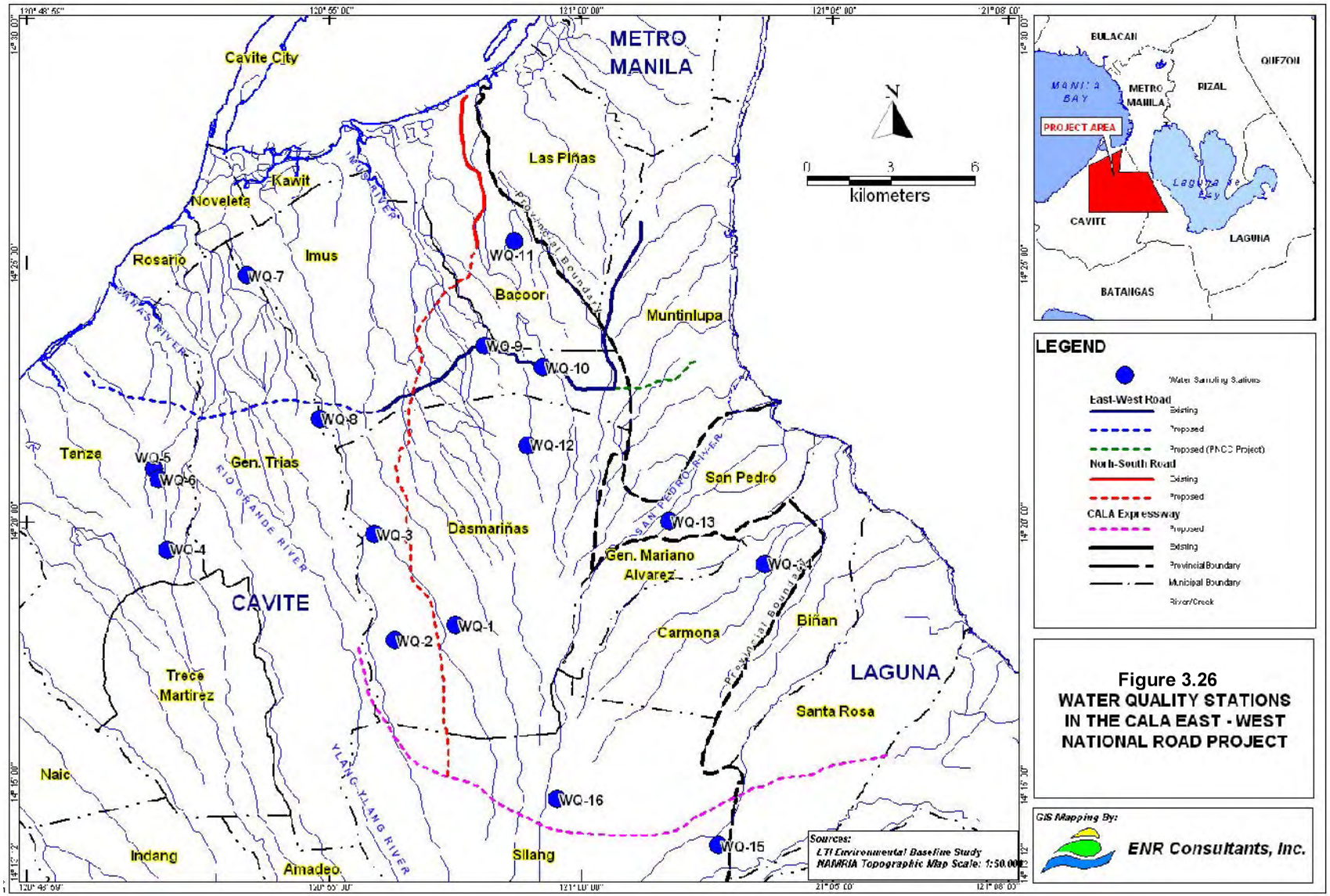


Figure 3.26
WATER QUALITY STATIONS IN THE CALA EAST - WEST NATIONAL ROAD PROJECT

3.2.6 River Water Quality

(1) Methodology

As earlier discussed in Hydrology, sixteen (16) sampling stations have been identified in the project area from which river water has been taken for analysis (Figure 3.26).

The 16 stations are distributed as follows: Five (5) water quality stations were established in Imus River (WQ1, WQ2, WQ3, WQ4 and WQ5). There are four (4) stations in Ylang-Ylang River (WQ6, WQ7, WQ8 and WQ9). Rio Grande River (WQ10, WQ11, WQ12 and WQ13). Three (3) stations (WQ14, WQ15 and WQ16) are sited in Canas River.

The stations directly relevant to the final road alignments are as follows:

Road Alignment	Water Quality Station
East – West Road	WQ8, WQ9, WQ10
North - South Road	WQ 1, WQ 2, WQ 3, WQ 11
CALA Expressway	WQ 2, WQ 15, WQ 16

Grab water samples were taken using the Aeronics Incorporated, Environmental Laboratory Division provided sampling containers. Containers were filled to the brim before it was capped, sealed and stored in an ice bath inside a covered plastic cooler. Physical parameters include conductivity (Mmhos), Salinity (ppm), Temperature (Degrees Centigrade). Chemical parameters include BOD (mg/L), DO (mg/L), Turbidity (mg/L), TSS (mg/L), pH, and Lead (mg/L). Bacteriological characteristic includes total coliform (MPN/100L). Samples were submitted to Aeronics Incorporated, Environmental Laboratory Division Laboratories for analysis using the guidelines prescribed on the Standard Procedure for the Analysis of Water and Wastewater, 19th edition.

The methodologies used for the different parameters are listed below:

Table 3.20 Methodologies Used for Surface Water Analysis

Parameters for Surface Water Quality	Methodology
Biological Oxygen Demand (BOD)	Azide Modification/Dilution Technique
Dissolved Oxygen (DO)	Glass Electrode
Lead (Pb)	AAS
Total Coliform	Multiple Tube Fermentation Technique
Color	Visual Comparison
pH	Glass Electrode
Conductivity	Glass Electrode
Turbidity	Glass Electrode
Temperature	Water Quality Checker (in-situ)
Salinity	Glass Electrode
Total Suspended Solids(TSS)	Gravimetric

The results were then used to classify river waters in the project area in accordance to beneficial uses.

All surface quality sampling stations except for stations WQ5, WQ9, WQ12, WQ13 and WQ14 was characterized as having a shallow to very shallow depth, light to dark murky color (light brown to brown), and a turbid water-flow in all portions, and muddy substrate

which indicate a typical polluted water body. Brownish color also indicates heavy siltation and erosion. Several sampling stations which are located in light to highly urbanized area were found to be full of garbage and used as sewerage discharges by the households nearby. Some stations also serve as dumping grounds of human excreta. Some of the clean water stations are all near agricultural farms and are used as irrigation source for the lands. These five stations are clean to moderately clean. Table 3.21 shows the location, geographical coordinates and descriptions of the sampling stations.

Table 3.21 Location and Descriptions of the Sampling Stations

Sampling Station	Location and Description of Sampling Stations	GPS Coordinates
WQ1	Imus River: located in Barangay Tanza Luma IV, Tanza Cavite. Station at the back of Barangay Hall. Heavy populated vicinity. River brown in color, very murky, shallow water with muddy substrate Serves as dumping ground of solid wastes. Presence of human excreta.	14 deg 24' 54"N 120 deg 56' 40"E
WQ2	Imus River Basin: located in Barangay Pasong Buwaya, Dasmariñas; under a bridge along Daang Hari Highway near Daang Hari Coliseum; water brownish, murky and full of garbage; substrate muddy.	14deg 23' 24.1" N 120deg 58' 04.5" E
WQ3	Imus River: located in Salitran-Salawag Road. Barangay Salitran, Dasmariñas Cavite. Heavy populated area. Murky, brownish and stagnant water. Serves as dumping ground of solid wastes. Presence of kangkong plants. Substrate muddy.	14 deg 21' 10.7"N 120deg 56' 31.7"E
WQ4	Imus River: located in Pala-pala Diversion Road. Located in Paredes Bridge. River very shallow, murky brown, Turbid flowing water, Presence of garbage, muddy substrate. Presence of households.	14deg 18' 2.0 "N 150deg 57'29.9"
WQ5	Imus River: located in Barangay Sabutan, Silang Cavite. River flowing, clear green water, shallow river. Presence of solid wastes mostly plastics. Several houses nearby. Presence of grasses. Sandy substrate.	14 deg 14' 04.8"N 120deg 58' 36.2E
WQ6	Ylang-Ylang River: located in Dasma-Naic Road, Barangay Langkaan II. Shallow dark brown water. Full of garbage, turbid flowing water, used as sewerage discharge, muddy substrate, highly populated	14 deg 17' 44.2"N 120 deg 56' 17.6" E
WQ7	Ylang-Ylang River Basin: located in Barangay Zone II, Dasmariñas; river in under a hanging bridge where access is the entrance of the Greenbrezze Village, brownish water is very murky which serves as the sewage drainage of all the villages nearby; the river is full of garbage and human excreta.	14deg 19' 46.6" N 120deg 55' 52.5" E
WQ8	Ylang-Ylang River Basin: located in Malagasang National Road, Barangay Malagasang 2-C, Imus. Near the Barangay Hall under an unnamed Bridge; a very shallow river; brownish, murky and full of garbage; substrate very muddy.	14deg 21' 59.9" N 120deg 54' 47.7" E Elev: 157 ft.
WQ9	Ylang-Ylang River Basin: located in Barangay San Sebastian, Kawit. Access going to Kawit Kalayaan General Hospital; River is under a newly constructed bridge which is near a big construction depot; water moderately clean, greenish and free-flowing; no houses nearby. Sandy.	14deg 24' 45.4" N 120deg 53' 20.9" E Elev: 4ft.
WQ10	Rio Grande River: located in Barangay Bacao II, Gen. Trias Cavite. Flowing water. Dark brown in color. Murky with presence of garbage and human excreta. Several houses nearby.	14 deg 25' 05.0"N 120deg 52' 57.5"E
WQ11	Rio Grande River: located in Barangay Sta. Clara. Bridge with steel railings. Stagnant river. Brown in color, River full of garbage. Located in a heavy populated area. Substrate muddy	14 deg 22' 58.8"N 120deg 52' 45.0"E
WQ12	Rio Grande River: located in Barangay San Francisco, Gen Trias Cavite. Near two industrial facilities. Located in Gov. Forbes drive. River clear and flowing. Presence of several houses nearby. Sandy substrate.	14 deg 17' 37.3"N 120deg 55' 0.60"E
WQ13	Rio Grande River: located in Barangay Javalera. Inside Javalera Subdivision Phase I. Clear and green flowing river. Presence of plastics. Near several households. Shallow water. Presence of fruit bearing trees (mango, banana). Also presence of bamboos. Sandy substrate.	14deg 15' 10.6"N 120 deg 55' 13.9"E
WQ14	Canas River Basin: located in Barangay Paradahan II, Tanza; river moderately clean and serves as a source of irrigation water to several agricultural farms in the vicinity; several houses of farmers are present nearby; water is greenish with sandy substrate; used as swimming pool.	14 deg 19' 28.8" N 129deg 51' 45.9" E
WQ15	Canas River: located in Barangay Uno Tanza, Tanza Cavite. Stagnant water with putrid smell. Murky water. Serves as dumping grounds of several houses nearby. Muddy substrate. Domestic waste and human excreta present.	14deg 23' 44.9"N 120deg 51' 22.1"E
WQ16	Canas River Basin: located in Daang Amaya, Barangay IV Poblacion, Tanza	14deg 20' 49.7" N

Sampling Station	Location and Description of Sampling Stations	GPS Coordinates
	under the big Tejero Bridge (Km 32+367); across is the PNP Tanza Traffic Management unit; water brownish and very murky turbid-flowing water; serves as dumping grounds of garbage of several houses nearby; serves also as drainage outfall of the residences; muddy substrate.	120deg 51' 35.8"E

(2) Surface Water Quality

The beneficial uses and classification based on the List of Classified Water Bodies from the Department of Environment and Natural Resources (DENR), classify all the Rivers in the proposed Project site as within the Class C water bodies. The result of water quality is shown in Table 3.22.

Table 3.22 Surface Water Quality Around the Project Area

Parameters	DENR Standard (Class C Waters)	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8
Physical Characteristics									
Temperature	3 (max. rise in deg Celsius)	28.8	26.1	27.7	26.0	25.3	25.4	26.4	28.6
Conductivity (ms/cm)	-	0.244	0.230	0.238	0.247	0.982	0.205	0.278	0.462
Salinity (ppm)	-	0.00	0.00	0.000	0.00	0.047	0.00	0.01	0.00
Chemical Characteristics									
pH	6.5 - 9.0	8.21	7.66	8.37	7.36	8.27	7.12	7.49	7.98
BOD	7(10) mg/L	3	2	3	7	10	12	2	10
DO	5.0 mg/L	3.08	2.09	3.08	2.18	3.00	2.13	2.10	2.16
Turbidity	NTU	21	12	20	15	20	17	11	18
TSS	60mg/L increase	20	60	20	40	70	60	30	60
Lead	0.05 mg/L	-	0.145	-	0.067	-	0.102	0.051	0.051
Bacteriological Characteristics									
Total coliform	5,000 MPN/100mL	-	$12x10^6$	-	$22x10^4$	-	$34x10^6$	$27x10^4$	$4x10^5$

Parameters	DENR Standard (Class C Waters)	WQ9	WQ10	WQ11	WQ12	WQ13	WQ14	WQ15	WQ16
Physical Characteristics									
Temperature	3 (max. rise in deg Celsius)	27.5	26.5	27.8	26.9	27.2	28.5	28.1	28.3
Conductivity (ms/cm)	-	0.278	21.6	0.612	0.307	0.500	0.223	0.673	5.70
Salinity (ppm)	-	0.01	1.297	0.027	0.017	0.027	0.00	0.027	0.30
Chemical Characteristics									
pH	6.5 - 9.0	7.63	8.10	8.50	8.23	8.31	7.65	8.40	7.39
BOD	7(10) mg/L	7	6	14	3	9	5	5	9
DO	5.0 mg/L	2.10	2.96	2.97	11	2.99	2.18	3.07	2.11
Turbidity	NTU	11	24	15	32	15	15	19	20
TSS	60mg/L increase	60	20	50	20	20	30	20	40
Lead	0.05 mg/L	0.057	-	-	-	-	0.030	-	0.244
Bacteriological Characteristics									
Total coliform	5,000 MPN/100mL	$8x10^6$	-	-	-	-	$9x10^5$	-	$3x10^6$

1) Color

The color of the water was determined by on-site ocular inspection. The color is mostly influenced by the suspended materials in the water and not the type of material or covering of the river substrate. The sampling result showed a color ranging from brownish to light light-brown to dark brown (murky) for dirty river and green to moderate cleaner water. Only five (5) out of sixteen (16) stations are with greenish water. The murky color of the 11 stations surveyed is due to the proliferation of domestic waste including human excreta that is dumped in the river, not to mention the silt run-off

emanating from the different construction activities in the entire Provinces especially in the upstream portion of the rivers involved. The different discharges coming from the households as well as those from the different industries in the area also contribute to the murky color of the rivers.

2) Substrate Characteristic

The substrates of the different sampling stations are described as muddy and sandy. Muddy substrate indicates a polluted water and sandy substrate indicate moderately cleaner water. Again, only 5 stations have a sandy bottom and 11 stations have muddy substrate.

3) Salinity and Conductivity

The results of the analysis for salinity ranged from 0.000 to 1.297 ppm. Water which has a salinity measurement lower than 5.00 ppm is considered as freshwater (Linsley, 1998). The high elevation of all station will prevent any intrusion of saline water if there are any near the site. Conductivity readings in all stations are consistent.

4) Water Temperature

The temperature of the water in the different sampling stations did not show any significant fluctuation. The temperature ranges from 25.3 to 28.8^{o}C. The almost uniform result of the analysis is due to the shallowness of the rivers and the lack of water circulation in these rivers. There are no standards and/or guide level for temperature except the 3^{o}C rise. Generally, higher temperature results in poor quality of water.

5) pH

The pH values obtained are neutral to very slightly basic (7.12-8.50) and are within the allowable range set by DENR of 6.5 – 9.0 for Class C waters, (i.e. water for propagation of fish and other resources).

6) Biological Oxygen Demand (BOD)

As industrial waste not Values obtained in the sampling range from 2 - 14 mg/L. Six (6) stations exceeded the DENR standard for Class C waters at 7 mg/L. This indicates a high level of organic pollution in the river.

7) Dissolved Oxygen (DO)

The DO levels in the stations ranged from 2.10 - 11.0 mg/L. All stations within the study areas have DO values below the 5 mg/L DENR standard for Class C waters. The unfavorable DO values could be attributed to the polluted state of the rivers due to the presence of domestic as well to mention the presence of human excreta in some of the stations.

The low oxygen level of all the rivers is indicative of decomposition and other oxygen depleting activities which are detrimental to fishes and other aquatic life. Also the volume of DO is an indicator of the level of productivity of a water body because it is an important life sustaining gas found in any body of water.

8) Turbidity

Turbidity is an independent parameter which is a measure of the amount of suspended materials in the water. Turbidity is not considered as a level of pollution. The result of analysis showed that turbidity in all the sampling station ranges from 11 - 32 NTU. There is no DENR standard for this parameter.

9) Total Suspended Solids (TSS)

Total suspended solids in the water consist normally with erosion silt brought about by sedimentation. Human activities may increase the suspended solids in the river by dumping of domestic waste as well as waste from industries. Erosion from deforested areas brought about by the massive housing development in the Provinces, is also a primary contributor of sedimentation in the rivers. The TSS level in the sampling stations ranges from a low 20 mg/L increase to a high 70 mg/L increase.

10) Heavy Metal - Lead (Pb)

Except for One (1) station, the concentrations of lead were above the DENR Water Quality Criteria for Class C water. Traces of lead may occur naturally in water bodies depending on the geologic composition (rocks/ores containing lead and arsenic) that the water comes in contact. Washings of the soil material into streams during runoff events is a potential source of dissolved lead in creeks. Likewise, industrial effluents as well as domestic sources (e.g. disposal lead batteries, etc.) may also contribute to the slightly elevated Pb concentrations.

11) Bacteriological Characteristics

Total coliform counts in all the stations were above the DENR Water Quality Criteria for Class C waters. The bacteriological level may be directly related to anthropogenic activities. Coliform occurrences in the rivers were highly attributed to human or animal feces/excreta. This is not entirely surprising as the rivers are occasionally used as a sewage and waste disposal area by nearby communities and industries.

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Species and Ecosystem

The geographical distribution of the flora and fauna of the Philippines is divided into fifteen biogeographical zones. The provinces of Cavite and Laguna form an integral part of the Luzon Biogeographical Zone. Each biogeographic zone is characteristically unique from each other having different ecosystems and habitats which harbours a high number of species and a diverse composition of flora and fauna. Figure 3.27 present the biogeographic zones of the Philippines.

Generally, the type of ecosystem, ecological succession and the degree of habitat deterioration and disturbance prevailing in a given area highly influence the diversity and richness of the flora and fauna species. In other words a secondary forest will have more number and species of plants and animals as compared to a primary forest converted into an agro-ecosystem with communities and built-up areas. Also, a small percentage of forest cover may be assumed to be indicative of a deteriorated wildlife habitat; hence, can

be associated with poor species diversity and a number of threatened animal species in the wild. Table 3.23 presents the Luzon endemic species of fauna.

As early as the late 1800's the Cavite and Laguna provinces were then predominantly agricultural land managed by the Spanish friars. From the 1980's to the present time, the land primarily cultivated to agricultural production have been converted and transformed into agro-industrial, economic and real estate housing development.

At present, there are 8 industrial estates being developed in terms of infrastructure support and facilities. There are also 74 industrial establishments engaged in a variety of agri-business processing and manufacturing activities.

In Cavite province the recent land use data indicate the following: Agricultural land spanned 74% of the total land area. Major crops are rice, corn, vegetable, fruits, root crops, coffee and coconut. Built-up areas consist 16%, forestlands account for 9%, and wetlands comprise only 1%. Laguna's landuse is almost similar to that of Cavite. Approximately 49% is devoted to agriculture. Forestlands comprise about 28% while built-up areas account for 23%.

LEGEND

Biogeographical Zone Boundary

NIPAP PA's

Coastline

Figure 3.27
BIOGEOGRAPHIC ZONES OF THE PHILIPPINES

Source:
PAWB

GIS Mapping By:
ENR Consultants, Inc.

Table 3.23 List of Luzon Endemic Species

Common Name	Scientific Name	Ecological Status
Amphibians		
Mountain Forest frog	Platymantis montanus	LI EV
Luzon Forest frog	Platymantis luzonensis	SL EV
Diminutive Forest frog	Platymantis mimulus	SL EV
Pygmy Forest frog	Platymantis pygmaeus	LI EV
Luzon Frog	Rana (everetti) luzonensis	GL NT
Giant Luzon Frog	Limnectes (magna) macrocephala	GL EB
Luzon Variable-backed Frog	Rana (signata) similis	GL CU
Woodworth's Frog	Rana woodworthi	SL NT
Luzon Chorus Frog	Kaloula (baleata) kalingensis	LI IS
Luzon Narrow-mouthed Frog	Kaloula rigida	LI EV
Luzon Pond Frog	Rana (limnocharis) vittiegera	IC EB CU
Reptiles		
Malay Water Monitor	Varanus salvator	En
Cumming's Mabouya	Mabuya cumingi	
Tree skinks	Lipinia pulchellum/auriculatum grp	
Flying lizards	Draco (spilopterus, reticulatus)	
King cobra	Ophiophagus hannah	
Philippine cobra	Naja philippensis	
Reticulated python	Python reticulatus	
Philippine Pit-viper	Trimeresurus flavomaculatus	
Birds		
Philippine Duck/ Pa-pan	Anas luzonica	L, En
Philippine Falconet	Microhierax erythrogonys	LI,
Philippine Serpent-Eagle	Spilornis holospilus	
Amethyst Brown-Dove	Phapitreron amethystina	
White-eared Brown Dove	Phapitreron leucotis	
Pink-bellied Imperial Pigeon	Ducula poliocephala	EN, NT
Luzon Bleeding-heart	Gallicolumba l. luzonica/rubiventris	LI, EN, NT
Cream-bellied Fruit-Dove	Ptilinopus merrillii	
Yellow-breasted Fruit-Dove	Ptilinopus occipitalis	
Pink-bellied Imperial-Pigeon	Ducula poliocephala	
Colasisi (LI race)	Loriculus p. philippensis	CU
Worcester's Buttonquail	Turnix worcesteri	CU
Guaiabero Fig-parrot (LI race)	Bolbopsittacus l. lunulatus	EN
Luzon Montane Racquet-tail	Prioniturus montanus	LI, EN, V
Blue-headed Racquet-tail	Prioniturus platenae	LI, EN, NT
Green Racquet-tail	Prioniturus luconensis	EN, V
Red-crested Malkoha	Phaenicophaeus s. superciliosus	LI, EN
Scale-feathered Malkoha	Phaenicophaeus cumingi	GL
Philippine Coucal	Centropus viridis	PE
Luzon Scops-Owl	Otus longicornis	GL
Phil. Scop's owl	Otus megalotis	EN
Phil. Eagle-owl	Bubo philippensis	PEN, En
Phil. Frogmouth	Batrachostomus septimus	PE
Pygmy swiftlet	Collocalia troglodytes	PE
Dwarf River kingfisher	Ceyx cyanopectus	GL, IS
Jungle kingfisher	Ceyx melanurus	
Luzon Tarictic Hornbill	Penelopides m. manillae	EN, En
Phil. Pygmy woodpecker	Picoides maculatus	
Sooty Woodpecker (GL race)	Mulleripicus f. funebris	GL, IS
White-bellied Woodpecker (SLr)	Dryocopus javensis confusus	GL, EV
Coppersmith Barbet/ Pok-pok	Megalaima h. haemacephala	NR
Grey-backed/ Philippine Tailorbird (LI race)/ Mountain Tailorbird (LI race)	Orthotomus derbianus/ O. castaneiceps chloronotus O. cucullatus philippinus	
Strong-billed Shrike (LI race)	Lanius v. validirostris	CU
White-fronted tit	Parus s. semilarvatus	GL
Elegant Tit (SL&Min/Bataan rc)	Parus e. elegans/ gilliardi	
Slender-billed Crow (LI race)	Corvus enca sierramadrensis	CU
Isabela Oriole	Oriolus isabellae	LI
Yellow-wattled Bulbul (SL race)	Pycnonotus u. urostictus	
Philippine Bulbul (GL/Burias rc)	Ixos p. philippinus/ parkesi	
Balicassiao (GL&Mindoro race)	Dicrurus b. balicassius	
Naked-faced Spider hunter (LI r)	Arachnothera clarae luzonensis	CU

Common Name	Scientific Name	Ecological Status
White-browed shama	Copsychus luzoniensis	GL
Olive-backed Flowerpecker	Prionochilus olivaceus parsonsi	LI
Striped Flowerpecker (GL&Sibuyan-Romblon race)	Dicaeum aeruginosum striatissimum	GL, IS
Flame-crowned Flowerpecker LI	Dicaeum a. anthonyi	IS
Orange-bellied Flowerpecker (GL & Mindoro race)	Dicaeum trigonostigma xanthopygium	IS
Fire-breasted Flowerpecker (LI)	Dicaeum ignipectus luzoniense	IS
Buzzing Flowerpecker (SL race)	Dicaeum hypoleucum obscurum	IS
Golden-yellow White-eye (SL/Central LI race)	Zosterops nigrorum luzonicus/ Z. n. innominatus	CU
Mammals		
Philippine Brown deer	Cervus mariannus	PE, EV
Philippine Warty pig	Sus p. philippensis	PE
Small/ Pygmy Fruit bats	Macroglossus minimus/ Otopteropus cartilagonodus/Haplonycteris fischeri	GL, NT
Medium Dog-faced Fruit bats	Ptenochirus jagori/ C. brachyotis	GL
Cave roosting Nectar bats	Eonycteris robustula/ E. spelaea Rousettus amplexicaudatus	GL
Flying foxes	Pteropus sp./ Acerodon jubatus	PE, EV
Leaf-nosed/Horseshoe bats	Hipposideros/ Rhinolophus	PE
Bamboo bats	Tylonycteris	LI, NT
Malay civet	Viverra tangalunga	PE
Common Palm civet	Paradoxurus hermaphroditus	
Field rats/ House rats & mice	Rattus tanezumi/R. exulans/ Mus musculus	PE
Striped Forest rats/Shrew-rats/ Shrew-mice	Chrotomys/ Rhynchomys/ Archboldomys/ Apomys	GL, NT
Forest rats & mice	Tryphomys/ Abditomys	PE
Large Forest rats	Batomys/ Bullimus/ Rattus everetti	GL
Southern Luzon Giant Cloud rat	Phloeomys cumingi	GL, NT
Fishes		
Palos/ I-gat or River eels	Anguilla	
Tilapia	Oreochromis nilotica/mosambicus	
Dalag/ Snakehead	Ophiocephalus striatus	
Native catfish	Clarias batrachus	
Freshwater shrimp	Macrobrachium	

Key:
GL - Endemic only to Greater Luzon faunal region
LI – Endemic only to Luzon Island
SL – Endemic only to Southern Luzon biogeographical region
CE – Critically Endangered species: seriously threatened with extinction
EV – Endangered or vulnerable species: threatened with extinction
IS – Indeterminate or insufficiently known: threatened but data insufficient to determine status
NT – Near-threatened or rare species
PE - Philippine Endemic species
NR - Non-endemic Resident species
EB - Ethno-biologically Significant species
IC - Introduced species or Commensal to Human habitation
CU – Common to Uncommon species and currently not threatened

3.3.2 Terrestrial Ecology

This study employed a combination of primary and secondary data gathering techniques. Secondary data was accessed from existing literature regarding the flora and fauna of the Luzon area. Primary data gathering was conducted on a reconnaissance level.

This involved a combination of enumeration or listing of whatever species encountered along the traverses to the area.

There are no protected areas established by National Integrated Protected Areas System (NIPAS). The project area does not include designated wetlands under the Ramsar

Convention, World Heritage-listed areas and Man and the Biosphere Reserve designated by UN Educational, Scientific and Cultural Organization (UNESCO).

The proposed roadway alignment traversed various land uses. These are the built up areas, agricultural land and the brush land / open land. Ocular observation showed that the density of flora and fauna here were relatively low.

Along the proposed alignment, the species of flora, which were perceived to be directly impacted by the construction phase of the project, are very common in the region and throughout the country as well. Common tree species such as ipil-ipil (*Leucaena leucocephala*), narra (Pterocarpus indicus), kakawate (*Glyricidia sepium*), dapdap (*Erythrina orientalis*) and acacia (*Samanea saman*) trees dominate the overstorey while the intermediate and understorey are covered with few shrubs, herbs, vines and grasses. Although common, the species exhibit a variety of uses such as food, medicine, ornamentals, construction materials, etc.

There are no faunal species considered as threatened or endangered within the project area. Common and those already associated with daily human activities were found at the time of survey. These are the yellow-vented bulbul (*Pycnonotus g. goiavier*), mayas (*Lonchura puntulata*), and tree sparrows (*Passer montanus*), which are all non-residents of the localities. Domesticated animals were also found such as dogs (*Canis familiaris*), cows (*Bos taurus*), fighting cocks (*Gallus gallus*) and goats (*Capra hircus*).

Table 3.24 shows the endemicity, distribution and ecological status of the plant species along the proposed road alignments.

Table 3.24 Endemicity, Distribution, Ecological Status and Roles/Uses of Plant Species along the Proposed Alignment

Family	Scientific Name	Common Name	Habit	Endemicity and Distribution	Ecological Role / Uses
AGAVACEAE					
	Dracaena fragrans	Fortune Plant	Shrub	W	Ornamental
APOCYNACEAE					
	Ervatamia pandacaqui	Pandakaki	Shrub	W	Ecological
ARACACEAE					
	Colocasia esculenta	Gabi	Herb	W	Edible crop
	Aglaonema sp.	*La suerte*	Herb	W	Ornamental
	Dieffenbachia amoena Bull.	Bachia	H erb	W	Ornamental
	Philodendron lacerum	*Philodendron* sp.	Herb	W	Ornamental
ARECACEAE (Palmae)					
	Cocos nucifera	Coconut	Palm	W	Multi-use species
COMPOSITAE (Asteraceae)					
	Ageratum conyzoides	Bulak manok	Herb	W,C	Weed; Medicinal
	Bidens pilosa	Beggar Ticks	Herb	W,C	Weed
	Chromolaena odorata	Hagonoy	Herb	W,C	Medicinal
	Mikania scandens	Ooko	Vine	W,C	Ground cover
	Tridax procumbens	Wild daisy	Herb	W,C	Weed
CARICACEAE					
	Carica papaya	Papaya	Tree-like	W,C	Fruits edible; medicinal
CYPERACEAE					
	Cyperus rotundus	Mutha	Grass	W	Weed
	Cyperus sp.	-	Grass	-	-do-
EUPHORBIACEAE					
	Codiaeum variegatum	San Francisco	Shrub	Euphorbiaceae	Ornamental
	Resinus communis	Tangan-tangan	Tree	W,C	Medicinal
LEGUMINOSAE (Caesalpiniaceae, Papilionaceae and Mimosaceae)					
	Gliovicidia sepium	Kakawate	Tree	W	Firewood
	Leucaena leococephala	Ipil-ipil	Tree	W	Firewood
	Mimosa pudica	Makahiya	spiny herbs	W	Weed/medicinal

Family	Scientific Name	Common Name	Habit	Endemicity and Distribution	Ecological Role / Uses
LAURACEAE					
	Persea Americana	Avocado	Tree	W	Fruits edible
	Litsea perrottetii	Marang	Tree	W	-do-
MALVACEAE					
	Hibiscus rosa-sinensis	Gummamela	Shrub	W,C	Ornamental
	Urena lobata	Kulut-kulutan	Shrub	W,C	Ground cover
MORACEAE					
	Artocapus heterophyllus	Langka	Tree	E,T	Fruits edible
	F. nota	Tibig	Tree	E,T	Wood for light construction
	F. pseudopalma	Niog-niogan	Shrub	E,T	-do-
	F. septica	Hawili	Shrub	W	-do-
	F. ulmifolia	Isis	Shrub	E,T	-do-
MUSACEAE					
	Musa paradiadica var. *compressa*	Saba	Tree like	W	Fruits edible
NYCTAGINACEAE					
	Bougainvillaea spectabilis	Bougainvilla	Shrub	W	Ornamental
POACEAE					
	Axonopus compressus	Carabao grass	Grass	W	Weed, lawn
	Bambusa vulgaris	Tewanak	Grass	W	-do-
	Imperata cylindrical	Cogon	Grass	W	-do-
	Oryza Sativa	Palay / Rice	Grass	W,C	Food grains
	Panicum repens	Luya-luyaan	Grass	W	Weed, lawn
	Paspalum conjugatum	Kulape	Grass	W	-do-
	Saccharum spontaneum	Talahib	Grass	W	-do-
POLYPODIACEAE					
	Nephrolepis sp.	n/a	Fern	W	Ornamental
SOLANACEAE					
	Talong Punay	*Datura metel*	Shrub	W,C	Medicinal
STERCULIACEAE					
	Sterculia foetida	Kalumpang	Tree	W,C	Wood used for panel and house construction
ULMACEAE					
	Trema orientalis	Anabiong	Tree	W,C	Wood for temporary construction; bark fibers made into vine
VERBENACEAE					
	Stachytarpheta jamaicensis	Kandi-kandilaan	Herb	W,C	Medicinal
	Premna odorata	Alagaw	Tree	E,T	Medicinal

Legend:

E,T - Endemic throughout the Philippines
W - Widely distributed in the Philippines (occurred also in other countries)
C - Common

Table 3.25 presents the faunal species and other wildlife commonly observed along the proposed road alignment.

Table 3.25 List of Faunal Species and Other Wildlife Commonly Observed Along the Project Alignment

Common Name	Scientific Name	Ecological Role / Use
Birds		
Maya (Chestnut Mannikin)	*Lonchura puntulata*	Insectivore/herbivore
Yellow-vented bulbul	*Pycnonotus g. goiavier*	Insectivore
Tree Sparrow	*Passer montanus*	Insectivore/herbivore
Swiftlet	*Collocalia sp.*	Insectivore
Amphibians		
Frog	*Rana spp.*	Insectivore
Mammals		
Small Field Rat	*Rattus exulans*	Commensal
Large Field Rat	*Rattus mindanensis*	Agric-pest
House Mouse	*Mus musculus*	Commensal

Insects		
Bee	*Apis indica*	Pollinator
Grasshopper Brown Grasshopper Meadow Grasshopper	*Gastrimargus marmoratus* *Mlanoplus sp.* *Conocephalus sp.*	Agric-pest Agric-pest Agric-pest
Common Dragonfly	*Labellia sp.*	Indicator species
Common housefly	*Musca domestica*	Vector (Disease)
Mosquitoes	*Culex sp.,*	Vector (Disease)
Red Ant Black Ant	*Formica sanguinea* *Monomorium sp.*	Symbiont Symbiont
Field Cricket Tree Cricket	*Nemobius fasciatus* *Oecanthus sp.*	Indicator species Indicator species
Spider	*Theridion sp.*	Indicator species
Yellow Butterfly	*Appias lyncida*	Pollinator
Domesticated Animals		
Cow	*Bos taurus*	Agriculture
Goat	*Capra hircus*	Economic
Chicken	*Gallus domestica*	Economic
Dog	*Canis familiaris*	Pet

3.3.3 Aquatic Ecology

The most common vegetation found within the rivers which traverse the project area is the common kangkong (*Ipomea aquatica*). The presence of *Colocasia esculanta* (gabi), Brachiara *muftica* (damong tubig) and *Musci sp.* (moss) which commonly grow on rocks and boulders was also noted.

Most of the rivers in the area have a muddy substrate with soft silty materials exuding putrid to very putrid smell. This is an indicator of a polluted water body. Putrefaction is present in some the stations. Actual observation showed that the substrate is composed of organic debris/materials as well as inorganic debris. Organic materials found were small leaf, barks of woods, twigs, kitchen waste and sometimes human waste or human excreta. Inorganic materials include materials and wastes usually found in domestic garbage, but the most common are different kinds of polyethylene materials or plastics. This condition is detrimental to fishes and other aquatic organisms. According to the residents near the water quality stations, the rivers used to serve as good fishing sites for *Glossogobius spp*. locally known as “bia” or “biya”, *Tilapia spp* (tilapia) *Ophicephalus spp* (dalag), *Clarias spp.* (hito), and *Anguilla spp*. (ell).

3.4 SOCIO ECONOMIC ENVIRONMENT

3.4.1 Methodology

In order to determine the existing socio-economic conditions of the project area the study was conducted employing the following methods and techniques

1. A review and assessment of secondary data from previous socio economic studies was conducted. The results of the preliminary report prepared by JICA were utilized in this assessment.

2. A walk through the alignments of the three proposed roads was first conducted to verify and confirm the location of these roads in the previously prepared base maps. The walk through resulted in the reduction of the seventy (70) originally listed affected barangays to only fifty-eight (58). Some barangays considered

included in the base map were excluded upon verification while other barangays considered outside were confirmed to be within the survey area. The list of the affected barangays is shown in Table 3.32.

3. Household and perception surveys were conducted in all the 58 affected barangays. Random sampling was employed for households that are indirectly affected by the project, and a hundred percent coverage was employed for households that are directly affected. The number of respondents for both types of households is shown respectively in Tables 3.31 and 3.32. Separate sets of questionnaire were used for these types of households[6].

4. Focus Group Discussions (FGDs) were also conducted in all the affected barangays in coordination with the barangay officials, except in one barangay where the Barangay Chairman insisted that it was no longer necessary. The FGDs were participated in by various stakeholder groups, such as barangay residents and those who have businesses likely to be affected by the proposed road alignments. Their opinions and suggestions were elicited for consideration in the final design and promote social acceptability of the project. During each session the DPWH representative briefed the participants about the project while the Project Consultant discussed the study to be conducted and facilitated the FGD proceedings. *See Volume 1 (Attachments) of LTI Social Study Report.*

5. Secondary data survey was also done to gather the needed information from existing documents and reports, such as the NSO Census Report and the respective Comprehensive Land Use Plan (CLUP) and/or Socio-Economic Profile (SEP) of the eight (8) municipalities and one (1) city in the project area.

3.4.2 Existing Socioeconomic Conditions in the CALA Area

(1) Economy

Cavite is predominantly an agricultural province since 71,829.21 ha of land is devoted to agriculture. Around 49.6% or 36,645.04 ha of the total agricultural land is devoted to crops. Major crops that are grown in Cavite are rice, corn, coffee, pineapple, and mango. In 2003, palay production was estimated at 49,879 metric tons covering 14,738 ha while corn production was at 3,607 metric tons. Laguna has basically the same conditions with Cavite. The province is also involved in crop production and livestock and poultry production. Laguna's palay production in 2003 is estimated at 97,606 metric tons covering an area of 23,888 ha while corn production was around 826 metric tons.

Cavite's carabao, goat, hog, chicken, and duck inventory in 2003 increased by 12.3%, 6.0%, 15.9%, 31.8%, and 13.0% respectively. The livestock inventory of carabao, goat, and hog in Laguna increased by 7.2%, 10.6%, and 7.1% respectively. Laguna's poultry industry decreased by 14.6% from 2002 to 2003.

Fishing and aquaculture are the other means of livelihood for the people in Cavite especially those in the coastal municipalities of Bacoor, Kawit, Noveleta, Rosario, Tanza, Naic, Maragondon, Ternate, and Cavite City. Fish production was recorded at 11,582 metric tons in 2003 while aquaculture fish production generated 3,950 metric tons. There are about 14,417 fisherfolk in Cavite. Species that are mostly caught in the province are tuna, mackerel, tanigue, hasa-hasa, galunggong, bisugo, lapu-lapu, tamban, tansuyo,

[6] See Volume 1 (Attachments) of LTI Social Study Report.

and alimasag. Those who are into aquaculture produce prawn (sugpo), milkfish (bangus), mussel, and oyster. Fish production in Laguna is comparatively higher than Cavite having 20,968 metric tons in 2003. Aquaculture fish production is also higher compared to Cavite with 8,064 metric tons in 2003.

(2) Industry

The industry sector is the largest contributor in terms of the Gross Domestic Product (GDP) in the CALA area.

Figure 3.24 shows the location of industrial estates in the study area and Table 3.38 gives the profile of these industries. It can be noted that employment is concentrated in municipalities in which major industrial estates are located.

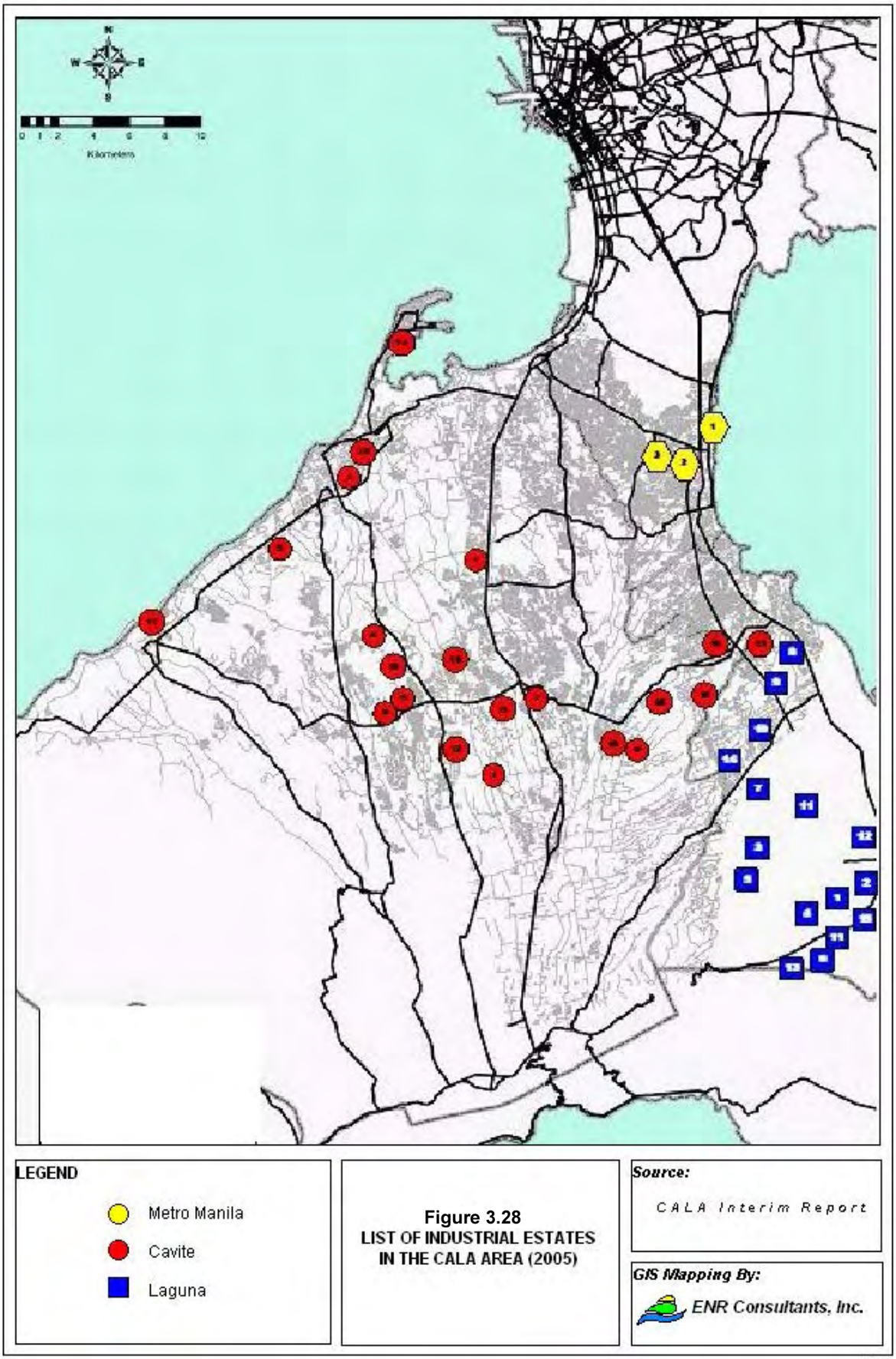


Figure 3.28
LIST OF INDUSTRIAL ESTATES IN THE CALA AREA (2005)

Table 3.26 List of Industrial Estates in the CALA Area

Code	Name	Location	Area (ha)	Preferred Industries
Cavite Area				
1	Best World Technopark	Batas, Silang, Cavite	145.1	Electronics and Semiconductors
2	Cambridge Intelligent Park	Malinta, Dasmariñas, Cavite	86.0	Light to medium scale, non-pollutive industries.
3	Cavite Economic Zone	Rosario, Cavite	278.5	Existing Industries: Tobacco Products, Wearing Apparels, Leather Products, Wood and Wood Products, Plastic, Rubber and Glass Products, Fabricated Metal, Office Computing Machinery, Electrical Machines, Food Industries, Clocks and Watch Parts, Packaging of Airline and Hotel Supplies, Fiberglass Products
4	Cavite Eco-Industrial Estate	Pasong Kawayan II, Gen. Trias, Cavite	105.0	Light to medium scale, non-pollutive industries.
5	Cavite Productivity & Economic Zone	Sahud-ulan, Tanza, Cavite	116.2	Electronic Products, Electrical Machinery, Semi-conductors
6	Daiichi Industrial Park	Maguyam, Silang, Cavite	55.0	Existing: Moulds, Plastic Products, Plastic Injection and parts for Audio Components and other Electronic Equipment Fabrication of Precision Molding Dye, Design of Equipment for Automation and Energy Conservation
7	EMI Special Economic Zone	Brgy. Anabu II, Imus, Cavite	26.7	Light Scale Industries
8	Fil – Estate Industrial Park	Trece Martires City and Tanza, Cavite	80.6	Electronics, Garments, Food Processing, Leather Products, Metal Fabrication, Toys, Gifts and House wares
9	Filinvest Technology Park – Cavite	Hugo Perez, Trece Martirez, Cavite	86.0	Light to Medium Scale, non-pollutive industries.
10	Filoil Special Economic Zone	Rosario, Cavite	50.3	Light to medium scale, non pollutive industries
11	First Cavite Industrial Estate	Langkaan, Dasmariñas, Cavite	59.8	Existing: Garments, Tents, Metal Stamping Parts, Printed Circuit Boards, Dyed Yams, Lead Frames, Molds and Die-Cast Metal Products and Screws, Magnetic Floppy Discs, Aluminum Products, Polyethylene Foams into Lid and Tray, Bags and Luggages, Automated Machine and Machine Parts, Various Grating Steel Products.
12	Gateway Business Park I	Javalera, Gen. Trias, Cavite	62.9	Light to medium scale, non-pollutive industries
12	Gateway Business Park II	Javalera, Gen. Trias, Cavite	18.7	Light to medium scale, non-pollutive industries
12	Gateway Business Park III	Javalera, Gen. Trias, Cavite	0.6	Light to medium scale, non-pollutive industries
13	Goldenmile Business Park	Governor's Drive, Brgy. Maduya, Carmona, Cavite	37.5	Light to medium scale, non-pollutive industries.
14	Marcelo IPG Industrial and Aqua Farming Park	Bacoor Bay, Cavite City	136.0	Light to medium scale industries.
15	PEC Industrial Park	Barrio Buenavista, Batas, Gen. Trias, Cavite	177.0	Garments, Textiles, Semiconductors, Food Processing, Pharmaceuticals
16	People's Technology Complex	Maduya, Carmona, Cavite	53.0	Processed Food, Metal Products, Electronics, Garments, Gifts, Toys, Housewares
17	Petroleum Industry Economic Zone	Brgy. Munting Mapino, Naic, Cavite	15.0	Petroleum-based Industries
18	Sterling Technopark Special Economic Zone	Maguyam, Silang, Cavite and Bancal and Lantic, Carmona, Cavite	100.0	Light to medium scale, non-polutive industries.
19	Taipan Gold Industrial Park	Defuego & San Francisco, Gen. Trias, Cavite	100.0	Electronics, Electrical Products, Transportation Equipment and Parts, Wearing Apparels
Laguna Area				
1	Allegis IT Park	Carmelray Industrial Park II, Brgy. Tulo,	5.7	IT Software Developers and Related Industries

Code	Name	Location	Area (ha)	Preferred Industries
		Calamba, Laguna		
2	Calamba Premier International Park	Batino, Parian & Barandal, Calamba, Laguna	65.6	Light to medium scale, non-pollutive industries.
3	Carmelray Industrial Park	Canlubang, Calamba, Laguna	50.8	Chemical and chemical products, precision instruments, transport and auto parts, electronics, semi-conductors, plastic products, metal products, precision tools packing and packaging materials.
4	Carmelray Industrial Park II	Punta & Tulo Calamba, Laguna	148.7	Existing Ind.: Electronics and Semi-conductors
5	Carmelray International Business Park	Canlubang, Calamba, Laguna	40.0	IT Service Industries
6	Filinvest Technology Park – Calamba	Punta & Burol-Bubuyan, Calamba, Laguna	51.1	Light scale, non-polluting industries.
7	Greenfield Automotive Park	Don Jose, Sta. Rosa, Laguna	50.0	Automotive Manufacturing
8	Greenfield Industrial Center Economic Zone	Brgy. Bungahan and Mamplasan, Biñan, Laguna	44.4	Pharmaceuticals Industries
9	Laguna International Industrial Park	Ganado & Mamplasan, Biñan, Laguna	34.9	Garments, Fabrics Electronics, Semiconductors, Plastic and other Packaging Materials, Molds and Tools, Auto Parts and Vehicle Accessories, Optical Lenses, Lighting Systems and Luminaries, Medical Supplies
10	Laguna Technopark I	Biñan, Laguna	75.2	Dies, Molds, Standard IC, Plastic Injection, Flex Printed Circuit, Copper Foil, Synthetic, Natural, Precious and Semi-precious gemstones, computer parts and various automobile parts, gaseous and liquid nitrogen and special gases.
10	Laguna Technopark II	Biñan, Laguna	67.7	-
10	Laguna Technopark III	Biñan, Laguna	96.4	-
10	Laguna Technopark IV	Biñan, Laguna	50.6	Automobile Assembly, Automotive Parts, Consumer Electronics/Appliance
11	Light Industry & Science Park I	Diezmo, Cabuyao, Laguna	69.1	Electronics, Semiconductors, Automotive and Motorcycle Parts, Wearing Apparels, Fashion Accessories
11	Light Industry & Science Park II	Real & La Mesa, Calamba, Laguna	66.7	Thermoforming Trays, Flexible Circuit Board, Rewritable CD Drive, Mechanical Loader Assembly, Hi-focus Asymmetrical Digital Subscriber Line, Pressed Metal Parts for Terminal Printers and Micro-printers, Main Board Printers, plastic injected gears, paperboard and various filing systems, Base and Blocks for Computer Hard Disk Drives, Multi-layer capacitor, Assembly Planner, Various Pumps, CPU and other Miscellaneous Cards
11	Light Industry & Science Park (Expansion)	Real & La Mesa, Calamba, Laguna	3.0	-
12	Prince Cabuyao Special Economic Zone	Banlic, Cabuyao, Laguna	25.5	-
13	Southwoods Ecocentrum Tourism Estate	Halang, Biñan, Laguna	76.0	Tourism and Cultural Related Activities
14	Toyota Sta. Rosa (Laguna) Special Economic Zone	Pulong Sta. Cruz, Sta. Rosa, Laguna	29.0	Automotive Parts
15	YTMI Realty Special Economic Zone	Brgy. Makiling, Calamba, Laguna	20.6	Automotive Wiring Harness
Muntinlupa Area				
1	Amkor Technology	East Service Rd.	14.1	Semiconductors and Test Strip

Code	Name	Location	Area (ha)	Preferred Industries
	Special Economic Zone	South Super Highway, Cupang, Muntinlupa City		
2	Northgate Cyber Zone	Filinvest Corporate City, Alabang Muntinlupa City	18.7	Software Development, Computer System Testing, Software Maintenance
3	IT Building	1207 Acacia Ave., Madrigal Business Park, Brgy. Ayala Alabang, Muntinlupa City	1,246 m^2. land area 11,977 m^2. gross floor area	IT Services

Source: Philippine Economic Zone Authority

(3) Social Welfare

1) Family Income Characteristics of the Study Area

Cavite and Laguna ranks second and the third in terms of the highest average family income for areas outside Metro Manila. Average income of municipalities adjacent to Metro Manila is almost at the same level as NCR.

Cavite has shown a steady growth of income. Dasmariñas and Imus recorded a very high increase in 1997-2000, while Laguna did not realize an increase in the real income.

Table 3.27 Trend of Annual Average Family Income of Study Areas (At current price)

	1991	1994	1997	2000
Muntinlupa City	NA	NA	202,266	238,038
Las Piñas	NA	NA	276,875	384,341
Cavite	85,416	115,915	163,660	196,401
Bacoor	NA	NA	189,286	225,218
Dasmariñas	NA	NA	137,756	191,347
Imus	NA	NA	171,808	231,208
Other Cavite	NA	NA	157,765	189,173
Laguna	87,030	109,184	157,765	189,173
Biñan	NA	NA	181,523	213,809
Calamba	NA	NA	174,234	211,459
San Pedro	NA	NA	198,321	224,026
San Pablo City	77,579	109,416	148,332	153,862

Table 3.28 Percentage Increase in Average Annual Family Income in the Provinces and Selected Municipalities (1994-2000)

	At current price (%)	At 1994 price (%)
Cavite	20.0	0.8
Bacoor	19.0	0.0
Dasmariñas	43.5	16.7
Imus	34.6	13.0
Other Cavite	12.9	-5.2
Laguna	19.9	-7.0
Biñan	17.8	-8.6
Calamba	21.4	-5.8
San Pedro	13.0	-12.4
San Pablo City	3.7	-19.5

The annual per capita poverty threshold of Cavite was estimated at P14,965 in 2000. Laguna on the other hand was estimated at P13,226. Family poverty incidence in Cavite reached 10.2% in 2000 while population poverty incidence was at 13%. Laguna's family poverty incidence in 2000 was at 8.6% while population poverty incidence was 11.4% (Table 3.29).

Table 3.29 Annual Per Capita Poverty Thresholds and Ratio of Poor Family

	1997		2000	
	Poverty Thresholds	Poverty Incidence (%)	Poverty Thresholds	Poverty Incidence (%)
NCR	13,201	4.8	15,678	5.7
Region	11,461	22.8	13,414	20.8
Cavite	13,114	8.0	14,965	10.0
Laguna	11,670	12.3	13,226	8.6

Source: 2004 Philippine Statistical Yearbook

2) Profile of Directly Affected Areas

The 3 road alignments of the proposed project will affect 58 barangays located in: 6 municipalities of Cavite, 2 municipalities of Laguna, and Muntinlupa City. See Table 3.30.

Table 3.30 List of Affected Barangays by Proposed Road Alignment

Province/ Municipality/City	List of Barangays (Bgys) by Proposed Road Alignment			
	North-South	East-West	Cavite-Laguna	Total No. of Bgys
Cavite				
1. Bacoor	Mambog 3 Mambog 4 Talaba 2 Talaba 3 Talaba 4 Zapote 5			6
2. Dasmariñas	Burol Main Salitran 1 Salitran 2 Salitran 3 Salitran 4 Sampaloc 1 San Agustin 1 San Agustin 2		Langkaan Paliparan 1 Sampaloc 2 Sampaloc 3	12
3. Gen. Trias		Bacao 1 Bacao 2 Navarro Pasong Camachile 1 Pasong Camachile 2 Tapia	San Francisco	7
4. Imus	Anabu 1-G Buhay na Tubig Pasong Buaya 1	Anabu 2-D Anabu 2-E Malagasang 2-B Malagasang 2-C		7
5. Silang	Biga 1 Biga 2		Kaong Batas Biluso Carmen Iba Maguyam Munting Ilog Sabutan Tibig	11
6. Tanza		Amaya 1 Biga Bunga Mulawin Sanja Mayor Santol		6
Laguna				
7. Biñan			Bungahan Ganado Loma Mamplasan Poblacion	5
8. Sta. Rosa			Don Jose Sto. Domingo	2
Muntinlupa City		**Poblacion Tunasan**		**2**
Total No. of Bgys	**19**	**18**	**21**	**58**

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

3.4.3 Survey Respondents

(1) Respondents for indirectly affected households (HH)

A total of 696 sample respondents, representing 1.5% of the 46,829 total number of households in the project area, were covered by the survey. This is distributed in the three proposed road alignments namely: i) 220 samples for the North-South (NS) Road, with a confidence level of 95% and 6.7% margin of error; ii) 145 for the East-West (EW) Road, with a confidence of 95% and 8.2% margin of error; and iii) 331 for the Cavite-Laguna (CL) Expressway, with confidence level of 95% and 5.45% margin of error. See details in Table 3.31.

Table 3.31 Sample Respondents for Indirectly Affected HH by Affected Barangay by Road Alignment

A. North-South Road Alignment					
	Barangay	**Total Population**	**Household Population**	**Number of Households**	**Number of Respondents**
	Bacoor				
1	Mambog III	3,559	3,559	701	7
2	Mambog IV	4,850	4,850	1,000	12
3	Talaba II	4,110	4,110	875	11
4	Talaba III	1,418	1,418	287	4
5	Talaba IV	2,990	2,990	658	5
6	Zapote V	5,944	5,944	1,316	16
	Imus				
7	Anabu I-G	960	960	207	3
8	Buhay na Tubig	6,287	6,275	1,334	17
9	Pasong Buaya I	1,054	1,054	224	5
	Dasmariñas				
10	Burol Main	5,937	5,833	1,291	16
11	Salitran I	3,381	3,381	753	9
12	Salitran II	6,070	6,034	1,314	16
13	Salitran III	10,310	10,296	2,189	22
14	Salitran IV	4,165	4,165	982	12
15	Sampaloc I	4,181	4,181	919	11
16	San Agustin I	7,671	7,671	1,747	22
17	San Agustin II	4,566	4,566	1,033	13
	Silang				
18	Biga I	4,817	4,769	1,029	13
19	Biga II	5,303	2,174	456	6
	Total	**87,573**	**84,230**	**18,315**	**220**
Note:	Sample size of 220 respondents is at 95% confidence level with 6.7% margin of error				

B. East-West Road Alignment					
	Barangay	**Total Population**	**Household Population**	**Number of Households**	**Number of Respondents**
	Muntinlupa				
1	Poblacion	49,128	43,232	8,890	
2	Tunasan	44,306	44,159	9,578	
	Imus				
3	Anabu II-D	1,959	1,957	467	6
4	Anabu II-E	2,330	2,330	505	7
5	Malagasang II-B	2,235	2,235	484	7
6	Malagasang II-C	1,675	1,675	374	5
	General Trias				
7	Bacao I	3,463	3,463	728	10
8	Bacao II	3,600	3,600	768	10
9	Navarro	2,277	2,230	494	7
10	Pasong Camachile I	3,206	3,184	652	9
11	Pasong Camachile II	5,994	5,994	1,405	19

B. East-West Road Alignment					
	Barangay	**Total Population**	**Household Population**	**Number of Households**	**Number of Respondents**
12	Tapia	1,620	1,620	374	5
	Tanza				
13	Amaya I	4,407	4,407	918	16
14	Biga	3,626	3,626	868	12
15	Bunga	1,640	1,640	328	4
16	Mulawin	3,167	3,167	693	9
17	Sanja Mayor	3,738	3,738	822	11
18	Santol	2,767	2,767	577	8
	Total	**47,704**	**47,633**	**10,457**	**145**
Note:	Totals of East West Road alignment do not include Barangays Tunasan and Poblacion in Muntinlupa pending resolution of the road alignment Sample size of 145 respondents is at 95% confidence level with 8.2% margin of error				

C. Cavite-Laguna Road Alignment					
	Barangay	**Total Population**	**Household Population**	**Number of Households**	**Number of Respondents**
	Biñan				
1	Biñan (Poblacion)	432	432	102	2
2	Bungahan	876	864	171	3
3	Ganado	2,381	2,364	524	10
4	Loma	1,601	1,601	340	6
5	Mamplasan	2,681	2,681	531	10
	Santa Rosa				
6	Don Jose	5,289	5,289	1,156	21
7	Sto. Domingo	1,295	1,295	253	5
	Silang				
8	Batas	2,220	2,220	470	9
9	Biluso	1,866	1,866	397	7
10	Carmen	1,280	1,280	247	5
11	Iba	2,995	2,989	623	11
12	Kaong	4,602	4,602	953	17
13	Maguyam	4,659	4,659	1,073	20
14	Munting Ilog	2,757	2,757	547	10
15	Sabutan	3,964	3,943	825	15
16	Tibig	2,042	2,042	405	7
	Dasmariñas				
17	Langkaan	6,981	6,973	1,624	30
18	Paliparan I	2,450	2,450	496	9
19	Sampaloc II	6,544	6,544	1,425	26
20	Sampaloc III	2,710	2,710	634	12
	General Trias				
21	San Francisco	25,446	25,379	5,261	96
	Total	**85,071**	**84,940**	**18,057**	**331**
Note:	Sample size of 331 respondents is at 95% confidence level with 5.5% margin of error				

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

(2) Respondents for the directly affected HH

A total of 826 HHs identified on all alternative road alignments will be directly affected by the project, all residing in the six municipalities of Cavite, namely: Bacoor, Dasmariñas, Gen.Trias, Imus, Silang, and Tanza. All of them were covered as respondents of the survey. But when considering only the selected alignment for implementation, 605 HHs will be directly affected (Table 3.32).

Table 3.32 Number of Directly Affected Households by Proposed Road Alignment by Municipality

City/Municipality	North-South Road	East-West Road	Cavite-Laguna Expressway	Total of 3 Alignments
Bacoor	344			344
Dasmarinas	65			65
Gen. Trias		13		13
Imus	14	44		58
Silang			10	10
Tanza		3		3
Muntinlupa City		112		112
Total	**423**	**172**	**10**	**605**

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

3.4.4 Population Characteristics

Census data from NSO in 2000 showed that Cavite is the most populous province in Southern Tagalog with a total population of 2,063,161 and an annual growth rate of 5.5%. Cavite's population accounts for 17.5% of the total population of Region IV. It was in the period between 1990-1995 that Cavite recorded its highest growth rate with 6.5%. Laguna on the other hand registered a population of 1,965,872 or 16.7% of the total Region IV population. Laguna's annual growth rate in 2000 was it's highest with 4.0%. Laguna ranks second to Cavite in terms of population in Region IV.

The rapid population increase in the area can be attributed to the following factors:

- Proximity to Metro Manila;
- Squatter relocation program of Metro Manila;
- Development of affordable middle-income housing;
- The 50-km radius ban policy of Metro Manila on industries, discouraging further industrial activity within Metro Manila and promoting the industrial dispersal strategy;
- Intensive middle-income residential development; and
- Rapid industrialization brought about by the promotion of the CALABARZON growth area.

3.4.5 Population Count and Growth Rate

The eight municipalities and 1 city of the project area have a total population of 2,021,175 as of the 2000 census. It increased by 21.2% from 1,575,442 of the previous 1995 census count. It has an annual growth rate of 4.0% for 1995-2000, which is much higher than the 2.2% national annual grown rate for the same period. Gen.Trias has the highest rate of 10.0% followed by Dasmariñas with 7.7%. On the other hand, Muntinlupa City has a negative growth rate of -1.1%.

Table 3.33 Population in CALA (1990-2000)

City/Municipality		1990 Total Population	1995 Total Population	2000 Total Population	AAGR 1990-2000 (%)	Land Area (km^2)	Population Density (pax/ha)
Cavite Province		**1,152,575**	**1,610,324**	**2,063,161**	**7.90**	**1,427.1**	**14.5**
District 1	Cavite City	91,629	92,641	99,367	0.84	11.83	84.0
	Bacoor	159,693	250,821	305,699	9.14	52.40	58.3
	Kawit	47,755	56,993	62,751	3.14	13.40	46.8
	Noveleta	20,405	27,306	31,959	5.66	5.41	59.1
	Rosario	45,407	54,086	73,665	6.22	5.67	129.9
District 2	Trece Martires City	15,685	20,451	41,653	16.55	47.90	8.7
	Carmona	28,242	35,686	47,856	6.94	30.92	15.5
	Dasmariñas	136,585	262,406	379,520	17.78	82.34	46.1
	Gen. Mariano Alvarez	65,962	86,824	112,446	7.04	9.38	119.9
	General Trias	52,895	66,837	107,691	10.35	117.68	9.2
	Imus	92,140	177,408	195,482	11.21	97.01	20.2
	Tanza	61,779	77,839	110,517	7.88	96.30	11.5
District 3	Tagaytay City	23,743	29,419	45,287	9.07	66.15	6.9
	Alfonso	28,947	34,613	39,674	3.70	64.60	6.1
	Amadeo	21,025	22,728	25,737	2.24	47.90	5.4
	Gen. E. Agunaldo	10,953	11,893	14,323	3.07	51.03	2.8
	Indang	39,289	42,765	51,281	3.05	89.20	5.8
	Magallanes	12,557	17,115	18,090	4.40	78.60	2.3
	Maragondon	22,817	25,828	31,227	3.68	165.49	1.9
	Mendez	17,649	20,321	22,937	2.99	16.67	13.8
	Naic	51,631	58,046	72,683	4.07	86.00	8.5
	Silang	93,807	124,062	156,137	6.64	156.41	10.0
	Ternate	11,981	14,236	17,179	4.33	43.50	4.0
Laguna Province		**1,370,267**	**1,631,082**	**1,965,872**	**4.34**	**1,759.5**	**11.2**
Dist.1	Biñan	134,564	160,206	201,186	4.95	43.50	46.3
	San Pedro	156,519	189,333	231,403	4.78	22.6	102.4
	Santa Rosa	94,719	138,257	185,633	9.59	39.10	47.5
Dist. 2	Bay	32,528	37,563	43,762	3.45	46.90	9.3
	Cabuyao	66,973	77,302	106,630	5.92	84.60	12.6
	Calamba	173,445	218,951	281,146	6.21	144.80	19.4
	Los Baños	66,124	71,683	82,027	2.40	56.5	14.5
District 3	San Pablo City	161,624	183,757	207,927	2.86	214.00	9.7
	Alaminos	27,414	31,442	36,120	3.17	54.70	6.6
	Calauan	32,735	36,677	43,284	3.22	66.40	6.5
	Liliw	21,915	24,434	27,537	2.56	39.1	7.0
	Nagcarlan	37,696	43,679	48,727	2.92	78.1	6.2
	Rizal	9,501	11,537	13,006	3.68	27.9	4.7
	Victoria	21,846	25,424	29,765	3.62	33.1	9.0
District 4	Cavinti	15,132	16,157	19,494	2.88	70.40	2.8
	Famy	7,929	9,661	10,419	3.14	19.4	5.4
	Kalayaan	13,115	16,955	19,580	4.92	46.6	4.2
	Luisiana	14,240	16,269	17,109	2.01	63.8	2.7
	Lumban	19,777	21,996	25,936	3.11	96.8	2.7
	Mabitac	11,442	13,309	15,097	3.19	73.3	2.1
	Magdalena	13,449	15,927	18,976	4.11	34.4	5.5
	Majayjay	15,873	18,989	22,153	3.95	69.4	3.2
	Paete	20,577	21,809	23,011	1.18	32.4	7.1
	Pagsanjan	25,027	28,999	32,622	3.03	26.4	12.4
	Pakil	13,439	15,663	18,021	3.40	13.0	13.9
	Pangil	15,215	17,664	20,698	3.60	23.0	9.0
	Pila	27,474	31,251	37,427	3.62	31.2	12.0
	Santa Cruz	76,614	86,978	92,694	2.09	38.6	24.0
	Santa Maria	20,524	22,296	24,574	1.97	128.4	1.9
	Siniloan	22,760	26,914	29,902	3.13	41.1	7.3

City/Municipality	1990 Total Population	1995 Total Population	2000 Total Population	AAGR 1990-2000 (%)	Land Area (km^2)	Population Density (pax/ha)
Metro Manila	**7,948,392**	**9,454,040**	**9,932,560**	**2.49**	**636.00**	**156.2**
City of Las Pinas	297,102	413,086	472,780	5.91	41.50	113.9
City of Muntinlupa	278,411	399,846	379,310	3.62	46.70	81.2
The Study Area	1,828,440	2,553,877	3,082,105	5.36	958.07	32.17
The Analysis Area	2,418,754	3,278,988	4,003,276	5.17	1,900.33	21.07

Source: National Statistics Office

Table 3.34 Population and Growth Rate by Affected Municipalities

Province/Municipality	2000	1995 Census	Annual Growth Rate
Cavite	**2,063,161**	**1,610,324**	**5.08**
1. Bacoor	305,690	250,821	4.04
2. Dasmariñas	379.520	262,406	7.66
3. Gen. Trias	107,631	66,837	10.01
4. Imus	195,482	177,408	1.96
5. Silang	156,132	124,062	5.05
6. Tanza	110,517	77,839	7.26
Laguna	**1,965,872**	**1,631,082**	**3.80**
7. Biñan	201,186	160.206	4.60
8. Sta. Rosa	185,633	138,257	6.07
Muntinlupa City	**379,310**	**399,846**	**-1.05**
Total of 9 mun/city	**2,021,175**	**1,575,442**	**4.04**
Philippines	**76,504,077**	**68,616,536**	**2.20**

3.4.6 Number of Households (HHs) and Average Household Size

The 9 municipalities/city have a combined total number of 416,802 HHs and an average household size of 4.8 persons/HH. Muntinlupa City has the largest average size (5.3 persons/HH), while Sta. Rosa as the smallest (4.3 persons/HH). See Table 3.35.

Table 3.35 No. of Households (HHs) and Average Household Size by Municipalities 2000

Province/Municipality	No. of HHs	HH Population	Average HH Size
Cavite			
1. Bacoor	64,067	305699	4.77
2. Dasmariñas	77,350	378,135	4.89
3. Gen. Trias	23,299	107,077	4.60
4. Imus	42,232	195,043	4.62
5. Silang	30,847	156,137	5.06
6. Tanza	23,059	110,517	4.79
Laguna			
7. Biñan	42,307	200,644	4.74
8. Sta. Rosa	43,625	185,802	4.26
Muntinlupa City	70,016	370,310	5,29
TOTAL	416,802	2,009,364	4.82

In the affected 28 barangays, there are a total of 46,829 HHs. The average HH size is 4.6 persons/HH, which is slightly lower than the municipal/city-wide average HH size. Mambog III of Bacoor has the largest average size of 6.7 persons/HH, while Biga of Tanza has the smallest (4.2 persons/HH). See Table 3.36.

Table 3.36 No. of Households and Average Household Size of Affected Barangays by Municipality 2000

A. North-South Road Alignment					
	Barangay	Total Population	Household Population	Number of Households	Average HH Size
	Bacoor				
1	Mambog III	3,559	3,559	701	6.7
2	Mambog IV	4,850	4,850	1,000	4.9
3	Talaba II	4,110	4,110	875	4.7
4	Talaba III	1,418	1,418	287	4.9
5	Talaba IV	2,990	2,990	658	4.5
6	Zapote V	5,944	5,944	1,316	4.3
	Imus				
7	Anabu I-G	960	960	207	6.6
8	Buhay na Tubig	6,287	6,275	1,334	4.7
9	Pasong Buaya I	1,054	1,054	224	4.7
	Dasmariñas				
10	Burol Main	5,937	5,833	1,291	4.5
11	Salitran I	3,381	3,381	753	4.5
12	Salitran II	6,070	6,034	1,314	4.6
13	Salitran III	10,310	10,296	2,189	4,7
14	Salitran IV	4,165	4,165	982	4.2
15	Sampaloc I	4,181	4,181	919	4.6
16	San Agustin I	7,671	7,671	1,747	4.4
17	San Agustin II	4,566	4,566	1,033	4.4
	Silang				
18	Biga I	4,817	4,769	1,029	4.7
19	Biga II	5,303	2,174	456	4.8
	Total	**87,573**	**84,230**	**18,315**	**4.6**

B. East-West Road Alignment					
	Barangay	Total Population	Household Population	Number of Households	Average HH Size
	Muntinlupa				
1	Poblacion	49,128	43,232	8,890	4.9
2	Tunasan	44,306	44,159	9,578	4.6
	Imus				
3	Anabu II-D	1,959	1,957	467	4.2
4	Anabu II-E	2,330	2,330	505	4.6
5	Malagasang II-B	2,235	2,235	484	4.6
6	Malagasang II-C	1,675	1,675	374	4.5
	General Trias				
7	Bacao I	3,463	3,463	728	4.8
8	Bacao II	3,600	3,600	768	4.7
9	Navarro	2,277	2,230	494	4.5
10	Pasong Camachile I	3,206	3,184	652	4.9
11	Pasong Camachile II	5,994	5,994	1,405	4.3
12	Tapia	1,620	1,620	374	4.3
	Tanza				
13	Amaya I	4,407	4,407	918	4.8
14	Biga	3,626	3,626	868	4.2
15	Bunga	1,640	1,640	328	5.1
16	Mulawin	3,167	3,167	693	4.6
17	Sanja Mayor	3,738	3,738	822	4.6
18	Santol	2,767	2,767	577	4.8
	Total	**47,704**	**47,633**	**10,457**	**4.6**

C. Cavite-Laguna Road Alignment					
	Barangay	**Total Population**	**Household Population**	**Number of Households**	**Average HH Size**
	Biñan				
1	Biñan (Poblacion)	432	432	102	4.2
2	Bungahan	876	864	171	5.1
3	Ganado	2,381	2,364	524	4.5
4	Loma	1,601	1,601	340	4.7
5	Mamplasan	2,681	2,681	531	5.1
	Santa Rosa				
6	Don Jose	5,289	5,289	1,156	4.6
7	Sto. Domingo	1,295	1,295	253	5.1
	Silang				
8	Batas	2,220	2,220	470	4.7
9	Biluso	1,866	1,866	397	4.7
10	Carmen	1,280	1,280	247	5.2
11	Iba	2,995	2,989	623	4.8
12	Kaong	4,602	4,602	953	4.8
13	Maguyam	4,659	4,659	1,073	4.3
14	Munting Ilog	2,757	2,757	547	5.0
15	Sabutan	3,964	3,943	825	4.8
16	Tibig	2,042	2,042	405	5.0
	Dasmariñas				
17	Langkaan	6,981	6,973	1,624	4.3
18	Paliparan I	2,450	2,450	496	4.9
19	Sampaloc II	6,544	6,544	1,425	4.6
20	Sampaloc III	2,710	2,710	634	4.3
	General Trias				
21	San Francisco	25,446	25,379	5,261	4.8
	Total	**85,071**	**84,940**	**18,057**	**4.7**

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

3.4.7 Population Density

At the municipal/city level, the project area has an average population density of 38.4 persons/ha, which is much higher than the national average of 2.6 persons/ha. Muntinlupa City has the highest density, with 81.2 persons, followed by Bacoor with 69.51 persons/ha. At the barangay level, the density ranges from the lowest range of 1.4 in Brgy Pasong Buaya, Imus, to the highest density of 112.2 persons/ha in Barangay Mambog 4, Bacoor. See Table 3.37.

Table 3.37 Population, Land Area & Population Density: 2000

Province/Municipality	Population (2000)	Land Area	Population Density (person/ha)
Cavite	**2,063,161**	**147,421**	**14.0**
(1) Bacoor	305,063,161	4,397	69.5
1. Mambog 3	1,682	98.57	17.1
2. Mambog 4	4,850	43.24	112.2
3. Talaba 2	4,110	ND	ND
4. Talaba 3	1,418	ND	ND
5. Talaba 4	2,032	ND	ND
6. Zapote 6	5,944	ND	ND
(2) Dasmariñas	379,520	9,013	42.1
1. Burol	5002	70.7**	70.7
2. Lankaan	4.468	687.1**	6.5
3. Paliparan 1	2,347	707.1**	3.2
4. Salitran1	7,344	85.4**	26.3
5. Salitran 2	3,421	85.4**	40.1
6. Salitran 3	7,418	85.4**	86.9
7. Salitran 4	3,984	85.4**	46.7
8. Sampaloc 1	4,393	246.9**	17.8
9. Sampaloc 2	4,540	246.9**	18.4
10. Sampaloc 3	3,306	246.9**	13.4
11. San Agustin 1	4,024	151.3**	26.6
12. San Agustin 2	3,833	151.3**	25.3
(3) Gen. Trias	107,691	8,700	12.4
1. Bacao 1	3,463	337.3**	10.3
2. Bacao 2	3,600	337.3**	10.7
3. Navarro	2,277	532.6	4.3
4. Pasong Camachile 1	3,206	301.8	10.6
5. Pasong Camachile 2	5,994	450.0	3.3
6. San Francisco	25,446	834.4	30.5
7. Tapia	1,620	153.9	10.5
(4) Imus	195,487	5,314.6	368
1. Anabu 1-G	960	190.0	5.0
2. Anabu 2-D	1,959	75.9	25.8
3. Anabu 2-E	2,330	73.3	31.8
4. Buhay na Tubig	6,287	282.4	22.3
5. Malagasang 2-B	2,235	91.1	24.5
6. Malagasang 2-C	1,675	60.1	27.9
7. Pasong Buaya 1	1,054	733.0	1.4
(5) Silang	156,137	15,641.00	18.0
1. Batas	2,220	747.1	3.0
2. Biga 1	4,817	159.4	30.2
3. Biga 2	5,303	18.4	47.8
4. Biluso	1,806	592.2	3.0
5. Carmen	1,280	265.1	4.8
6. Iba	2,995	341.5	8.8
7. Kaong	4,602	923.6	5.0
8. Maguyam	4,659	661.3	7.0
9. Munting Ilog	2,757	487.3	5.7
10. Sabutan	3,964	428.8	9.3
11. Tibig	2,042	609.1	3.4
(6) Tanza	110,517	7,824.3	14.1
1. Amaya 1*	14,717	329.1	44.7
2. Biga	3,626	368.0	9.8
3. Bunga	1,640	295.2	5.6
4. Mulawin	3,167	232.1	13.6
5. Sanja Mayor	3,738	908.8	4.1
6. Santol	2,767	269.5	10.3

Province/Municipality	Population (2000)	Land Area	Population Density (person/ha)
Laguna	**1,965,872**	**175,693**	**11.2**
(7) Biñan	201,186	4,550	44.2
1. Bungahan	876	91	9.6
2. Ganado	2,381	124	19.2
3. Loma	1,601	115	13.9
4. Mamplasan	2,681	268	10.0
5. Poblacion	2,842	537	52.9
(8) Sta. Rosa	185,633	5,543.4	33.5
1. Don Jose	5,289	1,025.5	5.2
2. Sto. Domingo	1,295	833.8	1.6
Muntinlupa City	**379,310**	**4,670**	**81.2**
(1) Poblacion	49,128	613	80.1
(2) Tunasan	44,306	959	46.2
Philippines	**76,504,077**	**30,000,000**	**2.6**

Note: *Combined with Amaya 2-7;
**Average size with other one or more barangays whose land areas were aggregated in the CLUP of the municipality.
Source: Based on NSO data and CLUP/SEP of respective municipalities/ity.

3.4.8 Main Source of Income

Until the last two decade or so, the main source of income in the area was agriculture and most households were dependent mainly on it. The situation has changed drastically since the 80's when the rapid progress and expansion of economic activities in Metro Manila has spelled over to neighboring areas such as the adjacent municipalities in the two provinces of Cavite and Laguna, greatly boosted by the policy of government to promote the dispersal of large industries and service institutions (especially on health and education) outside the metropolis.

The shift to a largely industrial and services-based economy in the project area has created new and numerous job opportunities that benefited the local residents. However, these opportunities are also open not only to residents but to outsiders. This resulted to unavoidable job competition and unemployment to unsuccessful applicants from the locality. This likewise resulted to the influx of migrants looking for job and residential space causing the drastic increase of population growth rate in the area.

The remaining farmlands in the six municipalities of Cavite, however, are still devoted to palay, vegetables, pineapple, coffee, banana, root crops and so forth. The farmland area in Silang is still considerable, constituting 62.2% of the total land area and devoted to an intensive multi-storey system of farming with coffee, coconut and pineapple as the major crops together with rice, corn, fruit trees, vegetables, sugarcane and cut flowers. Mussel production and fishpond industry (milkfish, prawn and tilapia) are still thriving albeit declining in Bacoor.

Rapid industrialization and urbanization in the project area has thus resulted to massive conversion of land uses from agriculture and fishing to industrial, commercial and residential uses. Large industrial estates, special economic zones and subdivisions are sprawling in the two Laguna municipalities of Biñan and Sta. Rosa, as well as in the municipalities of Cavite, especially Imus, Silang and Gen. Trias. Large agro-industries and agribusiness farms are established in Dasmariñas and Imus, such as poultry, piggery and dairy farms. Large educational and health institution are also located in Dasmariñas while large commercial establishment are located in Imus.

In Muntinlupa, majority of the establishments are commercial, mostly retailers, dealers and wholesalers.

3.4.9 Sex and Age Composition

Except for Silang, the males are a little fewer than the females in the 9 municipalities/city of the project area. At the different age level, however, the males tend to dominate in ages below 15 years old, while the females are dominating in ages 15 years old and above. Considering that the latter age category belongs to the working age group, the females (women) constitute the larger potential labor force than the males (men) in the project area. (See Table 3.38).

Table 3.38 Sex and Age Composition and Sex Ratio by Affected Municipality

Municipality/City	Total Population	Percent of Total Population						Sex Ratio (M/F)*
		Below 15 Yrs Old		15-64 Yrs Old		65 & above Yrs Old		
		M	F	M	F	M	F	
Cavite								
1. Bacoor	305,699	17.7	16.9	30.3	32.7	1.0	1.4	0.98
2. Dasmariñas	379,570	20.0	19,0	29.0	29.9	0.9	1.2	0.99
3. Gen Trias	107,691	ND	ND	ND	ND	ND	ND	ND
4. Imus	195,482	16.3	15.0	30.5	53.9	1.3	2.1	0.93
5. Silang	156,167	19.7	17.3	30.5	29.5	1.3	1.7	1.06
6. Tanza	110,517	18.5	17.3	29.8	31.2	1.4	1.8	0.99
Laguna								
7. Biñan	201,186	18.3	17.3	30.2	31.9	0.9	1.4	0.98
8. Sta. Rosa	185,633	18.3	17.3	30.0	31.8	1.1	1.4	0.98
Muntinlupa City	**370,310**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Note: *M – Male; F – Female. ND - No Data
Source: Based on respective CLUPs/SEPs.

3.4.10 Literacy Rate and Highest Educational Attainment

Available data show a relatively high literacy rate in the project area, ranging from 95.1 – 98.5%. Imus registers a high percentage of the population that has reached or finished the tertiary (college or its equivalent, and above) level, followed by Bacoor. Dasmariñas has the largest percentage among those that has only reached the elementary grade level, while Sta. Rosa has the largest in the secondary grade level.

Table 3.39 Literacy and Highest Educational Attainment (Population 5 Years Old and Above)

Municipality/ City	Population 5 Yrs Old and Above	Percent of the 5 Yrs Old and Above Population					Literacy Rate
		Pre-School	Elemen-tary	High School	Tertiary (College)	None	
Cavite							
1. Bacoor	258,890	2.9	29.3	33.1	29.3	4.9	95.1
2. Dasmariñas	320,776*	ND	48.0	37.0	8.0	ND	98.0
3. Gen Trias	ND	ND	ND	ND	ND	ND	ND
4. Imus	171,935	2.8	27.4	31.1	33.1	2.2	ND
5. Silang	135,240	3.7	37.3	35.3	17.2	5.3	97.5
6. Tanza	95,727	ND	ND	34.8	6.7	ND	97.0
Laguna							
7. Biñan	174,550*	3.0	35.1	33.1	23.2	4.8	98,5
8. Sta. Rosa	160,201*	3.1	39.1	37.3	13.4	3.5	98.0
Muntinlupa City	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Note: *The percentage distribution entries of these municipalities are based on the 1995 census figures.
Source: Based on respective CLUPs/SEPs.

3.4.11 Employment Status

Available data show that generally only a little more than half of the working age population (15 years old and above) has joined the labor force. This ranges from 51.0% in Imus to 64.5% in Biñan. This means that nearly half of those in the working age category are acting as dependents and are thus in the same category as those in the age category below 15 years old.

Out of those who join the labor force, a considerable percentage is still unemployed, the largest of which is found in Bacoor (19.5%) followed by Imus (19.4%), and then Tanza (13.0%). This is happening despite the various job opportunities created by the rapid industrialization and urbanization in the area. (See Table 3.40).

Table 3.40 Employment and Unemployment Rate

Municipality/ City	Population 15 Yrs Old and Above	In the Labor Force			% of Population Not in the Labor Force
		% of Population	% Employed	% Unemployed	
Cavite					
1. Bacoor	206,192	54.8	80.5	19.5	40.8
2. Dasmariñas	265,071	51.9	90.6	9.4	48.1
3. Gen Trias	ND	ND	ND	ND	ND
4. Imus	155,000	51.0	80.6	19.4	49.0
5. Silang	97,370	ND	ND	ND	ND
6. Tanza	71,025	55.0	87.0	13.0	45.0
Laguna					
7. Biñan	95,000	64.5	90.6	9.4	35.5
8. Sta.Rosa	ND	ND	ND	ND	ND
Muntinlupa City	**ND**	**ND**	**ND**	**ND**	**ND**

Source: Based on the respective CLUPs/SEPs of the 9 municipalities.

3.4.12 Household Profile

Results of the sample survey of households in all the 58 affected barangays in the survey area show the profile of households in terms of ownership of land and house, type and structure of house, and availability of basic services, HH composition, and monthly HH income.

(1) Ownership of land and house

An estimated 103 households (17.02%) owns the land where their house is located, while a larger percentage (74.9%) owns the house that they are residing. Between the 3 proposed roads, the North-South Road has the smallest percentage for landownership (14.4%) and house ownership (76.1%). (See Tables 3.41 and 3.42)

Table 3.43 Land Ownership

Land Ownership	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Own land and house	61	14.42	32	18.60	10	100.00	103	17.02
Rent land and own house	15	3.55	1	0.58	0	0.00	16	2.64
Rent land and house	31	7.33	3	1.74	0	0.00	34	5.62
Illegal occupancy of land and own house	152	35.93	6	3.49	0	0.00	158	26.12
With permission to use land and own house	159	37.59	120	69.77	0	0.00	279	46.12
No Answer	5	1.18	10	5.81	0	0.00	15	2.48
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

(2) Type of house and structure

A large majority HHs has houses that are single-detached 1-storey type (44.6%) and single-detached 2-storey type (19.0%). Likewise, a large majority has permanent (72.7%) and semi-permanent (22.2%) structure of house.

Table 3.44 Type of House

Type of House	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Single detached one-storey	148	34.99	116	67.44	6	60.00	270	44.63
Single detached two-storey	85	20.09	26	15.12	4	40.00	115	19.01
Apartment/Row House	23	5.44	3	1.74	0	0.00	26	4.30
Duplex	3	0.71	7	4.07	0	0.00	10	1.65
Shanties	164	38.77	20	11.63	0	0.00	184	30.41
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

Table 3.45 Nature of Structure of House

Type of House	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
All Concrete	139	32.86	82	47.67	4	40.00	225	37.19
Concrete and wood	144	34.04	65	37.79	6	60.00	215	35.54
All wood	121	28.61	13	7.56	0	0.00	134	22.15
Wood and sawali	8	1.89	7	4.07	0	0.00	15	2.48
Nipa and cogon	11	2.60	5	2.91	0	0.00	16	2.64
Others	0	0.00	0	0.00	0	0.00	0	0.00
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

(3) Availability of basic services

Although close to Metro Manila, 16.7% of the households are still not served with electricity, and a higher percentage (46.1%) is not served with pipe water supply. About one-fifth of the HHs does not have individual toilet. See Table 3.48.

Table 3.48 Availability of Basic Services

Basic Services	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Electricity	333	78.72	162	94.19	9	90.00	504	83.31
Water supply pipe	207	48.94	112	65.12	7	70.00	326	53.88
Well	72	17.02	34	19.77		0.00	106	17.52
Individual Toilet	301	71.16	157	91.28	9	90.00	467	77.19
Drain pipe	134	31.68	54	31.40		0.00	188	31.07
Others	3	0.71	1	0.58		0.00	4	0.66
Total	**1050**		**520**		**25**		**1595**	

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

(4) HH composition

The composition of the household, in terms of members living together and living outside of the household is shown in Table 3.49. There are 2,667 persons living together within the 696 households. Out of this total, 257 (9.6%) are under 6 years old while 2,410 persons (90.4%) are 6 years and above. The total number of persons living outside of the households is 378 persons.

Table 3.49 Household Composition

Household Composition	North-South Road		East-West Road		CALA Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	&	(F)	%
Living Together								
Under 6year-old	57	7.45	114	16.50	86	7.10	257	9.64
6 years-old and above	708	92.55	577	83.50	1125	92.90	2410	90.36
Sub-total	**765**	**100.00**	**691**	**100.00**	**1211**	**100.00**	**2667**	**100.00**
Living Outside								
Under 6year-old	40	47.62	5	11.90	35	13.89	80	21.16
6 years-old and above	44	52.38	37	88.10	217	86.11	298	78.84
Sub-total	**84**	**100.00**	**42**	**100.00**	**252**	**100.00**	**378**	**100.00**

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

(5) Monthly HH income

Majority of the HHs in the North-South Road and the East-West Road alignments has income less than P10,000. Those in the Cavite-Laguna Road alignment are comparatively well-off, majority of whom has income ranging from P10,000 to P20,000.

Table 3.50 Monthly Income of Respondents

Income Level (Peso)	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Below 5,000	136	32.15	41	23.84	0	0.00	177	29.26
5,000 - 9,999	156	36.88	25	14.53	0	0.00	181	29.92
10,000 - 19,999	77	18.20	39	22.67	8	80.00	124	20.50
20,000 - 49,999	23	5.44	37	21.51	2	20.00	62	10.25
50,000 - 99,999	5	1.18	7	4.07	0	0.00	12	1.98
100,000 & Over	0	0.00	0	0.00	0	0.00	0	0.00
No Answer	26	6.15	23	13.37	0	0.00	49	8.10
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

3.4.13 Morbidity/Mortality Rates and Health Services

(1) Leading causes of morbidity and mortality

Among the ten major causes of morbidity or illness in the respective municipalities/city of the project area, the most prevalent are: i) acute respiratory infection, ii) diarrhea, iii) skin disorder, iv) pneumonia, v) hypertension, vi) influenza/fever, vii) wound, viii) urinary tract infection, ix) parasitism, and x) gastro-intestinal disorder.

In the case of mortality or death, the most prevalent are: i) cancer, ii) heart disease, iii) pneumonia, iv) diabetes, v) tuberculosis vi) hypertension, vii) accident, viii) kidney, ix) stillbirth, and x) asthma.

(2) Health services

There are eight (8) Rural Health Units (RHUs) in Bacoor serving 73 barangays. The basic health service delivery function of the two RHUs is augmented by seven (7) private hospitals operating I the area. There are also 45 Rural Health Centers directly servicing the barangays. Dasmariñas has 2 RHUs and each barangay has a Barangay Health Station (BHS) manned by a midwife. Three major hospitals sustain the medical needs of the people, including the De La Salle University Medical Center.

There are two RHUs in Silang, with health manpower of 2 physicians, five nurses, 33 midwives, 1 dentist, 4 rural sanitary inspectors and 35 Barangay Nutrition Scholars. In Gen. Trias, there are 20 private hospitals and 1 public hospital, 8 dental clinics, 4 optical clinics and 2 RHUs. Imus also has 2 RHUs and 20 Barangay Health Centers. In Tanza, the available public health services consist of 1 RHU, 31 BHS, 28 private clinics and 3 private hospitals.

Biñan has also 2 RHUs complemented by 22 BHS serving the 24 barangays of the municipality. It has no public hospital, but there are 4 private hospitals and a number of smaller private health establishments serving the local populace. In Sta. Rosa, there are only 2 RHUs and 1 community hospital, implying a need to at least augment its primary level of health facilities.

3.4.14 Other Social Services

(1) Water Supply

Drinking water in Bacoor is supplied by the Maynilad Water Services, Inc. although many barangays still get their water from private deep well, especially those that are located in the inland areas. Dasmariñas is served by the Dasmariñas Water District, which provides the various population blocks with faucets. The Silang Water District also provide domestic water with pumping stations that serve 41 barangays, while the other barangays have Level III water supply system managed and operated by the respective barangay LGUs.

In Gen Trias, the General Trias Water Corporation provides Level III water supply system with 16 pumping stations that serve almost all the barangays, including domestic commercial and industrial establishments. The Metropolitan Waterworks and Sewerage System (MWSS) is operating 3 pumping stations in Imus, providing potable water to 15 barangays.

In Biñan, the municipality is served by the Laguna Provincial Waterwork System that, however, serves only the urban barangays and about 2.6% of its population. But there are around 3,100 Level I systems which are basically operated by individual households. The same Laguna provincial Waterworks System serves Sta. Rosa municipality, but only its urban population constituting about 5.7% of the total population. It has around 4,000 Level I systems operated by individual households. Muntinlupa City is served by the Maynilad Water Services.

(2) Transportation, Power Supply and Telecommunication

The Cavite part of the project area is accessible mainly by land transportation from Metro Manila. The primary mode of transportation is the public utility vehicles such as FX, jeepneys and buses, complemented by privately-owned vehicles.

Power supply in the project area is provided by the Manila Electric Company (MERALCO), which has a substation in Silang.

Telecommunication services are provided by a number of companies augmenting the services of the Bureau of Telecommunication (BUTEL), namely: PLDT, Globe Telecom, and Digitel Telephone Co. and Smart. Other telecommunication companies that also provide fast cargo and related services are: LBC Express, RCPI, PT&T, and JRS express.

3.4.15 Public Participation and Social Acceptability

(1) Perception Surveys and FGDs

To promote stakeholder participation and social acceptability of the project, perception surveys and FGDs were conducted to gather first-hand information from the affected households on their perceptions, values and attitudes towards the project and elicit opinions and suggestions on issues and concerns from project stakeholders in the area.

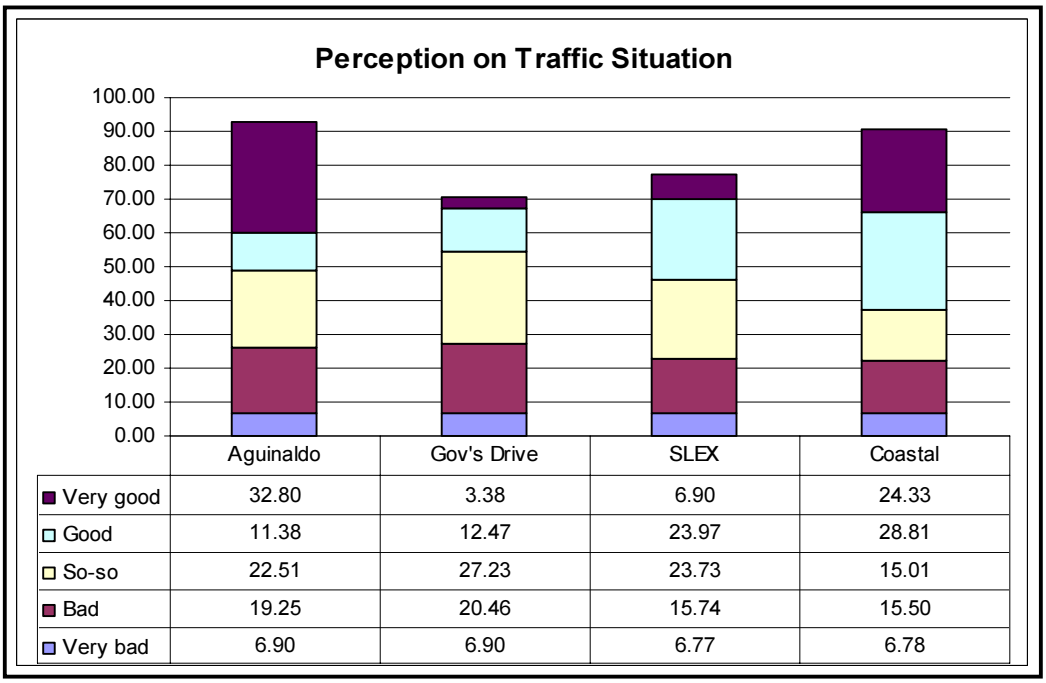
(2) Perception on the Traffic Condition in the Area

1) Traffic situation in the existing road alignments

Survey results reveal different perception among directly and indirectly affected households on the traffic condition of the existing major road alignments in the project area, namely: i) Aguinaldo Highway, ii) Governor's Drive, iii) South Luzon Expressway or SLEX; and iv) Manila-Cavite Coastal Expressway.

As shown in Figure 3.29, the Governor's Drive is the worst of the four alignments among the directly affected HHs. It is followed by Aguinaldo highway.

Figure 3.29 Comparison of the Four Road Alignments: Directly Affected HH

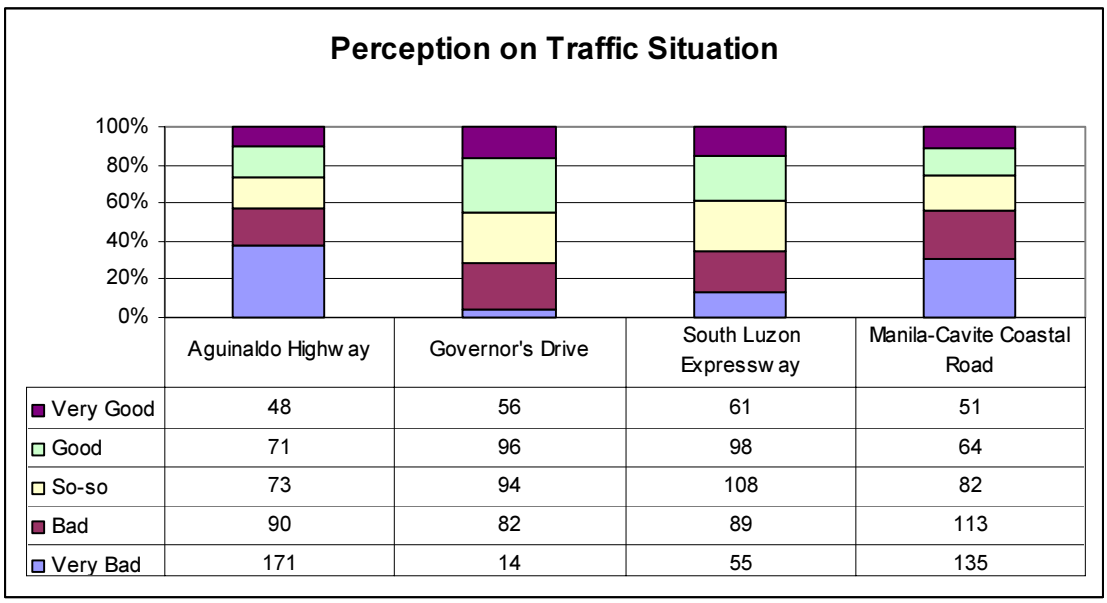


	Aguinaldo	Gov's Drive	SLEX	Coastal
Very good	32.80	3.38	6.90	24.33
Good	11.38	12.47	23.97	28.81
So-so	22.51	27.23	23.73	15.01
Bad	19.25	20.46	15.74	15.50
Very bad	6.90	6.90	6.77	6.78

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

Among the indirectly affected HH, the Coastal Road is the worst and also followed by the Aguinaldo Highway as shown in Figure 3.30. Among the same HH, the SLEX got the high rating, followed by the Governor's Drive. On the contrary, the Coastal Road got a high rating among the directly affected HH and, interestingly, is also followed by the Aguinaldo Highway.

Figure 3.30 Comparison of the Four Road Alignments: Indirectly Affected HH



	Aguinaldo Highw ay	Governor's Drive	South Luzon Expressw ay	Manila-Cavite Coastal Road
Very Good	48	56	61	51
Good	71	96	98	64
So-so	73	94	108	82
Bad	90	82	89	113
Very Bad	171	14	55	135

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

2) Causes of very bad/bad traffic situation

The perception of the two types of HHs on the cause of the bad traffic situation also varies. Among the directly affected HHs, the foremost cause in "increase of car traffic" followed by "lack of roads." Among the indirectly affected HH, "lack of road" is the foremost cause followed by "increase in car traffic."

Table 3.51 Causes of Very Bad/Bad Traffic Situation: Directly Affected HH

If Bad/Very Bad, What are the Causes	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Increase of car traffic	221	52.25	63	36.63	2	20.00	286	47.27
Increase of truck traffic	52	12.29	14	8.14	0	0.00	66	10.91
Lack of traffic lights	27	6.38	6	3.49	0	0.00	33	5.45
Lack of roads	121	28.61	27	15.70	0	0.00	148	24.46
Undisciplined people's driving manner	58	13.71	35	20.35	8	80.00	101	16.69
Insufficiency of public transport	5	1.18	6	3.49	0	0.00	11	1.82
Lack of traffic management and enforcement	44	10.40	6	3.49	0	0.00	50	8.26
Others	5	1.18	0	0.00	0	0.00	5	0.83
Total Responses	**533**		**157**		**10**		**700**	

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

Table 3.52 Causes of Very Bad/Bad Traffic Situation: Indirectly Affected HH

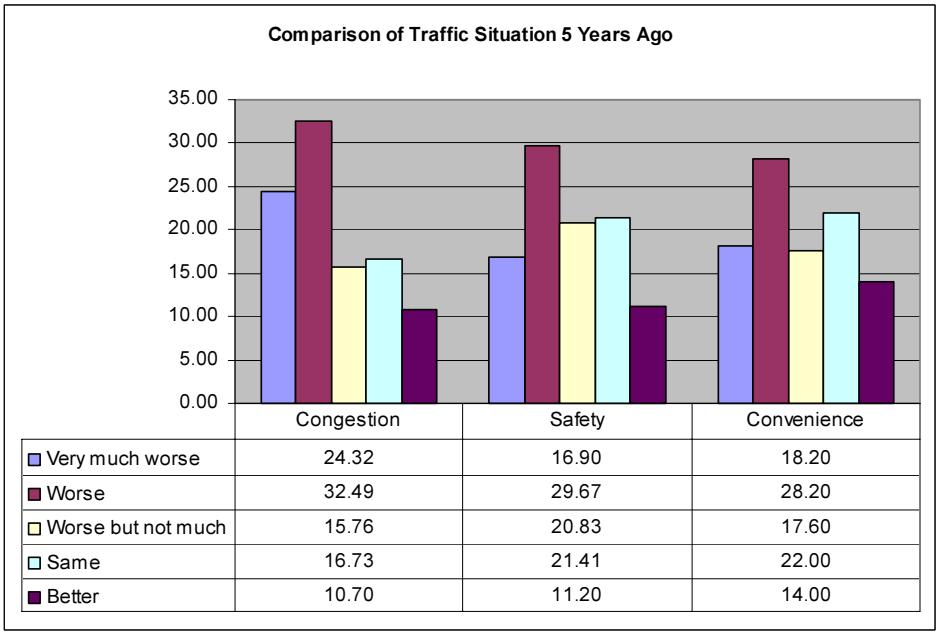
If Bad/Very Bad, What are the Causes	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Increase of car traffic	69	31.36	51	35.17	117	35.35	237	34.05
Increase of truck traffic	33	15.00	9	6.21	44	13.29	86	12.36
Lack of traffic lights	27	12.27	16	11.03	95	28.70	138	19.83
Lack of roads	82	37.27	55	37.93	123	37.16	260	37.36
Undisciplined people's driving manner	62	28.18	38	26.21	104	31.42	204	29.31
Insufficiency of public transport	17	7.73	24	16.55	43	12.99	84	12.07
Lack of traffic management and enforcement	18	8.18	19	13.10	79	23.87	116	16.67
Others	0	0.00	2	1.38	41	12.39	43	6.18
Total Responses	**308**		**214**		**646**		**1168**	

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

3) Comparison of Traffic Situation to 5 Years Ago

Both directly and indirectly affected HHs have also about the same pattern of perception on the present traffic situation compared to those 5 years ago, in terms of congestion, safety and convenience. In these three aspects, traffic congestion is seen to have worsened most, followed by convenience and then safety.

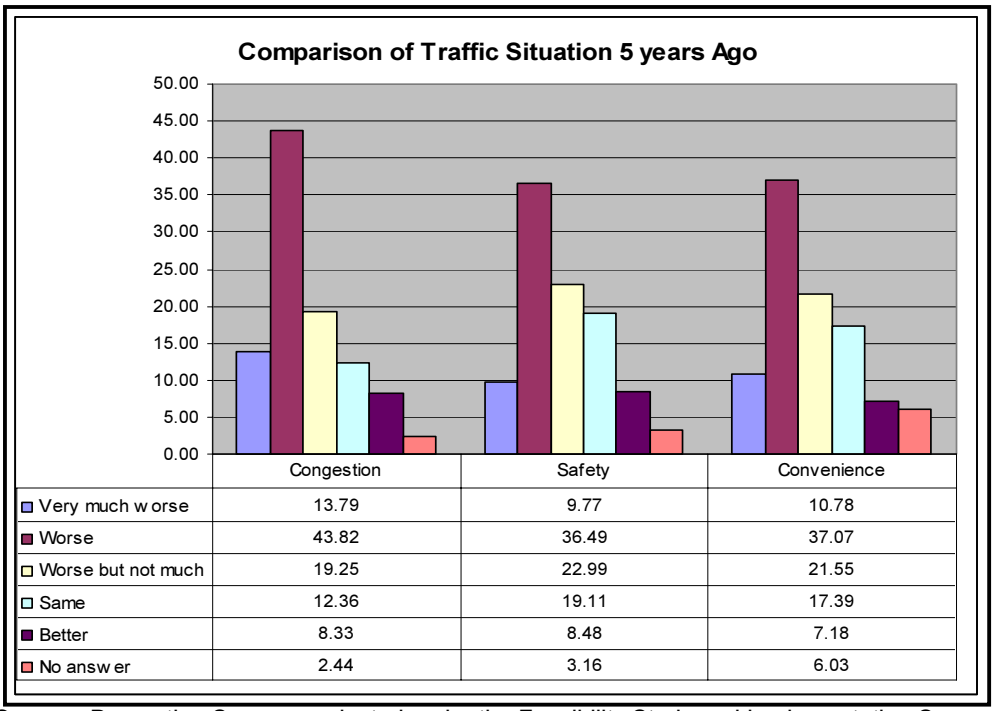
Figure 3.31 Comparison of Traffic Situation 5 years Ago: Directly Affected HH



	Congestion	Safety	Convenience
Very much worse	24.32	16.90	18.20
Worse	32.49	29.67	28.20
Worse but not much	15.76	20.83	17.60
Same	16.73	21.41	22.00
Better	10.70	11.20	14.00

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

Figure 3.32 Comparison of Traffic Situation 5 years Ago: Indirectly Affected HH



	Congestion	Safety	Convenience
Very much worse	13.79	9.77	10.78
Worse	43.82	36.49	37.07
Worse but not much	19.25	22.99	21.55
Same	12.36	19.11	17.39
Better	8.33	8.48	7.18
No answer	2.44	3.16	6.03

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

4) Assessment of the Provincial Road Network

Similar pattern of assessment on the existing provincial road network is also observed among both directly and indirectly affected HHs. Majority of them think of the existing network as either plainly insufficient or totally insufficient.

Table 3.53 Assessment of the Provincial Road Network Directly Affected HH

Assessment of Provincial Road Network	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Totally Insufficient	105	24.82	27	15.70	3	30.00	135	22.31
Insufficient	151	35.70	59	34.30	6	60.00	216	35.70
So-so	72	17.02	17	9.88	0	0.00	89	14.71
Comparatively Sufficient	42	9.93	2	1.16	0	0.00	44	7.27
Sufficient enough	24	5.67	18	10.47	0	0.00	42	6.94
No Answer	29	6.86	49	28.49	1	10.00	79	13.06
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

Table 3.54 Assessment of the Provincial Road Network: Indirectly Affected HH

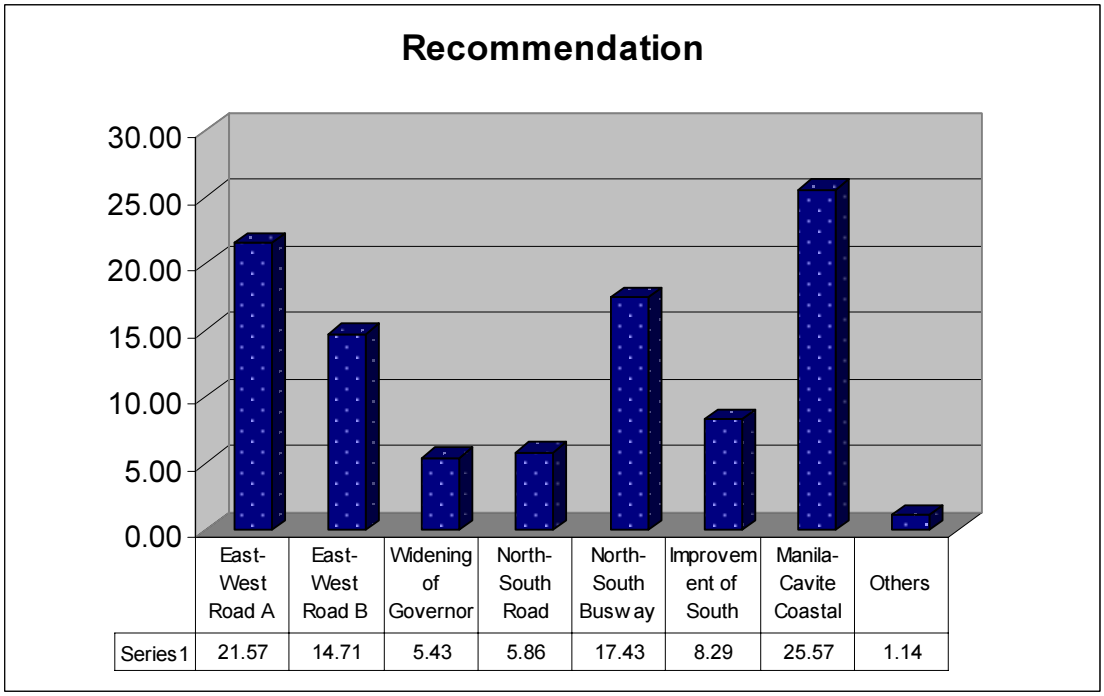
Assessment of the Road Network of the Province	North-South Road		East-West Road		CALA Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Totally insufficient	55	25.00	41	28.28	51	15.41	147	21.12
Insufficient	78	35.45	52	35.86	137	41.39	267	38.36
So-so	31	14.09	26	17.93	54	16.31	111	15.95
Comparatively sufficient	25	11.36	13	8.97	42	12.69	80	11.49
Sufficient enough	22	10.00	6	4.14	25	7.55	53	7.61
No answer	9	4.09	7	4.83	22	6.65	38	5.46
Sub-Total	**220**	**100.00**	**145**	**100.00**	**331**	**100.00**	**696**	**100.00**

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

5) Recommendation on Provincial Road Network

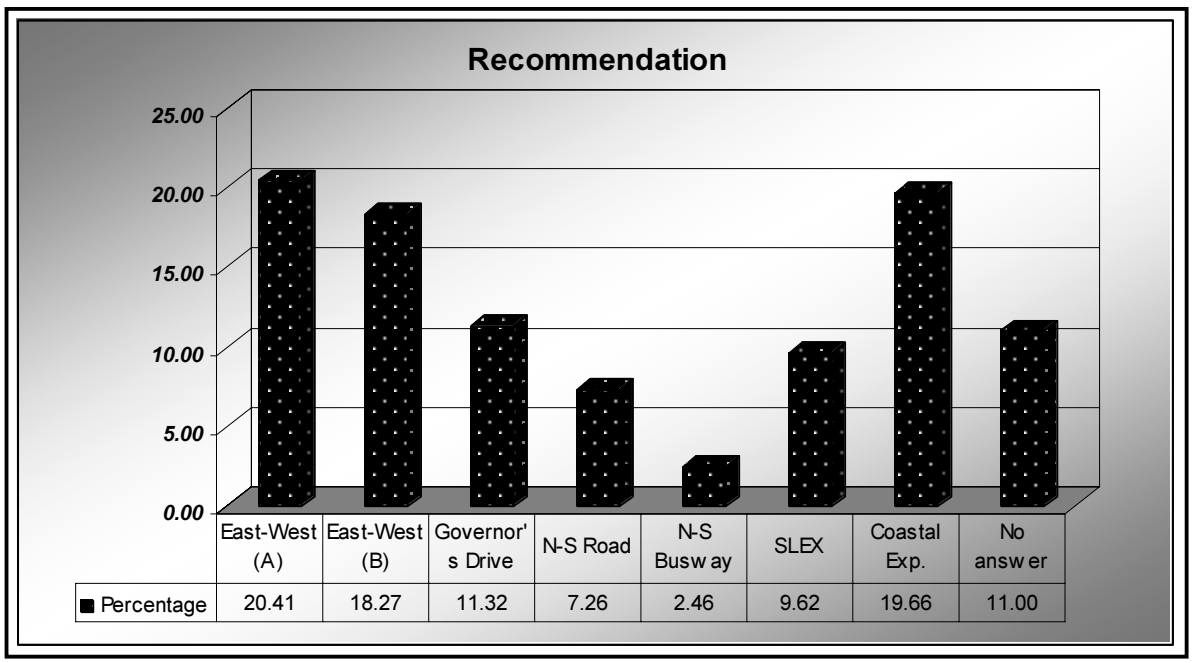
In order to address the problems brought about by the presently insufficient road network, both types of HH have recommendations that differ in terms of priority. Among the directly affected HHs, extension of the Manila-Cavite Road ranks first followed by improvement of the SLEX and the North-South Busway. Along the indirectly affected HHs, the top priority is the construction of the East-West Alternative A Road followed by expansion of the Coastal Road and the East-West Alternative B.

Figure 3.33 Recommendation on Provincial Road Network: Directly Affected HH



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

Figure 3.34 Recommendation on Provincial Road Network: Indirectly Affected HH



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

3.4.16 Perception of the Proposed Project

(1) Awareness of the Proposed Project

Awareness on the proposed three (3) road alignments of the project varies among the directly and indirectly affected HHs depending on the alignment that affects them. HHs that are directly affected by the Cavite-Laguna Road alignment manifest the highest level of awareness (91.7%), while among those indirectly affected by the North-South Road show the highest level (77.7%) of awareness.

Table 3.55 Awareness of the Proposed Project: Directly Affected HH

Awareness of the Proposed Project	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Yes	339	80.14	114	66.28	10	100.00	463	76.53
No	84	19.86	58	33.72	0	0.00	142	23.47
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

Table 3.56 Awareness of the Proposed Project: Indirectly Affected HH

Awareness of the Proposed Project	North-South Road		East-West Road		Cavite-Laguna Road		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Yes	171	77.73	110	75.86	249	75.23	530	76.15
No	31	14.09	30	20.69	58	17.52	119	17.10
Don't know	18	8.18	5	3.45	24	7.25	47	6.75
Sub-Total	**220**	**100.00**	**145**	**100.00**	**331**	**100.00**	**696**	**100.00**

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

(2) Source of Information about the Project

Majority of the directly and indirectly affected households got their information about the project from the barangay officials, 31.9% and 38.4% respectively. The second highest source of project information is the LGU Staff (both at around 20%).

Table 3.57 Source of Information: Directly Affected HH

If Yes, Source of Information	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
From LGU Staff	114	26.95	4	2.33	5	50.00	123	20.33
From Neighbors	42	9.93	30	17.44	0	0.00	72	11.90
From Friends	22	5.20	11	6.40	1	10.00	34	5.62
From the Barangay Officers	162	38.30	27	15.70	4	40.00	193	31.90
From Radio	4	0.95	0	0.00	0	0.00	4	0.66
Advertisement	4	0.95	1	0.58	0	0.00	5	0.83
Others (From Surveyors)	3	0.71	46	26.74	0	0.00	49	8.10
No Answer	72	17.02	53	30.81	0	0.00	125	20.66
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

Table 3.58 Source of Information: Indirectly Affected HH

If Yes, Source of Information	North-South Road		East-West Road		CALA Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
From LGU staff	40	18.18	17	11.72	88	26.59	145	20.83
From neighbors	10	4.55	7	4.83	23	6.95	40	5.75
From friends	6	2.73	10	6.90	23	6.95	39	5.60
From the barangay officers	110	50.00	54	37.24	103	31.12	267	38.36
From radio	10	4.55	27	18.62	4	1.21	41	5.89
Advertisement	0	0.00	10	6.90	1	0.30	11	1.58
Others	13	5.91	14	9.66	28	8.46	55	7.90
No answer	31	14.09	6	4.14	61	18.43	98	14.08
Sub-Total	**220**	**100.00**	**145**	**100.00**	**331**	**100.00**	**696**	**100.00**

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

(3) Project Assessment

Majority of the directly affected households (66.9%) assessed the project as a good initiative. Their most favorable assessment is given to the proposed Cavite-Laguna Road where they also have the highest level of awareness. Among the indirectly affected households, the majority (75.9%) also assesses the project as a good initiative, foremost of which is the proposed East-West Road even if here they have a relatively low level of awareness.

Table 3.59 Project Assessment: Directly Affected HH

Assessment if the Project is a Good Initiative	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Yes	293	69.27	102	59.30	10	100.00	405	66.94
No	55	13.00	22	12.79	0	0.00	77	12.73
Don't know	47	11.11	4	2.33	0	0.00	51	8.43
No Answer	28	6.62	44	25.58	0	0.00	72	11.90
Total	**423**	**100.00**	**172**	**100.00**	**10**	**100.00**	**605**	**100.00**

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

Table 3.60 Project Assessment: Indirectly Affected HH

Assessment if the Project is a Good Initiative	North-South Road		East-West Road		CALA Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Yes	185	84.09	124	85.52	219	66.16	528	75.86
No	11	5.00	9	6.21	61	18.43	81	11.64
Do Not Know	24	10.91	12	8.28	51	15.41	87	12.50
Sub-Total	**220**	**100.00**	**145**	**100.00**	**331**	**100.00**	**696**	**100.00**

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

(4) Positive Impacts of the Project

A number of positive project impacts have been perceived by both the directly and indirectly affected households. "More business opportunities" and "employment opportunities" are the most frequently mentioned of the identified nine (9) categories of impacts.

Table 3.61 Positive Impacts of the Project: Directly Affected HH

If Yes, What are the Perceived Positive Impacts	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
More business opportunities	178	42.08	69	40.12	10	100.00	257	42.48
Employment opportunities	184	43.50	60	34.88	9	90.00	253	41.82
Working efficiency due to time saved	179	42.32	51	29.65	1	10.00	231	38.18
Increased land value	192	45.39	34	19.77	3	30.00	229	37.85
Improved road network	195	46.10	79	45.93	1	10.00	275	45.45
Solve the problem of congestion	161	38.06	53	30.81		0.00	214	35.37
Improved environmental condition	103	24.35	19	11.05	1	10.00	123	20.33
Greater access to work and basic services	100	23.64	35	20.35	8	80.00	143	23.64
Total Responses	**1292**		**400**		**33**		**1725**	

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

Table 3.62 Positive Impacts of the Project: Indirectly Affected HH

If Yes, What are the Perceived Positive Impacts	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
More business opportunities	141	64.09	77	53.10	193	58.31	411	59.05
Employment opportunities	119	54.09	83	57.24	180	54.38	382	54.89
Working efficiency due to time saved	122	55.45	68	46.90	159	48.04	349	50.14
Increased land value	105	47.73	85	58.62	143	43.20	333	47.84
Improved road network	106	48.18	87	60.00	166	50.15	359	51.58
Solve the problem of congestion	103	46.82	73	50.34	130	39.27	306	43.97
Improved environmental condition	69	31.36	64	44.14	85	25.68	218	31.32
Greater access to work and basic services	77	35.00	61	42.07	108	32.63	246	35.34
Total Responses	**842**		**598**		**1164**		**2604**	

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

(5) Negative Impacts of the Project

There are six (6) categories of negative project impacts identified by both the directly and indirectly affected households. "Relocation to other places" is most frequently mentioned among the directly affected households (12.1%) and the indirectly affected ones (20.6%). However, a large percentage of respondent households did not answer the question.

Table 3.63 Negative Impacts of the Project: Directly Affected Households

If No, What are the Peceived Negative Impacts	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Relocation to other place	41	9.69	32	18.60	0		73	12.07
Low compensation benefits	36	8.51	22	12.79	0		58	9.59
Loss of social network	40	9.46	20	11.63	0		60	9.92
Loss of work	28	6.62	16	9.30	0		44	7.27
Loss of livelihood	26	6.15	26	15.12	0		52	8.60
Total Responses	**171**		**116**		**0**		**287**	

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

Table 3.64 Negative Impacts of the Project: Indirectly Affected HH

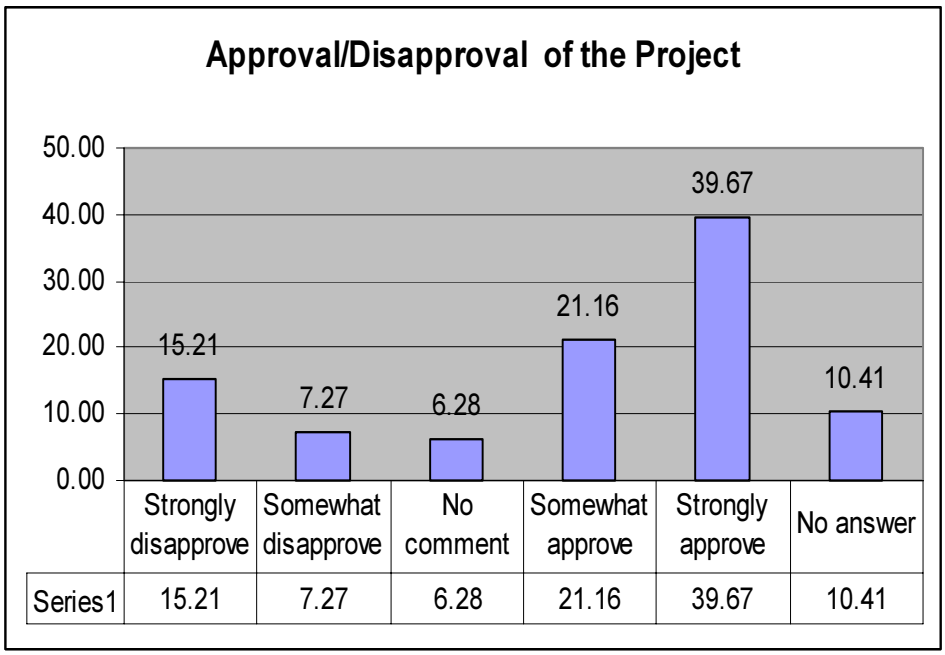
If No, What are the Peceived Negative Impacts	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Relocation to other place	26	11.82	26	17.93	91	27.49	143	20.55
Low compensation benefits	5	2.27	21	14.48	58	17.52	84	12.07
Loss of social network	8	3.64	4	2.76	25	7.55	37	5.32
Loss of work	6	2.73	6	4.14	72	21.75	84	12.07
Loss of livelihood	10	4.55	14	9.66	66	19.94	90	12.93
Total Responses	**55**		**71**		**312**		**438**	

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

(6) Approval/Disapproval of the Project

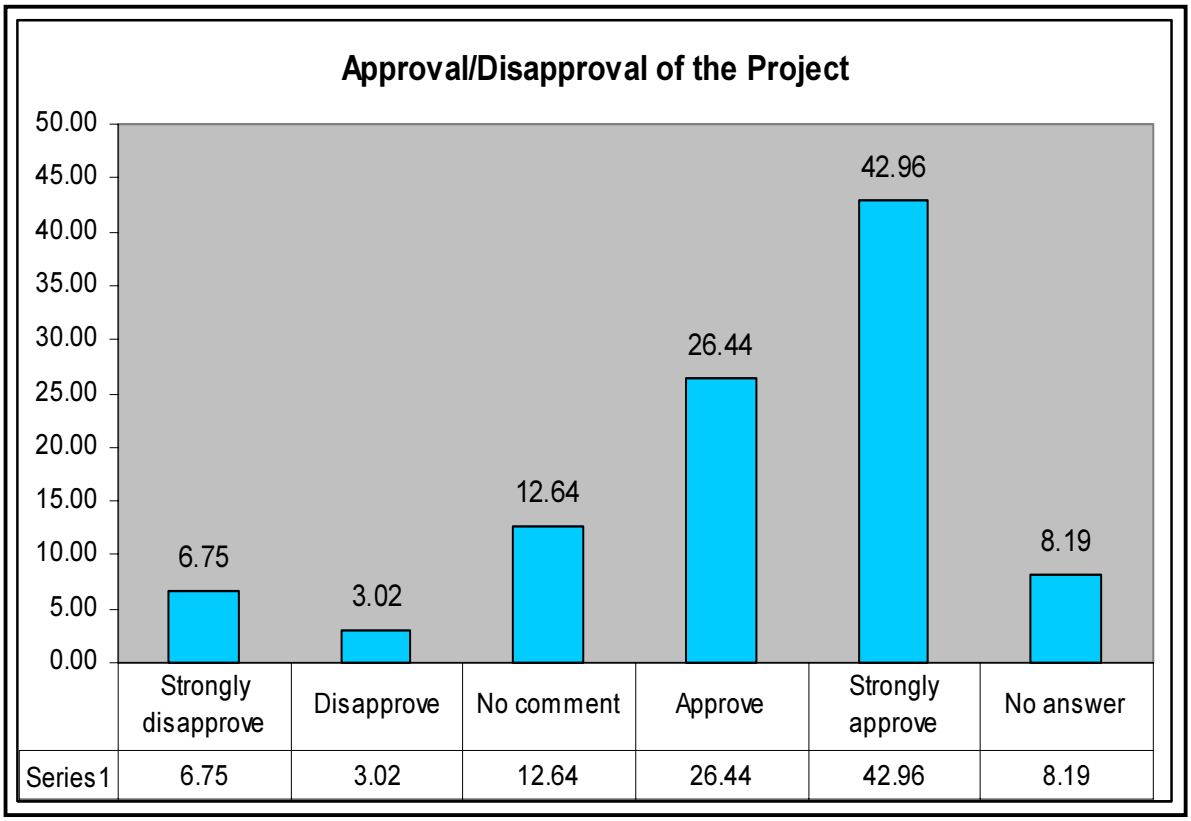
Overall, majority of the directly affected households (58.2%) and the indirectly affected ones (69.4%) have manifested their approval of the project.

Figure 3.35 Summary of Approval/Disapproval of the Project: Directly Affected HH



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

Figure 3.36 Summary of Approval/Disapproval of the Project: Indirectly Affected HH



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

(7) Acceptability of resettlement among directly affected HHs

The response of the directly affected HHs to the question on whether they accept resettlement as a measure to mitigate the adverse impacts of the project is largely conditional. 382 HHs out of the 605 affected HHs (63.1%) accepted resettlement, 33.9% gave conditional acceptance while 29.3% fully accepeted with no conditions. The rest either did not accept it (24.0%), or did not answer the question (12.9%). (See Table 3.65.) Those who accepted with conditions were demanding fair compensation and good relocation site complete with basic facilities such as light and water. Those who did not accept resettlement requested for fair compensation and will self-relocate themselves.

Table 3.65 No. of Directly Affected HHs by Acceptability of Resettlement

Acceptability	Bacoor	Imus	Dasma-rinas	Gen Trias	Tanza	Silang	Muntin-lupa City	Total	
								(F)	%
Fully Accept	137	6	7	1	0	0	26	177	29.26
Accept with Condition	96	18	19	10	1	10	51	205	33.88
Do Not Accept	95	20	15	2	0	0	13	145	23.97
No Answer	16	14	24	0	2	0	22	78	12.89
Total	**344**	**58**	**65**	**13**	**3**	**10**	**112**	**605**	**100.00**

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

(8) Preferred relocation site

It is interesting to note that while the positive responses, albeit mostly conditional, to the question of acceptability constituted 62.1% of the total number of directly affected HHs, 54.7% have positively answered the question as to their preference on the location of the relocation site or the place that they would prefer to transfer to in case of resettlement. This could be interpreted to mean as a manifestation that the supposed opposition to resettlement as reflected in the preceding table is not that serious after all, and might be only due to lack of information or appreciation of the information that they obtained.

Table 3.66 No. of Directly Affected HHs by Preferred Relocation Site

Preferred Relocation Site	Bacoor	Imus	Dasma-rinas	Gen Trias	Tanza	Silang	Muntin-lupa City	Total	
								(F)	%
Within the same barangay	138	14	20	6	1	4	76	259	42.81
Within the same municipality	31	0	3	4	0	6	11	55	9.09
Within the same province	6	2	3	1	0	0	0	12	1.98
Any nearby province	2	1	2	0	0	0	0	5	0.83
Return to original hometown	7	2	2	0	0	0	1	12	1.98
No particular preference	67	9	0	0	0	0	1	77	12.73
No Answer	93	30	35	2	2	0	23	185	30.58
Total	**344**	**58**	**65**	**13**	**3**	**10**	**112**	**605**	**100.00**

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

3.4.17 Social and Environmental Issues and Concerns

(1) Methodology and results of the surveys and FGDs

Identification of the issues and concerns during the household and perception surveys among the directly and indirectly affected households was facilitated through the use of structured questionnaire. In the FGDs, which were participated in by barangay officials and different project stakeholders, the issues and concerns were elicited through briefings of the participants about the project by a DPWH representative and through the facilitation done by the consultant. Some twenty-two (22) issues and concerns were identified in the process. (See Table 3.67.)

Table 3.67 Social and Environmental Concerns on the Project: Directly Affected HH

Social and Environmental Concerns on New Roads	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Land (land collapse, soil erosion, subsidence)	165	39.01	53	30.81	10	100.00	228	37.69
Water (increase water run-off, water contamination)	196	46.34	50	29.07	10	100.00	256	42.31
Air (air pollution, offensive odor)	243	57.45	78	45.35	4	40.00	325	53.72
Noise and vibration	254	60.05	86	50.00	2	20.00	342	56.53
Terrestrial biological environment (flora and fauna)	122	28.84	39	22.67	0	0.00	161	26.61
Freshwater biological environment (flora and fauna)	125	29.55	22	12.79	0	0.00	147	24.30
Land use and zoning (change in land use)	140	33.10	25	14.53	0	0.00	165	27.27
Aesthetics and visual effects (landscape)	61	14.42	20	11.63	0	0.00	81	13.39
Archaeological and historical sites (damage/destruction)	96	22.70	24	13.95	0	0.00	120	19.83
Population (resettlement, influx of workers)	183	43.26	57	33.14	1	10.00	241	39.83
Economic activities (economic activities in and around project site)	140	33.10	24	13.95	1	10.00	165	27.27
Labor and employment (generation of employment opportunity, increased employment)	147	34.75	22	12.79	3	30.00	172	28.43
Housing and social services	162	38.30	21	12.21	6	60.00	189	31.24
Infrastructure and public utilities (disruption of public utilities)	150	35.46	20	11.63	4	40.00	174	28.76
Public health and safety (increased occupational hazards associated w/ project development)	149	35.22	44	25.58	1	10.00	194	32.07
Culture, lifestyle and values	77	18.20	43	25.00		0.00	120	19.83
Women and vulnerable groups	61	14.42	17	9.88	1	10.00	79	13.06
Inequality between beneficiaries and project-affected people	108	25.53	26	15.12	0	0.00	134	22.15
Conflict of interests	134	31.68	26	15.12	2	20.00	162	26.78
Waste	182	43.03	54	31.40	6	60.00	242	40.00
Accidents	161	38.06	64	37.21	7	70.00	232	38.35
Others	1	0.24	12	6.98	0	0.00	13	2.15
Total	**3057**		**827**		**58**		**3942**	

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

Table 3.68 Social and Environmental Concerns on the Project: Indirectly Affected HH

Social and Environmental Concerns on New Roads	North-South Road		East-West Road		Cavite-Laguna Expressway		Total of 3 Alignments	
	(F)	%	(F)	%	(F)	%	(F)	%
Land (land collapse, soil erosion, subsidence)	88	40.00	64	44.14	115	34.74	267	44.13
Water (increase water run-off, water contamination)	76	34.55	64	44.14	105	31.72	245	40.50
Air (air pollution, offensive odor)	110	50.00	59	40.69	149	45.02	318	52.56
Noise and vibration	109	49.55	79	54.48	198	59.82	386	63.80
Terrestrial biological environment (flora and fauna)	30	13.64	31	21.38	79	23.87	140	23.14
Freshwater biological environment (flora and fauna)	39	17.73	25	17.24	84	25.38	148	24.46
Land use and zoning (change in land use)	56	25.45	34	23.45	105	31.72	195	32.23
Aesthetics and visual effects (landscape)	28	12.73	17	11.72	77	23.26	122	20.17
Archaeological and historical sites (damage/destruction)	40	18.18	15	10.34	83	25.08	138	22.81
Population (resettlement, influx of workers)	85	38.64	38	26.21	137	41.39	260	42.98
Economic activities (economic activities in and around project site)	53	24.09	36	24.83	99	29.91	188	31.07
Labor and employment (generation of employment opportunity, increased employment)	58	26.36	26	17.93	99	29.91	183	30.25
Housing and social services	40	18.18	30	20.69	61	18.43	131	21.65
Infrastructure and public utilities (disruption of public utilities)	43	19.55	26	17.93	63	19.03	132	21.82
Public health and safety (increased occupational hazards associated w/ project development)	43	19.55	35	24.14	85	25.68	163	26.94
Culture, lifestyle and values	33	15.00	19	13.10	71	21.45	123	20.33
Women and vulnerable groups	21	9.55	10	6.90	43	12.99	74	12.23
Inequality between beneficiaries and project-affected people	36	16.36	21	14.48	52	15.71	109	18.02
Conflict of interests	47	21.36	27	18.62	80	24.17	154	25.45
Waste	86	39.09	66	45.52	127	38.37	279	46.12
Accidents	101	45.91	74	51.03	143	43.20	318	52.56
Others	4	1.82	6	4.14	0	0.00	10	1.65
Total	**1226**		**802**		**2055**		**4083**	

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

The survey results show certain similarities in the significance attached by both the directly and the indirectly affected households on the issues and concerns raised with respect to the three phases of the project (pre-construction, construction, and operation). "Air pollution/offensive odor" and "noise and vibration" are the topmost concerns. During the construction phase, "economic activities" are the foremost concern of the directly affected households, while "accidents" and "waste generation" are the foremost concerns of the indirectly affected households.

"Rresettlement" and "influx of workers" are foremost concerns among the directly and indirectly affected households. "Conflict of interest" involving government personnel that are at the same time beneficiaries of the project, is likewise a common concern to both households.

The FGD results corroborate the issues and concerns identified during the surveys. In addition, more specific concerns were discussed, such as: i) alternatives of project affected persons, ii) payment of land, iii) payment of structures, and so forth.

(2) Pre-Construction issues and concerns

1) Population (Resettlement, influx of workers)

Respondents during the surveys raised their concerns on population particularly to the resettlement issue and the possible influx of workers. This concern is particularly evident among the affected households in the North-South Road and the East-West Road alignment. The concern raised during the FGDs was that migrant workers may take advantage of the employment and livelihood opportunities generated by the project at the expense of the local residents. In this respect, it was suggested that qualified residents should be given priority in employment and livelihood opportunities.

2) Inequality

This refers to the comparison of perceived benefits that the indirectly affected households will received from the project against the negative impacts that will be experienced by the directly affected households in terms of resettlement and "forced sales of land and crops". Some participants were worried that the directly affected households would have to sacrifice for the greater good. It was averred, however, that if the resettlement issues will be handled equitably and justly, and the economic conditions of the directly affected households will be restored if not improved, then there would be no sacrifice at all.

3) Conflict of Interest

This refers to local officials who may be involved in the project but who also have some interests that might be affected by the project. The survey respondents felt that there might be conflict of interest among these local officials involving the concepts of replacement value of structures, just compensation of lands and crops and the issue on resettlement that will be directly handled by the local officials.

The more specific concerns and suggestions that cropped up during the FGDs include the following:

> *Alternatives of Project Affected Persons - It was suggested that the project-affected persons (PAPs) will be given three choices, namely: a) "Balik Probinsya Program" (or return to the province program) wherein the households will be given*

financial assistance to be able to return to their respective provinces; b) just compensation through payment of the replacement value of their structures, wherein PAPs choosing this alternative will be left alone to relocate to other places; and c) relocation (provision of home lot), in coordination with the local government unit. It was also suggested that the home lot to be provided by the project is not free and the beneficiary households will have to pay the cost of the developed land. Furthermore, the said household may dismantle their houses and re-use their construction materials in the relocation site, and that they have to make their choice before the implementation of the proposed project.

3.4.18 Issues and concerns during construction

(1) Accidents

The respondents are concerned that accidents would occur at the construction site during the construction phase. They are concerned that school children may meet accidents during construction. In addition, vehicles may also be involved in accidents because of the digging and the presence of heavy equipment. This fear is most evident among Daang Hari Road and North-South Road respondents, which is understandable considering that the proposed alignments will pass through their build up areas.

Another issue to be addressed is the stocking of construction materials. Indiscriminate placement of these materials could cause accidents that may lead to injury and death not only for the construction workers but also to the residents of the affected areas.

(2) Land Collapse

Another concern of respondents is the possibility of land collapse or subsidence during construction. The proposed road alignment will pass through highly congested areas. Houses and structures may be adversely affected because of the closeness of the construction site to their properties. Hence, without mitigating measures during construction, their fears might be realized.

(3) Waste

Another serious concern of respondents is the generation of personal waste and construction spoils in the construction sites. The presence of construction spoils will impede their accessibility and may contribute to the occurrence of accidents. This issue should be addressed and be included in the Contractor's Management Program that will be required in the application of the ECC for this project.

(4) Archaeological and Historical Sites

Cavite and Laguna are provinces rich in archaeological and historical sites considering the roles of these provinces in the history of the country. This concern should be addressed during the construction phase. Coordination should be made with the National Museum and the National Historical Institute to assess the road alignments.

Any archaeological and historical sites on the proposed alignment have not been found so far according to the social surveys and field reconnaissances during the EIA study. Initial discussions with National Museum has been made during the Study and it was agreed in principle that should there be discoveries of archaeological sites during construction, the National Museum will be properly notified and an archaeological rescue activity will be arranged.

(5) Infrastructure and Public Utilities

The survey respondents were also concerned about the possible disruption of public utilities and infrastructure in their areas. During actual construction, there would likely be relocation of drainage system, electrical lines and water supply to give way to the road project. Coordination with utility companies should be done to minimize the negative effects of the project to the local residents. It is important that continued access be given to residents so as not to disturb their daily chores.

(6) Construction Aggregate

Usually when the road project passes through rice lands, the soft layer of the soil will be totally removed because it is unstable. When the scraping reaches the stable layer, aggregates will be added to make the foundation stronger. The layers to be placed in a road alignment are based on the load design. The bigger the load design, the stronger the foundation should be. It is expected that there would be an excess of soil or construction spoils in the area where the project will be implemented. Soil from the adjacent rice lands will not be used for construction.

3.4.19 Issues and concerns during operation phase

(1) Noise and Vibration

Based on the perception survey, the respondents are concerned about the noise and vibration that will be caused by passing vehicles especially trucks with container vans. The expected improvement in the traffic flow will increase the speed of vehicles traversing the roads and this will also increase the noise and vibration caused by passing vehicles.

(2) Air Pollution

Air pollution will increase as usage of the new road alignment rise over time and result in the passage of more vehicles.

(3) Water Run-Off and Contamination

Another environmental concern is the increase in water run-off and contamination (256 directly affected HHs; 245 indirectly affected HHs). Construction of paved surface roads will reduce total absorption area of soil cover in a given location that may result to a relative increase of run-off water. An adequate drainage design can mitigate this consequence.

Improper use, disposal and storage of fuel and lubricants during construction may contaminate nearby surface water unless safety measures are put in place.

(4) Land Use and Zoning

The construction of the road alignments will change the land use and zoning ordinances of the host LGUs. Developers will be encouraged to develop new subdivisions and other housing projects. New industrial areas will open up to take advantage of the new road alignments. Rural areas will experience development pressures to convert into other land uses. These pressures may lead to the conflict in land use. Agricultural areas would most likely be converted into other uses and farmers and tenants who till the land will be

displaced. Overall, the construction of the proposed roads will change drastically the land use and zoning of the directly affected areas.

(5) Aesthetics and Visual Effects

The aesthetic and visual effects of the areas where the road alignments will pass will improve because of the project. Shanties especially along the North-South road (Bacoor) and the East-West road will have to give way to the project. The areas that will be opened by the CALA alignment will be rural but development pressures will be exerted to convert into other land uses.

It is important that local government units exercise control over the newly opened areas through the enactment of new zoning ordinances that would regulate the types of structures to be constructed. It is also important to implement the pertinent provisions of RA 7279 for the prevention of squatters in the newly opened areas.

(6) Housing and Social Services

There will be households that will be relocated because of the project. The affected households will be given a chance to own land through monthly amortization. This will improve their tenure over the land where they will be relocated compared to their former status as squatters.

Private developers will start developing subdivisions that would partially address the perennial housing problem in the country. Necessarily they would also develop socialized housing project as mandated by law.

The development of the newly opened areas will result in the increase in revenue of the LGUs through higher real estate taxes, business permits and licenses. These revenues may be appropriated to the delivery of basic services for the residents. Hence, basic services may improve if the additional revenues that are directly attributable to the project will be allocated for the improvement of basic services.

(7) Socio-economic Activity

The project roads will affect transportation patterns and socio-economic activities as the these roads traverse existing communities, farm lands, access roads and some commercial areas. Regional severance (regional divide) can be mitigated by building structures like fly-overs, pedestrian overpasses/underpasses, interchanges and at-grade intersections which can provide access to residential areas, places of work, schools, hospitals, commercial areas, etc., at strategic locations along the proposed project roads.

(8) Public Health and Safety

When the project is operational, accidents involving property and human lives may increase because the project will enable vehicles to travel faster. Higher speed may most likely increase the number of accidents in the newly opened areas.

Hence, it is important in the detailed engineering stage that the safety aspect of the project be studied thoroughly. In the FGDs, there were questions of the safety aspects of the projects and the engineering interventions to prevent accidents such as fencing, interchange approaches, traffic lights, road signs, pedestrian lanes, exit gates, etc. This only shows the concerns of residents in the safety aspect of the project.

(9) Culture, Lifestyle and Values

It is expected that there will be no significant change in the culture, lifestyle and values of the residents in the affected areas. Presently, these residents have access to the urban lifestyle and shopping malls proliferates in the affected areas. If there is an effect, it is only the fact that residents will be given greater accessibility to malls and recreational centers through improve traffic conditions.

(10) Women and vulnerable groups

This proposed road project will have significant positive impact on women and vulnerable groups. The road project will improve the transport network of the region thereby promoting greater accessibility to basic services especially for this sector.