JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NATIONAL ECONOMIC DEVELOPMENT AUTHORITY (NEDA)

ROADMAP FOR TRANSPORT INFRASTRUCTURE DEVELOPMENT FOR METRO MANILA AND ITS SURROUNDING AREAS (REGION III & REGION IV-A)

FINAL REPORT

SUPPLEMENTAL REPORT NO. 1

New NAIA Project

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ALMEC CORPORATION

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ABBREVIATIONS

AGL	Airfield Ground Lighting
AGT	automated guided transport
ANS	air navigation service
ARCBC	ASEAN Regional Centre for Biodiversity Conservation
ARRC	All-Asia Resources and Reclamation Corporation
ASEAN	Association of South-East Asian Nations
ATC	air traffic control
ATM	air traffic management
B/C	benefit and cost
BOOT	build-own-operate-transfer
CAAP	Civil Aviation Authority of the Philippines
CAVITEX	Manila–Cavite Expressway
CBD	Central Business District
CIA	Clark International Airport
CNS	communication, navigation and surveillance
DENR	Department of Environment and Natural Resources
DMIA	Diosdado Macapagal International Airport
DME	distance measuring equipment
DOD	Department of Defense
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highway
ECC	Environmental Compliance Certificates
EDSA	Epifanio de los Santos Avenue
EIA	environmental impact assessment
EIRR	economic internal rates of return
EL	elevation
EMB	Environmental Management Bureau
ENPV	economic net present values
FS	feasibility study
FSC	full service carrier
FT	feet
GA	general aviation
GCR	Greater Capital Region
GFI	Government Financial Institutions
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICC	Infrastructure Coordinating Committee
ILS	instrument landing system
JICA	Japan International Cooperation Agency
KLIA	Kuala Lumpur International Airport
kt	knot
LCC	low cost carrier
LLDA	Laguna Lake Development Authority
LLEDP	Laguna Lakeshore Expressway Dike Project
LRT	light rail transit
MARILAQUE	Manila-Rizal-Laguna-Quezon
MET	meteorology
MIA	Manila International Airport Authority
MM	Metro Manila
MPPA	million passengers per annum

MPH	miles per hour
MRT	Manila Metro Rail Transit
NAIA	Ninoy Aquino International Airport
NCR	National Capital Region
NE	north-east
NLEX	North Luzon Expressway
NW	north-west
ODA	official development assistance
O&M	operation and maintenance
PHP	Philippines peso
PNR	Philippines National Railway
POL	point of load
PPP	public private partnership
PRA	Philippines Reclamation Authority
SE	south-east
SFC	surface
SLEX	South-Luzon Expressway
SW	south-west
VGF	viability gap/support fund
VHF	Very High Frequency
VOR	VHF omni-directional radio range

1 BACKGROUND AND OBJECTIVES

1) Background

1.1 As a core issue with serious impact on subsectors of the Dream Plan, the airport and port projects are part of the plan in terms of improving their current capacities and surrounding transport conditions. It was deemed practical that part of the long-term action is to address the congestion at these facilities by moving them to larger grounds. While NAIA's capacity is getting saturated, the functions of the two gateway airports of NAIA and Clark International Airport (CIA) should be urgently strengthened and integrated by clarifying their roles and improving access to and between these airports.

1.2 In the medium to long term, the existing NAIA will be replaced with a New NAIA which will be developed in the vicinity of Metro Manila. Upon opening of New NAIA as an internationally competitive regional airport, the existing one would be closed and converted for urban development. CIA will serve the Metropolitan Clark and Northern Luzon area, which is expected to grow as an independent significant regional center (Green City), as well as an alternative to New NAIA.

2) Objectives

1.3 The objectives of this Supplemental Study are as follows:

(i) To define more specifically the roles of existing and possible plans of gateway airports to meet increasing air traffic demand in the most effective manner.

(ii) To identify and study candidate occasions for a New NAIA and recommend the most appropriate one; and

(iii) To preliminarily formulate a concept plan for New NAIA at a selected location.

2 CONTEXT

1) Current Operational Airports in GCR

2.1 There are three operational airports in the Greater Capital Region (GCR) as follows:

(i) Ninoy Aquino International Airport (NAIA) – the gateway airport of the Philippines;

(ii) Clark International Airport (CIA); and

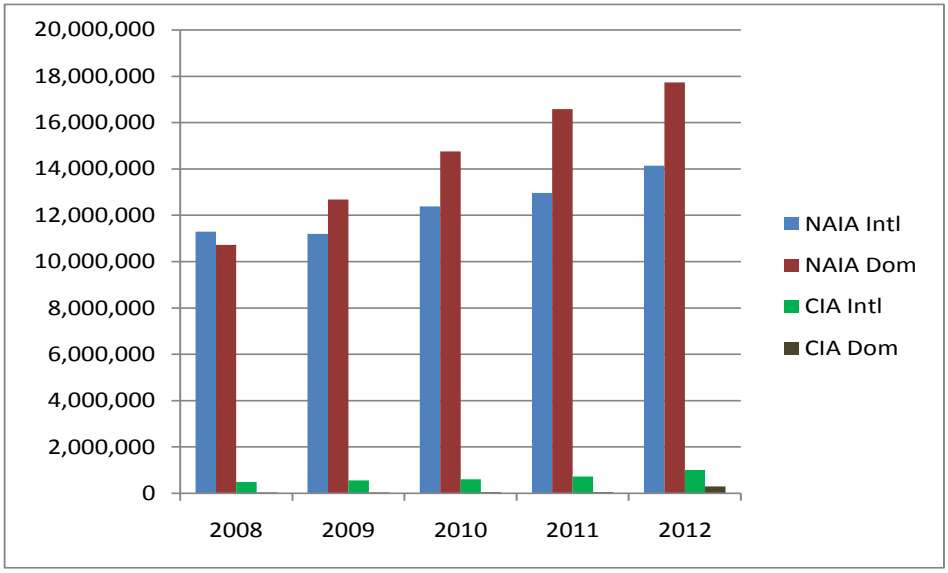
(iii) Plaridel in Bulacan Province.

2.2 Both domestic and international air traffic volumes in the Philippines have been growing at high annual growth rates of some 10% in the past 5 years. NAIA is currently facing capacity problems on both airside and landside facilities during peak hours. In comparison, CIA is not fully utilized despite the fact that it was designated as a premier international gateway airport for the Philippines by Executive Order No. 174 more than 17 years ago in 1994. And its status has been re-iterated/ defined many times after that through other Executive Orders. However, its use has remained limited until recently, with the introduction of budget carriers to/ from the Asian region that use CIA.

2.3 Plaridel airport mostly handles General aviation flights, with limited public passenger services. In 2009, it handled just over 5,000 air passengers (Philippines Statistical Year Book – 2011).

2.4 There has been considerable growth in air passenger demand at NAIA. The international demand is more volatile than the domestic demand. However, international passengers grew on average of around 5% p.a., whereas domestic demand has been growing at more than 10% p.a. since 2008. In 2009, the domestic demand was greater than the International demand for the first time, and in 2011 it was 25% more than the international demand. NAIA is currently handling around 30 million passengers per annum and is almost at its technical capacity for handling aircraft at peak times. Recently, there have been incidents where flights have been diverted from NAIA due to technical issues, as reported in the local press.

2.5 In contrast, in 2012 NAIA handled 96% of the GCR air transport demand of 31.9 million passengers (international and domestic combined) compared to 1.3 million passengers at CIA. This comparison is illustrated in Figure 2.1. It is also interesting to note that domestic demand is growing at both NAIA and CIA. This recent high growth in the domestic demand cannot be sustained by NAIA due to its capacity constraints and the domestic demand to/ from CIA is hampered with the unpredictable and long travel time to/ from Manila. However, CIA, in the short term, would continue to attract low cost (budget) international carriers mostly in the Asian region. If supported by provision of improved terminal facilities and better local transport, CIA could support the GCR air passenger growth in a short period only until further development of both airports is confirmed and realized



Source: Civil Aviation Authority of the Philippines, MIAA and CIAC

Figure 2.1 Comparison of Air Passenger 2010 Demand at NAIA & CIA

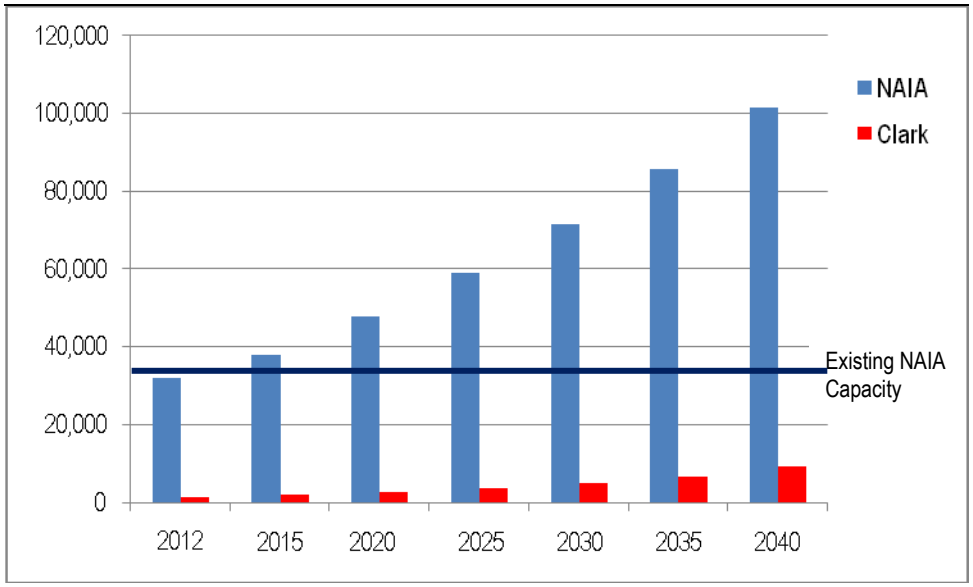
2) Air Passenger Demand Forecast

2.6 Table 2.1 presents approximate future air passenger demand at NAIA and Clark forecast in 2011 GCR Airport System Study. Although the forecast needs to be reviewed and revised based on the latest socio economic conditions, it can be assumed that, as a rule of thumb, NAIA would totally be capacity-saturated in 2015, and not be able to cater for the increasing passenger demand any more.

Table 2.1 Passenger Traffic Demand for GCR (Medium Case)

Year	NAIA Catchment Area ('000)			Clark Catchment Area ('000)		
	International	Domestic	Total	International	Domestic	Total
2012 (Actual)	14,140	17,739	31,879	1,013	300	1,313
2015	16,464	21,314	37,778	1,518	400	1,918
2020	21,172	26,658	47,830	1,989	640	2,629
2025	26,649	32,447	59,096	2,579	1,040	3,619
2030	32,901	38,683	71,584	3,237	1,670	4,907
2035	40,098	45,466	85,564	4,038	2,690	6,728
2040	48,526	52,959	101,485	4,900	4,330	9,230
Period	Average Annual Growth Rate			Average Annual Growth Rate		
2012-2020	5.2%	5.2%	5.2%	8.8%	10%	-
2010-2030	5.0%	4.9%	4.7%	8.7%	10%	-
2010-2040	4.7%	4.4%	4.5%	7.2%	10%	-

Source: 2011 GCR Airport System Study and 2012 data from Civil Aviation Authority of the Philippines
Note: The domestic passenger demand at Clark has been revised based on the latest traffic data in 2012 and assumed average growth rate of 10% annually.



Source: JICA Study Team based on 2011 GCR Airport System Study

Figure 2.2 Passenger Traffic Demand for GCR (Medium Case)

3) Opportunities and Constraints of NAIA and Clark

2.7 Development of both airports has obvious opportunities and constraints. That is, further capacity expansion of NAIA at its existing location is extremely difficult while capacity expansion of Clark is physically possible. However, inasmuch as Clark can offer opportunities to accommodate the overflow of traffic from NAIA, a critical concern is the distance of Clark from Metro Manila (major traffic generating source) of about 100 kilometers restricting easy access. Providing high-speed train access will be too costly. (Comparison of major gateway airports distances in the world cities is given in the table below.)

Table 2.2 Distances of Gateway Airports from City Centers in Other Countries

Country	Name of City	Name of Airport	Distance from CBD (km)	Number of Pax[1/] (000)
Indonesia	Jakarta	Soekarno–Hatta International Airport	20	39 582
Japan	Narita	Narita International Airport	58	32,793[2/]
Malaysia	Kuala Lumpur	Kuala Lumpur International Airport	57	30 423
Singapore	Singapore	Changi Airport	20	35 457
China	Hong Kong	Hong Kong International Airport	35	39 735
South Korea	Incheon Metropolitan City	Incheon International Airport	60	27 934
Thailand	Bangkok	Suvarnabhumi Airport	29	34 374

Source: Compiled by JICA Study Team

1/ Passengers over last 12 months. Updated as of November 18, 2013. Source: http://www.aci.aero/Data-Centre/Monthly-Traffic-Data/Passenger-Summary/Year-to-date

2/ Terminal passengers from January-December

4) Need for Re-organization and Capacity Expansions of Gateway Airports in GCR

2.8 Metro Manila must be provided with a competitive international gateway airport to sustain future sustainable growth of the country, which require much improved connectivity with major growth centers in the region and the world.

2.9 Existing NAIA (even after improvement) and improved Clark are unable to meet the requirements for GCR's air traffic demand, because GCR's demand is composed of large demand of Metro Manila and surrounding areas, and relatively small demand of Clark catchment area which are different. Because of long distance between Clark and gravity centre of Metro Manila market, Clark may not be able to tap the demand effectively. Improvement of existing NAIA can only expand its capacity to a limited extent.

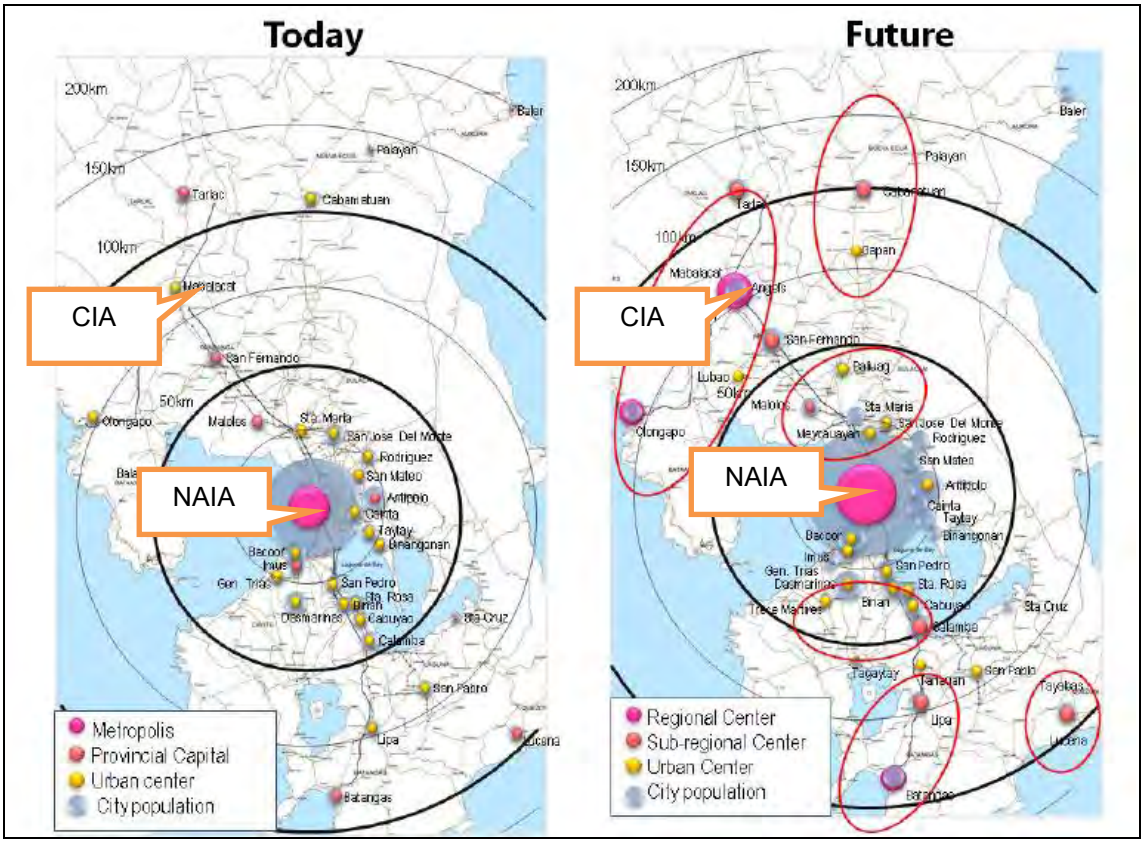
5) Traffic Distribution Scenario

2.10 NAIA is handling around 30 million passengers per annum (MPPA) while its maximum handling capacity is at about 35 MMPA. It is almost at its technical capacity for handling aircrafts at peak times.

2.11 Clark, already having two runways, is ready for development starting from the expansion of the existing terminal (capacity of 4 MPPA) and construction of low cost carrier (LCC) terminal (capacity of 10 to 30 MPPA). Therefore, it can be the only solution to address the immediate need to expand the airport capacity of GCR. Further development of the gateway airport facilities at Clark should be planned in the medium to long-term in line with the capacity enhancement of NLEX, etc. It means that, even in case of Clark, development of the airport itself and associated facilities such as access and utilities needs to be progressively implemented. Therefore, it is necessary to immediately develop Clark while maintaining NAIA for both airports to work as a Twin Airport System for GCR, which is necessary to support the future spatial structure of the region (see Figure 2.3).

2.12 The future air passenger demand of GCR has been distributed between NAIA, Clark and Sangley based on the following assumptions:

- NAIA's maximum passenger handling capacity would be approximately 35 MPPA;
- Minimum improvement of Sangley would be completed by 2015 and would start its operation as the supplemental airport (or the third runway) of NAIA;
- The domestic LCC operations account for 65 % of the total domestic passengers and a part of the domestic LCC operations would gradually move from NAIA to Sangley upon the commencement of operation at Sangley (maximum 5 MPPA);
- Air passenger demand of NAIA exceeding 35 MPPA would be transferred to Clark; and
- Upon opening of New NAIA right after 2025, 80 % of the traffic transferred from NAIA would move back to NAIA while the remainder (almost equivalent to LCC ratio at NAIA in 2010) would continue to operate at Clark.



Source: JICA Study Team based on Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas (region III and Region IV-A)

Figure 2.3 Proposed Future Spatial Structure of GCR

6) Basic Requirements for New NAIA Development

2.13 The target for development of New NAIA has been set at 2050 which is 30 years after the opening day. The target passenger and aircraft movements have been approximated based on the assumed annual passenger growth rate of 4% (after 2040) and increase of 10 average passengers per flight every 5 years as shown in Table 2.3. This means that New NAIA would need to have an ultimate capacity of approximately 131 million passengers per annum (MPPA).

Table 2.3 Assumptions on Passenger Volumes for New NAIA, 2025 - 2050

Item	2025	2030	2035	2040	2050 (Ultimate year)
International Passengers (MPPA)	23	27	31	36	53
Domestic Passengers (MPPA)	32	39	45	53	78
Total Passengers (MPPA)	55	66	76	89	131
Approx. Aircraft Movements ('1000)	400	440	475	524	690
Ave. Passengers per Flight	140	150	160	170	190

Source: JICA Study Team

2.14 According to IATA Aerodrome reference manual, for aircraft movement capacity realistically at 70% movements per annum, the estimated NAIA 2050 aircraft movements of 690,000 would require 4 runways (2 pairs of close parallel configuration), which can accommodate 708,000 aircraft movements.

2.15 As the gateway international airport with potential capacity of more than 100 MPPA, New NAIA should be provided with ample land area for the development of the 4 runways, the lighting system and navigational aids and terminal facilities. Given this scenario, a minimum of 2,400 hectares land area for the airport would be required. This would be a rectangular area of 6-km long and 4-km wide.

7) Proposed GCR Airport System: New NAIA, Supplemental Airport and Clark

2.16 In GCR, there are two international airports of NAIA and Clark, one community airport of Plaridel as well as the Sangley Military Airfield. It is considered apparent that the main GCR Airport System should consist of two gateway international airports of NAIA/New NAIA for NCR and Southern Luzon as well as Clark for Metro Clark and Northern Luzon. In addition, development of Sangley Airfield as NAIA's supplemental airport is considered necessary to alleviate expected severe capacity constraints of NAIA until completion of New NAIA. It is also considered necessary to expand/improve Plaridel Airport as the General Aviation (GA) base of GCR and all of the GA currently operated at NAIA should be transferred to Plaridel as Sanley will need to pay its role as the supplemental airport.

2.17 In order to maximize the available infrastructures and potential resources, it is proposed to undertake following strategies, though they are to be farther examined (see Table 2.4);

(i) Prepare the use of existing runway at Sangley as third runway of NAIA to share overflow of NAIA traffic together with Clark before NAIA is more or less saturated by 2016.

(ii) Prepare development of New NAIA in the vicinity of Metro Manila by 2025 to solve the gateway airport issue completely and join international competition in the global air market.

(iii) By the opening of New NAIA, Sangley and Clark should accommodate excessive traffic demand beyond the capacity of NAIA.

Table 2.4 Proposed Airport System for GCR

Airport	Remark	Actions Required			
		Immediate-term (2013-2016)	Short-term (2017-2020)	Medium-term (2020-2025)	Long-term (2025 and beyond)
NAIA	・Capacity being reached ・Expansion limited ・Good accessibility ・2runway x 3,410/1,998m	・Improve the existing terminals and taxiways, etc.	・Continue improvement of existing terminals and taxiways, etc.	・Partially transfer some domestic operations to Sangley.	・Close NAIA upon opening of New NAIA.
Clark	・Ready to be used ・Expansion unlimited ・Long access from Metro Manila (~100km) ・2runway x 3,200m	・Develop LCC terminal, etc. as required to share NAIA demand	・Develop required facilities/services to meet demand (NAIA and C&N Luzon)	・Develop required facilities/services to meet demand (NAIA and C&N Luzon)	・Develop required facilities/services to meet demand (NAIA and C&N Luzon)
Sangley (SRA)	・Underutilized ・Close to Metro Manila ・Poor accessibility ・Expansion limited ・1runway x 2,350m	・Transfer to CAAP ・Design/implement necessary measures to share function of NAIA	・Operate as third runway of NAIA under one single ATC with possible access by high speed boat and improved roads including bridge		・Integrate development with New NAIA (in case of Sangley as New NAIA)
Plaridel	・Base for General Aviation operation ・Expansion limited ・1runway x 900m	・Expand and improve to accept all GA operations.			

Airport	Remark		Actions Required					
			Immediate-term (2013-2016)		Short-term (2017-2020)	Medium-term (2020-2025)	Long-term (2025 and beyond)	
New NAIA	・Response to the need for globally competitive gateway airport		・Project plan/design: FS, EIA/ECC, ICC approval, etc.		・Design/construct seawalls/reclamation and access bridge (road and rail).	・Site development, construction of airport and related facilities and services.	・Inaugurate New NAIA.	
Demand (000)	NAIA Catchment Area	International	14,140	16,464	21,172	26,649	32,901	48,526
		Domestic	17,737	21,314	26,658	32,447	38,683	52,959
		Total	31,877	37,778	47,830	59,096	71,584	101,485
	Clark Catchment Area	International	1,015	1,518	1,989	2,579	3,237	4,900
		Domestic	300	400	640	1,040	1,670	4,330
		Total	1,315	1,918	2,629	3,619	4,907	9,230
Year			2012	2015	2020	2025	2030	2040

Source: JICA Study Team
Note: Capacity of NAIA is estimated to be approximately 35 million passenger/year.

3 ASSESSMENT OF ALTERNATIVE LOCATIONS FOR NEW NAIA

3.1 Alternative Sites for Development of New NAIA

1) Northern Portion of Manila Bay

3.1 There is no appropriate alternative site in Northern portion of Manila Bay near the boundary between NCR and Bulacan because of the following:

- This area has very high risk of flooding and significant operational difficulty is expected in an event of typhoon and/or tropical storm.
- The coastal area is densely occupied by residents. The existing roads are narrow and sometime flooded even on sunny days. Families are currently farming fish in the coastal area. Development of New NAIA in this area including the access roads and rail would cause relocation of significant number of residents and loss of their livelihood.
- According to a report prepared by DOTC (Manila International Airport Alternative Site Preliminary Engineering Study) in 1981 (DOTC Study 1981), majority of the sub-surface soil consists of soft and highly compressive clays. Bearing also the fact that the finished elevation of airport would need to be fairly raised to avoid risk of flooding, the consolidation settlement could be significant and hence the construction cost would be significantly high.

2) Central Portion of Manila Bay

3.2 There is also no appropriate alternative site in the central portion of Manila Bay as this area has already been developed for commercial and industrial purposes. There are several active harbors and ports. Moreover, construction of New NAIA in this area would cause significant problems and conflicts with the existing use of Manila Bay.

3) Southern Portion of Manila Bay

3.3 The nearest site at the southern portion of Manila Bay is the Sangley Point Air Base located just at the northern end of Cavite Peninsular. A number of proposals have been made in the past for this site. The latest one was prepared by All-Asia Resources and Reclamation Corporation (ARRC) and submitted to the Philippines Reclamation Authority (PRA) in January 2013. The proposal included development of an international gateway airport and seaport.

3.4 Sometime in 1981, DOTC examined the relevance of San Nicholas Shoal (as an alternative site of Sangley Point) for development of a new gateway airport, although no decision was made at the time (1981 DOTC Study).

3.5 In 2007, PRA was directed by former President Gloria Macapagal-Arroyo to convert Sangley Point in Cavity City into an international logistics hub through a reclamation project.

3.6 An offshore airport development at Sangley Point can offer adequate size of land, obstacle-free airspace above Manila Bay on both sides as well as convenient and reliable access to/from the NCR. Risk of conflict with urban development, natural hazard, aircraft crash and noise problems to urban areas can be minimized because of the surrounding water of Manila Bay. Therefore, the offshore area at Sangley Point has been identified as

one of the alternative sites for a New NAIA development.

3.7 It should be noted that there are several newspaper articles reporting strong opposition to the reclamation plan of Sangley from the affected fishermen and the residents due to their perception on loss of livelihood and degradation of the natural environment.

4) West Laguna de Bay

3.8 According to newspaper articles in December 2008, the City of Taguig prepared a plan to develop an airport city requiring the reclamation of 3,000 (some article says 5,000) hectares of lakeshore areas northwest of Laguna de Bay. The development of an international airport formed part of the project scope. A conceptual design for the airport city was undertaken by Palafox Associates, but no detailed information is available.

3.9 The proposed site within Taguig would involve the reclamation of Laguna Lake and can offer adequate size of land, obstacle-free airspace (except for several obstructions), and has been identified as the other alternative site for New NAIA development (West Laguna Lake Offshore Site).

3.10 It should also be noted that some newspaper articles reported some anticipated significant environmental and social risks inherent to the proposed airport and its associated facilities development project.

Source: JICA Study Team

Figure 3.1 Location of Alternatives Sites for New NAIA

5) Talim Island

3.11 A report for the development of Rizal International Airport on Talim Island in Laguna was prepared by REACH MPCT during the 1980's and submitted by the Rizal Provincial Government to DOTC through NEDA Regional Director for inclusion within the MARILAQUE (Manila-Rizal-Laguna-Quezon) Development Plan.

3.12 Because Talim Island constitutes a rocky hill with a maximum elevation of more than 400m, this option would be very costly and would cause very much significant negative environmental and social impacts. Therefore this option is not appropriate for further examination.

6) Other sites

3.13 The Study on the Airport Strategy for the Greater Capital Region in the Republic of the Philippines conducted by JICA in 2011 evaluated several sites for alternative airport for NAIA. There were six locations subjected to technical assessment, and these included the Rizal Talim Island and Laguna De Bay as discussed above as well as the DMIA (Clark International Airport). The other three sites were:

- **San Nicholas Shoals (offshore airport site in Manila Bay), approximately 32 km south of Manila.** The development is to be offshore along the coastlines of the Municipalities of Rosario and Tanza where fishing and agriculture are the predominant industries.
- **Angat-Pandi-Bustos (inland airport development in Bulacan),** approximately 53km to the north of Manila on the southern bank of the Angat River and stretching through the Municipalities of Angat, Pandi and Bustos in the Province of Bulacan.
- **Obando (offshore airport development in Bulacan),** approximately 25km to the north-northwest of Manila on the coastal area of Manila Bay. The site consists of existing fish ponds and Manila Bay where reclamation would be required for airport development.

3.2 Initial Screening of Candidate Sites for New NAIA

3.14 For the selected eight candidate sites for New NAIA, a rapid assessment was made based on a set of following criteria;

(1) Catchment area: size of market (demand) within the catchment area of each candidate location for New NAIA;

(2) Availability of land and future expansion: availability of large scale land necessary for development of New NAIA;

(3) Navigation risk due to mountain range: distance from mountain ranges;

(4) Flooding and other natural hazard risks: degree of flood and other hazard risks at and around the locations for New NAIA;

(5) Wind speed and direction: wind direction and frequencies which will affect air craft navigation:

(6) Accessibility: transport accessibility between New NAIA and respective market of candidate location for New NAIA;

(7) Minimal risks of aircraft crash and noise problems: land use conditions within the air space of each candidate location for New NAIA;

(8) Integrated urban development opportunity: integrated urban development opportunities for enhancement of airport function and cost recovery; and,

(9) Development cost: relative magnitude of development cost of New NAIA including land acquisition and compensation[1].

3.15 Based on the above, the sites in Sangley Point Offshore and Laguna Lake Offshore are considered as priority sites for further assessment (see Table 3.1).

Table 3.1 Rapid Assessment of Candidate Sites

Candidate Sites	Criteria[1)]									Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
①Angat-Pandi-Bustos	1	1	3	1	3	1	3	1	2	16
②Obando	1	1	3	1	3	1	2	1	2	15
③North Manila Bay	2	1	3	1	3	2	1	2	2	17
④Central Manila Bay	3	1	3	2	3	3	1	3	2	21[2)]
⑤Sangley Point	3	2	3	3	3	3	3	3	3	26
⑥San Nicholas Shoals	2	2	3	3	3	1	3	1	2	20
⑦West Laguna Lake	3	2	3	2	3	3	2	3	3	24
⑧Rizal – Talim Island	1	2	1	2	3	1	3	1	2	16

Source: JICA Study Team

1) 3: favorable, 2: moderate, 1: unfavorable

2) This option negatively affects marine landscape and waterfront value of the city.

[1] At this stage of the study, no detail analysis is made for candidate sites. Ratings were made based on relative judgment in comparison with that of Sangley case.

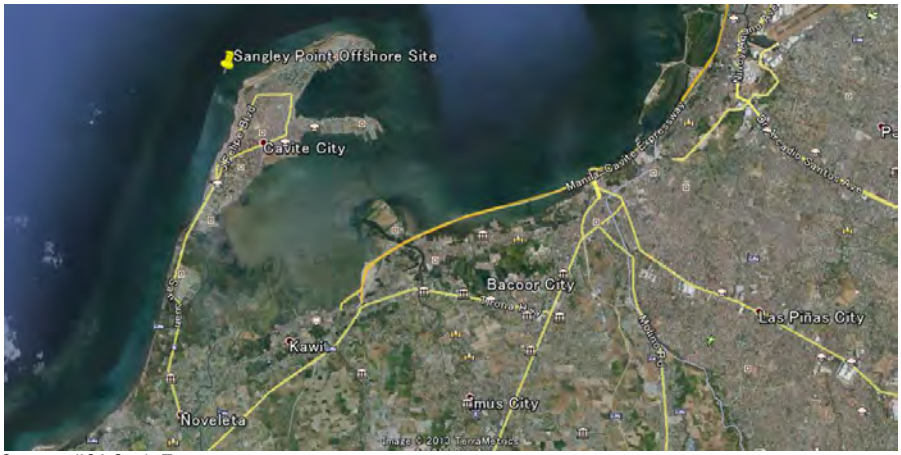
3.3 Farther Assessment of Alternative Sites with Relatively High Ratings

3.16 Farther assessment was made on the two candidate sites of Sangley Point and Laguna Lake considering more in detail cost implication for site development, obstacle-free airspace, reliable airport access, risk of flooding and tsunami, conflicts with urban development, environmental and social impacts. .

1) Sangley Point and Offshore Site

[General]

3.17 Sangley Point offshore site is located in the Manila Bay to the west of the existing Sangley Air Base on Cavite Peninsular. It is just at the immediate periphery of Metro Manila and near west of the existing NAIA.



Source: JICA Study Team

Figure 3.2 Location of Sangley Point and Offshore Site

[Site Development]

3.18 This option requires 2400-ha reclamation of the Manila Bay for airport development. The depth of water ranges from 1 m to 12 m (on average about 5 m). According to the boring data conducted at other locations of Manila Bay, the subsurface soils are supposed to consist of very weak highly plastic silt or clay (N value of almost zero) from the seabed to minus 4-5 m, followed by silt, clay or sand with N-value of 15 or more. However, the upper layer of very weak soil may sometimes exist to a depth of 11 m below the seabed. Detailed geotechnical investigation should be carried out during the Master Planning and Design stage. Materials for reclamation may be obtained from nearby quarry at San Nicholas Shoals.

[Airspace]

3.19 To the northeast of the Site is Manila Bay and therefore no obstacle exists, however coordination will be necessary with authorities concerned in respect of the navigation routes of ships and their maximum mast heights. To the southwest of the Site is the coastal area of Cavite, and there exists no obstruction at the moment. Coordination with authorities concerned will be necessary to impose height limitation and land use restriction in order to maintain obstacle-free airspace and to enhance airport-compatible land use.

3.20 Another issue to be taken into account is one prohibited area in Luzon Island, namely the official residence of the President of the Philippines (RP-P1) designated as

shown below:

Table 3.2 Prohibited Area in Luzon Land

Identification and Name	Upper Limit/Lower Limit	Remarks
PROHIBITED AREA; RP-P1 MALACANANG	ALT 5,500 FT/SFC	Official residence of the President of the Philippines

Source: Civil Aviation Authority

3.21 When determining the runway orientation, careful coordination is required with authorities concerned to clarify to what extent overlapping of aircraft flight paths with the RP-P1 could be allowed.

[Weather]

3.22 The climatic conditions of Manila Bay are described by "ASEAN Regional Centre for Biodiversity Conservation ARCBC)" as follows:

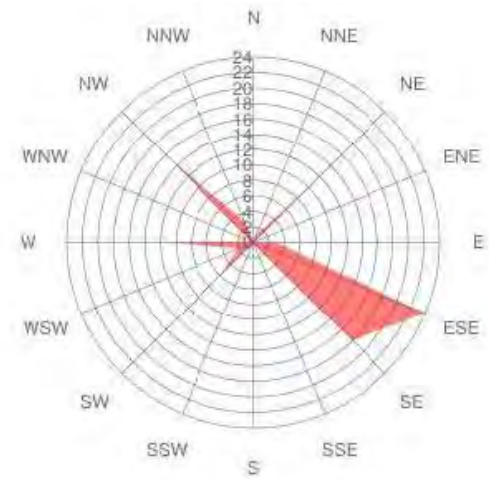
"Tropical climate with a pronounced dry season from November to April, and pronounced wet season for the remainder of the year. The area is protected from the northwest monsoon, but open to the southwest monsoon and cyclonic storms."

3.23 According to the weather data published by the "Windfinder", the easterly wind prevails from November to following May and westerly wind from June to October. The occurrences of "4 Beaufort" or stronger are relatively higher than NAIA (see Table 3.3). The average wind speed ranges between 7 kt and 9 kt. It can generally be observed that the wind condition at Sangley Point Offshore Site is very much similar to NAIA. During the forthcoming Master Planning stage, the weather data (hourly occurrences of wind speed and direction together with low visibility and ceiling) should be collected and analyzed.

Table 3.3 Wind Statistics at Sangley Point
(7:00 to 19:00 from October 2009 to September 2013)

Month	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Wind Direction	Easterly Wind					Westerly Wind					Easterly Wind	
Wind Probability >=4 Beaufort (%)	16	25	25	28	13	15	10	15	13	11	10	10
Average Wind Speed (kt)	8	9	9	9	8	8	7	8	7	8	7	7
Average Temperature (deg. C)	29	29	30	32	32	31	30	29	29	30	30	29

Note. Beaufort level 4: 11 to 15 kt (5.5 to 7.9 m/s), labeled as Moderate Breeze



Source: Windfinder

Figure 3.3 Wind Direction and Frequencies at Sangley

3.24 From the wind direction data, the runway should preferably be oriented to SE-NW; however this orientation does not fit the site condition as it would involve reclamation of deep sea water and the final approach/initial departure paths to be just above the densely populated Cavite. According to the analysis made in the 1981 DOTC Study, wind coverage of approximately 95 % (cross wind limit of 15 MPH) would be achievable at 07/25 runway orientation (same as the existing runway designation of Sangley). Therefore, the runways at Sangley Point Offshore Site may be oriented to NE-SW like Sangley (07/25) and NAIA (06/24), subject to further confirmation based on the weather data at Sangley Air Base.

[Access]

3.25 For access to the Site, initially one bridge, three-lane each, directly connecting the New NAIA with Manila Cavite Expressway should be developed as a minimum requirement to bypass the congested existing roads on the peninsula. High speed boat between coastal areas of Manila Bay and New NAIA is also considered useful option for smooth access to the site. In near future a second bridge for road and rail access will need to be constructed.

[Natural Hazard]

3.26 Cavite is a flood prone area but the airport and its related facilities are to be developed so that flooding should not adversely affect the airport operation. Similarly, in case of significant earthquake, a tsunami of 4-m height is expected to hit the area and such risk should be adequately taken into account when designing the airport and its related facilities.

[Negative Impact on Urban Area]

3.27 This site is surrounded by the water of Manila Bay and following negative impacts by development of New NAIA on the urbanized area are minimal:

- Height limitation on the buildings and other structures;
- Aircraft noise; and
- Risk of significant damage to the urban areas in case of aircraft crash near airport.

[Environmental Impacts]

3.28 “ASEAN Regional Centre for Biodiversity Conservation ARCBC)” identifies reclamation of intertidal areas for housing development, road construction, continuous dredging as well as continued denudation of the natural vegetation in the water catchment area, as disturbances and threats which Manila Bay has been facing. In order to minimize such negative impacts, EIA should be carefully carried out, Environmental Monitoring and Management Plan should be formulated and implemented, and the design should properly incorporate such requirements for the environmental protection and impact mitigation.

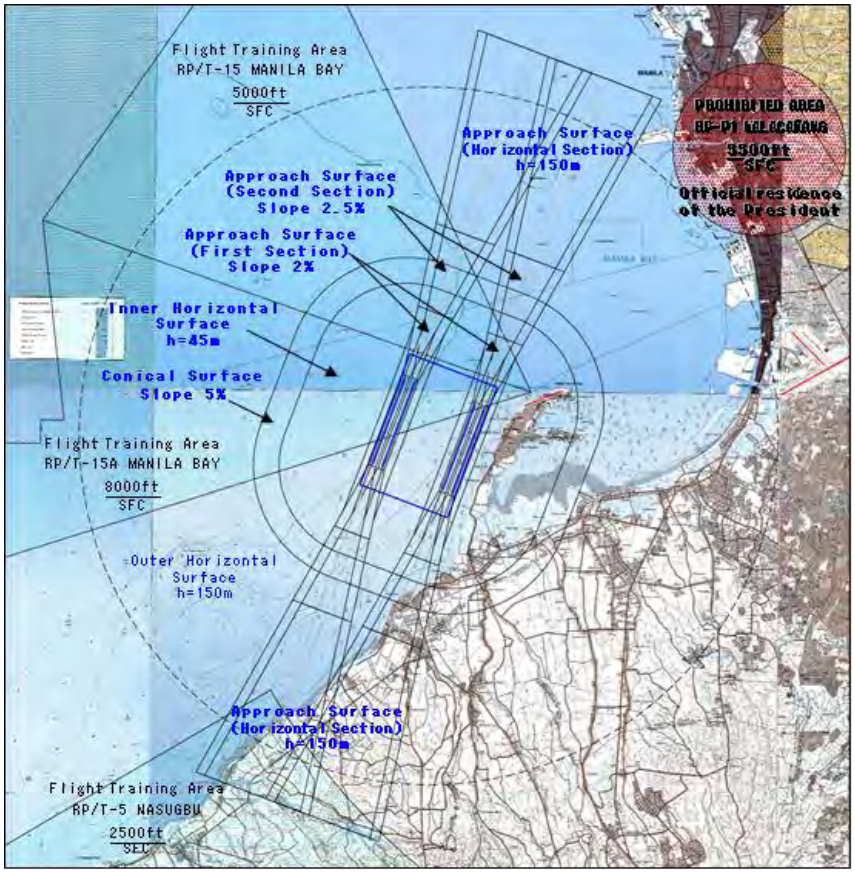
[Social Impacts]

3.29 “ASEAN Regional Centre for Biodiversity Conservation ARCBC)” states “The site (Manila Bay) is very important for its fisheries production which supports a large urban population along the periphery of the Bay. It is an ideal area for research on fisheries, wildlife, biomass and marine population because of its close proximity to major research agencies.”

3.30 There is high concentration of fish traps and extensive aquaculture in the Bacoor and Canacao Bays. One newspaper article stated that Sangley reclamation plan for airport will destroy livelihood of 26,000 Cavite fishing families. Appropriate livelihood restoration programs should be formulated and implemented when developing New NAIA in this site.

[Proposed Location of Runways and Obstacle Limitation Surfaces at Sangley Point Offshore Site]

3.31 In order to avoid direct overlapping of aircraft flight paths with the RP-P1, the runway orientation of 03/21 has tentatively been proposed as shown on Figure 3.4. During the forthcoming Master Planning stage, the runway orientation should further be refined based on the coordination on requirement of RP-P1, weather data, geological and geographical data and information of the seabed, etc.



Source: JICA Study Team

Figure 3.4 Proposed Preliminary Layout of Runways at Sangley Point and Offshore Site

2) West Laguna Lake Offshore Site

[General]

3.32 The West Laguna Lake Offshore Site is located approximately 25km to the southeast of Manila and approximately 15km to the southeast of NAIA on the coastal area of Laguna de Bay near the City of Taguig and Muntinglupa. Laguna de Bay is the largest lake in the Philippines. Currently there are a lot of aquaculture industries. To the west of the site is a densely populated urban area.

Source: JICA Study Team

Figure 3.5 Location of West Laguna Lake Offshore Site

[Site Development]

3.33 This option also requires 2400-ha reclamation of the Laguna de Bay for airport development. The depth of water is approximately 2to 3 m. The altitude is 2 m above sea level. The coastal area of Laguna de Bay is flood prone area. According to the website information of Department of Public Works and Highways (DPWH) regarding the proposed Laguna Lakeshore Expressway Dike Project, the design finished level of the road is approximately 13 m in order to function as the dike for flood prevention. When constructing New NAIA at this site, the finished elevation of the airport will also need to be as high as 13 m.

3.34 The Lake is surrounded by low-lying alluvial plains which are often inundated during heavy rainfall and deforestation in the water catchment area has resulted in severe soil erosion and increased siltation in the Lake (ARCBC). It is likely that the lakebed is covered by thick silt and clayey soils which require careful engineering scrutiny and significant amount of improvement cost. However, no geotechnical data and information is readily available for the Study Team. Detailed geotechnical investigation should be carried out during the Master Planning and Feasibility Study and Design stage, if this site is chosen as the preferred option.

3.35 Transportation of the materials for reclamation is also an issue specific to this site. The dredged soils from the lakebed are considered inappropriate as the materials for reclamation except for use as the topsoil. Belt conveyor system connecting quarry site at San Nicholas Shoals for example and the site will likely to be required.

[Airspace]

3.36 Laguna Lake Offshore Site is somehow surrounded by potential obstructions to aircraft operations; such as building and other high structures to the west such as the existing building and power transmission line; mountainous topography in Rizal to the east to north as well as in Cavite (Tagaytay) to the south. In case the runways are oriented to southeast/northwest, the mountainous topography may be outside of the approach surfaces, but still the power transmission line and a building would likely to infringe the

approach surfaces (see Figure 3.6).

Source: JICA Study Team

Figure 3.6 View from West Coast of Laguna de Bay toward Sucat Thermal Power Plant

3.37 This runway orientation coincides with the anticipated prevailing wind direction. Direct overlapping with RP-P1 can be avoided.

[Weather]

3.38 Currently, no data on the wind speed and direction are available. The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) described the climatic condition of the lake in the same manner as Manila Bay as follows and no significant difference from those at NAIA and Sangley is expected:

"Most of the lake has a tropical climate with a pronounced dry season from November to April and a pronounced rainy season from the remainder of the year, but in the extreme east the rainfall is more evenly distributed throughout the year."

[Access]

3.39 The site is easily accessible to SLEX, C-6 (future) and the PNR as they are running along the coastline of Laguna de Bay.

[Natural Hazard]

3.40 Flood prevention is one of the expected functions of Laguna de Bay as the peak water flows of the Marikina River, during heavy rain, are diverted via the Manggahan Floodway to Laguna de Bay, functioning like a regulating pond. One of the objectives of Laguna Lakeshore Expressway Dike Project is flood prevention by 13-m high dike. The airport and its related facilities will be so developed that their operation should not be adversely affected by flooding.

[Negative Impacts on Urbanized Area]

3.41 As Laguna de Bay is situated in close proximity to NCR, the existing and future urban areas surrounding the West Laguna Lake Offshore Site would be significantly affected by existence and operations of the airport as follows:

- Height limitation; in order to meet applicable international standards of ICAO, strict height restriction to the areas beneath the aircraft take-off and arrival paths would be imposed, which could result in limited opportunity for urban development.
- Aircraft noise; surrounding areas would be adversely affected by the aircraft noise although the aircraft noise level has become much lower than before; and
- Risk of disaster by aircraft crash on nearby urbanized area cannot be neglected as

the aircraft would need to fly very low just before landing on/after take-off from the airport.

[Environmental Impact]

3.42 The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) described the disturbances and threats to the lake as follows (abstract):

"The rapid development of the lake region has resulted in high levels of pollution from human, industrial and agricultural sources. The dumping of waste from plastic and textile factories and poultry farms has been especially harmful. The most serious pollutants are the heavy metals, lead, mercury and cadmium, and certain pesticides widely used on neighboring agricultural land. Other threats to the lake system included the control of water levels for agricultural, domestic and industrial purposes, and extensive reclamation works on the foreshore for development of industrial estates, residential estates and recreation facilities. Deforestation in the water catchment area has resulted in severe soil erosion and increased siltation in the lake. The closure of Napindan Channel with a hydraulic control structure has prevented the inflow of sea water from Manila Bay, and this has resulted in increased turbidity of the lake waters and a subsequent increase in algal blooms."

3.43 According to a presentation material prepared by an official of Laguna Lake Development Authority (LLDA) dated September 2011 titled "Water Quality Management in the Context of Basin Management", the proposed West Laguna Lake Offshore Site is designated as Rehabilitation area, which was defined as "areas needing special and immediate rehabilitation and restoration covering denuded watersheds, critical river tributaries, shore land and salvage zone (flooded areas) and west bay. Following management strategies are to be implemented:

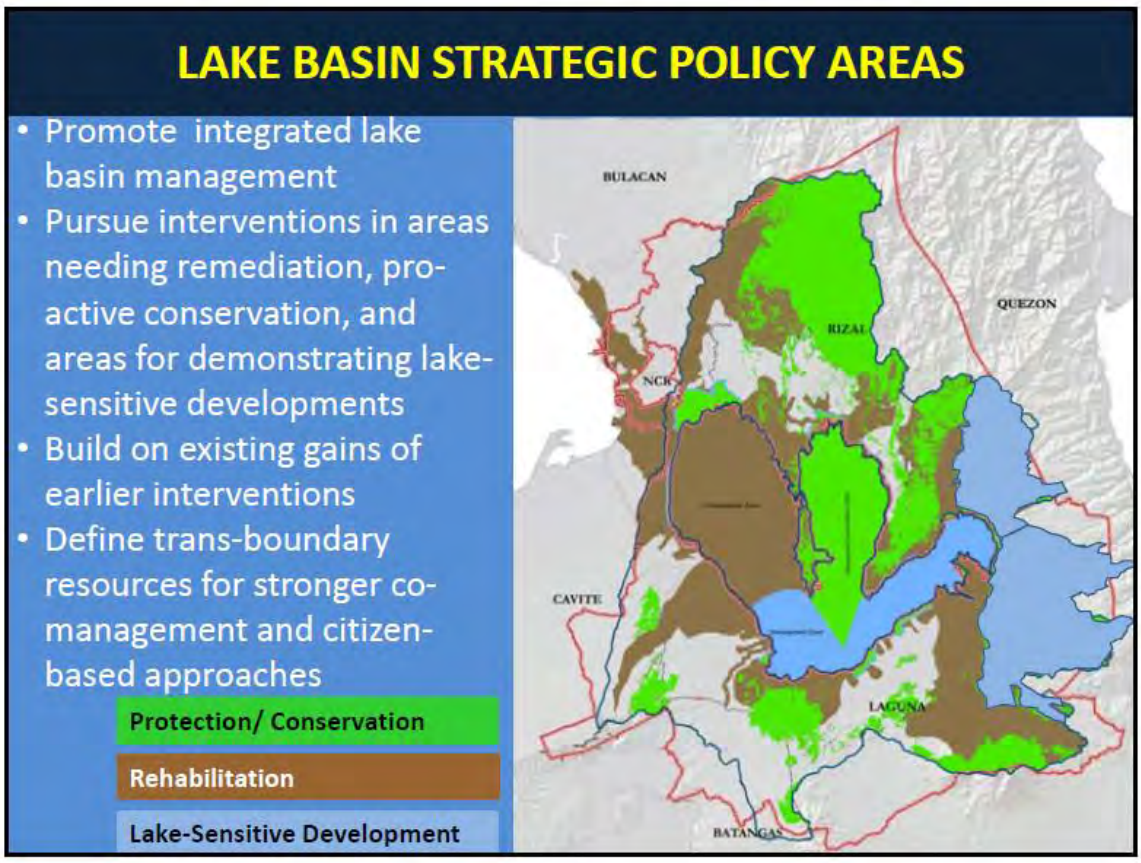
- Improve and protect lake water quality through an integrated network of environmental measures;
- Abate denudation and promote ecologically-sensitive land resource uses;
- Mitigate impacts of flooding and climate-induced hazards through sustainable infrastructure and non-infrastructure interventions; and
- Reduce vulnerability of the lakeshore communities and model sustainable settlement.

[Social Impacts]

3.44 The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) described the economic and social values of the lake as follows:

"Laguna de Bay is of outstanding importance for its fisheries production, and could provide a very substantial source of fresh water for Metro Manila. However, unless effective measures are taken in the near future to curb over-exploitation and reduce levels of pollution, there is a real danger that these valuable natural resources will be destroyed."

3.45 There is high concentration of fish traps and extensive aquaculture in the Laguna de Bay, and development of New NAIA would necessitate loss of significant number of fishing people, and therefore effective and sufficient livelihood restoration program will need to be formulated and implemented.

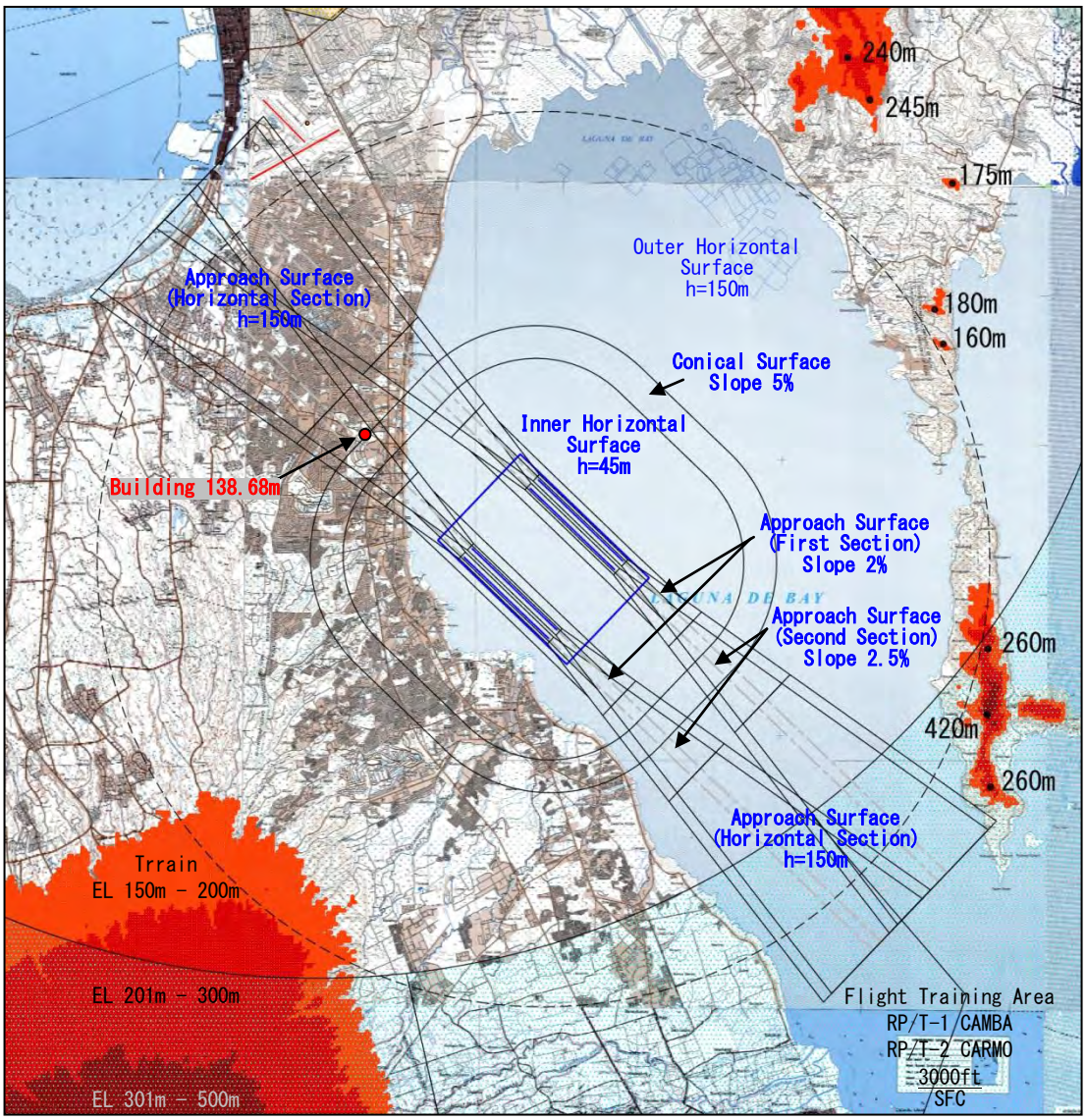


Source: Water Quality Management in the Context of Basin Management, LLDA

Figure 3.7 Lake Basin Strategic Policy Areas

[Proposed Location of Runways and Obstacle Limitation Surfaces]

3.46 In order to avoid hilly terrains from infringing obstacle limitation surfaces, the location and orientation of runways at West Laguna Lake Offshore Site has been proposed as shown on Figure 3.8. It should be noted that several structures including 138.68-m high building and power line located to the northwest of the site would protrude the approach surface and removal thereof would be required.

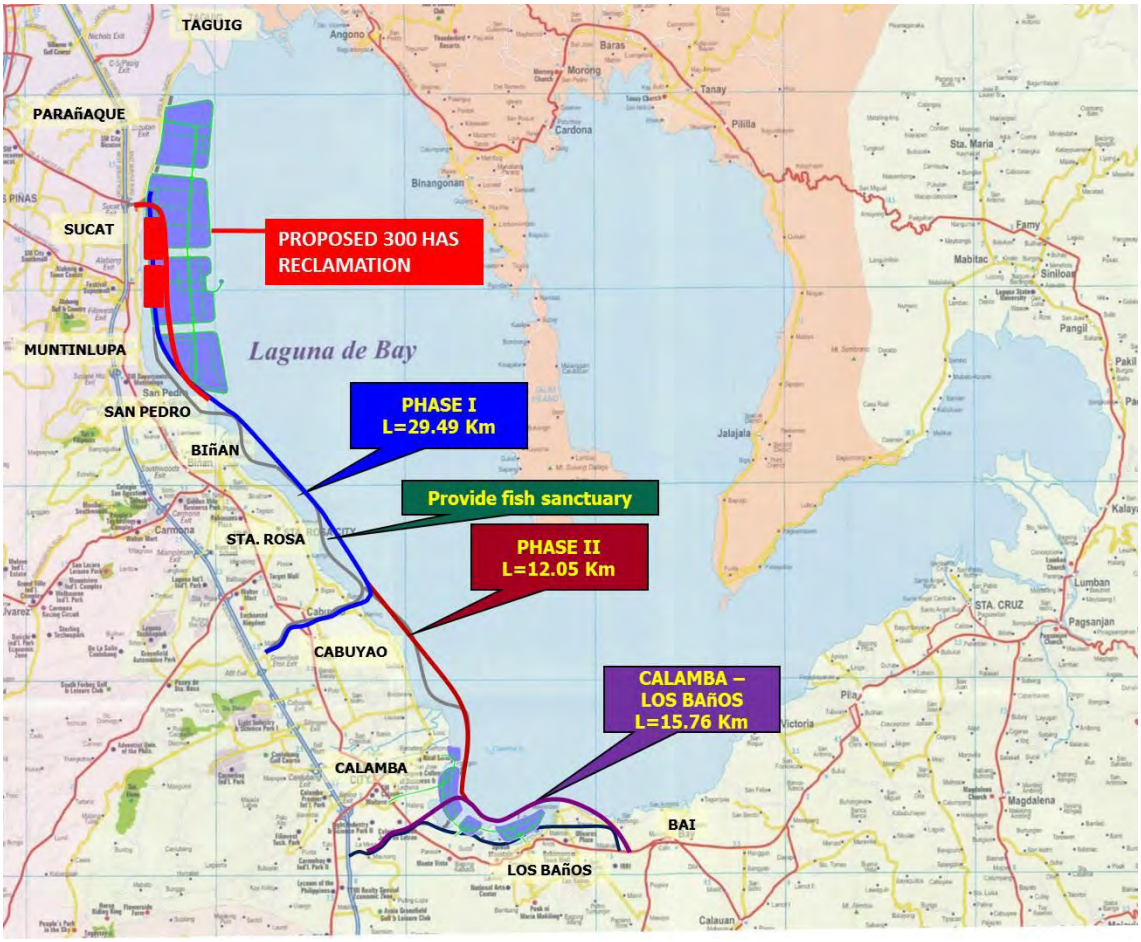


Source: JICA Study Team

Figure 3.8 Proposed Preliminary Layout of Runways at West Laguna Lake Offshore Site

[Related Project]

3.47 According to website of Department of Public Works and Highways (DPWH), Laguna Lakeshore Expressway Dike Project LLEDP) has been offered as one of the Public Private Partnership (PPP) Projects as presented in Figure 3.9. The LLEDP includes proposed reclamation near the West Laguna Lake Offshore Site, and hence coordination will be necessary between authorities concerned.



Source: DPWH website, 2013

Figure 3.9 Proposed Laguna Lakeshore Expressway Dike Project

[Reference Material]

3.48 According to newspaper articles in December 2008, the City of Taguig prepared a plan to develop an airport city requiring the reclamation of 3,000hectares of lakeshore areas northwest of Laguna de Bay. The development of an international airport formed part of the project scope. A conceptual design for the airport city was undertaken by Palafox Associates, but no detailed information is available.

3.49 Figure 3.10 shows an image of Airport City at Taguig which was obtained through internet. The size of airport seems to be too small to be an international gateway airport.

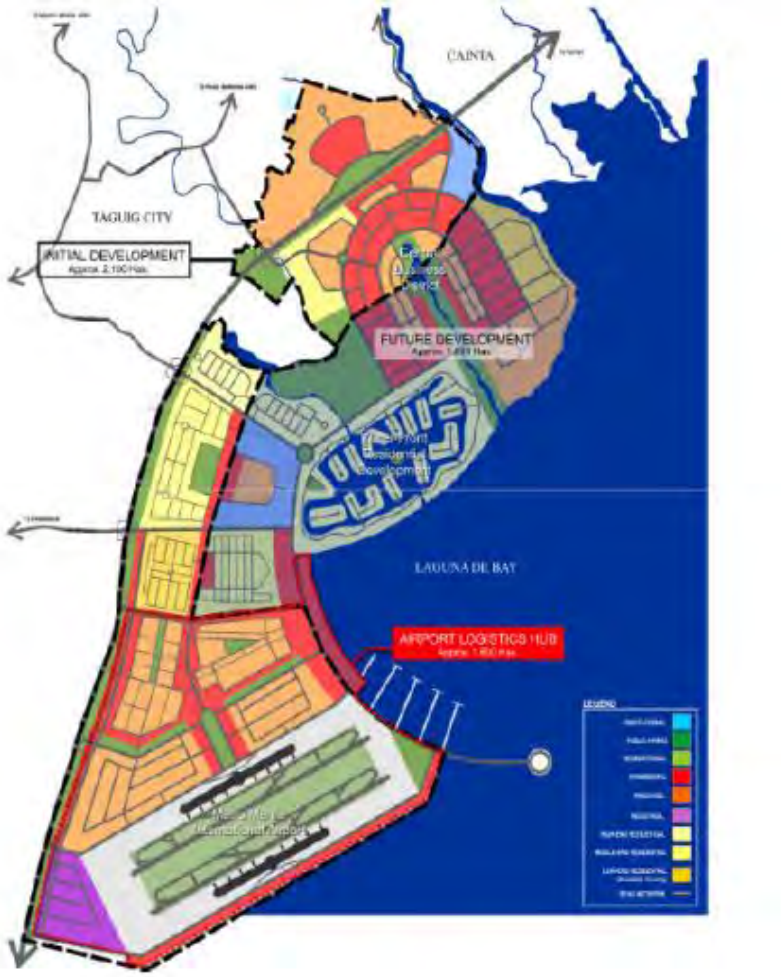


Figure 3.10 Image of Taguig Airport City

3) Evaluation and Selection of Preferred Option

3.50 Evaluation of the two alternative sites has been carried out based on the following criteria:

- Cost implication for site development;
- Availability of obstacle-free airspace;
- Availability of convenient and reliable airport access;
- Risk of flooding and tsunami;
- Conflict with existing or ongoing urban development;
- Environmental impacts; and
- Social impacts.

3.51 Table 3.4 shows results of the comparison and evaluation of two alternative sites. It has been identified that both of Sangley and West Laguna Sites have their own advantages and disadvantages.

3.52 In terms of the site development cost, Sangley Site would require smaller amount than West Laguna Site. However, cost for access for Sangley would be larger than that of West Laguna, and significant difference in the development cost between both Sites

cannot be identified at this stage.

3.53 With regard to the other issues, Sangley can offer following advantages:

- Obstacle-free airspace;
- Convenient airport access;
- Risk of flooding and tsunami as well as conflict with urban area of NCR could be minimized;
- Although significant negative environmental and social impacts are expected, formulation and implementation of proper mitigation/management measures would alleviate such impacts.

3.54 On the other hand, West Laguna has advantages in terms of the less cost for airport access development. Risk of flooding problem to the airport could be minimized.

3.55 However, West Laguna has several disadvantages as listed below:

- There would be several obstructions penetrating the approach surfaces and removal thereof would be required;
- Conflict with urban development in NCR (height restriction, aircraft noise, risk of crash) would be significant;
- There might be a strong concern that some of the negative environmental impacts could be irreversible.

3.56 In conclusion, Sangley Point Offshore Site can offer opportunity for more harmonized development of New NAIA than West Laguna Lake Offshore Site and therefore Sangley Point Offshore Site is considered as the preferred option for development of New NAIA.

Table 3.4 Comparison of Alternative Sites for New NAIA Development

Criteria	Sangley Point Offshore Site	West Laguna Lake Offshore Site
Cost implication for site development	Approximate volume of reclamation material: 120 million m^3 (2400 ha x 5-m depth) Approximate cost of reclamation: PhP 120 billion (PhP1,000 per m^3)	Approximate volume of reclamation material: 240 million m^3 (2400 ha x 10-m high) Approximate cost of reclamation: PhP 240 billion (PhP1,000 per m^3)
Availability of obstacle-free airspace	Available. Coordination is necessary to identify how to address any requirement related to the Prohibited area of RP-P1.	There would be several high buildings and structures on the western coast of the lake which infringe approach surfaces and hence need to be removed in accordance with ICAO Annex 14 requirement. Prohibited area of RP-P1 can be outside of the approach/take-off paths.
Availability of convenient and reliable airport access	Available. The site can be connected with GCR by expressway and extended LRT1. Construction of bridges would require considerable amount of cost.	Available. The site is closely located to SLEX and PNR. Upgraded services by PNR would offer convenient and reliable access.
Risk of flooding and tsunami	This risk can be minimized by appropriate design and construction technology.	This risk can be minimized by appropriate design and construction technology.
Conflict with existing or ongoing urban development	Conflict with urban development in NCR would be minimal. Coordination for height restriction and airport-compatible land use should be conducted among	Conflict with urban development in NCR would be significant as: ✓ Strict height restriction to the areas beneath the aircraft take-off and arrival paths would need to be

Criteria	Sangley Point Offshore Site	West Laguna Lake Offshore Site
	authorities concerned.	imposed; ✓ Surrounding areas would be affected by aircraft noise; and ✓ Risk of disaster by aircraft crash flying very low just above the urbanized area cannot be neglected.
Environmental impacts	Airport construction would bring about some significant negative environmental impacts such as sedimentation and degradation of water quality, but if proper mitigation/management plans would be formulated and strictly followed, such negative impacts could considerably be mitigated.	Airport construction would bring about several significant negative environmental impacts such as sedimentation and degradation of water quality, decrease of resource as drinking water, flood regulation capability, etc. There might be a strong concern that some of the negative impacts could be irreversible.
Social impacts	Significant negative social impacts such as loss of livelihood of fishing people would be unavoidable and effective and sufficient livelihood restoration program should be formulated and implemented. On the contrary, increase of employment opportunity could be expected as one of positive impacts.	Significant negative social impacts such as loss of livelihood of fishing people would be unavoidable and effective and sufficient livelihood restoration program should be formulated and implemented. On the contrary, increase of employment opportunity could be expected as one of positive impacts.
Overall Rating	In terms of the site development cost, this option would require smaller amount than West Laguna Lake Offshore Site. However, cost for access for Sangley would be larger than that of Laguna, and significant difference in the development cost between both sites cannot be identified at this stage. With regard to the other issues, Sangley can offer following advantages: ✓ Obstacle-free airspace; ✓ Convenient airport access; ✓ Risk of flooding and tsunami as well as conflict with urban area of NCR could be minimized; ✓ Although significant negative environmental and social impacts are expected, formulation and implementation of proper mitigation/management measures would alleviate such impacts. In conclusion, Sangley Point Offshore Site is considered much more preferable than West Laguna Lake Offshore Site.	Cost wise, significant difference between West Laguna Lake Offshore Site and Sangley cannot be identified at this stage. Laguna option can offer significant advantage in terms of the airport accessibility as there are NLEX and PNR running just beside the site. Risk of flooding problem to the airport could be minimized. However, Laguna option has several disadvantages as listed below: ✓ There would be several obstructions penetrating the approach surfaces and removal thereof would be required; ✓ Conflict with urban development in NCR (height restriction, aircraft noise, risk of crash) would be significant; ✓ There might be a strong concern that some of the negative environmental impacts could be irreversible. In conclusion, West Laguna Lake Offshore Site is considered less preferable than Sangley Point Offshore Site.

Source: JICA Study Team

4 PRELIMINARY STUDY ON NEW NAIA DEVELOPMENT

4.1 Concept

4.1 It is common practice in planning a world-class airport to choose the largest aircraft currently in service to ensure long-term capability and flexibility in operation of the airport. This is the A380 aircraft requiring more than 1,800 m-long runway with a little bit less than 80 m wing span. The airfield facilities such as the runways, taxiways and aprons should be designed based on the international standards and recommendations applicable to ICAO Code 4F.

4.2 The Study assumes that on opening day (2025), the New NAIA would be capable of accommodating the expected demand of 55 million passengers per annum (MPPA) and 400,000 aircraft movements, and would need to have a long-term capacity of more than 100 MPPA and 700,000 aircraft movements (see Table 4.1). This demand analysis will be further examined in the Master Planning and Feasibility Study.

Table 4.1 Projected Passenger Demand at New NAIA, 2025-2050

	2025	2030	2035	2040	Ultimate (2050)
International Passengers (MPPA)	23	27	31	36	53
Domestic Passengers (MPPA)	32	39	45	53	78
Total Passengers (MPPA)	55	66	76	89	131
Approx. Aircraft Movements ('1000)	400	440	475	524	690
Average Passengers per Flight	140	150	160	170	190

Source: JICA Study Team

4.3 The "ANS Planning Criteria for the Establishment of Air Navigation Facilities," established by CAAP, stipulates that Instrument Landing System (ILS) should be provided for both runways for international airports with a border control facility. For the purpose of this Study, it has been assumed that Category II precision approach would be required.

4.4 It would take more than 10 years to develop the New NAIA right after official decision-making by the Government of the Philippines, and until its opening, NAIA's capacity constraint issue must be addressed as much as possible. The measures would include improvement of NAIA's facilities and services to reduce the runway occupancy time of aircraft, improvement of nighttime operation capabillity of the local airports to expand the domestic operational hours at the local airports and, hence, NAIA.

4.5 In addition, a possibility to utilize the existing Sangley Air Base as a supplementary third, non-precision instrument runway of NAIA should be examined. NAIA and Sangley are very closely located, the current NAIA's departure and arrival routes are overlapping with Sangley's, and the independent operation of these airports would not be feasible. However, in case arriving and departing aircraft at three runways at both airports could be commonly controlled by means of NAIA's terminal radar and conflicts among them could be minimized, there could be a possibility to increase the runway capacity as a whole.

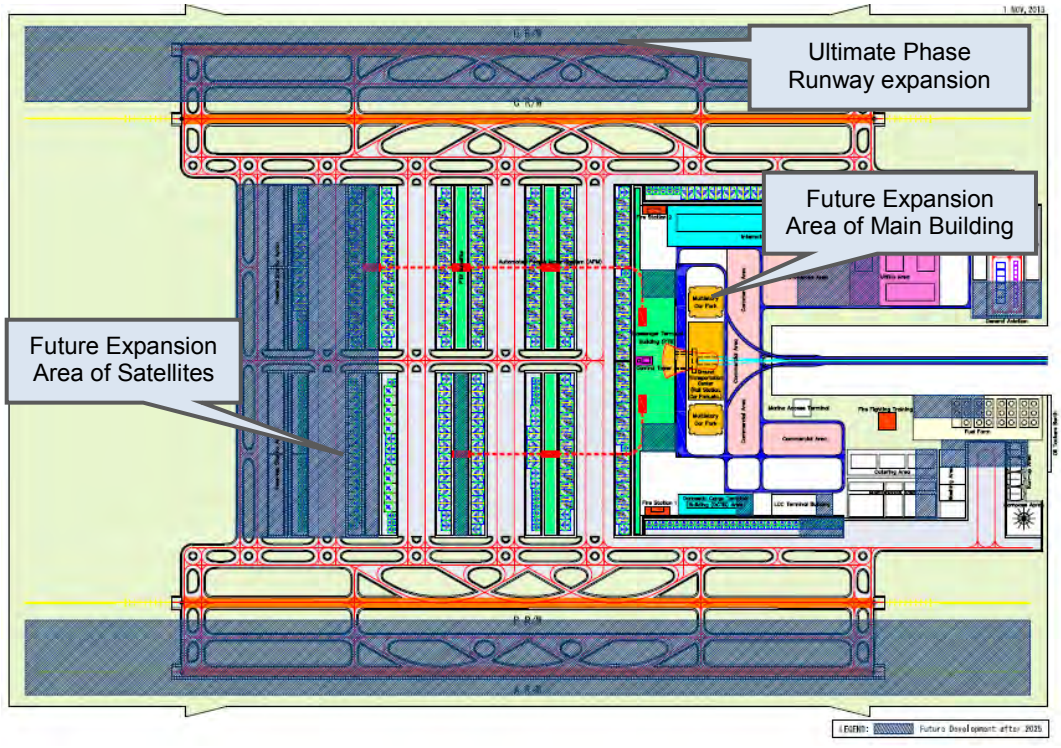
4.2 Project Concept for New NAIA

4.6 The New NAIA Development Project will consist of several project components, as summarized in Table 4.2 and shown in Figure 4.1.

Table 4.2 Summary of New NAIA Development Project Components

Phasing	Opening Day (2025)	Medium to Long-Term	Ultimate-Term
Approx. Pax. Movements	55 MPPA (Target 66 MPPA)	80-90 MPPA	130 MPPA
Approx. Aircraft Movements	400,000	500,000-524,000	700,000
RWY System (Capacity)	Independent parallel, segregated (442,000)	3 runways; 2 segregated, 1 mixed mode (675,000)	4 runways; 2 pairs of close parallel (708,000)
Passenger Terminals (FSC) with road and car park in Central Zone	Main terminal and satellites with connection by AGT for international and domestic.	Expansion of main terminal and addition of satellite.	Ditto
Passenger Terminal (LCC) with road and car park in Central Zone	Simple one-story passenger terminal with nearby aircraft parking stands.	Expansion as required.	Ditto
International Cargo Terminal in Central Zone	Cargo forwarders' warehouses, customs office, etc. with dedicated cargo aircraft apron.	Expansion as required.	Ditto
Domestic Cargo Terminal in Central Zone	Area is reserved for development of domestic cargo terminal near domestic passenger aircraft apron.	Develop facilities as necessary.	Ditto
Air Traffic Control Tower in Central Zone	To be located on the axis of New NAIA		
Supporting Facilities in Northeastern Zone	Aircraft maintenance hangars, aircraft washing, engine run-up, catering etc.		
Utilities in Northwestern Zone	Power supply, potable water supply, sewage treatment plant, fuel storage and supply (POL), etc.		

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1 Sample Overall Facility Layout Plan of New NAIA (Opening Day)

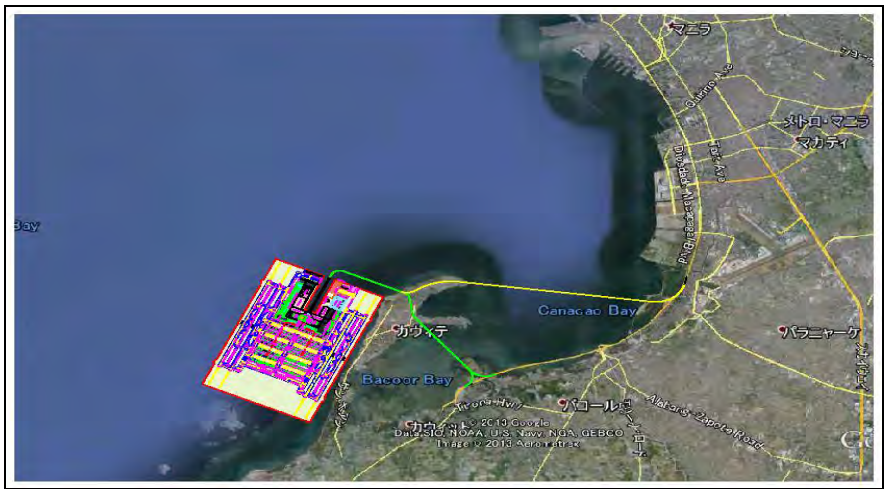
4.3 Preliminary Study on Technical Aspects

1) Alternative Location of Runways

4.7 Two options may be considered as to the location of runways at New NAIA. In order to finalize their location, further examination on the geotechnical conditions of the seabed, utilization of Sangley Air Base as the supplemental runway of NAIA, weather data (wind direction and speed), as well as the protection of Prohibited Area: RP-P1 MALACANANG, should be carried out during the Master Planning stage.

(a) Option 1

4.8 Under Option 1, the runways are to be located parallel to the coastline of the Cavite Peninsula (see Figure 4.2). One of the advantages of this option is that the aircraft approach and take-off paths would not overlap with the Prohibited Area: RP-P1 MALACANANG. Its disadvantage, however, is that the construction of New NAIA would obstruct the aircraft operation on the supplemental runway (Sangley) of NAIA during the transition stage. Usability factor of the runways should also be examined.



Source: JICA Study Team

Figure 4.2 Location of New NAIA's Runways: Option 1

(b) Option 2

4.9 In the case of Option 2, the runways are to be located parallel to the existing runway of Sangley Air Base (see Figure 4.3).

Source: JICA Study Team

Figure 4.3 Location of New NAIA's Runways: Option 2

4.10 One advantage of this option is that the supplemental runway (Sangley) of NAIA could be maintained operational during the construction of New NAIA, and the supplemental runway may be upgraded to the third runway of New NAIA after further strengthening and extension. A disadvantage is that the aircraft approach and take-off paths would overlap with the Prohibited Area: RP-P1.

2) Proposed Passenger Terminal/Apron Concept

4.11 There are several types of passenger terminal/ apron concepts applied to the development of ASEAN gateway international airports such as Changi Airport in Singapore (a series of multi-terminal development) as well as Kuala Lumpur International Airport (KLIA) and Suvarnabhumi International Airport in Bangkok (two multi-main buildings with satellites). There are advantages and disadvantages inherent to these passenger terminal concepts. It is not the intention of the Study to select one single passenger terminal concept but to present a general understanding of the advantages and disadvantages of the two main options, namely two main buildings and satellites, or a series of multi-terminal development, both with Automated Guided Transport (AGT) connections.

4.12 As the New NAIA would need to accommodate a significant volume of traffic from the opening day, the Single Main Terminal Concept has been used as the representative passenger terminal concept in this Study.

3) Air Traffic Control Tower

4.13 The air traffic control tower is a very important facility to ensure effective, efficient and safe aircraft operation in the air as well as on the ground, enforcing traffic separation rules, and providing necessary instructions and guidance to the pilots. It has been proposed that the air traffic control tower should be located on the extended axis of the main airport approach road and at the northern end of the Southern Zone where good visibility to the runways, taxiways and apron is available.

4.4 Airport Access

4.14 To ensure successful operation of the proposed airport, good transport infrastructure should be provided to serve all kinds of traffic to access the airport; including public and private vehicular traffic.

4.15 Existing transport network systems is composed of roads and two urban rails (i.e., LRT 1 and MRT 3) to access the New NAIA up to a certain point. The New NAIA will require direct access from these existing transport systems. Alternative routes are presented in reference to the viable runway layout options in Table 4.3.

Table 4.3 Characteristics of New NAIA Alternative Routes

Alternative Routes	Length (Km)	Total Construction Cost (PHP million)	Strengths	Weaknesses
a. NAIA 2 Extension	9.75	15,955	▪ Directly connects with NAIA Terminals. ▪ Directly interfaces with Skyway. ▪ Provides direct access to the future PAGCOR City. ▪ Alignment continuity will be available soon since NAIA Phase 2 is planned for construction in 2014.	▪ Longest route through offshore and will run through very deep seabed. ▪ Interfaces with NAIA Phase 2, which has relatively circuitous alignment. ▪ Interface with C5 will require new interchange ramp to connect to Skyway.
b. C5 Extension	8.85	14,905	▪ Directly interfaces with C5 Road and SLEX through future C5 Access Road to CAVITEX. ▪ Shorter than NAIA 2 Extension. ▪ Could interface with D.M Blvd for immediate utilization and availability.	▪ Full traffic capacity potential is dependent on the availability of C5 Access Road to CAVITEX. ▪ Interface scheme with C5 Access Road to CAVITEX should be coordinated prior to construction of the Access Road.
c. CAVITEX Spur Road	6.50	12,655	▪ Shortest route from CAVITEX. ▪ Will be installed in shallower depth. ▪ Meets standards (min. 1.5 km) in its interface location with CAVITEX.	▪ Access from EDSA and SKYWAY through CAVITEX requires passing through heavily congested roads such as NAIA Road or Roxas Blvd. ▪ Additional 9 km from NAIA Road. ▪ Will rely on C5 Access Road and NAIA Phase 2 completion for full traffic capacity potential.

Source: JICA Study Team

4.16 A separated as well as an integrated access system was evaluated for the New NAIA. A separated access system is ideal for facilities with different proponents and operators. Safety concerns are addressed with different locations. However, construction cost might be more expensive. An integrated system, on the other hand, will create some issues on operation and maintenance. Combining the components of the two different facilities into one structure could create issues on performance specifications and standards as railways and expressways. Adequate safety system should be installed to protect each facility from any untoward accident.

4.17 Cost estimates for probable construction for each alternative using 2013 prices are given in Table 4.4

Table 4.4 Probable Construction Costs of Alternative Routes

Alternative Routes	Length, Km	Unit Cost (PHP Million)	Total Construction Cost (PHP Million)
a. NAIA 2 Extension			
High Bridge	0.45	4,000.00	1,800.00
Low Bridge	8.35	1,000.00	8,350.00
Tunnel	1.00	5,805.00	5,805.00
Total	**9.75**		**15,955.00**
b. C5 Extension			
High Bridge	0.45	4,000.00	1,800.00
Low Bridge	7.30	1,000.00	7,300.00
Tunnel	1.00	5,805.00	5,805.00
Total	**8.85**		**14,905.00**
c. CAVITEX Spur Road			
High Bridge	0.45	4,000.00	1,800.00
Low Bridge	5.05	1,000.00	5,050.00
Tunnel	1.00	5,805.00	5,805.00
Total	**6.50**		**12,655.00**

Source: JICA Study Team

4.5 Possibility of Sangley as NAIA's Supplemental Runway

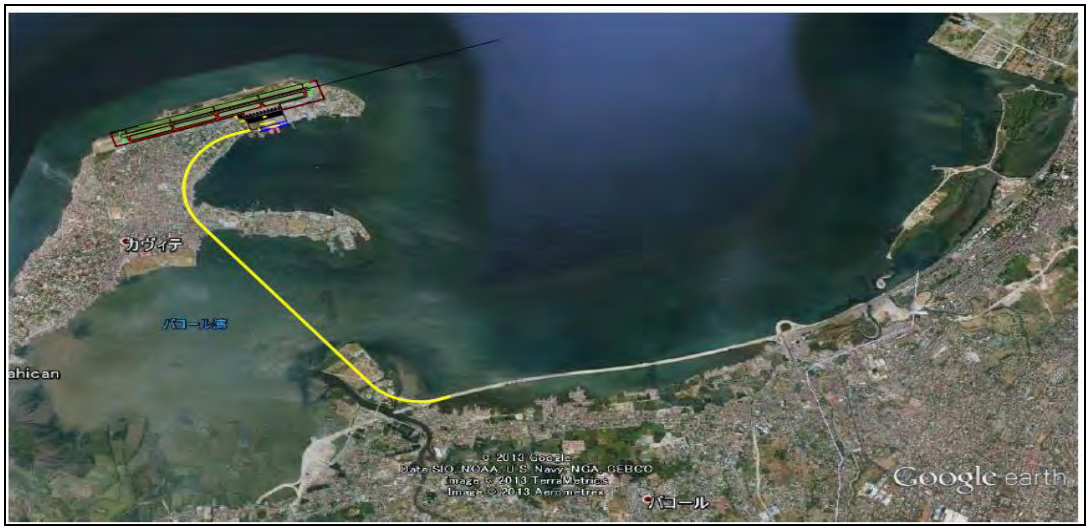
4.18 During the next Master Planning stage, the following issues should be examined in close cooperation with the Civil Aviation Authority of the Philippines (CAAP) in order to ensure utilization of Sangley as NAIA's supplemental runway:

- Restructuring of surrounding airspaces;
- Alternative arrival and departure routes for NAIA and Sangley;
- Review and adjustment of the minimum separation intervals between aircraft in the air;
- Aircraft flight procedure design method and tool;
- Ground control method and procedure at Sangley ; and
- Expected aircraft handling capacity of Three-Runway System at NAIA

4.19 In terms of airport facilities, the existing runway of Sangley may be strengthened and extended to approximatey 2,000 m. The runway may be utilized, after further strengthening and extension, as the third parallel runway of New NAIA, subject to further examination and coordination for overall layout of New NAIA.

4.20 According to ICAO Annex 14, a 2,000 m-long non-precision instrument runway should be provided with 150 m-wide strip on both sides of the runway. In the short term, a proposal in this Study is to allow the existing runway strip width for non-precision instrument approach (for example, localizer and VOR/DME approaches), as accepted at some Japanese local airports (e.g., Toyama, Izumo, Matsumoto, etc.).

4.21 A passenger terminal building to accommodate LCC passengers which would be transferred from NAIA would need to be constructed. Speed boats connecting the coastal area of NCR and Sangley would be the first option for access, followed by road transportation through a new bridge connecting Sangley and Manila Cavite Expressway.



Source: JICA Study Team

Figure 4.4 Suggested Improvement of Sangley as Third Runway of NAIA and Access Bridge

4.6 Preliminary Project Implementation Plan

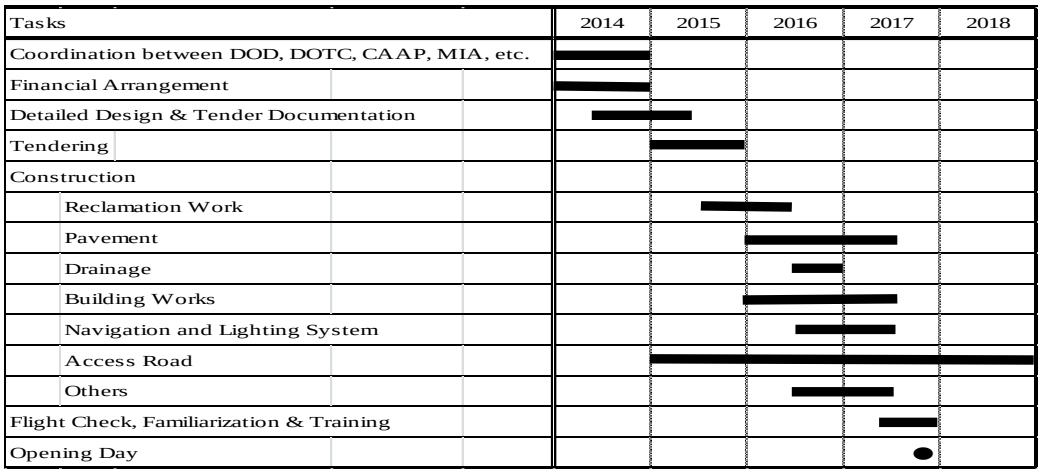
1) Preliminary Schedules for Development

4.22 Preliminary schedules were drafted for the development of Sangley as a supplement runway for the existing NAIA as well as for its development as a New NAIA. Both are based on assumptions that official decision will be made by the year 2014. (Refer to the charts in Table 4.5 and Table 4.6 below.)

2) Project Cost

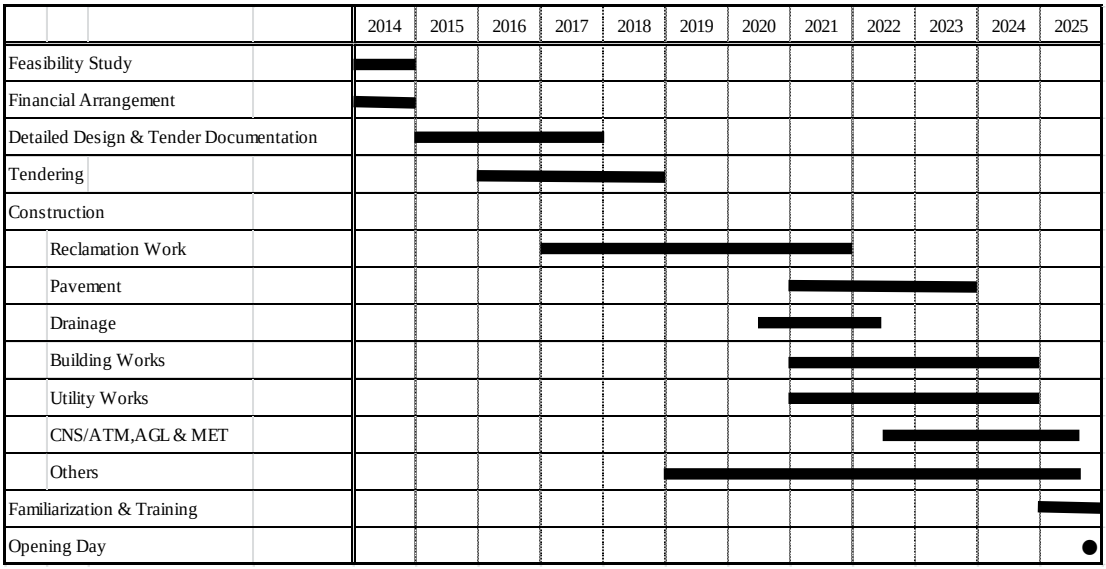
4.23 Based on the schedule assumed for upgrading Sangley Airport to become NAIA's third runway, a tentative cost estimate is given in Table 4.7. For the development of a New NAIA in the medium to long-term, preliminary costing for its development with associated works are shown in Table 4.8.

Table 4.5 Preliminary Schedule for Development of Supplemental Runway at Sangley



Source: JICA Study Team

Table 4.6 Preliminary Schedule of Development of New NAIA Phase I



Source: JICA Study Team
Note: Phase 1 development is for short term only with project component for opening day at 2025.

Table 4.7 Estimated Cost of Development for Supplemental Runway at Sangley

Work Items		Cost (mil PHP)
Preliminary Works		
Civil Works	Reclamation Work	39
	Pavement	1,257
	Drainage	174
	Miscellaneous Civil	92
	Sub-Total Civil Works	**1,562**
Building Works	Passenger Terminal Buildings	880
	Cargo Terminal Buildings	---
	Control Tower	53
	Administration Buildings	---
	Other Buildings	88
	Rescue & Fire Fighting	35
	Sub-Total Total Building Works	**1,056**
Navigation and Lighting System		1,382
	Total Construction Cost	**4,000**

Source: JICA Study Team

Table 4.8 Estimated Development Cost of the New NAIA

Work Items	Cost (in million pesos; 2013 prices)		
	Short-Term	Mid to Long-Term	Total
Civil Works	192,362	15,730	208,093
Building Works	80,592	36,738	117,330
CNS / ATM, AGL, MET	5,169	2,280	7,449
Utility Works	24,141	9,662	33,803
Sub-Total Construction Cost	**302,264**	**64,410**	**366,675**
Physical Contingency (5%)	15,113	3,221	18,334
Total Construction Cost	**317,377**	**67,631**	**385,009**
Engineering and Management (11.5%)	36,498	7,778	44,276
Miscellaneous Cost (15%)	5,475	1,167	6,641
Total Project Cost	**359,350**	**76,575**	**435,926**

Source: JICA Study Team

5 PRELIMINARY PROJECT EVALUATION

1) Economic Evaluation

5.1 An evaluation of the New NAIA project is performed preliminarily on its economic, social and environmental impacts. For the economic aspect, the study team conducted incremental discounted cash flow analysis to assess the economic viability of the proposed New Ninoy Aquino International Airport (NAIA). The economic internal rates of return (EIRRs) and economic net present values (ENPVs) were calculated to determine the viability of the proposed new airport. The analysis focused on the assessment of the "with-project" and "without project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 44 years, including a construction period of 9 years and operating period of 35 years.

5.2 Table 5.1 presents the estimated costs for developing the New NAIA project. The economic costs were determined by deducting all taxes and price contingencies included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the operating and maintenance (O&M) costs were also 85%.

Table 5.1 Estimated Economic Cost of the New NAIA

(In million pesos, constant 2013 prices)

Work Items	Short-Term	Medium- to Long-Term	Total
Civil works	163,508	13,371	176,878
Building Works	68,503	31,227	99,731
CNS / ATM, AGL, MET	4,394	1,938	6,332
Utility Works	20,520	8,213	28,733
Sub-Total Construction Cost	256,924	54,749	311,673
Physical Contingency (5%)	12,846	2,737	15,584
Total Construction Cost	**269,771**	**57,486**	**327,257**
Engineering and Management (11.5%)	31,024	6,611	37,635
Miscellaneous Cost (15%)	4,654	992	5,645
Total Project Cost	**305,448**	**65,088**	**370,536**

Source: JICA Study Team

5.3 Possible economic benefits of the project will include, but not limited, to the following:

(i) Savings in operating and maintenance costs;

(ii) Reduction in the cancellation of flights;

(iii) Induced passenger traffic;

(iv) Tourism benefits;

(v) Avoided cost of travel diversion; and

(vi) Salvage value of the existing facilities.

5.4 Due to data constraints, only tourism benefits, avoided cost of travel diversion, and salvage value of existing facilities were considered in the computations of economic

benefits of the proposed New NAIA Project. Results of the economic analysis are shown in Table 5.2 and the corresponding sensitivity runs are given in Table 5.3. Should cost increase by 30% and benefits decrease by 30%, the project becomes economically unviable.

Table 5.2 Results of Economic Valuation

Indicator	Unit	Value
EIRR	%	20.5%
ENPV	PHP Million	361,256.3
B/C	-	1.76

Source: JICA Study Team

Table 5.3 Sensitivity Analysis of Economic Evaluation

Benefits	Cost Change	Change in Economic Cost (%)			
		Base Case	+10%	+20%	+30%
Change in Economic Benefit (%)	Base Case	20.5%	19.5%	18.7%	17.9%
	-10%	19.4%	18.5%	17.6%	16.8%
	-20%	18.2%	17.3%	16.5%	15.7%
	-30%	16.9%	16.0%	15.2%	14.5%

Source: JICA Study Team

2) Social and Environmental Considerations

5.5 In connection with the social impacts of the New NAIA Project, the objective is for project design to avoid, to the maximum extent possible, or minimize adverse impacts on existing structures, land use and other assets. Activities must be carried out during feasibility study stage and detailed design to establish public and social support for the Project.

5.6 It should be noted that for the Sangley offshore site, there have been reports of strong opposition from affected fishing households in the province of Cavite and residents who claim that reclamation of Sangley for a new airport will cause significant loss of livelihood and degradation of the natural environment[2]. Approximately 26,000 fishing families (156,000 persons) living by Manila Bay will be displaced by the International Airport and Seaport projects on reclaimed land off Cavite City[3]. However, although the Sangley alternative may also entail significant negative environmental and social impacts it is expected that formulation and implementation of proper mitigation/management measures with the meaningful participation of affected households and other stakeholders could alleviate these impacts.

5.7 Possible environmental impacts of the project on the existing Sangley site are perceived to be during the reclamation stage and later on the activities of the construction phase. Impacts are predicted to be short term and basically localized within the project site and reclamation area. In general, the impacts on water, air and noise level are not significant and are temporary only during reclamation and construction works. Mitigation measures can be in place during activities of these project phases. Similarly, impact on

[2] Sangley Point International Airport Proposal Receives Mixed Reviews. July 1, 2013. Retrieved November 16, 2013 from http://www.philippineflightnetwork.com/2013/07/sangley-point-international-airport.html.
[3] Esplanada, J.E. July 15, 2013. Fisherfolk fear loss of homes, jobs to planned air, sea ports. Retrieved November 16, 2013 fromhttp://newsinfo.inquirer.net/444801/fisherfolk-fear-loss-of-homes-jobs-to-planned-air-sea-ports#ixzz2klvYEt69

the traffic condition in the area will be contained within the project site itself. Schedule of movements could be established so as not to affect traffic peak hours.

5.8 On the whole, an EIA should be conducted during the feasibility study to provide specific and complete information on a full range of environmental parameters in compliance with DENR-EMB requirements for the project. Appropriate mitigation measures can then be formulated to minimize or eliminate adverse impacts predicted.

3) Funding Opportunities

5.9 One possible funding strategy is to use a combination of public sector-official development assistance (ODA) and public-private partnership (PPP) arrangement to arrive at a workable project package. In effect, there will be three sources of funds–the public sector, ODA and the private sector.

5.10 The national government should consider availing of ODA loans from the Japan International Cooperation Agency (JICA). There are loan packages available to low middle-income economies like the Philippines that have preferential terms such as untied conditions for procurement. The terms of ODA loans include an interest rate of from 0.55% to 1.40% denominated in Japanese yen (inclusive of government guarantees and foreign exchange risk cover), 40-year repayment, and 10-year grace period on the principal repayment. If this project pushes through, the applicable interest rate will be 1.4% since there will be no need for an intermediary because the Japanese Government will be dealing directly with the Philippine Government.

5.11 The private sector proponent under a PPP scheme will be the other source of project financing. Due to the huge capital requirements of the project, the proponent should have substantial financial resources at its disposal. Alternatively, the source of fund can come from ODA, for example, the Program Fund Logistics Infrastructure Development of JICA where the leading bank could apply for the loan on behalf of the private sector. Originally airports did not form part of the loan priorities but JICA had agreed to the expansion of eligible projects under this loan facility to include airports provided such airports cater to both passengers and cargoes. The GFI could seek an approval to finance the project using ODA-sourced funds. Interest payments for the public sector will be 5% (1% ODA plus consideration for government guarantees and foreign exchange risk cover). Interest rate passed on the private sector will be 8% to 10% with a repayment period of 15 years (including a 3-year extension period). The following PPP format below can also be considered for the proposed New NAIA Project:

Table 5.4 PPP Format

PPP Format	Description	Private Investments and Risk Factors
Concession	Private company is given an exclusive right to build and operate an infrastructure asset or system.	Private investment can be significant. Possible risks will be development risk and revenue shortfall.
BOOT	Private company will build-own-operate-transfer an infrastructure or system with a fixed period (20+ years).	Private investment can be significant. Possible risks include development risk, revenue shortfall, and short operating period.

Source: JICA Study Team

5.12 The public sector will provide funds through a combination of the following sources: national government funds in the form of VGF, special infrastructure allotment,

and will include funds from the implementing agencies and select stakeholders. The lead government agency can partner with the GFIs in providing government undertakings in the form of cost sharing, credit enhancements, direct government subsidy, direct government equity, performance undertaking, and legal and security assistance. For the purpose of testing the viability of the New NAIA Project, cost sharing, direct government equity, and VGF can be considered.

6 PROPOSED IMPLEMENTATION STRATEGIES

6.1 The Roadmap for Transport Infrastructure Development for Metro Manila and its Surrounding Areas (Region III and Region IV-A) lay stress that the location and function of the gateway airports will affect long-term urban transport network. For NAIA, the development of a New NAIA in the vicinity of Metro Manila is advisable both from urban and regional transport perspective.

6.2 A development model for the new NAIA project was iterated in the previous study of GCR Airport Strategy Study. This model is premised on significant infusions of private capital in the New NAIA Project, which require a more in-depth look for applicability. The 4-step approach is basically as follows:

- Step 1: Establish a government body/ Special Task Force - In the first instance, a government body (or special task force hereafter referred to as the 'Task Force') endorsed by the Office of the President would be established to act as a high-level sponsor, driver and owner of the initiative to deliver sufficient airport capacity for the New NAIA.
- Step 2: Prepare the MIAA for the possible PPP arrangement - Privatization of airports offers the government a new operational approach and a way to finance airport development.
- Step 3: Secure official development assistance loan (or other forms of capital infusion) - Current government policies allow the government to provide financing to bridge any project financial viability gap in the form of a VGF (Viability Gap/Support Fund) provided that the project is economically viable overall. The objective here is to simply identify that it may be desirable for some form of capital injection to attract the private sector to invest in additional capacity/facilities at NAIA.
- Step 4: Implement Public-Private Partnership arrangements - Once any new organizational arrangements are in place, the task force would focus on furthering the PPP program for the New NAIA.

6.3 As this is a huge and complex project, key players for the implementation are the national government, regional and provincial governments, local government units, and the private sector. The roles and support from these agencies and entities should be orchestrated.

- National government agencies such as the DOTC and DPWH are executing agencies. The former for the airport and the latter for the road/bridge/expressway access system.
- Regional and provincial governments are part of the stakeholders and will, therefore, endorsements for the project are expected from them.
- Coordination and clarity between local and national government on the legal jurisdiction over this and other aspects of New NAIA development, maintenance and operation (e.g., ownership of land, payment of taxes) is important. Likewise, resolution for conflicts with urban development (existing and future) is expected.
- Private sector can come in under a PPP arrangement but it must be kept in mind that an "effective economic and service level regulatory framework"[4] must be in place to

[4]Montecillo, P.G. 2012. Reconsider plans to privatize major airports, IATA urges Philippines. 10 Nov.

ensure that air connectivity is efficient, cost-effective, and fuels national economic growth.

http://business.inquirer.net/92236/reconsider-plans-to-privatize-major-airports-iata-urges-philippines