MINISTRY OF INFRASTRUCTURE & PUBLIC UTILITIES
REPUBLIC OF VANUATU

REPUBLIC OF VANUATU
DATA COLLECTION SURVEY ON BAUERFIELD INTERNATIONAL AIRPORT
FINAL REPORT

FEBRUARY 2021

JAPAN INTERNATIONAL COOPERATION AGENCY

GYROS CORPORATION

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JR
20-034

1 Outline of the Study

Bauerfield International Airport plays a vital role as the capital airport in Port Vila and also the core of social and physical exchange in the country. The terminal area was developed by Japan's grant aid, "The Project for Constructing the Terminal Building of Bauerfield International Airport in the Republic of Vanuatu," in 1990. The existing terminal building was constructed with a capacity of 240,000 for both international and domestic air passengers, but the annual passenger volume increased up to 470,000 in 2018. The number of flights has increased, and the traffic demand has exceeded the capacity of the terminal facility.

The Government of Vanuatu (GoV) requested the Government of Japan (GoJ) for cooperation on development of the airport terminal facilities such as aprons, taxiways, passenger terminal building, control tower, fire station, road, car park, airport access road, fuel supply system, and hangar. Japan International Cooperation Agency (JICA) conducted a preliminary site survey and discussions with the GoV in February 2019. The meeting concluded that review of the appropriate scale of terminal facilities was necessary.

The objectives of the data collection survey are to collect and analyze necessary information and data related to the existing airport facilities, future air traffic demand forecast, and facility development within the appropriate scale, to study the possibility of Japan's cooperation, ascertain the scope of work by both Japan and Vanuatu side, and confirm project implementation schedule.

2 Current Situation

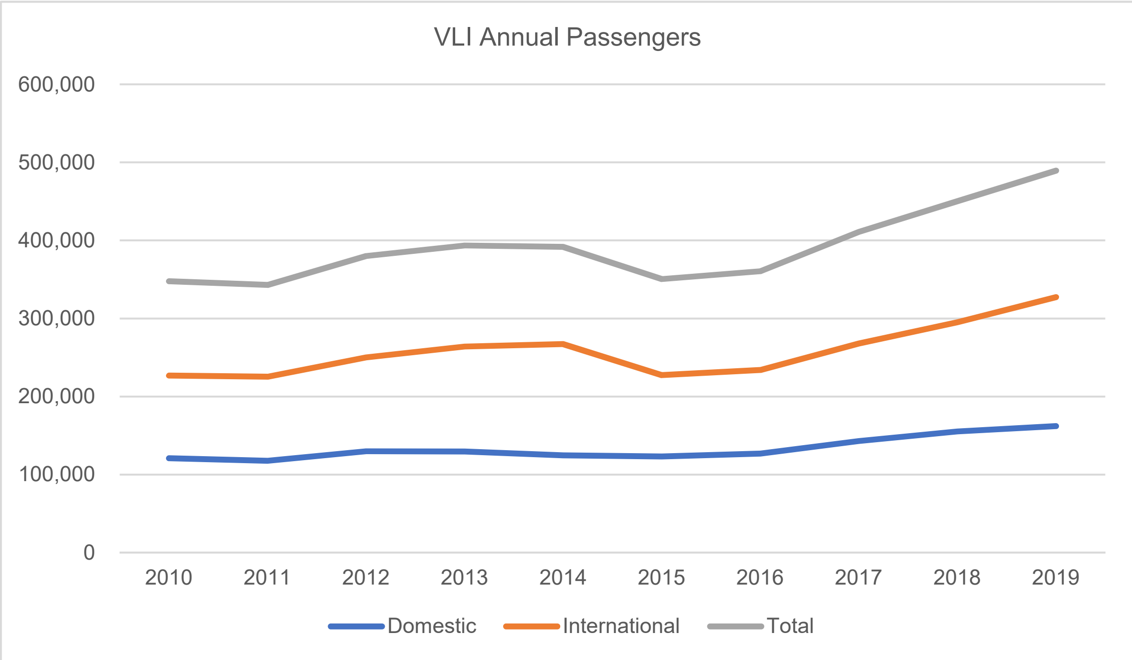
According to the air traffic statistics provided by Airport Vanuatu Limited (AVL), the air traffic volume of major airports in Vanuatu in 2019 was as shown in Table 1. Bauerfield International Airport handled most of the international passengers in Vanuatu as a gateway airport.

Table 1 Air Traffic Volume in 2019

Airport	International Passengers	Domestic Passengers	Total Passengers
Bauerfield International Airport:	327,455	161,961	489,416
Pekoa Airport	7,842	107,892	115,734
Whitegrass Airport	0	54,870	54,870
Total	335,297	324,723	660,020

Source: AVL

Figure 1 shows annual passengers at Bauerfield International Airport from 2010 to 2019. Traffic volume declined overall due to the impact of Cyclone Pam in 2015, but it has been on a recovery trend since 2016.



Source: AVL

Figure 1 Annual Air Passenger Trend in Bauerfield International Airport (2010-2019)

3 Existing Conditions of Bauerfield International Airport

3.1 Runway, Taxiway, and Apron

3.1.1 Runway

The existing runway is 2,600 m long and 45 m wide with 7.5 m wide shoulders on both sides. The pavement has been completely refurbished and reinforced to the strength that a Code E class aircraft can operate twice a week by the World Bank Project Vanuatu Aviation Investment Project (VAIP).

3.1.2 Runway Strip

The ICAO recommendation requires a runway strip of 280 m with 140 m on each side for a non-precision approach runway. The total width of the runway strip at Bauerfield International Airport is 150 m and does not meet this recommendation.

3.1.3 Taxiway

There is only one taxiway (26 m wide) connecting the runway and the apron. The overlay and shoulder pavement project were implemented by VAIP, and it is compatible with Code E aircraft like the runway.

3.1.4 Apron

The overlay, expansion, and shoulder pavement project were implemented by VAIP. Currently, there are one parking spot for Code E aircraft such as B787 or A330, two for Code C aircraft such as B737, and one for propeller aircraft. There is also a parking space for small propeller aircraft on the western side of the apron. Since the apron is close to the runway, the tail wing of the parked jet aircraft penetrates the transitional surface.

3.1.5 International Passenger Terminal Building

The international passenger terminal building was constructed by a Japanese grant aid project in 1991. The project was planned in 1990 with an annual demand of 140,000 passengers for the international terminal building and a peak demand of 360 departing/arrival passengers. The departure hall was expanded from 1997 to 2000 with EIB funding.

The building is seemingly in good condition as it was renovated by AVL. However, it is deteriorating as nearly 30 years have passed since its construction. As the busy hour passenger in 2019 was 390, the current demand exceeds the design capacity. The departure area is very crowded when two to three international flights depart at the same time. Also, since there is only one baggage belt in the arrival area, it becomes very crowded when more than one international flight arrives at the same time.

3.1.6 Domestic Passenger Terminal Building

The domestic passenger terminal building was expanded in 1982. The domestic/international terminal building at that time has been used as the domestic terminal building since 1990. The design capacity is for B737 aircraft. Currently, ATR72 for 70 passengers and small propeller for 19 passengers operate for domestic flights. During busy seasons, the terminal is crowded as the B737 aircraft flies to and from Santo-Pecoa Airport. The terminal is also very old. The check-in hall has four Vanuatu Airlines counters. There are offices of other airlines such as Belair Airways, Unity Airlines, and Air Taxi, and booths of car rental companies. Baggage inspection is conducted manually for domestic flights. As there is no departure gate, passengers wait for departure in a waiting room next to the check-in counter, and board the flight at the departure time after undergoing manual security screening.

3.1.7 Control Tower

Air traffic control (ATC) tower is located at the northern side across a runway, and the Air Traffic Control Service is managed by AVL’s air traffic controllers. Although the 14-m-high ATC tower is more than 30 years old and is aged now, the building is still strong because of its strength derived from concrete. The visibility from the ATC tower is not perfect but there is no significant problem except the slight lack of visibility to the surface of the west end of the runway. ATC equipment and radio communication devices installed inside the control cabin will be renewed from 2020 to 2021 with funds from the World Bank and the GoV.

3.1.8 Fire Station

The fire station was built after the fire engine house was severely damaged by Cyclone Pam in 2015. The condition of the building is still good, but the location is problematic since the building will be inside the runway strip when the runway strip is expanded to 280 m. Besides, the capacity of the adjacent water-storage tank is not enough. ICAO's RFFS category provided is 7.

3.1.9 Airfield Lighting System

In 2019, the World Bank renewed airfield lighting facilities in Bauerfield International Airport, including runway light, taxiway light, runway threshold light, PAPI, and apron floodlight. Some other equipment that were destroyed by Cyclone Pam in 2015 have not been repaired yet (e.g., the circling-approach guidance light). Since airlines have officially requested AVL to repair the equipment, AVL will repair them using the GoV budget.

3.1.10 Air Traffic Control and Equipment

Because it has been 30 years since ATC equipment, radio communication equipment, and navigation equipment were installed in 1990 by the grant aid from Japan, those equipment are already degraded and they will be replaced by the World Bank project in 2020 and 2021. Equipment that are not included in the scope of the World Bank project (e.g., radio communication equipment) due to the budgetary constraints will be replaced using funds from the GoV.

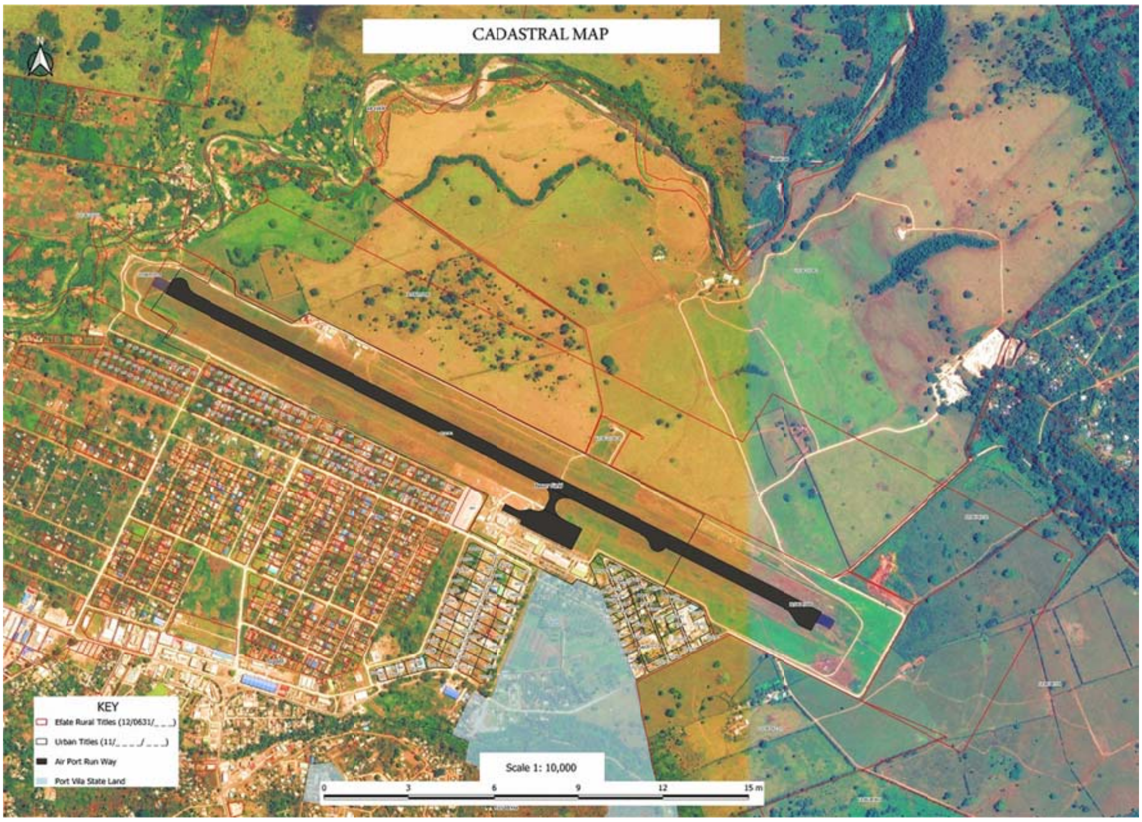
3.1.11 Aviation Security Equipment

Aviation security equipment (e.g., X-ray inspection machines and metal detectors) will be replaced by the equipment that meet the EASA (European Aviation Safety Agency) standard during 2020 to 2021 with cooperation from the Government of New Zealand. After these replacements, security equipment currently used in the international terminal will be used in the domestic terminal.

3.2 Land Use Plan

3.2.1 Land Use Plan

The airport site is leased to AVL. The cadastral map around the airport is shown in Figure 2.



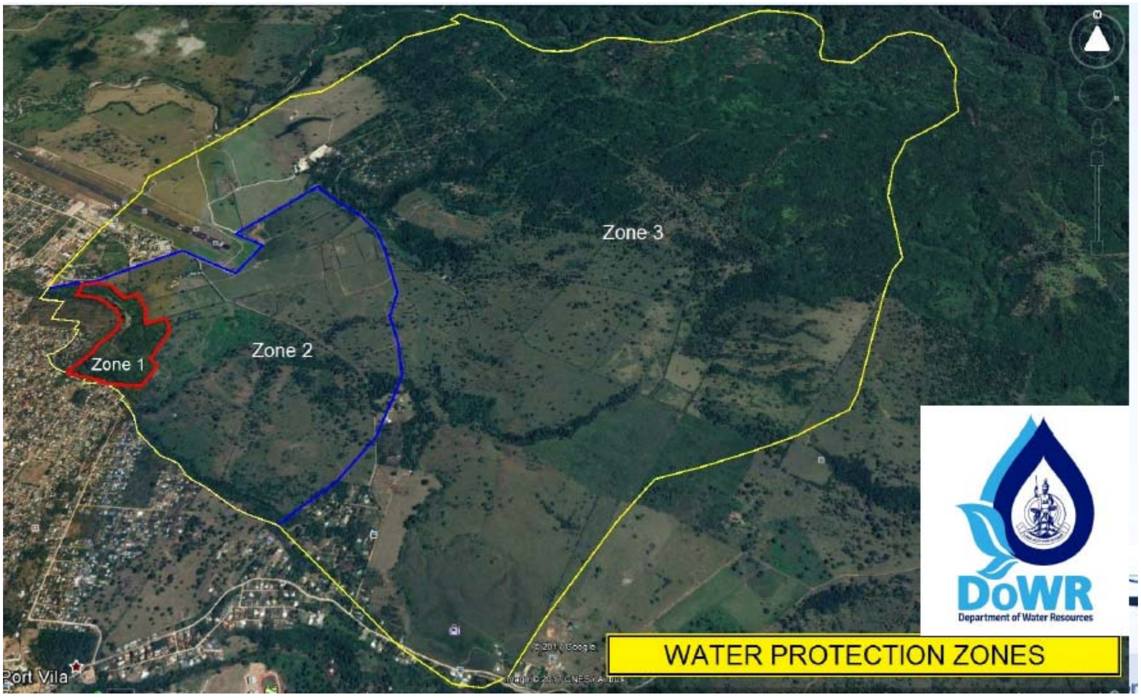
Source: Land Department

Figure 2 Land Ownership Surrounding Bauerfield International Airport

The southern part of the airport terminal area is considered as an industrial area, and there is a power plant that supplies electricity to Port Vila. An agriculture experimental station is located in the southeastern part of the terminal area and the residential area is located in the western part. A pump station that supplies water to Port Vila is located in the southeast of the terminal area. The area extending from the east side to the north side of the airport is used as a ranch. The La Colle river runs in the northwestern part of the airport. The Tagabe river flowing on the east side of the airport is the water source for Port Vila. There is also a limestone quarry in the northeastern of the airport.

3.2.2 Water Source Protection Zone

The large area of eastern side of the airport was designated as a water source protection zone by the Resource Management ACT [CAP281] Declaration of Matnakara Water Protection Zone (Tagabe River) Order No. 119 of 2017.



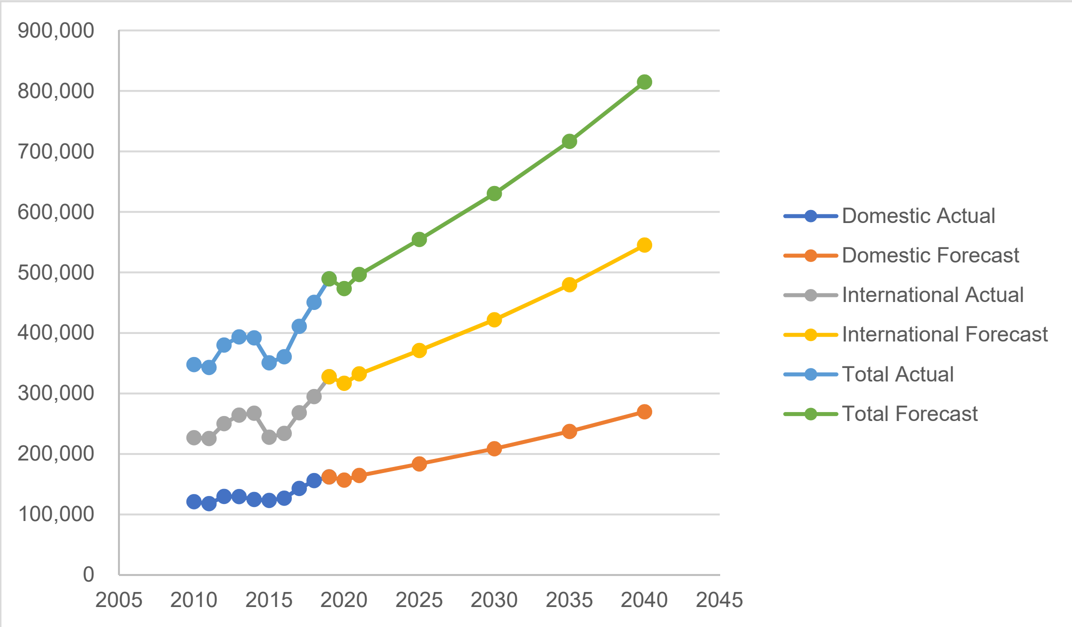
Source: Department of Water Resources

Figure 3 Water Protection Zone Layout

This is the only water source for Port Vila City. The protected area is divided into three zones: Zone 1, Zone 2, and Zone 3. The northeastern side of the airport is within Zone 3. Zone 3 is water catchment area and major development of this area is prohibited for avoiding contamination of the water source.

4 Air Traffic Demand Forecast

Figure 4 shows the result of the passenger air traffic demand forecast. As compared to the actual number of annual passengers in 2019, the total number of passengers will be 1.3 times and 1.7 times more in 2030 and 2040, respectively.



Source: JICA Study Team

Figure 4 Annual Air Passenger Demand Forecast

Future annual, busy day, and busy hour passengers are summarized in Table 2.

Table 2 Summary of Passenger Traffic Forecast

	2019 (Actual)	2025	2030	2035	2040
Annual International Passengers	327,455	370,959	421,758	479,512	545,176
Busy Day International Passengers	1,313	1,788	2,033	2,312	2,628
Busy Hour International Passengers	379	523	594	676	768
Annual Domestic Passengers	161,961	183,478	208,604	237,169	269,647
Busy Day Domestic Passengers	624	691	786	894	1,016
Busy Hour Domestic Passengers	128	151	172	196	222
Annual Total Passengers	489,416	554,437	630,362	716,681	814,823
Busy Day Total Passengers	1,886	2,351	2,673	3,039	3,456
Busy Hour Total Passengers	389	550	625	711	808

Source: JICA Study Team

5 Terminal Development Plan

5.1 Development Policy

According to the air traffic demand forecast, the number of passengers in 2030 will be 630,000 and 814,000 in 2030 and 2040, respectively. This is approximately 1.3 and 1.7 times more passengers as compared with the passenger volume in 2019, which was 490,000. As shown in Figure 5, there is not enough space to expand the existing terminal area in the southern side of the runway to accommodate the future demand; therefore, it is necessary to develop the north side of the runway.

Source: Land Department

Figure 5 Land Ownership around Terminal Area

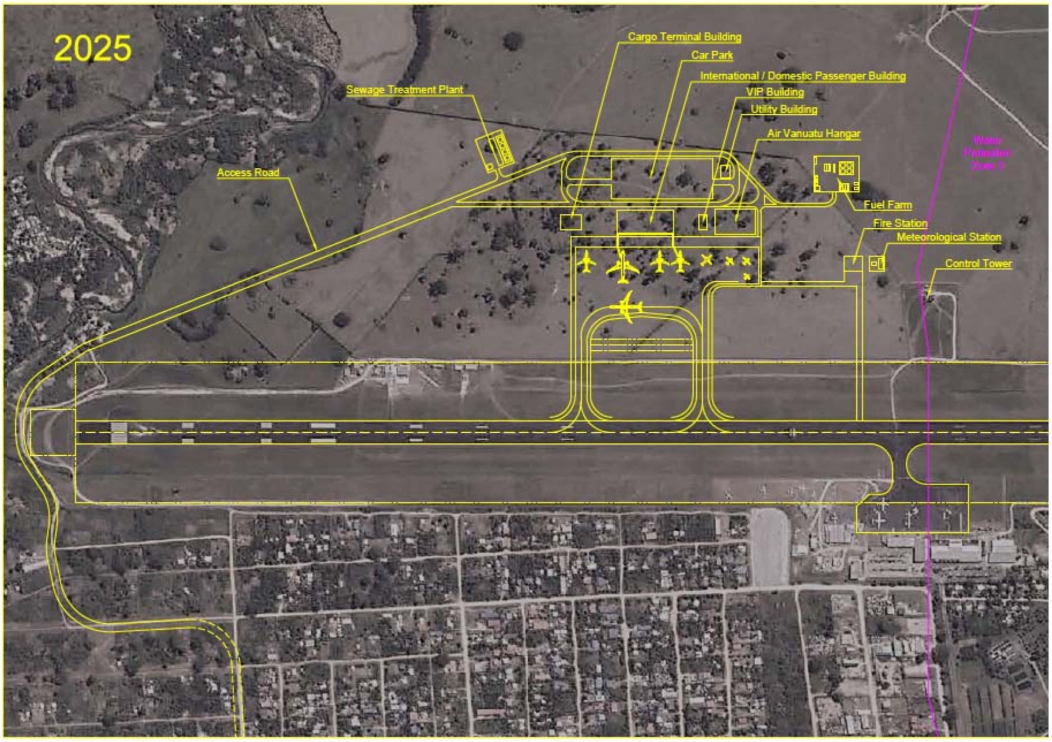
There is a water protection zone in the northeastern and eastern side of the airport and considering difficulties to construct a new terminal area in the area, the new terminal is planned to avoid the water protection zone.

5.2 Facility Layout Plan

New terminal is planned at the northern side of the runway. The location is selected to prevent developments in the water protection zone. All terminal facilities are planned in the northern side. The existing terminal in the southern side of the runway will be used for general aviation operation.

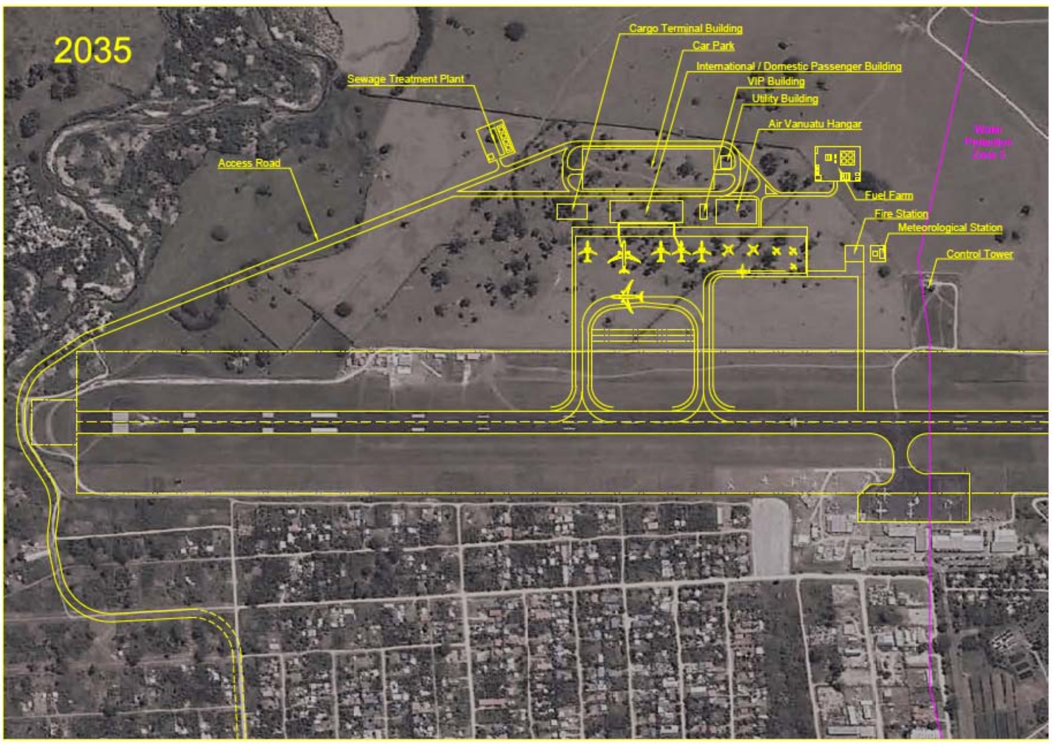
Figures 6 and 7 show facility layout plans in 2025 and 2035. Two connecting taxiways from the runway to the apron is planned. Parking spots for domestic flight are planned at the eastern side of the apron and those for international flight are at western side. The passenger terminal building is planned at the middle of the apron. Both sides of the passenger terminal building are reserved for future expansion. Cargo terminal building is planned at the western end of the apron and Air Vanuatu Hangar is planned at the east end of the apron. The VIP building is planned at the eastern side of the passenger terminal building.

A new fire station is planned next to the existing control tower since this location is almost at the center of the runway and facilitates easy access to the airport boundary. A meteorological station is also planned next to the fire station. Fuel farm is planned at the eastern side of the new terminal area so that it does not obstruct the future development of other facilities. A sewage treatment plant is planned at the northern side of the terminal area. An access road is planned from the western side of the airport area.



Source: JICA Study Team

Figure 6 Airport Layout Plan in 2025



Source: JICA Study Team

Figure 7 Airport Layout Plan in 2035

5.2.1 Passenger Terminal Building

The passenger terminal building that can handle both international and domestic passengers is planned as shown in Figure 8.

Confidential Information

Figure 8 PTB Layout Plan (2-story type)

Total floor area of the building is 8,548 m^2. Two passenger loading bridges are planned on the first floor. Considering requirement to quarantine after COVID-19, a large area is secured for international arrival quarantine. To conduct health checkups for the passengers entering the building and avoid congestions, a large concourse area is planned. On the ground floor, both sides of the building are secured for future expansion. Domestic passengers are handled on the ground floor, and the first floor is for international departure and arrival passengers. However, domestic passengers can use passenger loading bridge in case of small jet aircraft operated in the domestic route.

5.3 Project Cost Estimate

Table 3 shows the calculation of the total project cost.

Table 3 Total Project Cost

(Exchange Rate: USD 1 = JPY 106)

Item	Cost (Million JPY)	Cost (Million USD)
1) Total of Construction Cost	10,019	94.5
2) Consulting Fee 10% of 1)	1,002	9.5
3) Contingency 5% of 1)	501	4.7
Total of Project Cost	11,522	108.7

5.4 Project Package

The total project cost to construct a new terminal area at the northern side of the runway is about JPY 11,000 million, which is approximately USD 110 million. It is practical to divide the project components into packages so that several donors and funds can jointly invest to realize the project. The following packaging is proposed considering the nature of facilities and ease of construction.

Package 1: Passenger Terminal Building

Package 2: Other buildings such as Cargo Terminal Building, VIP Building, Fire Station, Utility Building, Water Reservoir and Pump, Meteorological Station, Meteorological Equipment, Sewage Pipe, and Sewage Treatment Plant.

Package 3: Airside civil facilities such as Apron, Taxiways, Ground Service Equipment (GSE) Road, and Airfield Lighting System

Package 4: Landside civil facilities such as Car Park, Terminal Road, Drainage, Fence, Access Road, Sidewalk, Street Lights, Power Cable, and Water Pipes

Package 5: Other facilities of private companies such as Fuel Farm and Hangar.

Figure 9 shows the layout plan of each package.

Source: JICA Study Team

Figure 9 Layout Plan of Each Package

Table 4 Project Cost of Each Package

(Exchange Rate: USD 1 = JPY 106)

Package	Category	Facility	Project Cost (million JPY)	Project Cost (million USD)
Package 1	Passenger Terminal Building	Passenger Terminal Building	4,425	41.8
Package 2	Other buildings	Cargo Terminal Building, VIP Building, Fire Station, Utility Building, Water Reservoir and Pump, Meteorological Station, Meteorological Equipment, Sewage Pipe, and Sewage Treatment Plant	1,978	18.7
Package 3	Airside civil facilities	Apron, Taxiways, GSE Road, and airfield Lighting System	2,703	25.5
Package 4	Landside civil facilities	Car Park, Terminal Road, Drainage, Fence, Access Road, Sidewalk, Street Lights, Power Cable, and Water Pipes	1,495	14.1
Package 5	Private company facilities	Fuel Farm and Hangar.	920	8.7
Total			11,522	108.7

6 Land Acquisition and Environmental and Social Considerations

6.1 Land Acquisition Status

The Vanuatu government has been acquiring land for the airport expansion. As shown in Figure 10, the government has already acquired the area adjacent to the east side of the airport (colored in red) and has agreed with the landowner for the acquisition of the eastern half of the north side of the airport (colored in blue).

Figure 10 Land Acquisition Situation

6.2 Environmental Category

A new terminal area is planned at the northern side of the runway. The new terminal location is decided so as to prevent development in the water protection zone and to build the terminal at almost center of the runway. The area is used as a ranch and no residence exists, but the area is privately owned by a person and it is necessary to obtain the land. The environmental category of this project is category B in accordance with JICA Guidelines for Environmental and Social Consideration since environmental and social impact of the project is not large.

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Abbreviations

A320	Airbus A320
A330	Airbus A330
ADB	Asian Development Bank
ADRM	Airport Development Reference Manual
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATR 72	ATR 72
AUS	Australia
AUSD	Australia Dollar
AVL	Airports Vanuatu Limited
B737	Boeing 737
BN-2	Britten-Norman BN-2 Islander
CAAV	Civil Aviation Authority of Vanuatu
CAGR	Compound Annual Growth Rate
CBR	California Bearing Ratio
CCR	Constant Current Regulator
CCS	Communication Console System
CIIP	Competitive Industries and Innovation Program
COVID-19	Corona Virus Disease 2019
CRP	Comprehensive Reform Program
DHC 6	de Havilland Canada DHC-6 Twin Otter
DME	Distance Measurement Equipment
DOT	Department of Tourism
DS	Duct Space
EASA	European Aviation Safety Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMG	Emergency
EMMP	Environmental Monitoring and Management Plan
EPS	Electrical Pipe Space
FAA	Federal Aviation Administration
GDP	Gross Domestic Product
GoJ	Government of Japan
GoV	Government of Vanuatu
GRD	Ground
GSE	Ground Service Equipment
HF	High Frequency
HYEFR	Half Year Economic and Fiscal Update
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rule
IMF	International Monetary Fund
ISA	International Standard Atmosphere
JCAB	Japan Civil Aviation Bureau
JICA	Japan International Cooperation Agency

JPY	Japanese Yen
LLZ	Localizer
MDRR	Mainstreaming Disaster Risk Reduction Project
MFEM	Ministry of Finance and Economic Management
MIPU	Ministry of Infrastructure & Public Utilities
NDB	Non-directional Beacon
NSDP	National Sustainable Development Plan
NZ	New Zealand
NZD	New Zealand Dollar
OAG	Official Airline Guide
ODA	Official Development Aid
OMGWS	Outer Main Gear Wheel Span
PAIP	Pacific Aviation Investment Program
PAPI	Precision Approach Path Indicator
PASO	Pacific Aviation Safety Office
PCN	Pavement Classification Number
PEA	Preliminary Environmental Assessment
PICASST	Pacific Aviation Safety and Security Treaty
PMO	Prime Minister's Office
PNG	Papua New Guinea
PTB	Passenger Terminal Building
PWD	Public Works Department
RFFS	Rescue and Fire Fighting Service
SON	Santo Pekoa Airport
TAH	Tana Whitegrass Airport
TC Pam	Tropical Cyclone Pam
TWR	Tower
USD	United States Dollar
VAT	Value Added Tax
VFR	Visual Flight Rule
VHF	Very High Frequency
VIP	Very Important Person
VIPA	Vanuatu Investment Promotion Authority
VLI	Bauerfield International Airport
VMGD	Vanuatu Meteorology and Geohazard Department
VNSO	Vanuatu National Statistics Office
VOR	VHF Omni-directional Radio Range
VPMU	Vanuatu Project Management Unit
VSAT	Very Small Aperture Terminal
VSIP	Vanuatu Infrastructure Strategic Investment Plan
VT	Vatu
VTO	Vanuatu Tourism Office
VTS	Vanuatu Terminal Service
WB	World Bank

1 Outline of the Study

1.1 Study Background

Bauerfield International Airport plays a vital role as the capital airport in Port Vila and also the core of social and physical exchange in the country. The terminal area was developed by Japan's grant aid, "The Project for Constructing the Terminal Building of Bauerfield International Airport in the Republic of Vanuatu," in 1990. The existing terminal building was constructed with a capacity of 240,000 for both international and domestic air passengers, but the annual passenger volume increased up to 470,000 in 2018. The number of flights has also increased, and the traffic demand has exceeded the capacity of the terminal facility.

As it was constructed more than 20 years ago, deterioration of the facilities is an urgent issue. The World Bank (WB) conducted the Pacific Aviation Investment Program (PAIP). The PAIP includes runway rehabilitation, apron pavement rehabilitation, and development of rescue and firefighting facilities. The objective was to invest in aviation infrastructure and improve the aviation sector in the Pacific Region. Airports Vanuatu Limited (AVL) renovated the passenger terminal building and cargo facilities with their funds, but the renovation is not adequate to cope with significant deterioration. Since passenger handling capacity is not enough, there are concerns about declining service level accompanied with increasing demand and not meeting international standards.

The Government of Vanuatu (GoV) requested the Government of Japan (GoJ) for cooperation on development of the airport terminal facilities such as aprons, taxiways, passenger terminal building, control tower, fire station, road, car park, airport access road, fuel supply system, and hanger. Japan International Cooperation Agency (JICA) conducted a preliminary site survey and discussions with the GoV in February 2019. The meeting concluded that review of the appropriate scale of terminal facilities was necessary.

The WB prepared master plans to measure airports in Vanuatu including Bauerfield International Airport in PAIP in 2017. The master plan of Bauerfield International Airport will be reviewed and appropriate project scale will be determined.

1.2 Objective of the Study

The objectives of the data collection survey are to collect and analyze necessary information and data related to the existing airport facilities, future air traffic demand forecast, and facility development within the appropriate scale, to study the possibility of Japan's cooperation, ascertain the scope of work by both Japan and Vanuatu side, and confirm project implementation schedule.

1.3 Study Schedule

This study was conducted from January to December 2020. The first field survey was conducted from January 21 to February 16, 2020. The survey itinerary is shown in Appendix 1. The second field survey was planned in May 2020; however, because of the COVID-19 outbreak and travel restrictions to Vanuatu, the second field survey was not conducted. The Draft Final Report was explained to Vanuatu side by video conferencing on September 17, 2020.

1.4 Consultant members

Table 1.1 lists the consultant members in the survey.

Table 1.1 Consultant Members

Position	Name
Team Leader/ Airport Planning	Takao Yamaguchi
Air Traffic Demand Forecast	Hiroshi Matsuoka
Airport Facility Planning	Hiromu Kadowaki
Airport Equipment Planning	Hiroshi Mizumasa

2 Current Situation

2.1 Socio-economic Situation

2.1.1 GDP Trend

As shown in Table 2.1, the Vanuatu economy has a GDP growth rate of around a little less than 2% since the year 2010, and in 2015 secured positive growth despite the enormous damage caused by Cyclone Pam. Since 2016, it has maintained 3.5%–4.4% growth with the support of international organizations and others. The statistical values of ADB's key indicators are the same as those in Table 2.1 by the Vanuatu National Statistics Office (VNSO).

Table 2.1 Vanuatu GDP Trend (2010－2018)

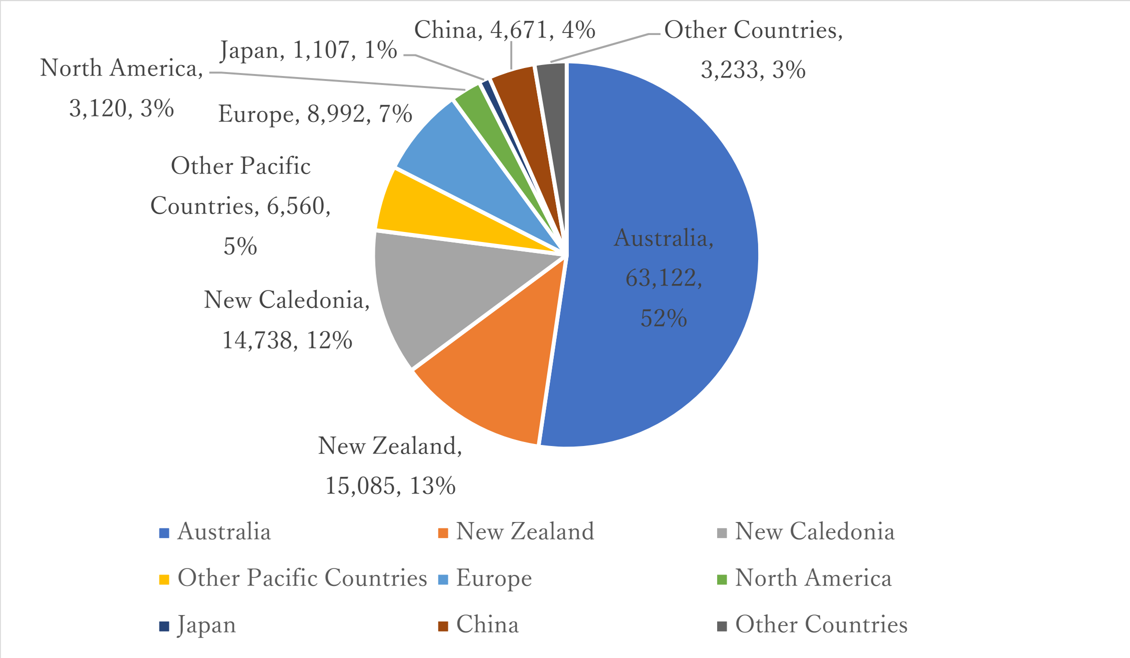
	2010	2011	2012	2013	2014	2015	2016	2017	2018
GDP at constant 2006 prices in million Vatu	57,144	57,843	58,858	60,017	61,400	61,500	63,635	66,443	*68,303*
GDP growth rate	1.6	1.2	1.8	2.0	2.3	0.2	3.5	4.4	2.8

Source: VNSO Statistical Databases, Growth rate for 2018 is estimated by Ministry of Finance and Economic Management in Half-Year Economic and Fiscal Update, 31 July 2019

2.2 Tourism Situation

Tourism is a major industry in Vanuatu. According to the annual research by the World Travel and Tourism Council, tourism industry contributed 34.7% to national GDP in 2019. There are 83 islands in Vanuatu, and many foreign tourists visit Efate Islands and Santo Islands.

Australia and New Zealand are the primary market; in 2019, there were 63,112 and 15,085 visitors from Australia and New Zealand, respectively. There were 14,738 visitors from New Caledonia. The number of visitors from China had increased, but it was only 4% of the total visitors. Figure 2.1 shows the visitor arrival by market in percentage in 2019.



Source: VNSO

Figure 2.1 Visitor Arrivals by Market in 2019

2.3 Aviation Sector Situation

2.3.1 Air Transport Service and Traffic Volume

According to the air traffic statistics from 2010 to 2019 obtained from AVL, the air traffic volume in 2019 is shown in Table 2.2.

Table 2.2 Air Traffic Volume in 2019

Airport	International Passengers	Domestic Passengers	Total Passengers
Bauerfield International Airport:	327,455	161,961	489,416
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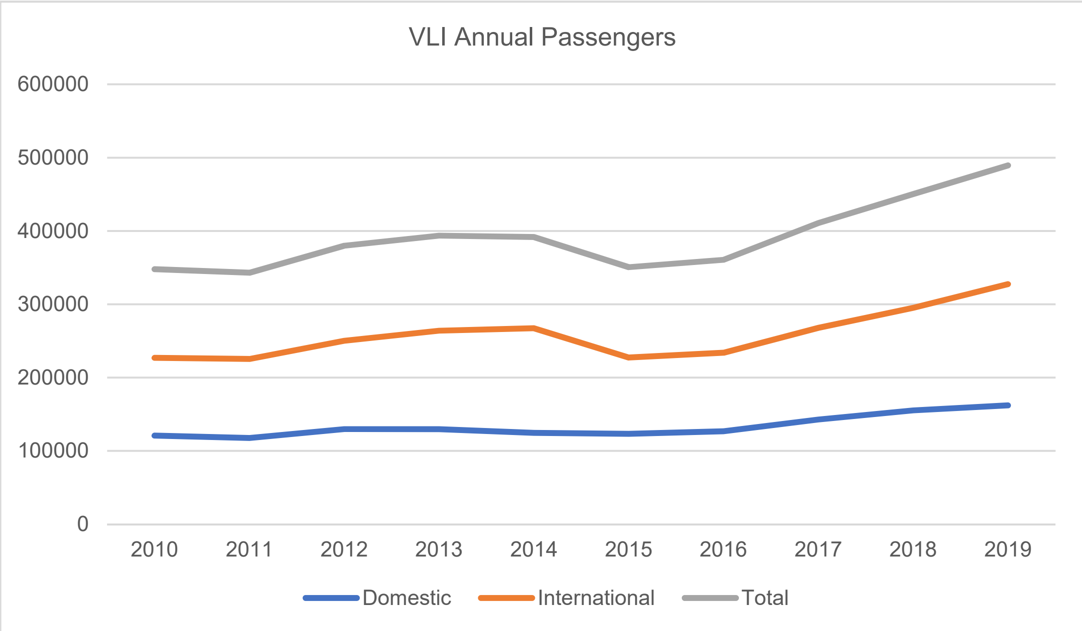
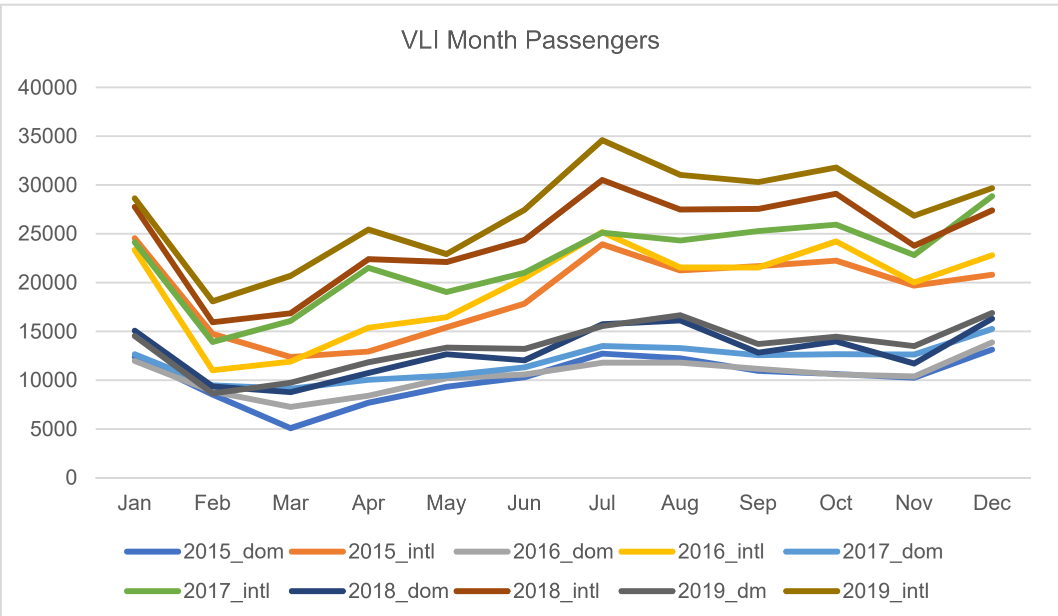


Source: AVL

Figure 2.2 Annual Air Passenger Trend in Bauerfield International Airport (2010–2019)

Figure 2.3 shows the monthly traffic trend for the last five years. The traffic volume varies significantly each month. For both international and domestic flights, June to October and December to January are busy seasons. The dry season is from June to October, which is a tourist season. December and January are busy with more passengers for school holidays and the year-end and New Year holidays. Many seasonal workers leave for Australia in January and return in June. The number of passengers in February 2019 was 26,715, compared with the number of passengers in July same year, 50,145, which was 1.9 times as many passengers.



Source: AVL

Figure 2.3 Monthly Passengers in Bauerfield International Airport (2015–2019)

Tables 2.3 and 2.4 summarize domestic and international air routes. Domestic flights are mainly operated using propeller-driven aircraft. The traffic volume is high at Bauerfield International Airport in Efate Island, Pekoa Airport in Santo Island, Whitegrass Airport in Tanna Island, and Norsup Airport in Malekula Island. The 70-seat ATR72 operates only at Bauerfield International Airport and Pekoa Airport, and all other airports operate 19-seat DHC6 and 8-seat BN-2 (Islander).

International flights are operated by Air Vanuatu, Virgin Australia, Fiji Airways, Solomon Airlines, Aircalin, and Air Niugini. Small jet planes such as B737 and A320 are deployed, and ATR72 propeller-driven aircraft is operated in neighboring Noumea and Nadi.

Table 2.3 Domestic Air Routes

To/From	Departure	Arrival	Total	Distance (km)	Aircraft
Espiritu Santo Pekoa Airport	19	19	38	309	ATR72/ DHC-6
Whitegrass Airport	13	14	27	250	ATR72// DHC-6/ BN-2
Norsup Airport	11	11	22	235	DHC-6/ BN-2
Ema Airport	0	3	3	78	DHC-6/ BN-2
Valesdir Airport	3	0	3	117	DHC-6
Lonorore Airport	3	3	6	233	DHC-6/ BN-2
Tongoa Airport	2	2	4	107	DHC-6
Craig Cove Airport	2	2	4	189	DHC-6/ BN-2
Lamen Bay Airport	2	2	4	143	DHC-6
Lamap Airport	1	1	2	170	DHC-6
Ipota Airport	1	1	2	193	DHC-6
Dillons Bay Airport	1	1	2	159	DHC-6
South West Bay Airport	1	1	2	187	DHC-6
Paama Airport	1	1	2	161	DHC-6
Total	60	61	121		

Source: Official Airline Guide (OAG)

Table 2.4 International Air Routes

To/From	Departure	Arrival	Total	Distance(km)	Airline	Aircraft
Sydney Airport (Australia)	7	7	14	2,856	Air Vanuatu	B737-800
Brisbane Airport (Australia)	5 2	5 2	10 4	2,178	Air Vanuatu Virgin Australia	B737-300 B737-800
Nadi Airport (Fiji)	3 3 1	3 3 1	6 6 2	1,113	Air Vanuatu Fiji Airways Solomon Airlines	B737-300 ATR72 A320
Noumea Airport (New Caledonia)	7	7	14	606	Air Vanuatu Aircalin	ATR72 A320
Auckland Airport (New Zealand)	6	6	12	2,569	Air Vanuatu	B737-300
Melbourne Airport (Australia)	3	3	6	3,665	Air Vanuatu	B737-800
Suva Airport (Fiji)	2	2	4	1,250	Fiji Airways	ATR72
Honiara Airport (Solomon Islands)	1 1	1 1	2 2	1,472	Solomon Airlines Air Niugini	A320 B737-800
Total	41	41	82			

Source: OAG

2.4 Air Cargo

Vanuatu and its major trading partners, such as Australia, New Zealand, New Caledonia, and Fiji, have been trading at roughly same level. Transactions with the Solomon Islands and the United States are still increasing.

Copra, palm, kava, cocoa, and beef are the major trade items of entire Vanuatu by air and sea, but either of AVL, Vanuatu Terminal Service (VTS), or Statistics Bureau does not hold detailed specific data for air freight.

2.5 Airport and Air Traffic Control Services

2.5.1 Airports

There are 30 airports in Vanuatu, including three international airports—Port Vila Bauerfield International Airport, Santo Pekoa Airport, and Tana White Grass Airport. AVL manages these three airports, while MIPU's Public Works Department (PWD) manages the remaining ones.

Table 2.5 Airports in Vanuatu

Airport Name	Location	Location Indicator	IATA Code	International/ National	IFR/VFR	S=Scheduled N=Non Scheduled, P=Privates
ANEITYUM	Aneityum	NVVA	AUY	NTL	VFR	S, NS, P*
ANIWA	Aneityum	NVVB	AWD	NTL	VFR	S, NS, P
CRAIG COVE	Ambrym	NVSF	CCY	NTL	IFR/VFR	S, NS, P
DILLON'S BAY	Erromango	NVVD	DLY	NTL	VFR	S, NS, P*
EMAE	Emae	NVSE	EAE	NTL	VFR	S, NS, P
FUTUNA	Futuna	NVVF	FTA	NTL	IFR/VFR	S, NS, P*
GAUA	Gaua	NVSQ	ZGU	NTL	VFR	S, NS, P
IPOTA	Erromango	NVVI	IPA	NTL	VFR	S, NS, P
LAJMOLI	Santo	NVSZ	OLJ	NTL	VFR	S, NS, P
LAMAP	Malekula	NVSL	LPM	NTL	VFR	S, NS, P
LAMEN BAY	Epi	NVSM	LNB	NTL	VFR	S, NS, P
LONGANA	Ambae	NVSG	LOD	NTL	IFR/VFR	S, NS, P
LONORORE	Pentecost	NVSO	LNE	NTL	IFR/VFR	S, NS, P*
MAEWO	Maewo	NVSN	MMF	NTL	VFR	S, NS, P
MOTA LAVA	Mota Lava	NVSA	MTV	NTL	IFR/VFR	S, NS, P
NORSUP	Malekula	NVSP	NUS	NTL	IFR/VFR	S, NS, P
PAAMA	Paama	NVSI	PBJ	NTL	VFR	S, NS, P*
PORT VILA BAUERFIELD	Efate	NVVV	VPI	INTL/NTL	IFR/VFR	S, NS, P
QUOIN HILL	Efate	NVVQ	UIQ	NTL	VFR	NS, P
REDCLIFF	Ambau	NVSR	RCL	NTL	VFR	S, NS, P
SANTO Pekoa	Santo	NVSS	SON	INTL/NTL	IFR/VFR	S, NS, P
SARA	Pentecost	NVSH	SSR	NTL	VFR	S, NS, P
SOLA	Vanua Lava	NVSC	SLH	NTL	IFR/VFR	S, NS, P*
SOUTH WEST BAY	Malekula	NCSX	SWJ	NTL	VFR	S, NS, P*
TANNA WHITEGRASS	Tanna	NVVW	TAH	INTL/NTL	IFR/VFR	S, NS, P*
TONGOA	Tongoa	NVST	TGH	NTL	VFR	S, NS, P*
TORRES	Torres	NVSD	TOH	NTL	VFR	S, NS, P
ULEI	Ambrym	NVSU	ULB	NTL	VFR	S, NS, P
VALESDIR	Epi	NVSV	VLS	NTL	VFR	S, NS, P
WALAHA	Ambae	NVSW	WLH	NTL	VFR	S, NS, P*

**Written permission required*
Source: AIP Vanuatu

2.5.2 Air Traffic Control Operation

Vanuatu consists of more than 80 islands and many airfields. Air traffic control service is provided at Port Villa airport in the capital. In Espiritu Santo Island and Tanna Island, only aeronautical information service is available. In other airfields, there is no station staff and communication with Port Villa is done through telephone or HF radio.

Air traffic control service in Port Villa is limited to the area close to its airport and lower airspace between the islands. Air traffic control service for the aircraft flying upper airspace of over 24,500 ft (8,000 m) in Vanuatu is provided in Nadi, Republic of the Fiji Islands.

Air traffic control service in this airport is taken care of by only three controllers working in rotation. However, in response to a shortfall in human power, recruitment of cadets for air traffic controllers was started in October 2019 (training was supposed to commence in April 2020, but due to COVID-19, the commencement date of training has not been fixed yet).

2.5.3 Airlines

There are two scheduled air carriers in Vanuatu—Air Vanuatu and Belair Airlines. There are three companies for non-scheduled operations—Air Taxi, Unity Airlines, and Vanuatu Helicopter. Unity Airlines and Air Taxi operate fixed-wing aircraft and Vanuatu Helicopter operates rotary-wing aircraft. Air Taxi and Unity Airlines operate mainly charter flights for the volcanic tourism on Tana Island.

Table 2.6 Air Vanuatu Fleet Equipment

Equipment	Number	Seats	Main routes	Status
B737-800	1	170	Australia, New Zealand and Fiji	In service
B737-300	1		Brisbane, Auckland and Fiji	On lease from Air Nauru
ATR-72	1	68	Domestic and Noumea	In service
DHC-6	3	16	Domestic	In service
BN-2 Islander	1	8	Small airfields	

Source: Air Vanuatu

Table 2.7 Belair Airlines Fleet Equipment

Equipment	Number	Seats	Main routes	Status
BN-2 Islander	2	9	Domestic	In service

Source: Belair Airlines

Table 2.8 Unity Airlines Fleet Equipment

Equipment	Number	Seats	Main routes	Status
Piper Chieftain	1	9	Domestic	In service
BN-2 Islander	2	9	Domestic	In service

Source: Unity Airlines

Table 2.9 Air Taxi Fleet Equipment

Equipment	Number	Seats	Main routes	Status
BN2A-26 Islander	3	9	Tanna Charter	In service
Cessna 207	2	6	Tanna Charter	In service
Cessna 206	1	5	Tanna Unpaved airfield	In service
Cessna 172	1	3	Tanna Unpaved airfield	In service

Source: Air Taxi

Source: Air Vanuatu

Figure 2.4 Domestic Routes of Air Vanuatu

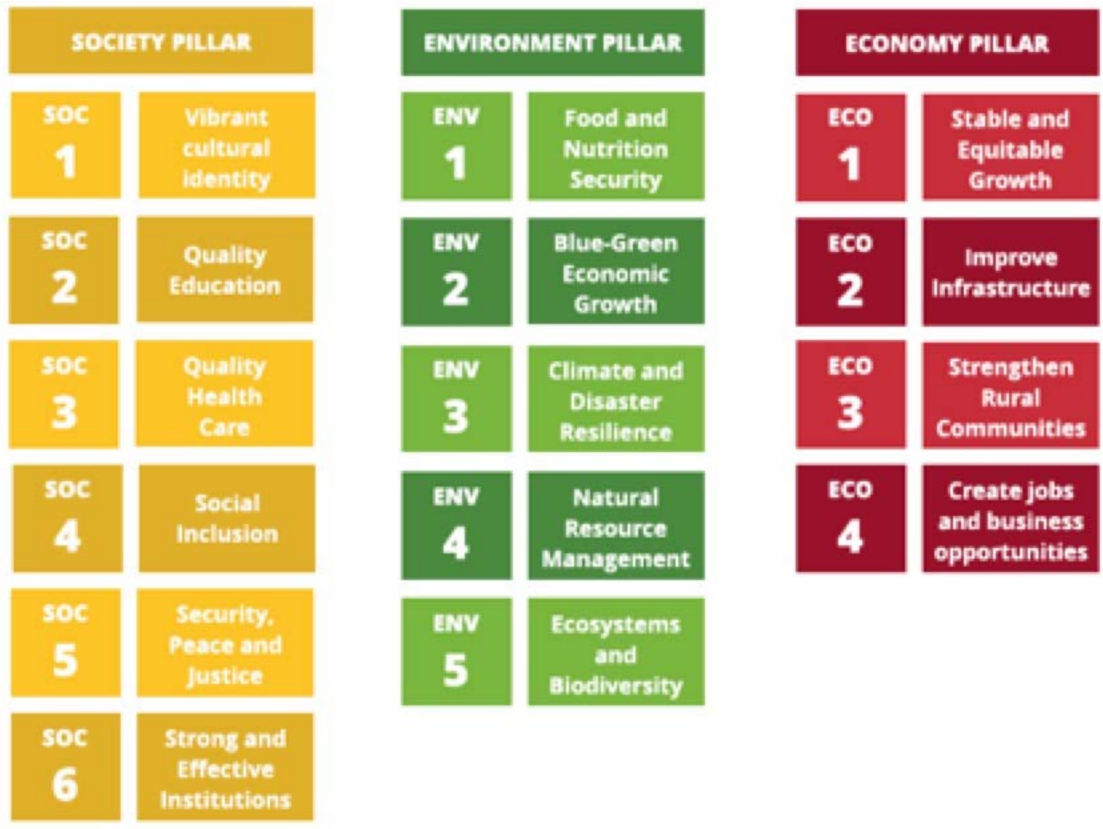
Source: Air Vanuatu

Figure 2.5 International Routes of Air Vanuatu

2.5.4 National-level Aviation Sector Program

(1) Long-term National Development Plan

Vanuatu 2030 The Peoples Plan is the National Sustainable Development Plan (NSDP) for the period 2016 to 2030, formulated by the GoV in November 2016. This NSDP divides the national development goals into three pillars, 1) Society, 2) Environment, and 3) Economy; and each pillar is further divided into several targets for 2030.



Source: NSDP

Figure 2.6 Three Pillars of NSDP

Aviation is included in "Improve Infrastructure" in the Economy Pillar. Table 2.10 shows excerpts related to aviation policy.

Table 2.10 Policy Objectives for Aviation in NSDP

NSDP ID	Policy Objectives
ECO 2.4	Enact clear infrastructure governance, legislative frameworks and standards for resilient infrastructure and maintenance
ECO 2.5	Improve partnerships and the cost effective use of resources to ensure sustainable asset management and maintenance
ECO 2.6	Provide equitable and affordable access to efficient transport in rural and urban areas
ECO 2.7	Ensure compliance with international conventions and standards for safe and secure transport
ECO 2.8	Establish effective partnerships that facilitate the development of the private sector and rural communities as service suppliers in the provision of transport and the infrastructure sector

Source: NSDP

(2) Long-term Policy for Aviation Infrastructure Development

The long-term policy regarding aviation infrastructure development set out by the GoV includes Vanuatu Infrastructure Strategic Investment Plan 2015-2024 by the GoV (VISIP 2015) and

Corporate Plan 2018-2020 set out by MIPU in December 2017.

VISIP 2015 proposes methods of financing and implementation to formulate an optimal strategic infrastructure investment plan and aims for institutional development to implement an efficient, practical, and sustainable infrastructure development plan. VISIP 2015 conforms to the NSDP and includes social and economic infrastructure. VISIP updated infrastructure projects selected in 2012, prioritizing them based on government policies and strategies, and included new projects. VISIP 2015 plans to develop an existing airport instead of building a new one that was previously proposed at Bauerfield International Airport. MIPU Corporate Plan 2018-2020 aims to formulate master plans for the three major airports and utilize the airport departure tax to maintain a sustainable domestic network, but both aims have been already implemented.

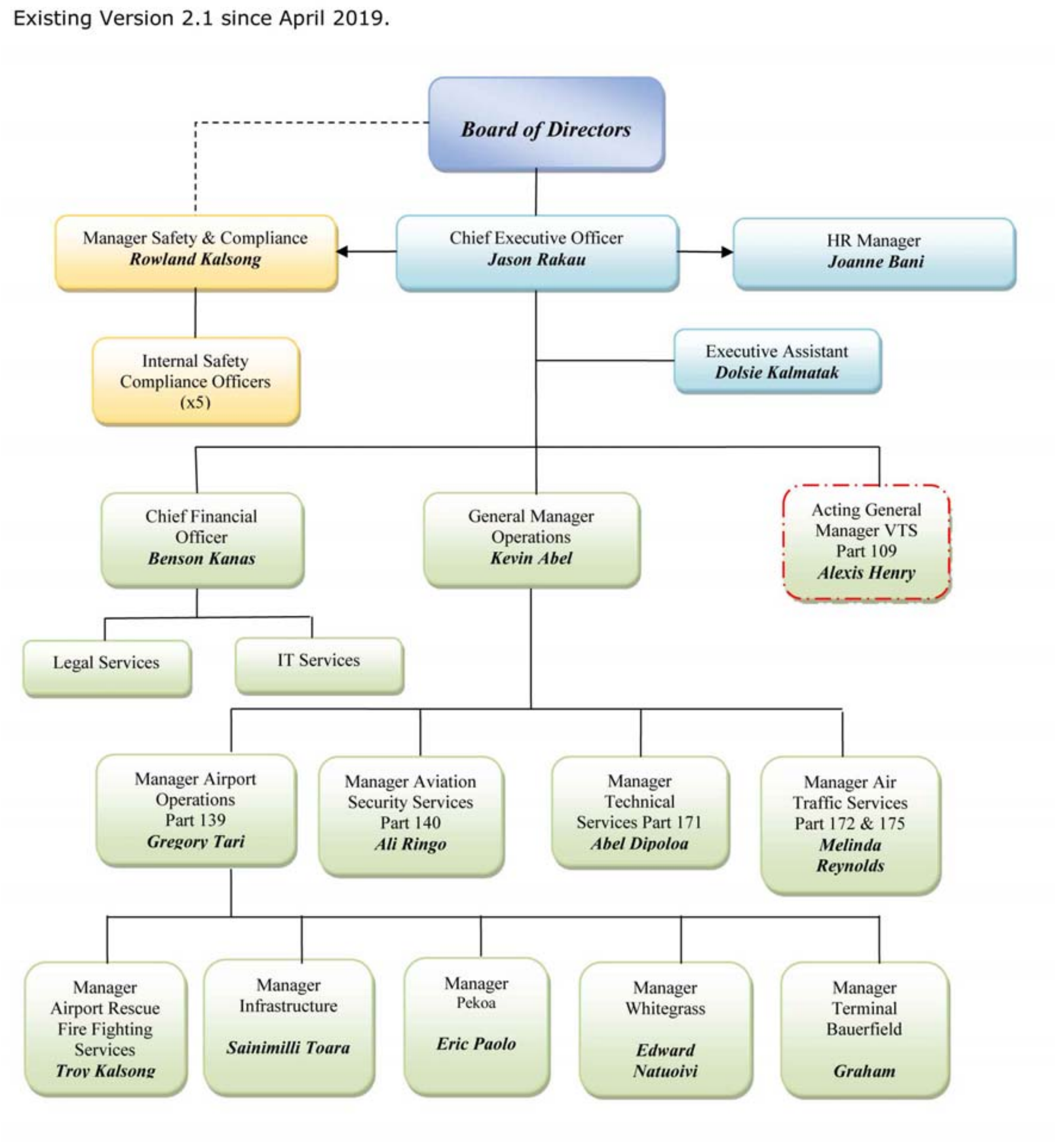
2.6 Related Organizations

2.6.1 Overview

Until 1997, the Department of Civil Aviation was in charge of airport management, air traffic control services, and aviation regulation and supervision in Vanuatu; however, after the government's Comprehensive Reform Program (CRP) was implemented, the regulatory and operational departments were separated. As a result, AVL was established in 2000, and the Civil Aviation Authority of Vanuatu (CAAV) was established as a regulatory department.

2.6.2 Airports Vanuatu Limited

AVL is an airport corporation that operates and manages three major airports in Vanuatu (Bauerfield International Airport, Santo Pecoa International Airport, and Tanna Whitegrass International Airport). AVL is also in charge of air traffic control services. AVL's shareholders are MIPU and the Ministry of Finance and Economic Management (MFEM).



Source: AVL

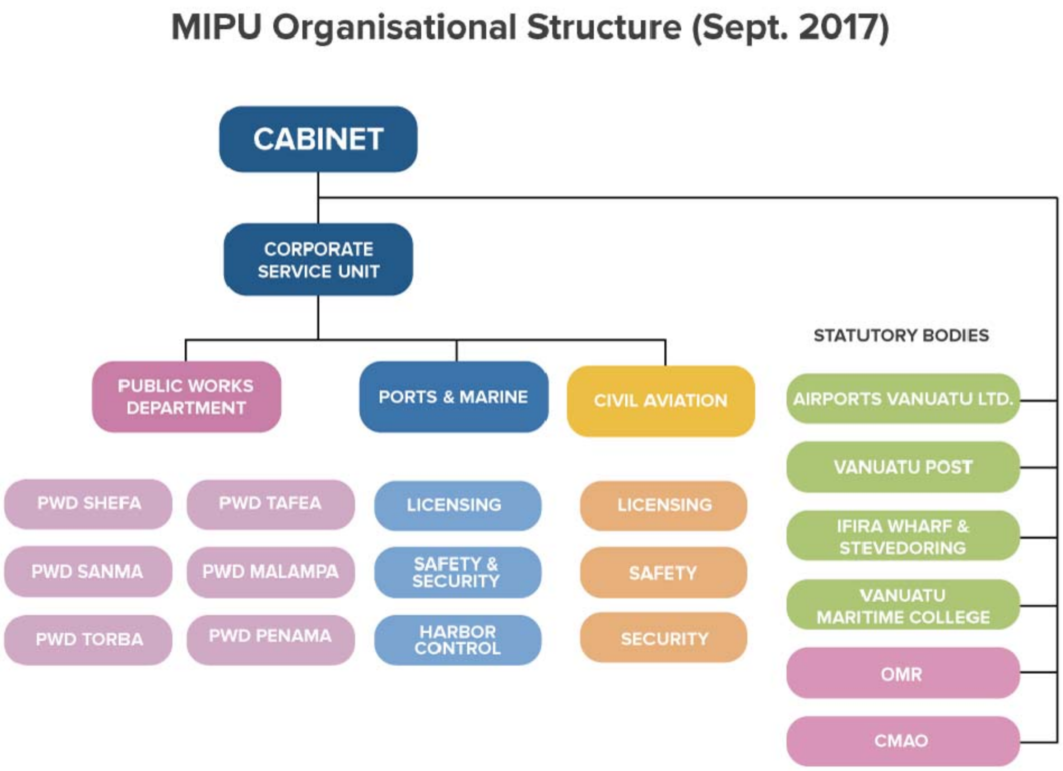
Figure 2.7 Organization Chart of AVL

Financial reports from 2012 to 2014 were provided by AVL. The latest report was not available to the study team during the survey. Most of the revenue to AVL comes from operating revenue such as passenger service fees, landing and parking fees, and concession and rental income such as operating leases rented by third parties inside the airport terminal building. As the air traffic passengers increased, AVL has recorded profit every year, and net profit in 2014 was VT 46 million (USD 409,000).

2.6.3 MIPU

Ministry of Infrastructure and Public Utilities (MIPU) is in charge of development, maintenance, and operation of infrastructure facilities and postal services, etc. in Vanuatu, which consists of

Public Works Department, Civil Aviation Department, and Ports and Marine Department. The organization chart of MIPU is shown in Figure 2.8.



Source: MIPU

Figure 2.8 Organization Chart of MIPU

2.6.4 Civil Aviation Authority of Vanuatu

CAAV is the aviation regulator of Vanuatu and is responsible for aviation safety in the Vanuatu airspace. CAAV consists of several departments in charge of air traffic control, airport management, air transportation, search and rescue, and flight information.

2.6.5 Vanuatu Project Management Unit

Vanuatu Project Management Unit (VPMU) was established in 2012 to manage significant infrastructure in Vanuatu and coordinate development projects. VPMU is a subordinate organization of the Prime Minister's Office (PMO). For many large-scale infrastructure projects, the jurisdiction is transferred from the responsible ministry to the VPMU at the project implementation stage. The Vanuatu Aviation Investment Project (VAIP) of the WB was conducted by VPMU, but it is understood that the implementation of JICA's grant aid is under the contract with MIPU and VPMU is not involved for the JICA's grant aid project.

3 Existing Conditions of Bauerfield International Airport

3.1 Airport History

Bauerfield International Airport was built in 1942 by the US Forces during the Pacific War. In 1990, the international terminal building was constructed by a Japanese grant aid project. At that time, the present domestic passenger building, which was used as the domestic/international passenger building, was refurbished for domestic flights. In 1988, the runway was extended from 1,400 m to 2,000 m and was extended further by 600 m from 1997 to 2000 by EIB funding. The current length of the runway is 2,600 m.

According to the AVL staff, the pavement of the runway at Bauerfield International Airport deteriorated from around 2011. The condition of the runway further deteriorated as many large aircrafts took off and landed to support the relief operations of Cyclone Pam in 2015. A runway overlay project was subsequently implemented in 2018 by the WB.

3.2 Facility and Equipment

3.2.1 Runway, Taxiway, and Apron

(1) Runway

The existing runway is 2,600 m long, 45 m wide, and 7.5 m wide shoulders. The pavement has been completely refurbished and reinforced to the strength that Code E class aircraft can operate twice a week. The current pavement strength is PCN 61/F/C/X/T. From 1997 to 2000, the runway was extended by 600 m to the east, and other parts were overlaid with EIB funding.

Photo 3.1 Runway Pavement

Photo 3.2 Turning Pad and Runway Shoulder

(2) Runway Strip

The ICAO recommendation requires a runway strip of 280 m with 140 m on each side for a non-precision approach runway. The total width of the runway strip at Bauerfield International Airport is 150 m and does not meet this recommendation.

(3) Taxiway

There is only one taxiway (26 m wide) connecting the runway and the apron. The overlay and shoulder pavement project were implemented by VAIP, and they are compatible with Code E aircraft like the runway.

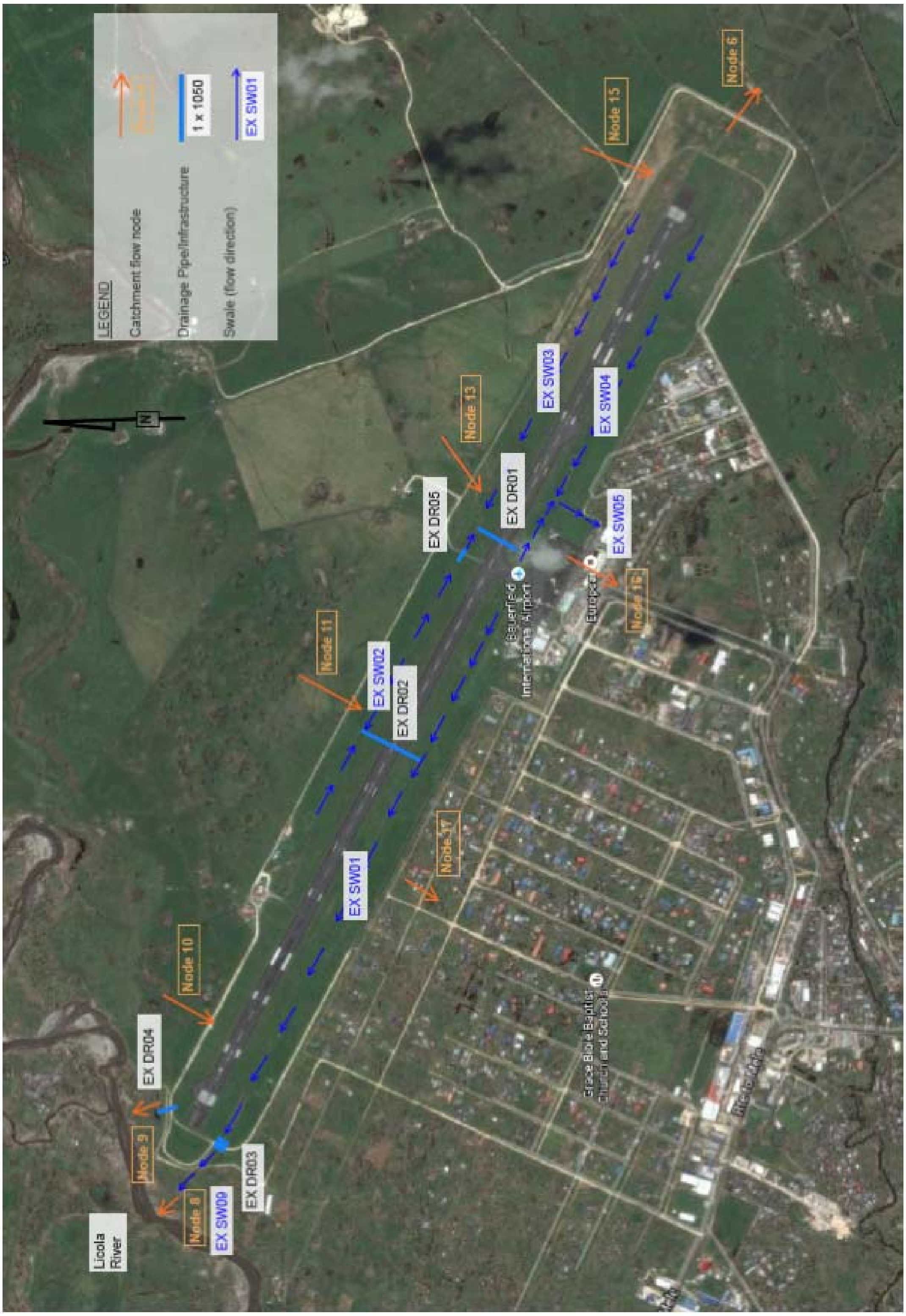
(4) Apron

The overlay, expansion, and shoulder pavement project were implemented by VAIP. Currently, there are one parking spot for Code E aircraft B787 or A330, two for Code C aircraft B737, and one for propeller aircraft. There is also a parking space for small propeller aircraft on the western side of the apron. Since the apron is close to the runway, the tail wing of the parked jet penetrates the transition surface. Besides, since the parking spot for Code E is a push-out type, it is not possible to operate Code E aircraft without a towing tractor. The small aircrafts are parked on the west side of the apron, but because there are not enough tie-down rings installed, it could be dangerous when the wind is strong such as in case of a cyclone.

Photo 3.3 Existing Apron

(5) Drainage System

Drainage is installed on both sides of the runway on the runway strip. There are two drainage pipes crossing the runway. Rainwater on the north side of the runway flows to the south side of the runway by these crossing pipes and flows into the river in the terminal area and La Colle river on the west side of the airport.



Source: Final Detailed Design Report, Bauerfield International Airport, Tonkin and Taylor May 2017

Figure 3.1 Drainage Layout

3.2.2 Passenger Terminal Building

(1) Terminal Area

From the east side, the existing terminal area is lined with the cargo terminal building, international terminal building, domestic terminal building, the AVL office, an Air Vanuatu hangar, and an Air Taxi hangar. Both domestic and international terminal buildings have a parking lot.

Photo 3.4 Aerial Image of the Existing Terminal Area

(2) International Passenger Terminal Building

The international passenger terminal building was constructed by a Japanese grant aid project completed in 1991. The project was planned in 1990 with an annual demand of 140,000 passengers for the international terminal building and a peak demand of 360 departing/arrival passengers. The departure hall was expanded from 1997 to 2000 with EIB funding.

The building is in seemingly good condition as it was renovated by AVL. However, it is deteriorating as nearly 30 years have passed since its construction. The departure area is very crowded when two to three international flights depart at the same time. Also, since there is only one baggage carrier belt in the arrival area, it becomes very crowded when more than one international flight arrives at the same time. The main facilities at international terminal building are mentioned in Table 3.1.

Table 3.1 Main Facilities at the International Terminal Building

Facilities	Specifications
Check-in counter	10 units
Immigration counter	4 units
Security inspection area	2 lanes (X-ray inspection machine and metal detector)
Departure lobby	About 300 seats
Arrival lobby	There is space for about 200 people.
Baggage claim	1 baggage carrier belt
Customs	2 X-ray inspection machines (1 CT type and 1 single view type)

Photo 3.5 Check-in Counter for International Flights

Photo 3.6 Concourse at International Building

(3) Domestic Passenger Terminal Building

The domestic passenger terminal building was expanded in 1982. The domestic/international terminal building at that time was used as the domestic terminal building since 1990. The design capacity is for B737 aircraft. Currently, mainly ATR72 for 70 passengers and small propeller for 19 passengers operate for domestic flights. During busy seasons, the terminal is crowded as the B737 aircraft flies to and from Santo-Pecoa Airport. The terminal is also very old. The check-in hall has four Vanuatu Airlines counters; offices of other airlines such as Belair Airways, Unity Airlines, and Air Taxi; and booths of car rental companies. Baggage inspection is conducted manually for domestic flights. As there is no departure gate, passengers wait for departure in a waiting room next to the check-in counter, and board the flight at the departure time after undergoing manual security screening.

Photo 3.7 Domestic Flight Check-in Counter and the Waiting Room

Photo 3.8 Domestic Terminal Building Exterior

(4) VIP Terminal Building

The VIP terminal building was built about 10 years ago and is located between the international terminal building and the domestic terminal building. In addition to VIPs, general passengers can also use it after paying a certain fee. Since it is relatively new, it is in good condition and has sufficient capacity.

3.2.3 Cargo Terminal Building

The cargo terminal building is large enough to store air cargoes and has a refrigerating room and a monitor room for surveillance cameras. All export cargoes are inspected by X-ray inspection machine, but import cargoes are not inspected. The cargo terminal building is managed by VTS, a subsidiary of AVL.

3.2.4 Control Tower

ATC tower is located at the northern side across a runway and the air traffic control service is managed by AVL's air traffic controllers. Although the 14-m-high ATC tower is more than 30 years old, the building is still strong because of its strength derived from concrete. The visibility from the ATC tower is not perfect but there is no significant problem except the slight lack of visibility to the surface of the west end of the runway. ATC equipment and radio communication devices installed inside are scheduled to be renewed during the period of 2020–2021 with funds from the WB and the GoV.

Photo 3.9 Runway 11 End View from the Control Tower

Photo 3.10 Air Traffic Control Tower

3.2.5 Fire Station

The fire station was built after the fire engine house was severely damaged by Cyclone Pam in 2015. The condition of the building is still good, but the location is problematic since the building will be inside the runway strip when the strip is expanded to 280 m. Besides, the capacity of the adjacent water storage tank is not enough. ICAO's RFFS category provided is 7, and A320 and B737 aircraft are mainly operated at Bauerfield International Airport. Considering the length of A320 (37.6 m) and B737-800 (39.50 m), the current fire-fighting capacity satisfies the criteria required for ICAO's RFFS category 7.

Figure 3.2 Fire Station and Runway

Photo 3.11 Broken Fire Station by Cyclone Pam

Photo 3.12 Fire Station

3.2.6 Car Park and Road

(1) Car Park

The passenger parking area adjacent to the international/domestic terminal building can accommodate around 150 cars. However, since vehicles can be parked free of charge, many passengers leave their vehicles at the car park during their trip, and this causes congestion. The pavement in front of the international terminal building is significantly degraded. The parking area in front of the domestic terminal building is constructed with concrete pavement and is in good condition. The curve side road in front of the domestic terminal building that is constructed with asphaltic pavement gets inundated during rainfall because of its low elevation.

Photo 3.13 Curb Side Road in front of Domestic Terminal Building during Rainfall

Photo 3.14 Parking and Road in front of International Terminal Building

(2) Boundary Road

There is a 3.0–4.0-m wide perimeter road on the entire outer perimeter of the airport. In most of the sections, the road is covered with coral stone breakage except some parts that are paved with permeable pavement (Chip Seal). There is no problem in the current width and surface condition of the road.

3.2.7 Airfield Lighting System

In 2019, the WB renewed airfield lighting facilities in Bauerfield International Airport, including runway light, taxiway light, runway threshold light, PAPI, and apron floodlight. Some other equipment that were destroyed by Cyclone Pam in 2015 have not been repaired yet (e.g., the circling-approach guidance light). Since airlines have officially requested AVL to repair the equipment, AVL will repair them with the GoV budget.

Photo 3.15 :Airfield Lighting CCR Unit

Photo 3.16 Runway Light

3.2.8 Air Traffic Control and Equipment

Because it has been 30 years since ATC equipment, radio communication equipment, and navigation equipment were installed in 1990 by the grant aid from Japan, those equipment are already degraded and they will be replaced by the WB project in 2020 and 2021. Equipment that are not included in the scope of the WB project (e.g., radio communication equipment) due to the budgetary constraints will be replaced using funds from the GoV.

Table 3.2 Air Traffic Control Equipment

Facility	Qty	Descriptions	Remarks
VOR/DME	1	DVOR 114.3 Mhz / DME 1177 Mhz	Replaced by WB in 2021
LLZ/DME	1	LLZ 110.7 Mhz / DME 330.2 Mhz	
NDB	1	361 Khz	
CCS	1	Communication Console in TWR	
CCS Recorder	1	Digital memory system	
VHF Com. for Port Villa TWR	1	130.7 Mhz on the hill	Replaced by GoV in 2021
VHF Com. for Port Villa GRD	1	121.9 Mhz for Grand Service	
VHF Com. for Port Villa EMG	1	121.5 Mhz for Emergency	
HF Com.	1	2.8~22 Mhz for long distance communication	
Emergency Gen,	1	Back-up power for Radio & Airfield Lighting	Replaced in 2019

Source: JICA Study Team

Photo 3.17 VOR/DME

Photo 3.18 ATC Tower

3.2.9 Aviation Security Equipment

Aviation security equipment such as X-ray inspection machines and metal detectors will be replaced by the equipment that meet the EASA (European Aviation Safety Agency) standard during 2020 to 2021 with cooperation from the Government of New Zealand. After these replacements, security equipment currently used in the international terminal will be used in the domestic terminal.

Table 3.3 Aviation Security Equipment

Confidential Information

3.2.10 Utilities

(1) Water Supply

Water is supplied to the entire airport by UNELCO. There is a connection with the main pipe (4 inches) in the vicinity of the international terminal parking area.

(2) Sewage Treatment System

Sewage water from buildings flows into water seepage facility located at the west side of the cargo terminal and is treated through underground seepage. Besides, there is a separate discharge facility for sewage water from aircraft. However, it seems that this facility has not been used recently.

(3) Power Supply

Substation including distributer and emergency generator system for the electricity is located at the west of the cargo terminal building, and electricity is provided to the entire airport by UNELCO.

(4) Solid Waste

There is no waste treatment facility in the airport. Waste is randomly stacked in the open space at the west side of the aviation fuel facility until subcontractor transports it to the treatment facility.

3.2.11 Fuel Supply System

Aviation fuel facility is located at the west side of the domestic terminal building owned by Pacific Energy Corporation and aviation fuel hydrant for fuel supply is located at the apron.

3.3 Access Traffic

No public transportation to/from Bauerfield International Airport is provided, and the airport is accessible only by private cars and shared small buses (locally simply called a bus). Taxis are available only at hotels, and there is no taxi stand in the other parts of the city. Access to the airport is by road only and it takes about 15 minutes from the center of Port Vila to reach there.

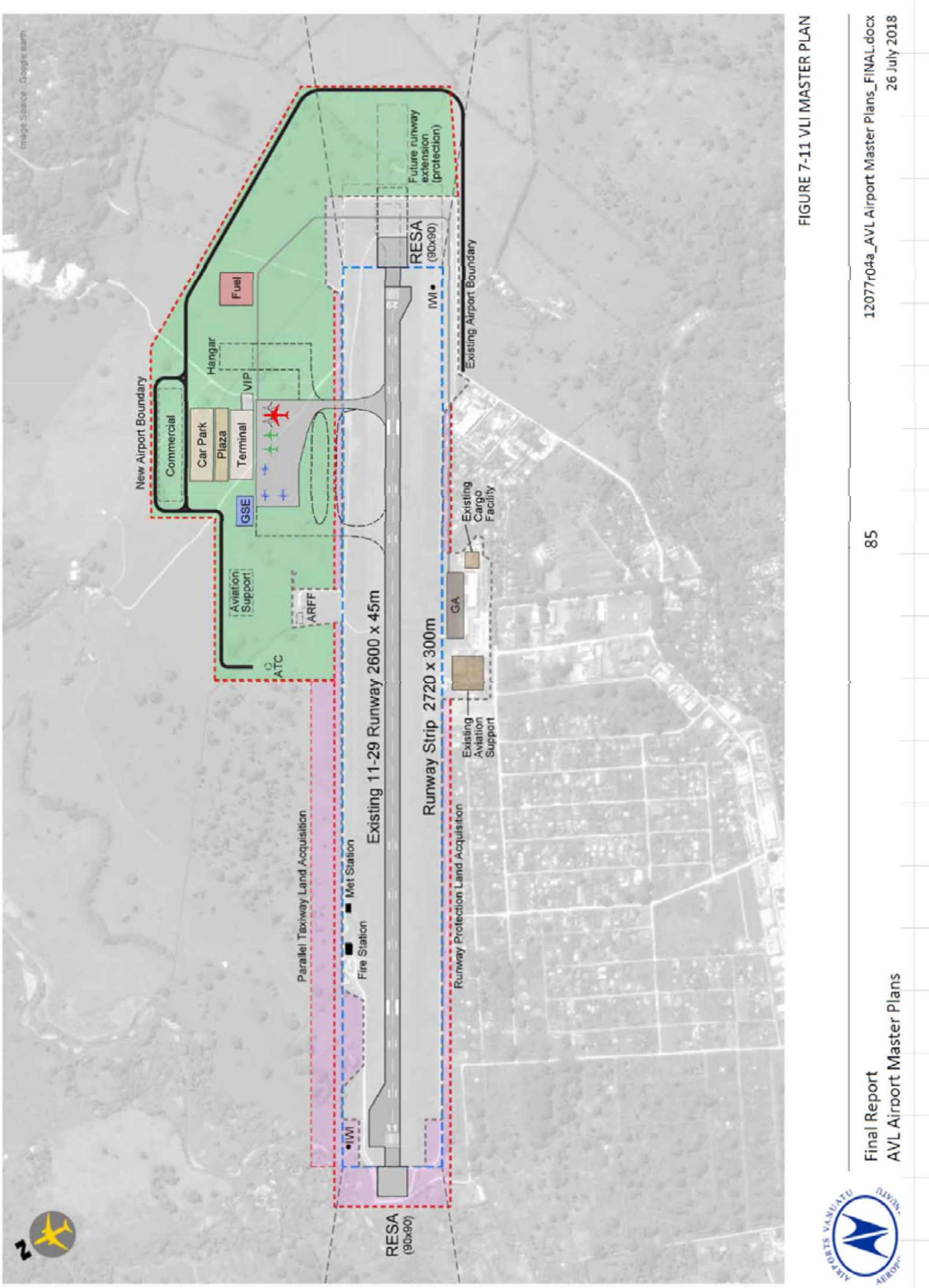
3.4 Ongoing and Future Projects and Activities by Other Donors

3.4.1 The World Bank Project

The World Bank implemented the Vanuatu Aviation Investment Project (VAIP) between May 2015 and December 2019. The project budget was USD 59.80 million. The target airports were Port Vila Bauerfield International Airport, Santo-Pecoa International Airport, and Tana White Grass International Airport. The scope of the project included runway rehabilitation; navigation radio facility maintenance; replacement of fire-fighting vehicle, design and construction supervision; master plan survey; and training for project implementation.

3.4.2 The Bauerfield International Airport Master Plan by the World Bank

The World Bank project formulated a long-term development master plan for three airports—Port Vila Bauerfield, Santo Pecoa, and Tana Whitegrass. The Master Plan Project was a part of the VAIP and formulated 20-year airport strategic development plans for the period 2017 to 2037. Air traffic demand forecast in the master plan predicted 310,000 international and 150,000 domestic annual passengers in 2022, and 470,000 international and 200,000 domestic annual passengers in 2037. Figure 3.2 shows the Bauerfield International Airport Master Plan. It is planned to build a new terminal in the northeastern part of the runway considering constraints to develop the existing terminal area. Total project cost was estimated as USD 131.6 million. The new terminal area is planned in the Zone 3 of the water protection zone.



Source: Final Report AVL Airport Master Plan

Figure 3.3 The Master Plan by the World Bank

3.4.3 Pacific Aviation Safety Office

The Pacific Aviation Safety Office (PASO) is an international organization established in 2005 by Pacific Islands Civil Aviation Safety and Security Treaty (PICASST) to improve the safety and security of regional aviation. PICASST consists of 10 member countries: PNG, Vanuatu, Solomon Islands, Cook Islands, Tonga, Kiribati, Nauru, Niue, Samoa, Tuvalu. Fiji, New Zealand, and Australia are associate members. The headquarters of PASO is located in Vanuatu, and the GoV bears the cost of the office and local staff.

3.4.4 Australian Government Projects

The Australian government provides aviation safety and legal assistance to CAAV in Vanuatu. The Australian government has prepared a loan budget of AUSD 200 million and grant AUSD 50 million for infrastructure assistance funds to Vanuatu, but the target of assistance has not yet been decided.

3.4.5 New Zealand Government Projects

The New Zealand government is supporting the development of airport security equipment at airports in the South Pacific region. The equipment will be procured and installed with a budget of NZD 15 million in three years from 2017. The following equipment are planned to be provided to Bauerfield International Airport from January to March 2021.

Table 3.4 Aviation Security Equipment provided by NZ Government

Confidential Information

3.4.6 European Investment Bank Project

With the funding from the European Investment Bank (EIB), the runway was refurbished and extended from 1997 to 2000, the departure hall of the international terminal was expanded, fire engines were procured, and navigation radio facilities were replaced.

3.5 Natural Environment

3.5.1 Meteorology

Bauerfield International Airport is located in the South Pacific Ocean at longitude 168 degrees 19 minutes east and latitude 17 degrees 41 minutes south. It is hot and rainy throughout the year due to the tropical climate. According to the meteorological observation results at Bauerfield

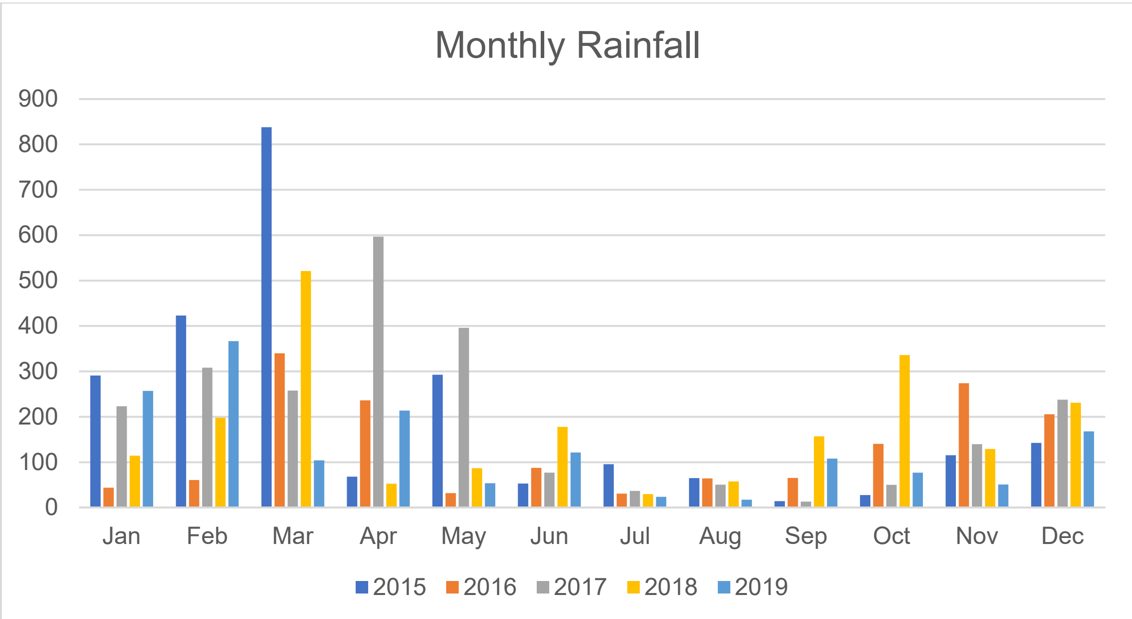
International Airport for the past five years, the average minimum temperature is approximately 18–23°C and the average maximum temperature is 26–33°C.

The rainy season is from October to May, and the annual rainfall is high at about 2000 mm or more. The maximum monthly precipitation was 838 mm during Cyclone Pam of Category 5 in March 2015.

Table 3.5 Maximum and Minimum Temperature at Bauerfield International Airport (2015–2019)

Year	2015		2016		2017		2018		2019	
Month	Max Temp	Min Temp	Max Temp	Min Temp	Max Temp	Min Temp	Max Temp	Min Temp	Max Temp	Min Temp
Jan	30.7	22.6	31.0	21.7	31.4	22.1	31.2	22.5	30.7	20.7
Feb	31.7	24.5	33.5	23.8	31.0	23.6	31.1	22.3	31.3	23.5
Mar	29.9	22.4	31.6	23.6	31.5	22.7	30.9	23.2	31.1	22.0
Apr	29.7	22.1	30.1	22.0	30.4	22.4	29.6	21.3	29.8	21.4
May	27.8	21.2	29.3	19.5	29.2	22.1	28.4	19.0	28.3	19.8
Jun	26.6	18.7	28.1	19.4	27.6	19.3	27.4	18.8	27.0	18.4
Jul	26.2	19.5	26.9	18.7	26.6	17.4	27.5	18.1	26.6	16.5
Aug	26.0	17.4	27.8	18.6	27.3	17.7	26.9	16.7	26.8	18.3
Sep	27.1	16.8	28.1	18.0	27.8	18.3	26.8	19.3	26.9	17.6
Oct	29.2	19.9	29.0	18.2	30.3	20.1	28.5	20.5	28.3	19.5
Nov	30.5	21.2	30.1	21.0	30.0	21.9	30.2	19.8	29.2	19.2
Dec	31.0	22.4	30.1	22.0	30.2	20.2	30.2	21.9	31.0	20.9

Source: Vanuatu Meteorology and Geohazards Department



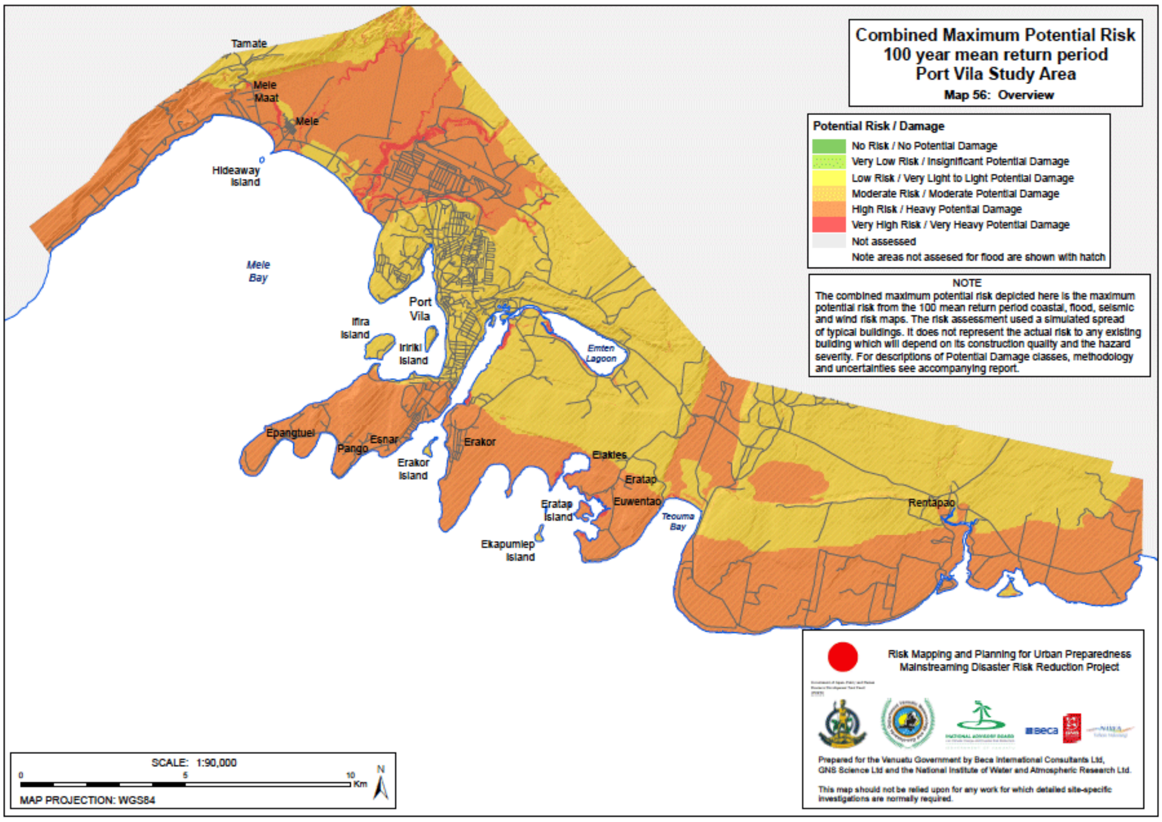
Source: Vanuatu Meteorology and Geohazards Department

Figure 3.4 Monthly Rainfall in Bauerfield International Airport (2015–2019)

3.5.2 Natural Disaster Risks

Vanuatu Meteorology and Geohazard Department (VMGD) published Hazard and Risk Maps and Geo-data Report in January 2016 as part of Mainstreaming Disaster Risk Reduction Project

(MDRR) for two cities—Efate Port Vila in Efate Island and Luganville in Espiritu Santo Island. According to the report, the region where Bauerfield International Airport is situated is most likely to suffer from High Risk/Heavy Potential Damage, which is the second-highest level among the six levels of risk in a 100-year probability natural disaster analysis. The risks analyzed in this report are five natural disasters—earthquakes, river floods, storms, coastal inundation, and tsunamis; and the area around the airport is at high risk for earthquakes and liquefaction due to earthquakes. In addition, there are two rivers near the airport—the Tagabe river on the east side and the La Colle river on the west side; both rivers are subject to flooding of 0.5–10 m around the airport based on a 10-year probability analysis of rainfall intensity. However, the risk of coastal inundation and tsunami for the airport is low as its altitude is 21.3 m.



Source: Vanuatu Meteorology and Geohazards Department

Figure 3.5 Risk Hazard Map for 100-year Probability

3.5.3 Cyclone Pam

Cyclone Pam, which struck Vanuatu from March 12 to 14, 2015, caused enormous damage. The cyclone was Category 5, with wind speeds of 250 km/h and peak storms of 320 km/h. It is estimated that 65,000 people lost their houses, 17,000 houses were destroyed, and the economic loss was 4.86 billion VT (USD 449,4 million). The cyclone also caused damage to the airport, which remained close for three days. The roofs of meteorological stations and fire departments were blown off by storms.

3.5.4 Earthquakes

Due to the Vanuatu Trench, which is located at the boundary between the Vanuatu Plate and the Australian Plate, and many volcanic islands, earthquakes frequently occur around Vanuatu.

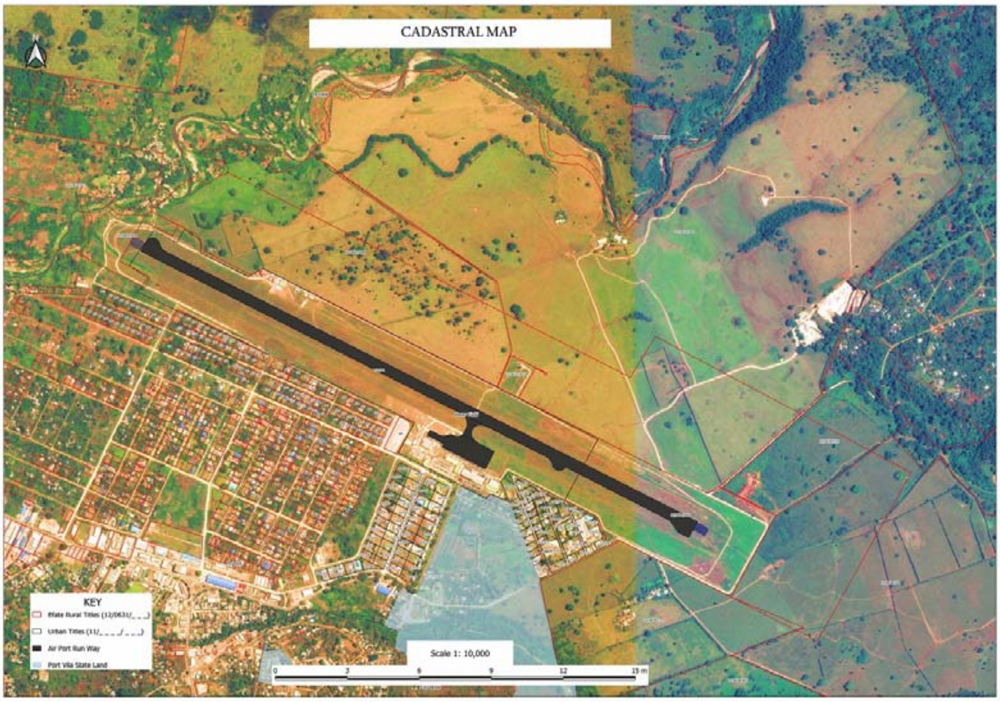
3.5.5 Topography and Geology

Bauerfield International Airport is located in a flat area about 5 km from Port Vila city and is surrounded by hills except the southwestern part of the airport. The altitude of the airport is 22 m. The Tagabe and La Colle rivers flow on the east and west side of the airport, respectively; therefore, it is assumed that the airport was the floodplain of these rivers. According to the MDRR report mentioned previously, the geology of Bauerfield International Airport is classified as “deep or soft soil” in the existing airport area and “shallow soil” in the north side of the airport. The WB's VAIP project conducted soil tests on the runway, and the roadbed strength is rated as CBR 6, which is a weak classification. Based on these information, the geology around the airport is considered to be relatively weak.

3.6 Land Use plan

(1) Airport Land Use Plan

The airport site is leased to AVL. The cadastral map around the airport is shown in Figure 3.6.



Source: Land Department

Figure 3.6 Land Ownership Surrounding Bauerfield International Airport

(2) Land Use around Airport

The southern part of the airport terminal area is considered as an industrial area, and there is a power plant that supplies electricity to Port Vila. An agriculture experimental station is located in the southeastern part of the terminal area and a residential area is located in the western part. A pump station that supplies water to Port Vila is located in the southeast of the terminal area. The area extending from the east side to the north side of the airport is used as a ranch. The La Colle river runs in the northwestern part of the airport. The Tagabe river flowing on the east side of the airport is the water source for Port Vila. There is also a limestone quarry in the northeastern part of the airport.

Photo 3.19 Airport Viewed from the Quarry

Photo 3.20 The Northeastern Part of Airport Viewed from the Control Tower

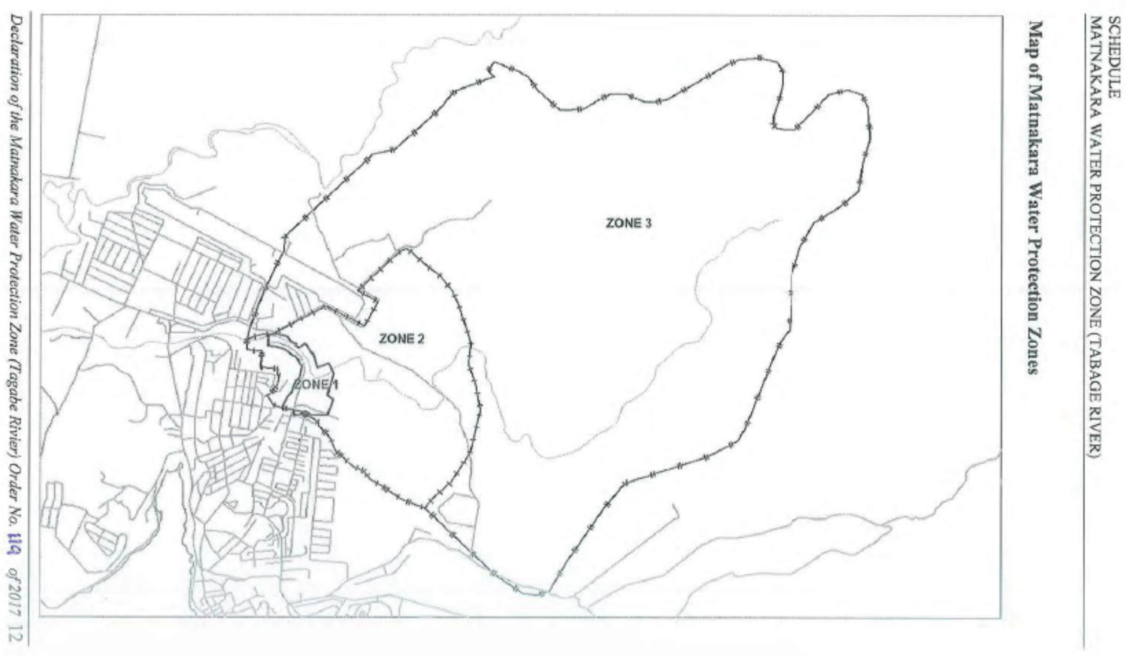
The current land use around the airport is shown in Figure 3.6.

Figure 3.7 Current Land Use Plan

The blue and green areas in Figure 3.6 are national land, and the green area is the airport site. All the other areas are private land and are classified by owners. The lower yellow area of the private land has been sold for residential use and is densely populated with houses. The red area is a private economic activity area. As mentioned, most of the area around the airport is already owned by the private sector, and it is already extremely difficult to acquire land on the south side (lower side) of the runway for airport expansion.

3.6.2 Water Source Protection Zone

The eastern side of the airport was designated as a water source protection zone by the Resource Management ACT [CAP281] Declaration of Matnakara Water Protection Zone (Tagabe River) Order No. 119 of 2017.



Source: Water Resource Management ACT [CAP281] Declaration of Matnakara Water Protection Zone (Tagabe River) Order No. 119 of 2017

Figure 3.8 Water Protection Zone Layout

This is the only water source that supplies water to Port Vila city. The protected area is divided into three zones: Zone 1 to Zone 3. The purpose and area of each zone are shown in Table 3.6.

Table 3.6 Definitions of Zones in the Water Protection Zone

Zone	Name	Purpose	Area
Zone 1	Tabu Area	To avoid local contamination of the supply sources	Around the identified perennially flowing section of the Tagabe river as far as the spring source, and around the well field and spring
Zone 2	Recharge Area	To limit the possibility of contamination of the resource by industrial, agricultural, and domestic waste.	Area of 1–2 km within the ground water recharge area
Zone 3	Water Catchment Area	To avoid contamination of the water resource	Where specific activities within the outer limits of the ground water catchment are allowed

The permitted and prohibited activities within each zone are shown in Appendix 2.

3.7 Construction Market

3.7.1 Labor Force

According to the interview survey of the local contractors, unskilled labor is available but it is difficult to employ skilled labor such as electricians, plumbers, and construction equipment operators. This situation is confirmed by a few Japanese construction companies that have experience in this region; they usually employ skilled laborers from the third-world countries such as Philippines and Vietnam. Recently, there are some contracts including a condition to employ a certain percentage of local labor (approximately 80% of total). The unit labor cost of unskilled labors is between VT 3,500 and VT 4,000 per day, but it is increasing year by year.

3.7.2 Construction Equipment

There is no company to rent out construction equipment. Local construction companies rent out their equipment, but the rental prices are relatively high and the number and type of equipment are limited. Hence, Japanese contractors used to mobilize their construction equipment from Japan for the past projects.

3.7.3 Construction Material

Previously, it was difficult to obtain good-quality aggregate locally, and aggregate was imported from overseas such as New Caledonia, Fiji, and Australia. However, at the time of the survey, local aggregate was available because land issue in the quarry was solved in January 2019. In general, Basalt, which is a high durable material and volcanic stone, is used for the pavement, and coral stone is used for concrete. Other major construction materials include cement, which is imported from New Zealand and Thailand, and steel.

3.7.4 Pavement Works

Due to the difficulties in procuring hot mixed asphalt in Vanuatu, most of the roads are paved by double chip seal with cold mixed asphalt. The durability of the pavement is low; there are pot holes in many places. This issue was considered as a national problem and a new policy to apply concrete pavement on the major road in the country appeared in “Vanuatu Public Roads Strategy August 2019.”

3.7.5 Transportation

A new container wharf was constructed in Lapetasi port by Japanese grant aid project. There is no quay crane but ship gear can be used to handle 40-feet container; therefore, there is no problem for sea transport.

3.7.6 Tax

It is not necessary to pay income tax and corporate tax in Vanuatu but only 15% VAT has to be paid. Since ODA project is exempted from tax, no tax is levied for the project implementation.

4 Air Traffic Demand Forecast

4.1 Basic Concept of Air Traffic Demand Forecast

The air traffic demand forecast by "Aviation Sector Strategy for Vanuatu, Draft Final Report (2017)," which is also referred to as "Vanuatu Airport Master Plans, Final Report (2018)" is based on the statistics till 2015. In this study, the team have collected statistics from 2010 till 2019 and historical GDP data as well as future GDP forecast data to update the future socio-economic frame to revise the air traffic demand forecast in every five year till 2040.

The basic concept of the air traffic demand forecast is described as follows:

i) Future passenger and cargo volume are correlated to the future GDP projection;

ii) The future GDP will be projected in consideration of:
- the historical trend of the GDP growth rate of Vanuatu for the last decade (2010 to 2018);
- the forecast of GDP growth rate of Vanuatu till 2039 estimated by IMF;
- the revised projection of GDP growth rate under the COVID-19 pandemic estimated by IMF; and
- the future growth rate of Australian GDP described by IMF as reference.

The numbers of passengers and cargo volumes have a close relationship with the economic situation and are heavily impacted by the economic activities in the same region or country. International Civil Aviation Organization (ICAO), Boeing, and many other organizations often provide air traffic forecasts using regression analysis with GDP as an explanatory variable. Therefore, in this report, the future passenger and cargo volume are forecasted by the correlation with the future GDP projection as many others do.

For the cargo handled at Bauerfield International Airport, no detail or reliable data and information about type of cargo, volume of each type of cargo, etc. are available from any source. Therefore, it is not possible to forecast commodity-wise. Hence, the forecast is carried out for the total aggregate amount.

4.2 Current Traffic

4.2.1 Air Passengers

According to the air traffic statistics from 2010 to 2019 obtained from AVL, the annual traffic volume at three major airports in Vanuatu in 2019 is as shown in Table 4.1.

Table.4.1 Traffic Volume at Three Major Airports in Vanuatu (2019)

	International	Domestic	Total
Bauerfield Int'l Airport	327,892	161,961	489,416
Pekoa Int'l Airport	7,842	107,892	115,734
Whitegrass Airport	0	54,870	54,870
Total	335,297	324,723	660,020

Source: AVL

As Table 4.2 shows, overall, traffic volume has declined because of Cyclone Pam in 2015, and has been showing a recovery trend since 2016. However, international flights at Pecoa Airport had recovered sharply in 2016, but declined from 2017 to 2019.

Table 4.2 Historical Changes in Passenger Numbers at Three Airports from 2010 to 2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bauerfield International										
Arrivals	113,185	111,167	125,490	131,914	133,864	114,566	116,961	132,956	147,449	163,154
Departures	113,623	114,134	124,648	132,127	133,324	112,844	116,866	135,035	147,223	164,301
Total International	226,808	225,301	250,138	264,041	267,188	227,410	233,827	267,991	294,672	327,455
Bauerfield Domestic										
Arrivals	61,735	60,062	66,262	65,807	63,796	59,860	64,473	73,179	78,730	82,930
Departures	59,160	57,571	63,519	63,667	60,742	63,287	62,306	69,687	77,017	79,031
Total Domestic	120,895	117,633	129,781	129,474	124,538	123,147	126,779	142,866	155,747	161,961
Total Bauerfield										
Total Arrival VLI	174,920	171,229	191,752	197,721	197,660	174,426	181,434	206,135	226,179	246,084
Total Departure VLI	172,783	171,705	188,167	195,794	194,066	176,131	179,172	204,722	224,240	243,332
Total VLI	347,703	342,934	379,919	393,515	391,726	350,557	360,606	410,857	450,419	489,416
Pekoa International										
Arrivals	2,759	2,801	2,606	3,619	4,254	4,846	5,825	5,144	3,975	3,993
Departures	3,482	1,560	4,213	4,782	5,775	4,254	7,041	6,438	5,112	3,849
Total International	6,241	4,361	6,819	8,401	10,029	9,100	12,866	11,582	9,087	7,842
Pekoa Domestic										
Arrivals	41,778	40,634	42,757	44,933	41,544	43,427	43,092	50,072	52,878	52,833
Departures	42,177	41,611	43,925	45,954	43,078	42,250	44,813	51,801	53,708	53,946
Total Domestic	84,354	83,222	87,850	91,908	86,156	84,500	89,626	103,602	107,416	107,892
Total Pekoa										
Total Arrival SON	44,537	43,435	45,363	48,552	45,798	48,273	48,917	55,216	56,853	56,826
Total Departure SON	45,659	43,171	48,138	50,736	48,853	46,504	51,854	58,239	58,820	57,795
Total SON	90,595	87,583	94,669	100,309	96,185	93,600	102,492	115,184	116,503	115,734
Whitegrass Domestic										
Arrivals	22,053	21,153	23,905	24,746	23,360	20,840	20,631	24,900	26,452	27,388
Departures	21,657	21,213	23,725	24,449	22,957	21,079	20,286	24,419	26,196	27,482
Total TAH	43,710	42,366	47,630	49,195	46,317	41,919	40,917	49,319	52,648	54,870
Total VLI+SON+TAH										
Total Domestic	248,959	243,221	265,261	270,577	257,011	249,566	257,322	295,787	315,811	324,723
Total International	233,049	229,662	256,957	272,442	277,217	236,510	246,693	279,573	303,759	335,297
Total Pax Movements	482,008	472,883	522,218	543,019	534,228	486,076	504,015	575,360	619,570	660,020

Source: AVL

Table 4.3 Changes in the Number of Passengers at Three Airports from 2011 to 2019 (Ratio)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bauerfield International										
Arrivals	0.5%	-1.8%	12.9%	5.1%	1.5%	-14.4%	2.1%	13.7%	10.9%	10.7%
Departures	-0.1%	0.4%	9.2%	6.0%	0.9%	-15.4%	3.6%	15.5%	9.0%	11.6%
Total International	-2.9%	-0.7%	11.0%	5.6%	1.2%	-14.9%	2.8%	14.6%	10.0%	11.1%
Bauerfield Domestic										
Arrivals	10.8%	-2.7%	10.3%	-0.7%	-3.1%	-6.2%	7.7%	13.5%	7.6%	5.3%
Departures	6.6%	-2.7%	10.3%	0.2%	-4.6%	4.2%	-1.6%	11.8%	10.5%	2.6%
Total Domestic	8.7%	-2.7%	10.3%	-0.2%	-3.8%	-1.1%	2.9%	12.7%	9.0%	4.0%
Total Bauerfield										
Total Arrival VLI	3.9%	-2.1%	12.0%	3.1%	0.0%	-11.8%	4.0%	13.6%	9.7%	8.8%
Total Departure VLI	2.1%	-0.6%	9.6%	4.1%	-0.9%	-9.2%	1.7%	14.3%	9.5%	8.5%
Total VLI	0.9%	-1.4%	10.8%	3.6%	-0.5%	-10.5%	2.9%	13.9%	9.6%	8.7%
Pekoa International										
Arrivals	-17.3%	1.5%	-7.0%	38.9%	17.5%	13.9%	20.2%	-11.7%	-22.7%	0.5%
Departures	92.7%	-55.2%	170.1%	13.5%	20.8%	-26.3%	65.5%	-8.6%	-20.6%	-24.7%
Total International	-26.9%	-30.1%	56.4%	23.2%	19.4%	-9.3%	41.4%	-10.0%	-21.5%	-13.7%
Pekoa Domestic										
Arrivals	22.9%	-2.7%	5.2%	5.1%	-7.5%	4.5%	-0.8%	16.2%	5.6%	-0.1%
Departures	21.9%	-1.3%	5.6%	4.6%	-6.3%	-1.9%	6.1%	15.6%	3.7%	0.4%
Total Domestic	22.9%	-1.3%	5.6%	4.6%	-6.3%	-1.9%	6.1%	15.6%	3.7%	0.4%
Total Pekoa										
Total Arrival SON	19.3%	-2.5%	4.4%	7.0%	-5.7%	5.4%	1.3%	12.9%	3.0%	0.0%
Total Departure SON	25.4%	-5.4%	11.5%	5.4%	-3.7%	-4.8%	11.5%	12.3%	1.0%	-1.7%
Total SON	17.4%	-3.3%	8.1%	6.0%	-4.1%	-2.7%	9.5%	12.4%	1.1%	-0.7%
Whitegrass Domestic										
Arrivals	0.0%	-4.1%	13.0%	3.5%	-5.6%	-10.8%	-1.0%	20.7%	6.2%	3.5%
Departures	2.8%	-2.1%	11.8%	3.1%	-6.1%	-8.2%	-3.8%	20.4%	7.3%	4.9%
Total TAH	1.4%	-3.1%	12.4%	3.3%	-5.9%	-9.5%	-2.4%	20.5%	6.7%	4.2%
Total VLI+SON+TAH										
Total Domestic	38.4%	-2.3%	9.1%	2.0%	-5.0%	-2.9%	3.1%	14.9%	6.8%	2.8%
Total International	-3.7%	-1.5%	11.9%	6.0%	1.8%	-14.7%	4.3%	13.3%	8.7%	10.4%
Total Pax Movements	14.2%	-1.9%	10.4%	4.0%	-1.6%	-9.0%	3.7%	14.2%	7.7%	6.5%

Source: AVL

4.2.2 Air Cargo

Table 4.4 shows the volume of air cargo handled at Bauerfield International Airport from 2016 to 2019. The statistical data before 2015 were lost due to the damage caused by Cyclone Pam in 2015 and could not be restored. In addition, statistical data for each airline were obtained separately by AVL; however, they were not used due to abnormal values found in the numerical data.

Table 4.4 Air Cargo at Bauerfield International Airport (2016–2019)

Unit: kg

Country	2016			2017			2018			2019		
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total
Australia	515,460	72,717	588,177	553,913	65,832	619,745	512,749	48,271	561,020	472,488	43,927	516,415
Brazil	11	253	264	368		368	46		46			0
Congo	70		70			0			0	378		378
Fiji	41,403	6,324	47,727	35,173	9,148	44,321	40,329	6,337	46,666	49,749	12,359	62,108
France		86	86	9		9		23	23	139		139
French Polynesia	941	178	1,119	134		134	7		7	162		162
Georgia			0			0	368		368	1,484		1,484
Germany		850	850			0			0	349		349
Hong Kong	1,834	107	1,941	2,142	39	2,181	2,728	127	2,855	1,060	783	1,843
India	192		192			0	115		115	585		585
Indonesia	33		33			0	3		3	276		276
Japan	3,148	252	3,400	1,066	291	1,357	815		815	7		7
Kiribati			0			0		17,664	17,664	31	900	931
Malaysia	153	288	441			0			0			0
Mauritius	373		373			0			0			0
New Caledonia	43,332	25,233	68,565	48,203	38,866	87,069	50,555	50,962	101,517	35,879	90,661	126,540
New Zealand	215,663	80,657	296,320	205,791	58,274	264,065	216,125	58,286	274,411	192,328	48,275	240,603
PNG	8,023	263	8,286	24,645	2,849	27,494	15,299	447	15,746	7,075	1,976	9,051
Russia			0			0	168		168	283		283
Saint Vincent & Grenadines			0			0			0	21		21
Samoa			0			0		215	215	270	388	658
Saudi Arabia	130		130			0			0			0
Singapore	328	504	832	442		442	382		382	6,837	144	6,981
Solomon Island	3,531	6,823	10,354	2,123	8,617	10,740	2,879	9,873	12,752	3,841	21,369	25,210
South Africa	536		536	32		32			0			0
Thailand		9	9			0			0			0
UK			0			0		44	44			0
USA	175	5,506	5,681	482	15,509	15,991	1,677	17,742	19,419	930	25,260	26,190
Vanuatu			0		85	85	575		575			0
Total	835,336	200,050	1,035,386	874,523	199,510	1,074,033	844,820	209,991	1,054,811	774,172	246,042	1,020,214

Source: VTS

4.3 Socio-Economic Framework

4.3.1 Estimation of the Future GDP

The Ministry of Finance and Economic Management (MFEM) reported the average GDP growth rate of Vanuatu from 2011/12 to 2019/20 as 7.6% in the Half Year Economic and Fiscal Update (HYEFR, July 31, 2019). In addition, it announced the forecasts for 2019 and 2020 as 3.4% and 4.0%, respectively.

Regarding the long-term GDP forecast, the National Sustainable Development Plan 2016-2030 Monitoring and Evaluation Framework sets a target of GDP growth rate of 4.0% for 2030 (Pillar 3 Economy: ECO 1.1.2). No long-term forecast values or plan values were issued after that the national authorities.

Table 4.5 GDP Growth Rate of Vanuatu Described in HYEFR (2006/07-2012/13)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2030
Growth Rate	1.8	2.0	2.3	0.2	3.5	4.4	2.8	3.4	4.0	4.0

Source: HYEFR (HALF-YEAR ECONOMIC AND FISCAL UPDATE), 2019.07.31, Figure 2030 is from NSDP M&E Framework

As an indicator of the long-term economic prospects of international organizations, the IMF has published long-term GDP projections for up to 2039 in the Article IV consultation report of the Country Report of Vanuatu as shown in Table 4.6. In the report, the IMF indicated a GDP growth rate of 2.3% for 2008–2018 as the economic growth rate for the past 10 years and 2.8% for the next 10 years (2019–2029).

Table 4.6 Vanuatu External Debt Sustainable Framework Baseline Scenario 2016-2039

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2029	2039
Real GDP	3.5	4.4	3.2	3.4	3.0	2.8	2.8	2.9	2.9	2.6	2.6
Nominal GDP (mil $)	798	880	928	947	998	1,051	1,109	1,170	1,236	1,598	2,675
Nominal Growth	3.1	10.3	5.4	2.1	5.4	5.3	5.5	5.6	5.6	5.3	5.3

Source: IMF Country Report No. 19/162

4.3.2 Changes in the Number of Tourists and Future Plans

The tourism-related industry is a key industry in Vanuatu and is a very important field for estimating future GDP. The Vanuatu Tourism Marketing Plan 2030 by the Vanuatu Tourism Office (VTO), Ministry of Tourism, has set a target of 300,000 tourists in 2030. This value is relatively well known among the public organizations. Table 4.7 shows the tourism market projections described in the Vanuatu Tourism Marketing Plan 2030.

Table 4.7 Vanuatu Tourism Market Projection

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Arrival	119,519	134,739	144,923	154,508	166,391	186,028	205,765	225,302	244,439	263,776	283,513	303,650
Growth	9.67%	12.73%	7.56%	6.61%	7.69%	11.80%	10.61%	9.49%	8.49%	7.91%	7.48%	7.10%

Source: Vanuatu Tourism Marketing Plan 2030, World Travel & Tourism Council

The market development is projected in the Vanuatu Tourism Marketing Plan 2030.

Table 4.8 Market Projection

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total												
Arrival	119,519	134,739	144,923	154,508	166,391	186,028	205,765	225,302	244,439	263,776	283,513	303,650
Growth	9.67%	12.73%	7.56%	6.61%	7.69%	11.80%	10.61%	9.49%	8.49%	7.91%	7.48%	7.10%
Short Haul Markets												
Arrival	105,670	110,192	114,714	119,236	124,091	132,435	140,779	149,123	157,468	165,812	174,156	182,500
Growth	9.51%	7.73%	4.13%	3.96%	3.81%	6.60%	6.20%	5.83%	5.51%	5.22%	4.97%	4.73%
Australia Markets												
Arrival	74,416	76,979	79,541	82,104	85,000	90,714	96,429	102,143	107,857	113,571	119,286	125,000
Growth	n.a.	3.44%	3.33%	3.22%	3.53%	6.72%	6.30%	5.93%	5.59%	5.30%	5.03%	4.79%
NZ Markets												
Arrival	13,869	15,186	16,503	17,820	19,136	21,045	22,955	24,864	26,773	28,682	30,591	32,500
Growth	n.a.	9.49%	8.67%	7.98%	7.38%	9.97%	9.08%	8.32%	7.68%	7.13%	6.66%	6.24%
New Caledonia Markets												
Arrival	17,385	18,027	18,670	19,312	19,955	20,675	21,396	22,117	22,838	23,558	24,279	25,000
Growth	n.a.	3.6%	3.57%	3.44%	3.33%	3.61%	3.49%	3.37%	3.26%	3.15%	3.06%	2.97%
Long Haul Markets												
Arrival	17,849	20,214	21,876	23,939	25,300	31,214	37,229	43,043	48,457	54,071	60,086	66,500
Growth	10.54%	13.25%	8.23%	9.43%	5.69%	23.38%	19.27%	15.62%	12.58%	11.59%	11.12%	10.68%
Europe Markets												
Arrival	7,534	7,901	8,267	8,634	9,000	9,857	10,714	11,571	12,429	13,286	14,143	15,000
Growth	n.a.	4.87%	4.63%	4.44%	4.24%	9.52%	8.69%	7.99%	7.42%	6.90%	6.45%	6.06%
North America Markets												
Arrival	3,500	3,600	3,600	4,000	4,300	5,000	5,800	6,400	6,600	7,000	7,800	9,000
Growth	n.a.	2.86%	0%	11.1%	7.50%	16.3%	16.0%	10.34%	3.13%	6.06%	11.4%	15.4%
China and Hong Kong Markets												
Arrival	5,739	7,406	8,471	9,536	10,000	12,857	15,714	18,571	21,429	24,286	27,143	30,000
Growth	n.a.	29.0%	14.4%	12.6%	4.87%	28.6%	22.2%	18.2%	15.4%	13.3%	12.9%	10.5%
Japan Markets												
Arrival	1,076	1,307	1,538	1,769	2,000	3,500	5,000	6,500	8,000	9,500	11,000	12,500
Growth	n.a.	21.4%	17.7%	15.0%	13.1%	75.0%	42.9%	30.0%	23.1%	18.8%	15.8%	13.6%

Source: Vanuatu Tourism Marketing Plan 2030, World Travel & Tourism Council

Meanwhile, the WB is conducting tourism analysis of the South Pacific in the “Improving Tourism Competitiveness for a Pacific Possible” project as a joint project with multi-donor organizations such as the EU in the “Competitive Industries and Innovation Program (CIIP).” The Tourism Investment Needs and Assessment Plan 2020-2030 is a tourism plan with the target year 2030 by CIIP and the Vanuatu Department of Tourism (DOT), with the two cases as “business-as-usual” and “best-case scenario,” in which investment in the strategic areas is an extension of the current status. Both cases are the planned values up to 2030, and there are no longer-term planned values after that.

Tourism Investment Needs Assessment and Plan (2020-2030) has developed two different forecast scenarios to distinguish between potential demand outcomes with and without strategic public investments in the tourism sector. The scenarios are:

- ✓ **Business-as-usual:** the expected future of evolution of tourism demand based on recent trends, changes in the external factors shaping tourism activity (e.g., growth in key Vanuatu's tourism source markets), and the potential impact of any existing tourism marketing, policy, and investment initiatives already under way;
- ✓ **Best case:** the future demand that could materialize if Vanuatu could, through a set of strategic and coordinated investments, relieve key constraints to tourism growth, enhance the attractiveness of its tourism destinations, and elicit a strong complementary private sector investment response.

Table 4.9 shows the forecast results of International visitor by two scenarios.

Table 4.9 International Visitor Forecasts by Market Segment

Year	2019	2024	2030
Business-as-usual scenario			
Forecast (by Air)	115,634	159,441	197,858
CAGR (%)	n.a.	5.5%	3.7%
Forecast (by Cruise)	176,470	173,042	221,871
CAGR (%)	n.a.	-0.3%	4.2%
Best case scenario			
Forecast (by Air)	115,634	191,213	253,206
CAGR (%)	n.a.	8.7%	4.8%
Forecast (by Cruise)	176,470	226,483	320,426
CAGR (%)	n.a.	4.2%	6.0%

Source: Vanuatu Tourism Investment Plan

Vanuatu is heavily affected by natural disasters such as Cyclone Pam as a good example, and it is difficult to predict future GDP demand, because the industrial structure is highly dependent on tourism, which is hugely affected by the natural disasters.

4.3.3 Revised GDP Projection under the COVID-19 Pandemic

The IMF issued revised World Economic Outlook in April 2020 with the subtitle The Great Lockdown. It describes the world economy as: "There is extreme uncertainty around the global growth forecast. As a result of the pandemic, the global economy is projected to contract sharply by minus 3% in 2020, much worse than during the 2008–09 financial crisis." As the baseline scenario in the report, it assumes that the pandemic fades in the second half of 2020 and containment efforts can be gradually unwound, the global economy is projected to grow by 5.8% in 2021 as economic activities normalize, helped by policy support. The report also made analysis and forecast of economy in each country including Vanuatu. Table 4.10 shows the revised projection of GDP growth rate of Vanuatu with the minus 3.3% growth in 2020 and 4.9% growth in 2021 instead of the previous growth rate of 3.0% in 2020.

Table 4.10 Revised Projections of GDP Growth Rate in Vanuatu by IMF

Unit: %

Year	Ave. 02-11	2012	2013	2014	2015	2016	2017	2018	2019	2020		2021
Real GDP	3.4	1.8	2.0	2.3	0.2	3.5	4.4	2.8	2.9	△3.3		4.9

Source: IMF World Economic Outlook - The Great Lockdown, April 2020

Considering these facts, the estimation of future GDP up to 2040 in this study was basically calculated as shown in Table 4.11.

Table 4.11 Projections of GDP Growth Rate in Vanuatu

Unit: %

Year	2016	2017	2018	2019	2020	2021	2025	2030	2035	2040
Real GDP	3.5	4.4	2.8	2.9	△3.3	4.9	2.8	2.6	2.6	2.6

Source: JICA Study Team

4.4 Air Traffic Demand Forecast

4.4.1 Air Passengers

In estimating future air traffic demand, the statistics bureau has a breakdown of the number of passengers (Vanuatu and foreign); so for the Vanuatu citizens, estimation shall be based on the projected value of future GDP of Vanuatu, while the estimation for the foreigners shall be analyzed by the correlation between the GDP of Australia, which accounted for the largest percentage of the tourists, and the GDP of New Zealand that accounted for the second largest.

Table 4.12 Foreign Passenger Ratio of International Passengers

	Arrival					Departure				
	Resident		Visitor		Total	Resident		Visitor		Total
2010	21,053	*17.8%*	97,180	*82.2%*	118,233	13,321	*11.1%*	106,572	*88.9%*	119,893
2011	22,273	*19.2%*	93,960	*80.8%*	116,233	13,114	*11.7%*	98,790	*88.3%*	111,904
2012	22,958	*17.5%*	108,161	*82.5%*	131,119	14,937	*11.5%*	115,497	*88.5%*	130,434
2013	25,611	*18.9%*	110,109	*81.1%*	135,720	16,544	*11.9%*	122,249	*88.1%*	138,793
2014	25,884	*19.2%*	108,808	*80.8%*	134,692	19,080	*13.6%*	120,767	*86.4%*	139,847
2015	26,962	*23.1%*	89,952	*76.9%*	116,914	19,277	*16.4%*	98,331	*83.6%*	117,608
2016	25,160	*20.9%*	95,117	*79.1%*	120,277	20,283	*17.5%*	95,470	*82.5%*	115,753
2017	28,248	*20.6%*	109,170	*79.4%*	137,418	26,286	*19.0%*	112,258	*81.0%*	138,544
2018	28,936	*20.0%*	115,634	*80.0%*	144,570	28,391	*18.6%*	124,576	*81.4%*	152,967

Source：VSNO/Department of Customs

Table 4.12 shows the results of a correlation analysis of GDP and Vanuatu and foreign travelers in the number of international flights from 2010 to 2018. As for foreign tourists, the value of 2015 has dropped sharply due to the impact of Cyclone Pam, and it has been found that it is not useful for the study. For this reason, the analysis was performed using figures from 2010 to 2014 (Table 4.13).

Table 4.13 Results of Correlation Analysis of International Passenger Numbers (2010–2018) with GDP

Correlation analysis between Visitor (foreigner) and GDP			
	Australia's GDP	NZ's GDP	Vanuatu's GDP
Arrival	0.389628	0.331479	0.22195
Departure	0.216884	0.144614	-0.018382
Correlation analysis between Resident (Vanuatu citizen) and GDP			
Arrival	0.934948	0.902016	0.876824
Departure	0.958886	0.964469	0.985936
Correlation analysis between Visitor + Resident and GDP			
Arrival	0.571978	0.513735	0.432655
Departure	0.543604	0.487991	0.35507

Source: JICA Study Team

Table 4.14 Results of Correlation Analysis of International Passenger Numbers (2010–2014) with GDP

Correlation analysis between Visitor (foreigner) and GDP			
	Australia's GDP	NZ's GDP	Vanuatu's GDP
Arrival	0.86438	0.820034	0.814475
Departure	0.845634	0.825323	0.829577
Correlation analysis between Resident (Vanuatu citizen) and GDP			
Arrival	0.958249	0.958463	0.964435
Departure	0.944847	0.975621	0.981005
Correlation analysis between Visitor + Resident and GDP			
Arrival	0.915821	0.88009	0.876966
Departure	0.88693	0.876572	0.881163

Source: JICA Study Team

The analysis shows that domestic tourists have a slightly stronger correlation with Vanuatu's GDP, and foreign tourists have a slightly stronger correlation with Australia's GDP; however, the difference in the results of correlation is very small, indicating a higher correlation with GDP in almost all three countries.

Next, although there is no breakdown of passengers by nationality for international and domestic flights, as mentioned previously, the number of passengers by international and domestic flights at the three major airports is known. Hence, the correlation analysis for the GDP of Vanuatu, Australia, and New Zealand and the number of passengers for each was performed (Table 4.14).

Table 4.15 Results of Correlation Analysis of International Passengers

	GDP from 2010 to 2019			GDP from 2010 to 2013			GDP from 2015 to 2019		
	Vanuatu	Australia	NZ	Vanuatu	Australia	NZ	Vanuatu	Australia	NZ
VLI all	0.597	0.527	0.449	0.938	0.935	0.938	0.959	0.980	0.969
VLI Int'l	0.480	0.421	0.326	0.962	0.948	0.957	0.956	0.975	0.965
VLI Dom	0.767	0.680	0.663	0.818	0.844	0.829	0.963	0.984	0.971
SON all	0.903	0.819	0.823	0.897	0.855	0.879	0.999	0.916	0.918
SON Int'l	0.894	0.913	0.911	0.758	0.705	0.734	0.587	-0.459	-0.411
SON Dom	0.790	0.672	0.678	0.939	0.902	0.924	0.983	0.954	0.946
TAH Dom	0.212	0.124	0.042	0.902	0.897	0.900	0.850	0.946	0.927
Total all	0.668	0.589	0.526	0.933	0.922	0.929	0.968	0.986	0.976
Total Dom	0.710	0.605	0.583	0.892	0.891	0.891	0.959	0.977	0.964
Total Int'l	0.571	0.520	0.430	0.953	0.936	0.946	0.977	0.981	0.974

Source: JICA Study Team

Based on the analysis results, the domestic flights of Whitegrass Airport for the tour of Tanna Island, which is very popular with international and foreign tourists at Bauerfield International Airport, have strong correlations with GDP of Vanuatu, Australia, and New Zealand from results of analysis in 2010–2013 and 2015–2019, excluding special factors due to Cyclone Pam in 2015. As mentioned, the international flights at Pecoa Airport have had a sharp recovery in 2016 and have been declining since 2017, with negative correlation coefficients from the analysis results for 2016–2019.

4.4.2 Aviation Demand Forecast

As for the correlation between passenger numbers and GDP, the correlations between Vanuatu's GDP, Australia's GDP, and New Zealand's GDP are extremely high, approximating 0.98, 0.98, 0.97 for international flights and 0.96, 0.98, 0.96 for domestic flights, respectively. Regarding future GDP forecasts, the IMF has published forecasts for Vanuatu's GDP up to 2039 but only up to 2024 for Australia and NZ. Considering the above, this study will use the estimated value of Vanuatu's GDP for both international and domestic flights.

Table 4.16 shows historical changes in the GDP value of Vanuatu and the number of international and domestic passengers.

Table 4.16 Real GDP and Number of Passengers at Bauerfield Int'l Airport

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Real GDP	57,144	57,843	58,858	60,017	61,400	61,500	63,635	66,443	68,304	70,284
Domestic	120,895	117,633	129,781	129,474	124,538	123,147	126,779	142,866	155,747	161,961
International	226,808	225,301	250,138	264,041	267,188	227,410	233,827	267,991	294,672	327,455

Source: JICA Study Team

The results of forecasting the number of international and domestic passengers using the regression equation are shown in Figure 4.1 and Table 4.17.

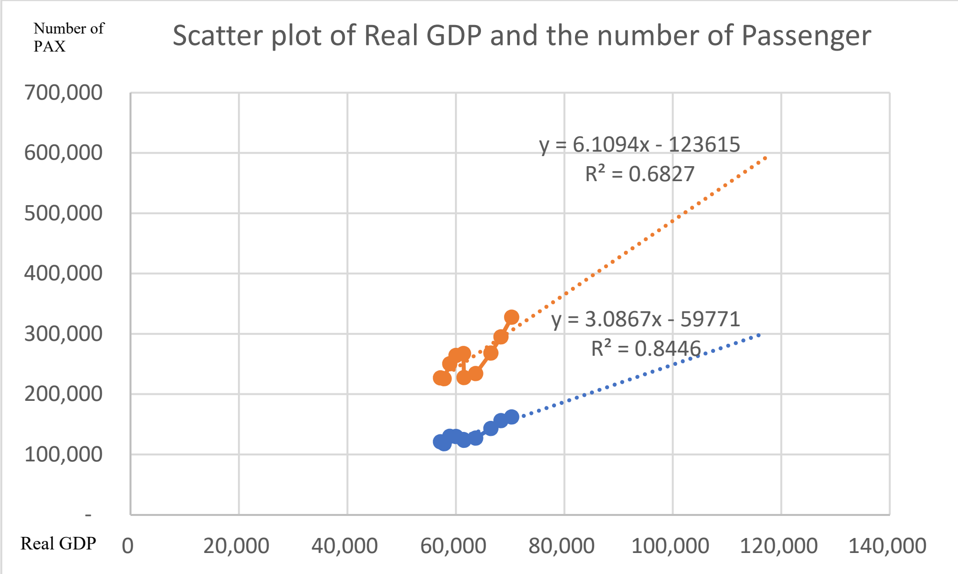


Figure 4.1 Scatter Plot of Real GDP and Number of Passengers

The estimated number of international and domestic passengers based on regression analysis is shown in Table 4.17.

Table 4.17 Real GDP and Number of Passengers at Bauerfield Int'l Airport

Year	2018	2019	2020	2021	2025	2030	2035	2040
Real GDP	68,304	70,284	67,965	71,295	79,622	90,525	102,922	117,016
Domestic	155,747	161,961	**150,017**	**160,296**	**185,998**	**219,654**	**257,917**	**301,421**
International	294,672	327,455	**291,611**	**311,957**	**362,828**	**429,441**	**505,175**	**591,280**

Source: JICA Study Team

For the reference purpose, we calculated the estimated number of international and domestic passengers based on the GDP growth rate of Vanuatu (Table 4.16).

The estimated number of international passengers in 2020 is declining despite GDP growth (Table 4.17); therefore, the numbers were revised based on the above GDP growth rate estimation. Table 4.18 shows the revised international and domestic passenger numbers.

Table 4.18 Estimated Number of Passenger at Bauerfield Int'l Airport

Year	2016	2017	2018	2019	2020	2021	2025	2030	2035	2040
GDP Growth	3.50%	4.40%	2.80%	2.90%	△3.3%	4.9%	2.80%	2.60%	2.60%	2.60%
Domestic	126,779	142,866	155,747	161,961	**156,616**	**164,290**	**183,478**	**208,604**	**237,169**	**269,647**
International	233,827	267,991	294,672	327,455	**316,659**	**332,165**	**370,959**	**421,758**	**479,512**	**545,176**

Source: JICA Study Team

Figure 4.2 shows the result of the passenger air traffic demand forecast. As compared to the actual number of annual passengers in 2019, the total number of passengers will be 1.3 times more and 1.7 times more in 2030 and 2040.

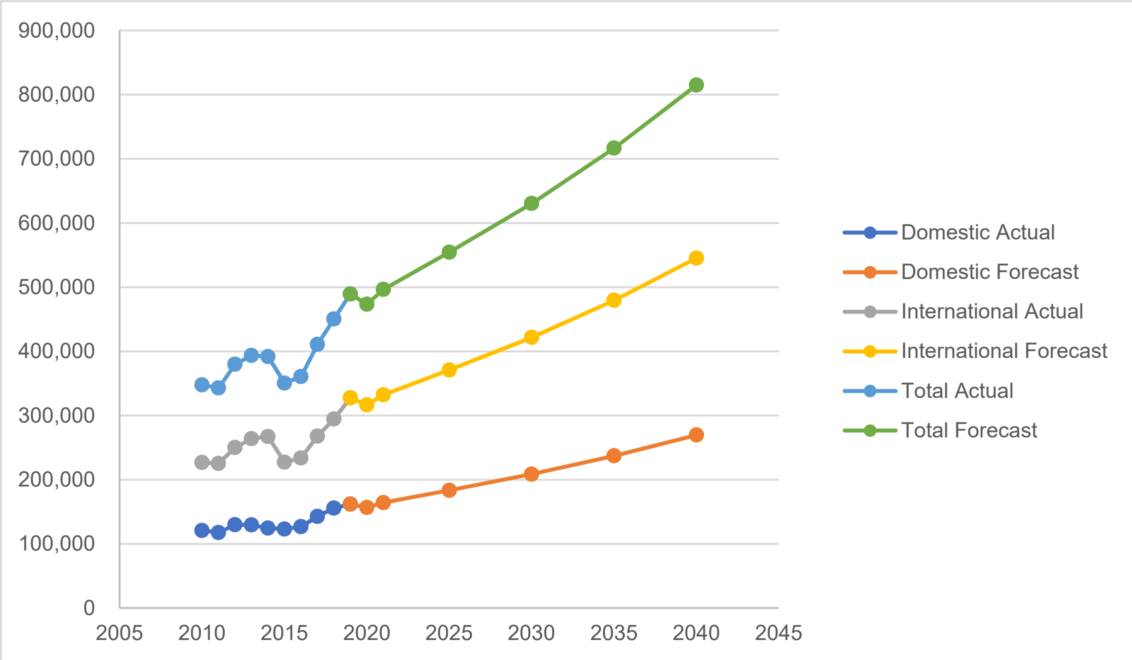


Figure 4.2 Annual Air Passenger Demand Forecast

4.4.3 Air Freight

As mentioned previously, statistical data on air cargo volume are available for Bauerfield International Airport since 2016. Future cargo volume is estimated by assuming an income elasticity to GDP of 1.0, at the same growth rate as GDP. Table 4.20 shows the present and future forecast of the cargo handling volume at Bauerfield International Airport.

Table 4.19 Estimated Cargo Volume at Bauerfield Int'l Airport

Year	2016	2017	2018	2019	2020	2025	2030	2035	2040
GDP Growth	3.50%	4.40%	3.20%	3.40%	3.00%	2.80%	2.60%	2.60%	2.60%
Cargo Total	1,035,386	1,074,033	1,054,811	1,020,214	1,050,820	1,206,408	1,371,611	1,559,436	1,772,983
Cargo Import	835,336	874,523	844,820	774,172	797,397	915,462	1,040,823	1,183,352	1,345,398
Cargo Export	200,050	199,510	209,991	246,042	253,423	246,424	239,557	239,557	239,557

Source: JICA Study Team

4.4.4 Busy Day and Busy Hour Passengers

The following formula is used to calculate the busy day and busy hour passengers from the annual passengers.

(Busy day passengers) = (Annual passengers) x (Busy day ratio)

(Busy hour passengers) = (Busy day passengers) x (Busy hour ratio)

The definition of busy day and busy hour by IATA is applied. IATA defines the design day, or busy day, as the second busiest day in an average week during the peak month. To determine the average week, the monthly passengers or movements are divided by the number or weeks in the peak month or the number of days of the month multiplied by 7. The seven-day period (Monday through Sunday) that is closest to an average week is selected and the second busiest day of the week during that period is identified. Finally, the hourly profile for the second busiest day is then analyzed to determine the peak hour.

The future annual, busy day, and busy hour passengers are summarized in Table 4.20. Detailed calculation is shown in Appendix 3.

Table 4.20 Summary of Passenger Traffic Forecast

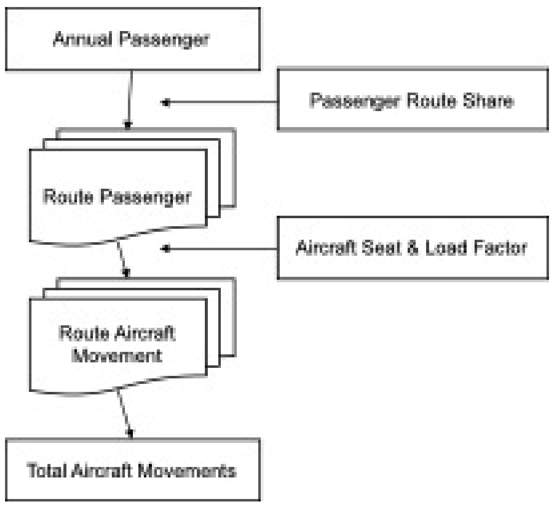
	2019 (Actual)	2025	2030	2035	2040
Annual International Passengers	327,455	370,959	421,758	479,512	545,176
Busy Day International Passengers	1,313	1,788	2,033	2,312	2,628
Busy Hour International Passengers	379	523	594	676	768
Annual Domestic Passengers	161,961	183,478	208,604	237,169	269,647
Busy Day Domestic Passengers	624	691	786	894	1,016
Busy Hour Domestic Passengers	128	151	172	196	222
Annual Total Passengers	489,416	554,437	630,362	716,681	814,823
Busy Day Total Passengers	1,886	2,351	2,673	3,039	3,456
Busy Hour Total Passengers	389	550	625	711	808

Source: JICA Study Team

4.4.5 Aircraft Movement Forecasts

(1) International Annual Aircraft Movement Forecast

International aircraft movement is estimated from the forecasted annual passengers. Route passengers is estimated from the past trend of passenger route share. The route aircraft movement is estimated by dividing route passengers by aircraft seat capacity. The total aircraft movement by aircraft type is sum of the route aircraft movements. The calculation flow of international aircraft movement is shown in Figure 4.3.



Source: JICA Study Team

Figure 4.3 Calculation Flow of International Aircraft Movement

Table 4.21 shows total annual aircraft movements in the future. Detailed calculation is shown in Appendix 4.

Table 4.21 Annual Aircraft Movements of International Flights

	2025	2030	2035	2040
A330	223	254	289	328
A220	2,724	3,097	3,521	4,003
B737-800	552	627	713	811
A320	33	37	42	48
ATR72	966	1,098	1,249	1,420
Total	4,274	4,859	5,525	6,281

Source: JICA Study Team

(2) International Busy Day Aircraft Movements

The busy day aircraft movements were calculated by applying the following formula.

(Busy day aircraft movements) = (Annual aircraft movements) x (Busy day factor)

Peak day and peak hour for international aircraft movements were calculated by the same method of IATA definition from the statistics provided by AVL from 2015 to 2019.

Table 4.22 Busy Day Factor for International Aircraft Movements

Year	Annual Movements	Peak Month	Monthly Movements	2nd Busiest Day	Busy Day Movements	Busy Day Factor	
2015	3,150	July	365	2015/7/10	15	0.0048	(1/210)
2016	3,016	July	310	2016/7/13	14	0.0046	(1/215)
2017	3,310	December	335	2017/12/27	13	0.0039	(1/255)
2018	3,490	July	323	2018/7/2	14	0.0040	(1/249)
2019	3,939	July	372	2019/7/22	14	0.0036	(1/281)

Source: JICA Study Team

The average of busy day factor for last five years, which is 0.0042 (=1/238), was applied to calculate daily aircraft movements as shown in Table 4.23.

Table 4.23 Daily International Aircraft Movement Forecast

	2025	2030	2035	2040
A330	1	1	1	1
A220	11	13	15	17
B737-800	2	3	3	3
ATR72	4	5	5	6
Total	17	21	23	26

Source: JICA Study Team

(3) International Busy Hour Aircraft Movements

The busy hour aircraft movement was calculated by the following formula.

(Busy Hour Aircraft Movement) = (Daily Aircraft Movement) x (Busy Hour Factor)

The busy hour factor was calculated based on the IATA definition, which is hourly profile of the second busiest day during the average week of peak month.

Table 4.24 Busy Hour Factor for International Aircraft Movements

Year	Annual Movements	Busy Day Movements	Busy Hour Movements	Busy Hour Factor (H/Year)	Busy Hour Factor (H/Day)
2015	3,150	15	3	0.0010	0.2000
2016	3,016	14	3	0.0010	0.2143
2017	3,310	13	3	0.0009	0.2308
2018	3,490	14	7	0.0020	0.5000
2019	3,939	14	4	0.0010	0.2857

Source: JICA Study Team

The average busy hour factor of last five years, which is 0.2862, versus daily movements was selected to calculate future busy hour traffic.

Table 4.25 Busy Hour International Aircraft Movement Forecast

	2025	2030	2035	2040
A220	4	4	5	5
B737-800	1	1	1	1
ATR72	2	2	2	2
Total	7	7	8	8

Source: JICA Study Team

(4) Domestic Aircraft Movement Forecast

Domestic aircraft movement is calculated from annual passengers and share of aircraft type in the domestic routes. Future aircraft movements were calculated by applying the aircraft share to the annual domestic passengers and dividing by the number of seats. The future load factor of 70% is assumed for the calculation. Table 4.26 shows annual aircraft movements of each aircraft type. Detailed calculation is shown in Appendix 5.

Table 4.26 Annual Domestic Aircraft Movement Forecast

	2025	2030	2035	2040
B737	179	203	231	263
ATR-72	2,467	2,805	3,189	3,626
DHC-6	2,949	3,353	3,812	4,334
BN-2	1,747	1,987	2,259	2,568
Total	7,163	8,144	9,259	10,527

Source: JICA Study Team

(5) Domestic Busy Day Aircraft Movements

The busy day aircraft movements were calculated by applying the following formula.

(Busy day aircraft movements) = (Annual aircraft movements) x (Busy day factor)

As same as international aircraft movement, peak day domestic aircraft movements were calculated from the statistics provided by AVL from 2016 to 2019.

Table 4.27 Busy Day Factor for Domestic Aircraft Movements

Year	Annual Movements	Peak Month	Monthly Movements	2nd Busiest Day	Busy Day Movements	Busy Day Factor	
2015	5,665	January	639	2015/1/28	21	0.0037	(1/270)
2016	5,989	December	742	2016/12/28	28	0.0047	(1/214)
2017	6,005	December	665	2017/12/27	26	0.0043	(1/231)
2018	6,650	December	710	2018/12/28	26	0.0039	(1/256)
2019	6,905	August	719	2019/8/16	30	0.0043	(1/230)

Source: JICA Study Team

The average of busy day factor for last five years, which is 0.0042 (=1/238), was applied to calculate daily aircraft movements.

Table 4.28 Daily Domestic Aircraft Movement Forecast

	2025	2030	2035	2040
B737	1	1	1	2
ATR-72	10	12	13	15
DHC-6	12	14	16	18
BN-2	7	8	9	11
Total	29	34	38	44

Source: JICA Study Team

(6) Domestic Busy Hour Aircraft Movements

The busy hour aircraft movement was calculated by the following formula.

(Busy Hour Aircraft Movement) = (Daily Aircraft Movement) x (Busy Hour Factor)

The busy hour factor was calculated based on the IATA definition, which is hourly profile of the second busiest day during the average week of peak month.

Table 4.29 Busy Hour Factor for Domestic Aircraft Movements

Year	Annual Movements	Busy Day Movements	Busy Hour Movements	Busy Hour Factor (H/Year)	Busy Hour Factor (H/Day)
2015	5,665	21	5	0.0009	0.2381
2016	5,989	28	5	0.0008	0.1786
2017	6,005	26	5	0.0008	0.1923
2018	6,650	26	4	0.0006	0.1538
2019	6,905	30	6	0.0009	0.2000

Source: JICA Study Team

The average busy hour factor of last five years, which is 0.1926, versus daily movements was selected to calculate future busy hour traffic.

Table 4.30 Busy Hour Domestic Aircraft Movement Forecast

		2025	2030	2035	2040
B737		1	1	1	1
ATR-72		2	2	3	3
DHC-6		2	3	3	3
BN-2		1	2	2	2
Total		5	7	8	8

Source: JICA Study Team

5 Terminal Development Plan

5.1 Development Policy

According to the air traffic demand forecast, the number of passengers in 2030 will be 630,000 and 814,000 in 2030 and 2040, respectively. This result is approximately 1.3 and 1.7 times more passengers as compared with the passenger volume in 2019, which was 490,000. As shown in Figure 5.1, there is not enough space to expand the existing terminal area in the southern side of the runway to accommodate the future demand; therefore, it is necessary to develop the northern side of the runway.

Figure 5.1 Map of Terminal Area

As explained in the environment-related issues in this report, there is a water protection zone in the northeastern and eastern side of the airport; and considering difficulties to construct a new terminal area in the area, the new terminal is planned to avoid the water protection zone.

Bauerfield International Airport is the capital airport and expected to be a base for disaster relief activities immediately after natural disaster. All airport facilities should be designed to withstand earthquake and strong wind and rain during Category 5 cyclones.

5.1.1 Runway, Taxiway, and Apron

(1) Design Aircraft

Aircraft types that will be operated in Bauerfield International Airport will include Code E aircraft such as A330; Code C aircraft such as B737-800, A320, and A220; and Code A & B aircraft such as ATR-72, DHC-6, and BN-2. A330 is the largest aircraft among all aircraft types, so the design aircraft is A330.

(2) Runway

Existing runway is 2,600 m in length and 45 m in width. There are 7.5 m wide shoulders on both sides of the runway; therefore, the total width of the runway with the shoulder is 60 m. The widths meet ICAO recommendation for Code E aircraft.

The runway length requirements for normal operation of each aircraft type in the airport is shown in Table 5.1. The runway length in the table is based on maximum takeoff weight under international standard atmosphere (ISA).

Table 5.1 Runway Length in ISA

Aircraft	Runway Length
A330-900neo	2,350 m
B737-800	2,300m
A320	2,190m
A220	1,890m
ATR-72	1,500m
DHC-6	500m
BN-2	450m

Source: Aircraft Performance Database by Eurocontrol

The runway length should be corrected by elevation and temperature to reflect the conditions of Bauerfield International Airport. According to the ICAO Design Manual Part 1 Runway, the runway length should be increased at the rate of 7 per cent per 300m elevation and further extended at the rate of 1 per cent for every 1 deg C by which aerodrome reference temperature exceeds the temperature in the standard atmosphere for the aerodrome elevation. The elevation of the airport is 21.3m and the temperature is 30 deg C. Table 5.2 shows corrected runway length of aircraft. Temperature of 14.86 deg C

Table 5.2 Runway Length after correction of elevation and temperature

Aircraft	Runway Length (m)	After Elevation Correction (m)	After Temperature Correction (m)
A330-900neo	2,350	2,362	2,719
B737-800	2,300	2,311	2,661
A320	2,190	2,201	2,534
A220	1,890	1,899	2,187
ATR-72	1,500	1,507	1,736
DHC-6	500	502	579
BN-2	450	452	521

The aircraft that requires the most runway length is A330-900neo, 2,719 m. It is longer than the current 2,600m runway length. Runway length requirement of B737-800 is also longer than the existing runway. Currently, there is no request from airlines to extend the runway. It is presumed that most of the current route is short as compared to the range performance of the aircraft. For example, the longest route operated by B737-800 is to Sydney, and the distance is 2,856km, while the maximum range of B737-800 is 3,700km. Aircalin expresses interest to operate A330-900neo in the airport, but the intended route is between Noumea. The distance to Noumea is 600km, and it is below the range of A330-900neo, which is more than 13,000km. Such a short route requires less fuel and take off wait is less than maximum weight and hence, runway length requirement is shorter. If airline plans a new longer route, the extension of the runway will be required.

The pavement strength is PCN 61/F/C/X/T. ACN of A330 in flexible pavement where subgrade is low is 76 and it is higher than the PCN of the runway. Because the PCN exceeds more than 20% of the ACN, detailed analysis is required to know whether weight restriction will apply for the operation.

(3) Taxiway

According to the aircraft movements forecast, there are 11 aircraft movements of international route and 11 aircraft movements of domestic route. Although the peak hours for domestic and international routes do not overlap, it is reasonable to presume there will be about 15–20 aircraft movements per hour. Normal taxi speed of jet aircraft is 30–35 km/h. In this speed, moving time of 200-m length exit taxiway from the runway to the apron is about 30 seconds. However, considering the time to enter the taxiway and safety margin for aircraft passing each other, it takes about 1.5–2.0 minutes. As the peak hour movement is 15–20 aircrafts per hour, a single taxiway is not sufficient, and two exit taxiways between the runway and the apron are planned.

In accordance with the ICAO recommendation, the taxiway width is determined by outer main gear wheel span (OMGWS). The OMGWS of the aircraft to be operated in Bauerfield International Airport is shown in Table 5.3.

Table 5.3 Outer Main Gear Wheel Span (OMGWS) of Jet Aircraft

Aircraft	OMGWS
A330-900neo	12.61m
B737-800	7.0m
A320	8.7m
A220	4.01m

Source: Aircraft characteristics for airport planning by Airbus and Boeing

Since taxiway width for OMGWS of 9 m up to 15 m is 23 m, the planned taxiway width is 23 m. The ICAO recommendation on total width of taxiway and shoulder for Code E aircraft is 38 m, so 7.5 m wide shoulders on both side of the taxiway are planned.

(4) Apron

1) Apron Depth

Apron depth, which is the distance from the runway center line to the edge of the apron, is planned considering future construction of full parallel taxiway. Table 5.4 shows ICAO taxiway minimum separation distances.

Table 5.4 ICAO Taxiway Minimum Separation Distances

Table 3-1. Taxiway minimum separation distances

	Distance between taxiway centre line and runway centre line (metres)								Taxiway centre line to taxiway centre line (metres)	Taxiway, other than aircraft stand taxilane, centre line to object (metres)	Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres)	Aircraft stand taxilane centre line to object (metres)
	Instrument runways Code number				Non-instrument runways Code number							
Code letter	1	2	3	4	1	2	3	4				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	77.5	77.5	–	–	37.5	47.5	–	–	23	15.5	19.5	12
B	82	82	152	–	42	52	87	–	32	20	28.5	16.5
C	88	88	158	158	48	58	93	93	44	26	40.5	22.5
D	–	–	166	166	–	–	101	101	63	37	59.5	33.5
E	–	–	172.5	172.5	–	–	107.5	107.5	76	43.5	72.5	40
F	–	–	180	180	–	–	115	115	91	51	87.5	47.5

Note 1.— The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways. The basis for development of these distances is given in the Aerodrome Design Manual *(Doc 9157), Part 2.*

Note 2.— The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway. See the Aerodrome Design Manual *(Doc 9157), Part 2.*

Source: ICAO Annex 14

On planning the apron dimension, following Code 4E instrument runway is considered.

Table 5.5 Separation Distance for Code 4E

Item	Distances
Runway centerline to parallel taxiway centerline	172.5m
Taxiway centerline to taxiway centerline	76m
Taxiway centerline to object	43.5m

Source: JICA Study Team

The distance between the runway centerline and the apron edge is the sum of runway centerline to future parallel taxiway center line (172.5 m), taxiway centerline to apron taxiway centerline (76 m), apron centerline to parking aircraft (43.5 m), length of parking aircraft (64.0 m), and towing tractor moving area (20 m), which is 376.0 m as shown in Figure 5.2.

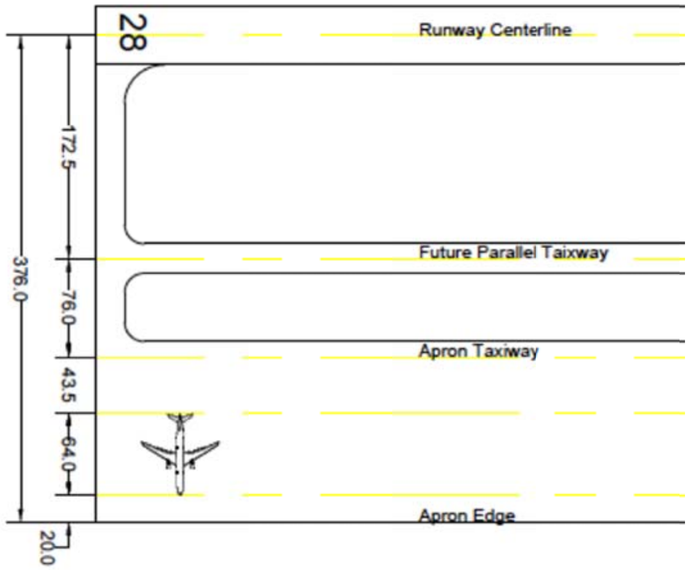


Figure 5.2 Apron Depth

2) International Apron

An aircraft is categorized into Large Jet (LJ), Small Jet (SJ), and Turbo Prop (TP). A330 is the only Code E class aircraft in LJ; A220, B737-800, and A320 are all single isle Code C aircrafts in SJ; and ATR72 is Code C in TP.

Table 5.6 Busy Hour International Aircraft Movement by Aircraft Class

	2025	2030	2035	2040
Small Jet	5	5	6	6
Turbo Prop	2	2	2	2

Source: JICA Study Team

The number of aircraft parking spots required is calculated from the following formula.

(Number of parking spot by category) = (Peak hour movement) x 1/2 x (Spot occupancy time in minutes/60) x (contingency)

The following spot occupancy time is applied for international flights.

Table 5.7 Spot Occupancy Time for International Flights

Aircraft Type	Spot occupancy time (min)
Small Jet	60
Turbo Prop	50

Source: JICA Study Team

It is necessary to consider time for unexpected aircraft delay and time adjustment for meteorological reason, and value of 1.2 is used for planning in general. The calculated number of spots is shown in Table 5.8.

Table 5.8 Number of International Spots Required

	2025	2030	2035	2040
Small Jet (Code C)	3	3	4	4
Turbo Prop (Code C)	1	1	1	1

Source: JICA Study Team

Because Code E class aircraft is expected to be operated in the airport, one of the spots for small jet is changed to Code E.

Table 5.9 Revised Number of International Spots Required

	2025	2030	2035	2040
Large Jet (Code E)	1	1	1	1
Small Jet (Code C)	2	2	3	3
Turbo Prop (Code C)	1	1	1	1

Source: JICA Study Team

3) Domestic Apron

Domestic apron spot is calculated by the same formula as for international apron. The following spot occupancy time for domestic flights is applied.

Table 5.10 Spot Occupancy Time for Domestic Flights

	Occupancy time (min)
B737	60
ATR-72	50
DHC-6	40
BN-2	40

Source: JICA Study Team

Apron requirements for domestic flights are shown in Table 5.11.

Table 5.11 Number of Required Domestic Spots

	2025	2030	2035	2040
B737	1	1	1	1
ATR-72	1	1	2	2
DHC-6	1	2	2	2
BN-2	1	1	1	1

Source: JICA Study Team

4) Apron Layout Plan

Figures 5.3 and 5.4 show the apron layout plans for year 2025 and 2035.

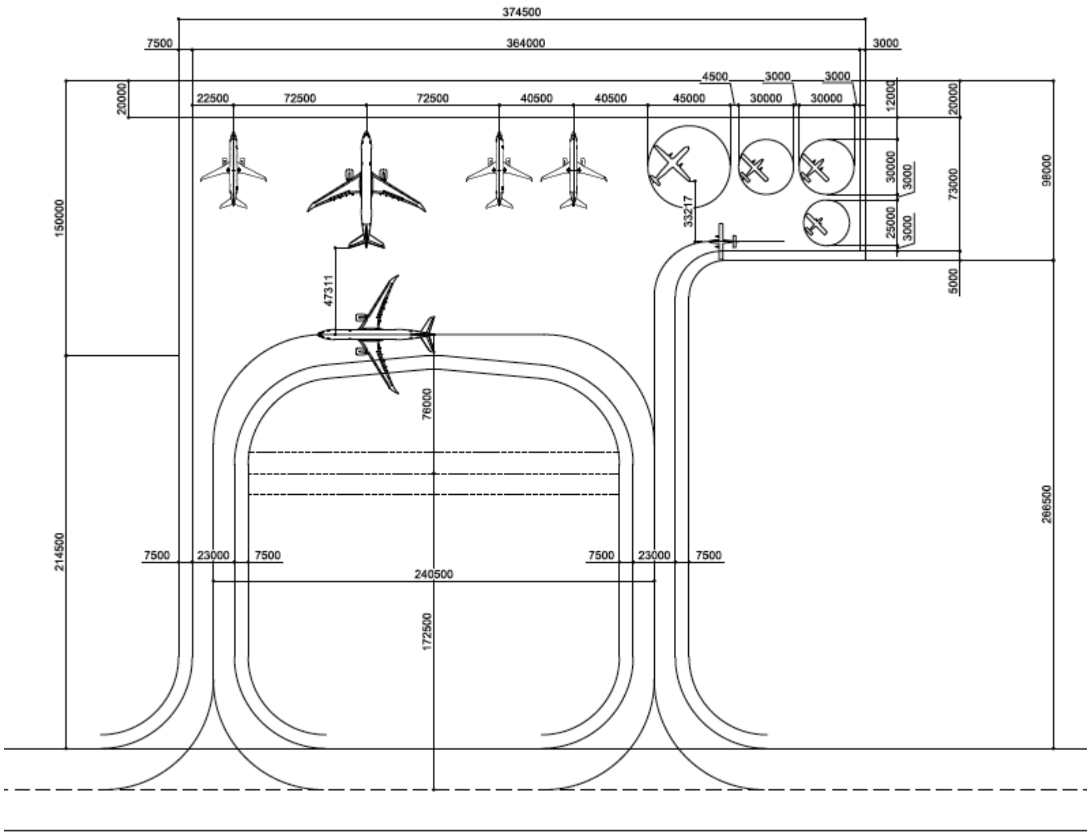


Figure 5.3 Apron Layout Plan in 2025

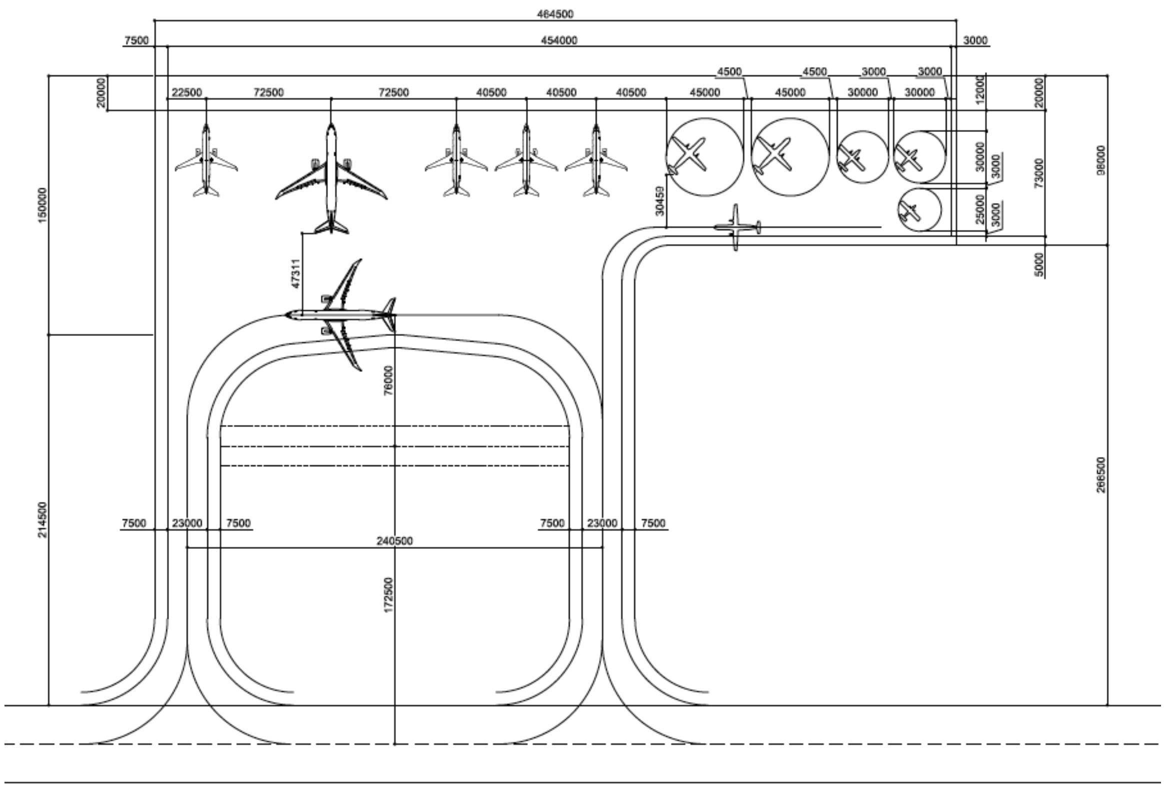


Figure 5.4 Apron Layout Plan in 2035

5.1.2 Airfield Pavement

(1) Design Method

The FAA software for calculation of airfield pavement structure, FAARFIELD v 1.42 and FAA AC 150-5320-6F Airport Pavement Design and Evaluation, are used to calculate airfield pavement structure.

Subgrade strength of CBR = 6.0 and K Value = 10.9 are used based on the existing information. The annual aircraft movement forecast is used for the design value and 20 years life is applied.

(2) Apron and Taxiways

The following aircraft information is applied for apron and taxiway pavement design.

Table 5.12 Design Input for Apron and Taxiway

Aircraft Name	Gross Weight kg	Annual Departures	Annual Growth Rate %
A330	233,900	273	3.67
A220	21,200	3,331	3.67
B737-800	79,243	675	3.67
A320	68,400	40	3.67
ATR72	22,680	1,181	3.67

Source: JICA Study Team

The result of the pavement structure calculation is shown in Tables 5.13 and 5.14.

Table 5.13 Asphalt Pavement Structure for Apron and Taxiway

Type	Calculated Thickness [mm]	Design Thickness [mm]
Hot Mix Asphalt Surface	101.6	100
Stabilized Base Course	127.0	130
Crushed Aggregate Base Course	531.2	530

Source: JICA Study Team

Table 5.14 Concrete Pavement Structure for Apron and Taxiway

Type	Calculated Thickness [mm]	Design Thickness [mm]
Portland Cement Concrete Surface	492.9	490
Stabilized Base Course	127.0	130
Crushed Aggregate Base Course	152.4	150

Source: JICA Study Team

5.1.3 Car Park and Access Road

To access the new terminal area in the northern side of the runway, a new access road from Port Vila City is required. To avoid water protection zone in the eastern and northeastern side of the airport, an access road from the western side of the airport is planned.

The area of the existing car park is approximately 8,000 m^2. As the number of peak hour passengers will be 1.9 times and 2.6 times more in 2030 and 2040, respectively, than the peak hour passengers in 2019, required area of the car park is 16,000 m^2 and 20,800 m^2 in 2025 and 2035, respectively.

5.1.4 Passenger Terminal Building

(1) Floor Plan of Passenger Terminal Building (PTB)

1) Scale Calculation of the Rooms and the Facilities

The numerical value for the various rooms was derived from the calculation based on the figures from the demand forecast survey and IATA Airport Development Reference Manual (ADRM).

Calculation of facilities based on the IATA ADRM is shown in Appendix 6.

(2) Layout Plan

Two alternative layout plans are considered, and the layout plans based on the calculation are shown in Figures 5.5 and 5.6.

1) Alternative Plan 1: One-story Type

Confidential Information

Figure 5.5 PTB Layout Plan (One-story Type)

Total floor area: 8,437.5 m^2

2) Alternative Plan 2: Two-story Type

Confidential Information

Figure 5.6 PTB Layout Plan (Two-story Type)

Total floor area: 8,458 m^2 (includes fixed bridge and corridor.)

Two passenger loading bridges are planned on the first floor. Considering the requirement to quarantine after COVID-19, a large area is secured for international arrival quarantine. To conduct health checkup for the passengers entering the building and avoid congestions, a large concourse area is planned. On the ground floor, both sides of the building are secured for future expansion. Domestic passengers are handled on the ground floor, and the first floor is for international departure and arrival passengers. However, domestic passengers can use passenger loading bridges in case of small jet aircraft operated in the domestic route.

3) Comparison of the Two Alternative Plans

The advantages of the one-story type are that since passengers do not have to move vertically, it is convenient and considers special measures for passengers with difficulties. On the other hand, it is not possible to use passenger boarding bridges. Hence, it is not convenient for passengers on rainy or windy days and for passengers with difficulties to go up and down on the boarding ramp. The total footprint area of the building is larger than that of the two-story type.

The advantages of the two-story type are that passengers can use passenger boarding bridges to board aircrafts, which improves the convenience to passengers. However, vertical movements are necessary, so special equipment such as a lift is necessary to apply universal design concept. Total footprint area of the building is smaller than one- type because it is possible to utilize the area more efficiently.

The two-story type is applied in the planning as it is more advantageous than the one-story type.

Table 5.15 Comparison of Two Plans

	One-story	Two-story
Main building area	Fair: Large (8,437.5 m^2)	Good: Small (4,680 m^2)
Barrier-free	Good	Fair: (The elevators are required in addition to stairs in the vertical flow line.)
Scalability	Good: (It will be able to extend the departure concourse, check-in counter and baggage claim hall.)	Good: (Same as one-story type)
Passenger Boarding Bridge	Poor	Good

Source: JICA Study Team

5.1.5 Cargo Terminal Building

The result of the cargo volume forecast is shown in Table 5.16.

Table 5.16 Future Air Cargo Volume

Year	2025	2030	2035	2040
Cargo Total (kg)	1,206,408	1,371,611	1,559,436	1,772,983
Cargo Import (kg)	915,462	1,040,823	1,183,352	1,345,398
Cargo Export (kg)	246,424	239,557	239,557	239,557

Source: JICA Study Team

When planning the cargo terminal building in future, 5 tons per square meter, as recommended in IATA ADRM 9th for low automation mostly for manual cargo terminal, is applied. The required floor area of the cargo terminal in future is shown in Table 5.17.

Table 5.17 Cargo Terminal Building Floor Area

	2025	2035
Cargo Terminal Area (sq. m)	274	355

Source: JICA Study Team

5.1.6 Control Tower

The existing control tower is adequate for the current runway length, so no new tower is required.

5.1.7 Fire Station

As explained in the existing conditions of the fire station in this report, because the current fire station is located inside the runway strip, a new fire station is planned in the new location.

ICAO Rescue and firefighting category is shown in Table 5.17. Current ICAO RFF category provided in the airport is Category 7.

Table 5.18 ICAO Rescue and Firefighting Category

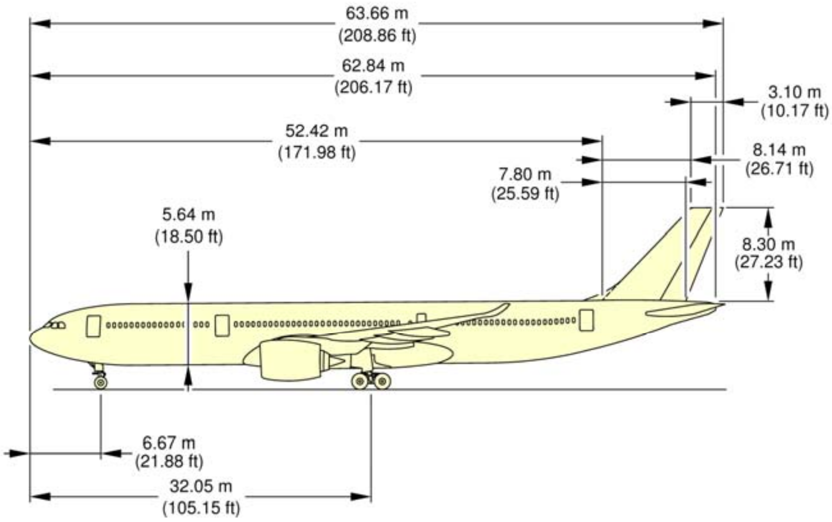
Table 9-1. Aerodrome category for rescue and firefighting

Aerodrome category (1)	Aeroplane overall length (2)	Maximum fuselage width (3)
1	0 m up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49 m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Source: ICAO Annex 14

The dimensions of A330-900 are shown in Figure 5.7. The overall length of A330-900 is 63.86 m and the width of fuselage is 5.64 m. From the overall length, the ICAO RFF category is 9.

**ON A/C A330-900



Source: Airbus

Figure 5.7 Dimensions of A330-900

It is necessary to upgrade the category from 7 to 9 in future. According to the ICAO recommendation, the minimum number of the firefighting vehicles for Category 9 is three. The new fire station should have at least three bays for firefighting vehicles and one bay for ambulance. A room for Airport Emergency Operation Center, which will be center of emergency operations such as accident and after natural disaster, will be included in the fire station in case of emergency.

5.1.8 Fuel Supply System

A new fuel farm shown in Figure 5.8 is planned. Detailed calculation of the scale of the facility is shown in Appendix 7.

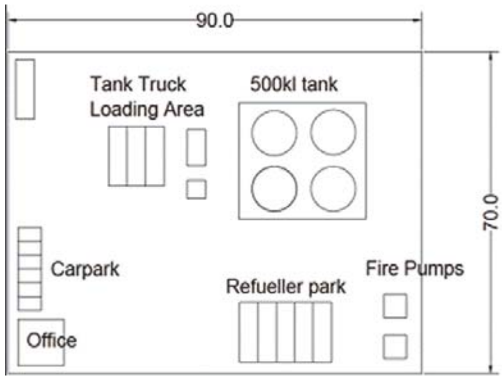


Figure 5.8 Layout Plan of Fuel Farm

5.2 Terminal Area Layout Plan

New terminal is planned at the northern side of the runway. The location is selected to prevent developments in the water protection zone. All terminal facilities are planned in the northern side. As a reference, the layout plan in case of development in the water protection zone is attached in

Appendix 8. The existing terminal in the southern side of the runway will be used for general aviation operation and as a base for disaster relief activities.

Figures 5.9 and 5.10 show facility layout plans in 2025 and 2035. The new fire station is planned next to the existing control tower since this location is almost at the center of the runway and facilitates easy access to the airport boundary. A meteorological station is also planned next to the fire station. Fuel farm is planned at the eastern side of the new terminal area so that it does not obstruct the future development of other facilities. Aircraft maintenance hangar is planned at the eastern end of the apron area. The new passenger terminal building is planned at the center of the apron area and the cargo terminal is planned at the western side of the passenger terminal. The VIP building is planned at the eastern side of the passenger building. The sewage treatment plan to process all waste water from the new terminal area is planned at the northern side of the terminal area. The new car park is planned in front of the passenger terminal building. A new utility building consisting of power supply, backup generator, and water supply system is planned in the east end of the car park.

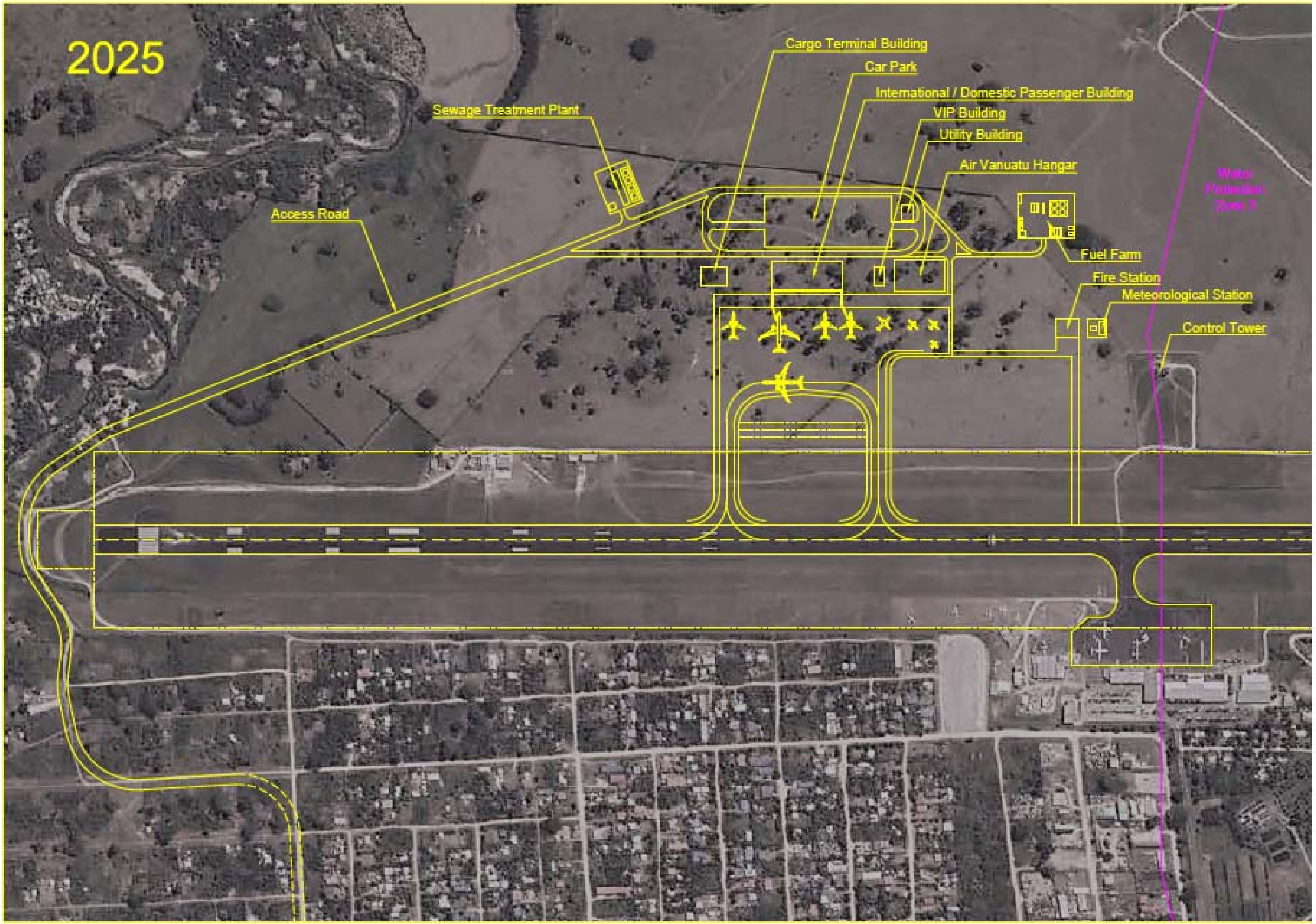


Figure 5.9 Terminal Area Layout Plan in 2025

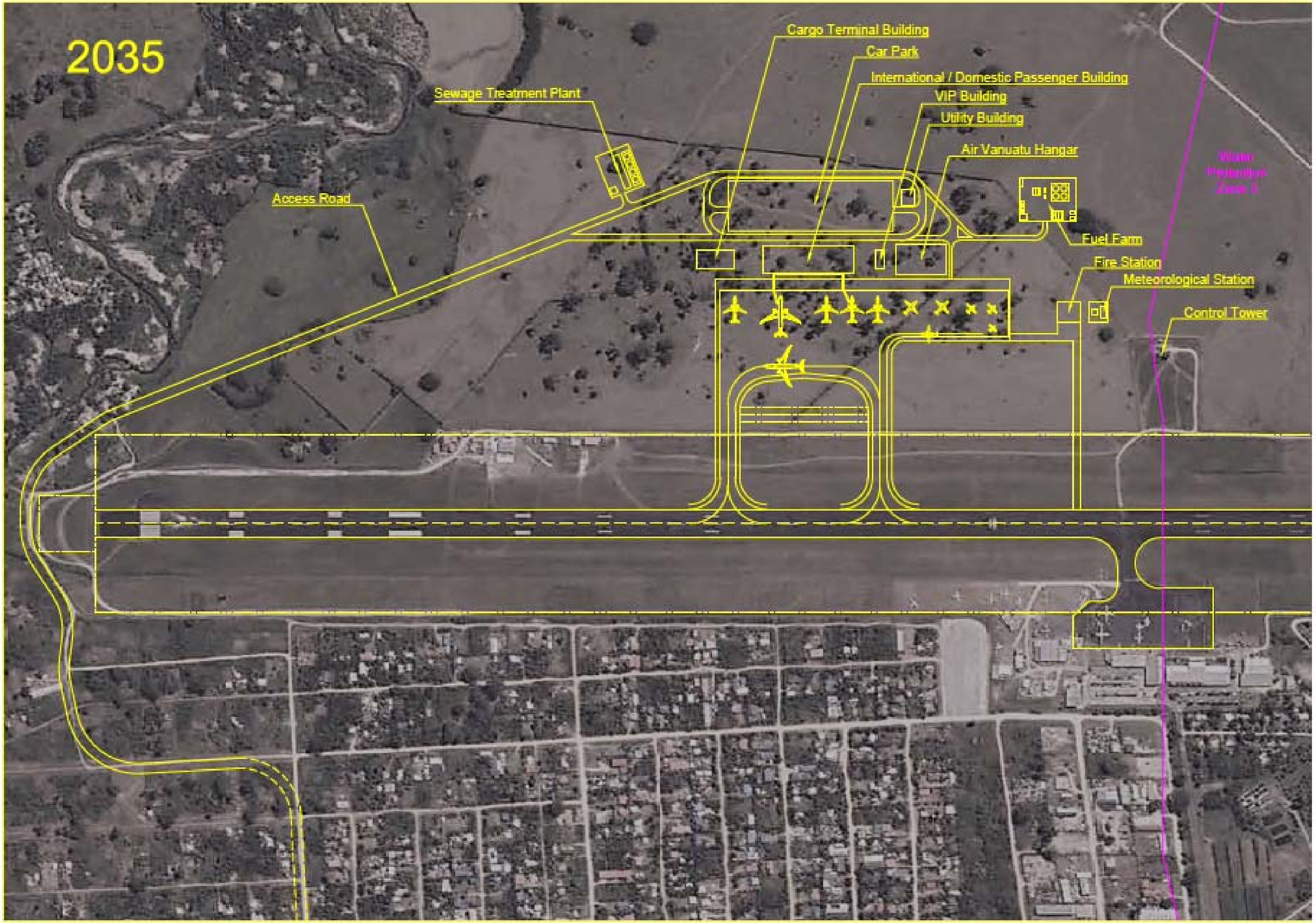


Figure 5.10 Terminal Area Layout Plan in 2035

5.3 Project Cost Estimate

5.3.1 Unit Price of Construction Works

(1) Precondition

In general, prices in Vanuatu are high, almost twice or three times higher than prices in Japan. Construction material and labor cost are also high. The construction condition in Vanuatu is somehow similar to that of the Solomon Islands in the following aspects:

- Culture is similar as both countries belong to Melanesia, and sense of labor is similar;
- Major construction material such as cement and reinforcing bar are imported;
- Unskilled labor is available but skilled labor is few;
- There is no rental company for construction equipment, and these are imported from overseas; and
- The unit price of major construction material is almost same.

In this regard, construction unit prices of Vanuatu are estimated based on the unit prices of the Honiara International Airport Project by considering the difference of pavement structure and structure type of building.

(2) Unit Price of Major Construction Material

Based on the information from local contractors, unit prices of major construction materials are summarized in Table 5.19. It was assumed that reinforcing bar will be imported from Japan; therefore, it is not included in the table.

Table 5.19 Unit Price of Construction Material

(Exchange Rate: VT1 = JPY0.93)

Material	Local contractors		Unit Price for cost estimation (JPY)
	Fletcher (VT)	Dinh Van Tu (VT)	
Cement	25/kg	24/kg	23/kg
Basalt Aggregate	15,000/m^3	15,000/m^3	14,000/m^3
Coral Aggregate	4,000/m^3	4,000/m^3	3,750/m^3
Concrete N 20	20,200/m^3	19,000/m^3	17,800/m^3
Concrete N 25	22,100/m^3	21,500/m^3	20,100/m^3
Chip seal	1,360/m^2+1,700=3,064/m^2	2,860/m^2	2,754/m^2

5.3.2 Unit Price of Building Works

Based on the construction cost of the new international passenger departure building in Honiara International Airport, unit price of the passenger terminal building was estimated. The building in Honiara is made of steel structure and this price is converted to the reinforced concrete structure. The unit price of other building is estimated from deducting the finish cost of the passenger terminal building as shown in Table 5.20.

Table 5.20 Building Unit Price

	Direct Cost (JPY)	Transportation Cost, etc. (JPY)	Indirect Cost (23%) (JPY)	Total unit price in JPY/sq^2	Total unit price in VT/sq^2
Passenger Terminal Building	280,811	63,760	79,251	423,822	455,723
Other Buildings	181,958	57,384	239,342	294,391	316,549

5.3.3 Unit Price of Civil Works

Most of civil works is pavement works, and unit prices of concrete and crushed aggregate as shown in Table 5.21 are applied, which were used for the cost estimate of the Honiara International Airport Project.

Table 5.21 Civil Works Unit Price

	Direct Cost (JPY)	Transportation cost, etc. (JPY)	Indirect Cost (23%) (JPY)	Total unit price in JPY/sq^2	Total unit price in VT/sq^2
Apron/Taxiway (Con.t=44cm)	14,042	5,197	13,663	32,902	35,378
Road and Car Park (Con. t=15 cm	7,892	2,920	7,677	18,490	19,882
Chip seal	3,060	0	1,530(50%)	4,590	4,935

Indirect cost of civil works is expensive because it includes transportation cost of construction equipment and plant.

5.3.4 Other Unit Prices

Unit prices of other works—such as trunk line equipment works, civil works other than pavement works, and airfield lighting works—used in the Honiara International Airport Project are applied.

5.3.5 Scope of Works

Scope of works include all airport terminal facilities. Major buildings include the passenger terminal building, the cargo terminal building, the fire station, the utility building, and the meteorological station. The utility building has power supply such as transmitter, switching board and backup generators, and water supply system. Major equipment works include power supply system, water reservoir and pump, and meteorological equipment. Civil works are divided into airside works and landside works. The airside works include apron, taxiways, GSE road, drainage, and air field lighting system. The landside works include car park, terminal area road, drainage, fence, and sewage pipes. Outside works include access road, street lights, power cables, and water pipes. In addition, other supporting facilities such as sewage plant, fuel farm, and hangar will be included.

5.3.6 Project Cost Estimate

Project cost was estimated based on the unit price information collected in Port Vila and project cost of similar projects in the neighboring country. Breakdown of the construction cost is shown in Appendix 9.

Table 5.22 Project Cost

(Exchange Rate: USD1 = JPY106)

Item	Cost (Million JPY)	Cost (Million USD)
1) Total of Construction Cost	10,019	94.5
2) Consulting Fee 10% of 1)	1,002	9.5
3) Contingency 5% of 1)	501	4.7
Total of Project Cost	11,522	108.7

5.4 Project Implementation Schedule

The Implementation schedule of the project is prepared. Preparatory works such as site clearance, preparation of construction materials and equipment, and temporary works is presumed to take three months at the beginning of the project. The building works will be started after the preparatory works and construction of the passenger building will be started as the building is the largest in the terminal area. It is presumed to take 18 months to complete the passenger building to consider experiences of similar size project in other countries. Sewage treatment lant and the utility building will be completed at the same time of the passenger building. Other buildings will be constructed after the completion the passenger building. The construction of the taxiways and the apron will be started after the preparatory work and it will take 18 months to consider similar size projects in other countries. Drainages and terminal road will be constructed after the completion of the passenger terminal building. After completion of the terminal road, perimeter road and perimeter fence will be constructed. Air field lightings will be installed at the same time of the taxiway and the apron construction. The fuel hydrant pipes will be installed before construction of the apron pavement and fuel farm will be constructed after. The airport access road will be constructed by one lane to secure access to the terminal area during the construction of other facilities and one month curing period is considered for the concrete pavement work. Final test and removal of temporary facilities will be two months. It is planned to take 36 months to complete the whole terminal area. Implementation schedule is shown in figure 5.11

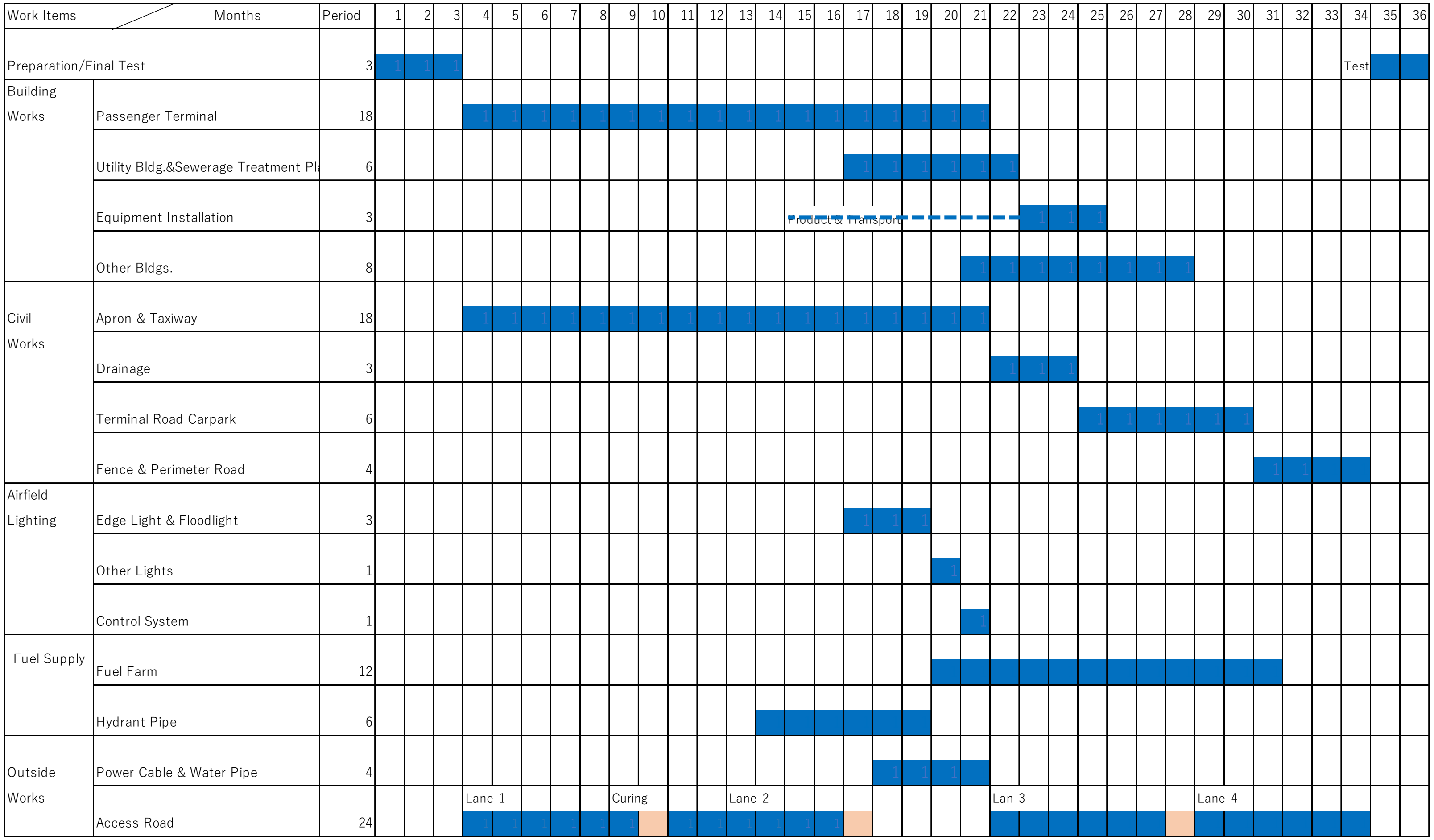


Figure 5.11 Project Implementation Schedule

5.5 Operational Effect Index

The air traffic demand at Bauerfield International Airport is expected to grow in the future. The annual international and domestic passengers will be 420,000 and 630,000 in 2030, respectively, and the total annual passengers will be 810,000. In 2040, international passengers will be 540,000, and domestic passenger will be 270,000, and the total annual passengers will be 810,000. It is impossible to handle those passenger volumes in the existing passenger building so that a new terminal building with larger capacity is necessary. There are only three spots for jet aircraft in the existing apron, and it will not be enough for demand in 2030, which requires five spots for jet aircraft. Distance between the runway and the existing apron is close, and tail wing of the jet aircraft infringes the transitional surface. Also, the existing fire station is located inside the runway strip, and it does not comply with ICAO Recommendation, which requires no fixed objects in the runway strip. These issues, such as the inadequate capacity of the apron and safety aircraft operation, will be solved by constructing a new terminal area.

Outline of the quantitative effect of the project is shown in Table 5.23. The target year of the index is 2028, which is after three years of the completion of the project in 2025.

Table 5.23 Outline of Quantitative Effect Index

Current conditions and Issues	Countermeasures by the project	Effect of the project in 2028
Inadequate capacity of the passenger buildings International Annual Passenger: 327,000 Domestic Annual Passenger: 162,000	Capacity increase by constructing a new passenger building	International Annual Passenger: 401,000 Domestic Annual Passenger: 198,000
Inadequate capacity of the apron spots: Large jet aircraft: 1 spot Small het aircraft: 2 spots Turboprop aircraft: 2 spots	Capacity increase by constructing a new apron	Large jet aircraft: 1 spot Small het aircraft: 3 spots Turboprop aircraft: 4 spots
Tail wing of the parking jet aircraft infringes the transitional surface	New aircraft parking spots not infringes the transitional surface by constructing a new apron	There is no aircraft infringes the transitional surface.
There is a fire station in the runway strip, which is an obstacle.	Construction of a new fire station in a new terminal area	There is no obstacle in the runway strip.

Quantitative effect index of the project is shown in Table 5.24.

Table 5.24 Quantitative Effect Index

Index	Standard Value (2019)	Target Value (2028)
Increase of annual international passengers	327,000	401,000
Increase of annual domestic passengers	182,000	198,000
Obstacle in the runway strip	Exists (Fire station)	None
Obstacle infringes the transitional surface	Exists (Parking small jet aircraft)	None

Qualitative effects of the project are as follows:

- Convenience of usage of the airport is increased by constructing the new passenger building, and congestion of the passengers will be removed.
- Air passengers will be increased by expansion of the passenger handling capacity of the airport, and it will contribute the development of tourism sector and investment condition and as a result, growth of the national economy will be enhanced.
- The airport facilities will be designed to withstand against earthquakes and cyclone. The airport will be used as a base of disaster recovery.

5.6 Project Package

The total project cost to construct a new terminal area at the northern side of the runway is about JPY 11,000 million, which is approximately USD 110 million. It is practical to divide project components into several packages so that several donors and funds can jointly invest to realize the project. The following packaging is proposed considering the nature of facilities and ease of construction.

Package-1: Passenger Terminal Building

Package-2: Other buildings such as Cargo Terminal Building, VIP Building, Fire Station, Utility Building, Water Reservoir and Pump, Meteorological Station, Meteorological Equipment, Sewage Pipe, and Sewage Treatment Plant.

Package-3: Airside civil facilities such as Apron, Taxiways, Ground Service Equipment (GSE) Road, and Airfield Lighting System

Package-4: Landside civil facilities such as Car Park, Terminal Road, Drainage, Fence, Access Road, Sidewalk, Street Lights, Power Cable, and Water Pipes

Package-5: Other facilities of private companies such as Fuel Farm and Hangar.

Figure 5.11 shows the layout plan of each package and Table 5.25 shows the project cost of each package.

Figure 5.12 Layout Plan of Each Package

Table 5.25 Project Package and Cost

(Exchange Rate: USD 1 = JPY 106)

Package	Category	Facility	Project Cost (million JPY)	Project Cost (million USD)
Package 1	Passenger Terminal Building	Passenger Terminal Building	4,425	41.8
Package 2	Other buildings	Cargo Terminal Building, VIP Building, Fire Station, Utility Building, Water Reservoir and Pump, Meteorological Station, Meteorological Equipment, Sewage Pipe, and Sewage Treatment Plant	1,978	18.7
Package 3	Airside civil facilities	Apron, Taxiways, GSE Road, Drainage, and airfield Lighting System	2,703	25.5
Package 4	Landside civil facilities	Car Park, Terminal Road, Drainage, Fence, Access Road, Sidewalk, Street Lights, Power Cable, and Water Pipes	1,495	14.1
Package 5	Private company facilities	Fuel Farm and Hangar.	920	8.7
Total			11,522	108.7

6 Land Acquisition and Environmental and Social Considerations

6.1 Land Acquisition Status

The Vanuatu government has been acquiring land for the airport expansion. As shown in Figure 6.1, the government has already acquired the area adjacent to the east side of the airport (colored in red) and has agreed with the landowner for the acquisition of the eastern half of the north side of the airport (colored in blue).

Figure 6.1 Land Acquisition Situation

6.2 Environmental Category

A new terminal area is planned at the northern side of the runway. The new terminal location is decided so as to prevent development in the water protection zone and to build the terminal at almost center of the runway. The area is used as a ranch and no residence exists, but the area is privately owned by a person and it is necessary to obtain the land.

It is possible to plan access roads from both the eastern and western sides of the airport. The east access road along the airport boundary is closer to Port Vila City but it is not possible to avoid the water protection zone. Since it is difficult to construct a road in this zone, this alternative is difficult. On the other hand, the west access road should consider residence area at the northwest side of the airport. Figure 6.1 shows aerial photograph of the western side of the airport with the planned access road. As shown in the figure, it is possible to construct a road while securing the runway end safety area in accordance with the ICAO standard.

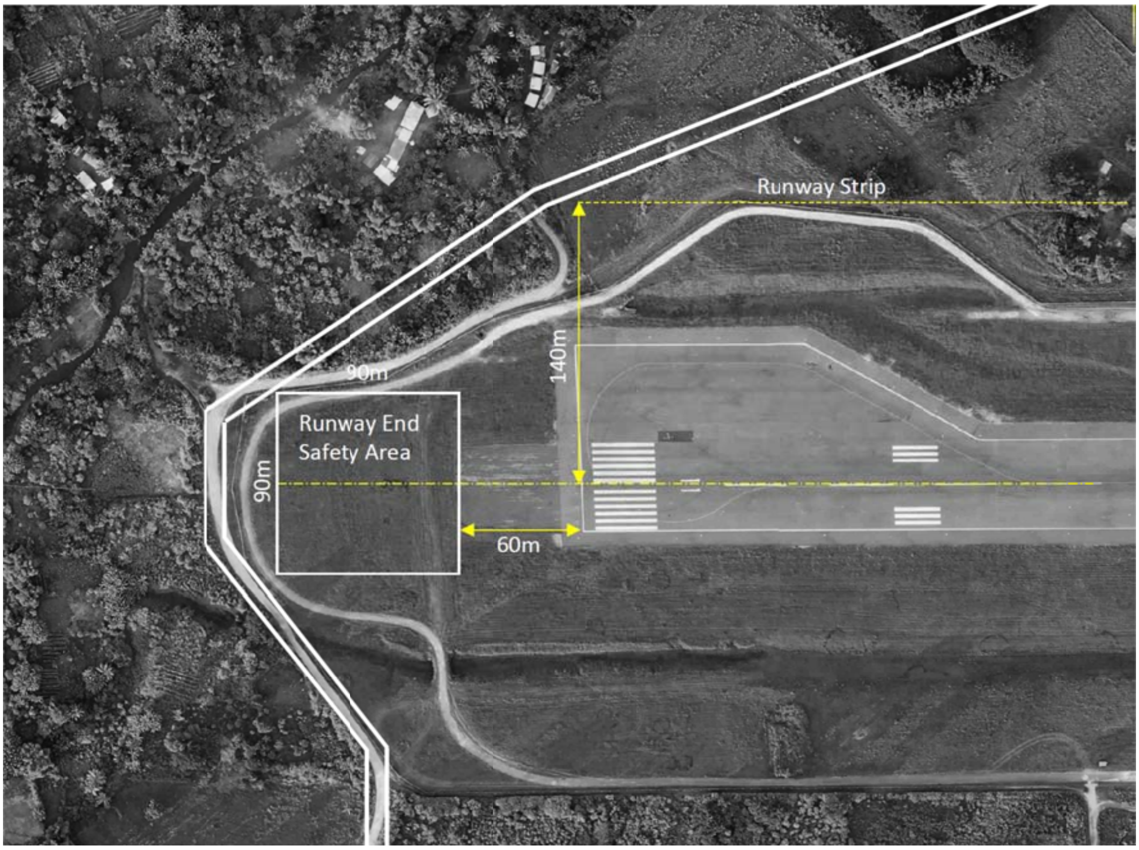


Figure 6.2 Access Road from the Western Side

The environmental category of this project is category B in accordance with JICA Guidelines for Environmental and Social Consideration since environmental and social impact of the project is not large.

The environmental category of the Master Plan by the World Bank is category A because it required development in the water protection zone and undesirable effects to the natural environment will be large.

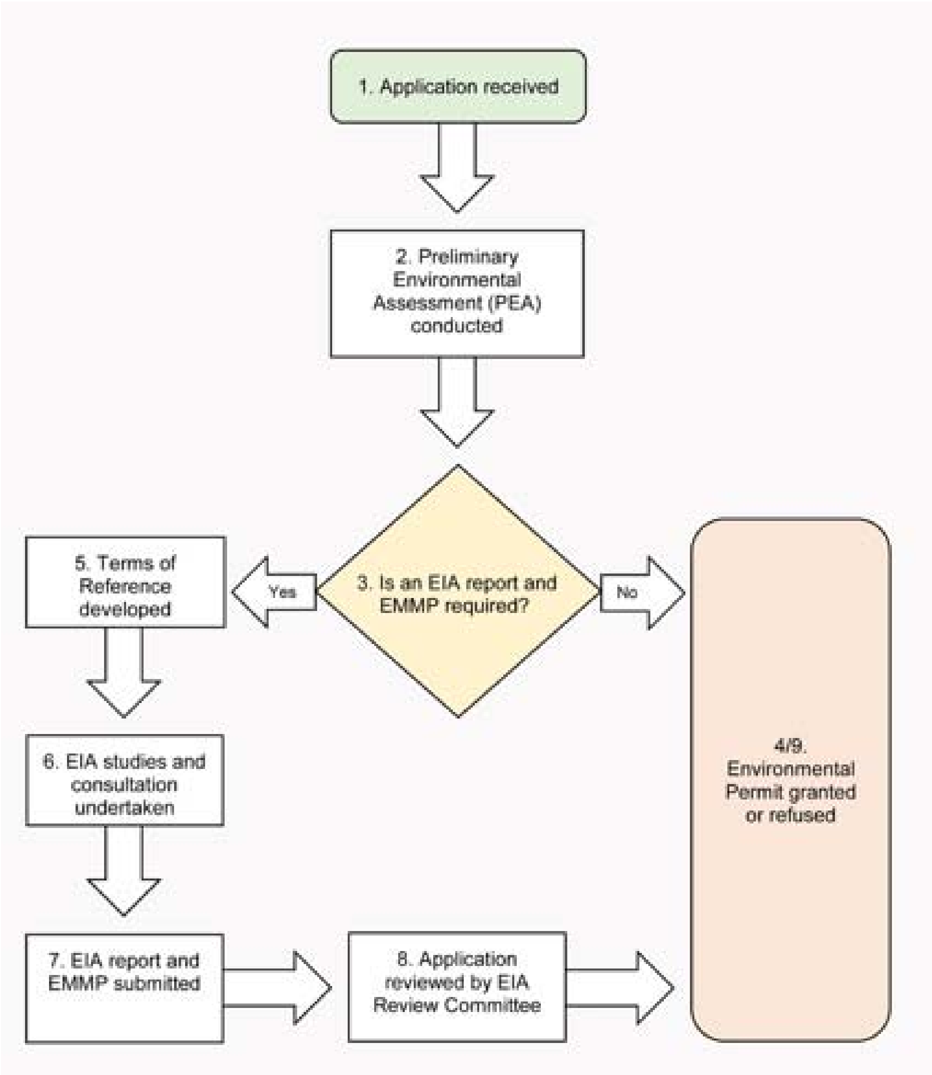
6.3 Submission of Project-Related Documents and Preliminary Screening

It is required to submit the documents describing in details on “Detailed plan” (such as details on facility construction) and “Proposal for construction method aiming for minimizing environmental impact” to the Department of Environmental Protection and Conservation for environmental screening prior to commencement of the project.

In case it is found, based on screening, that environmental/social impact is zero or extremely minor, approval will be granted immediately after screening. However, in case if an additional environmental impact assessment is needed, a consultant registered with the Department of Environmental Protection and Conservation will conduct an environmental impact assessment. Consultants who are not registered (such as overseas consultant) are also eligible to conduct the environmental impact assessment as long as the concerned authorities admit that the consultant is appropriate in terms of certificates and past results.

Since the list of consultants who are registered with the Department of Environmental Protection and Conservation of the government of Vanuatu is publicly available, it is desirable to proceed with opinions of the consultants in the list in preliminary survey stage.

Procedures for environmental permission and EIA are shown in Figure 6.3.



Source: EIA and VIPA Guidelines Department of Environmental Protection and Conservation

Figure 6.3 The Process for Obtaining an Environmental Permit – EIA

Appendix

Appendix 1: Itinerary of the First Field Survey in Vanuatu

Date	Day	Activities
2020/1/21	Tue	Leave Narita
2020/1/22	Wed	Arrive Port Vila
2020/1/23	Thu	9:00 JICA Office 10:00 Kick Off Meeting at MIPI
2020/1/24	Fri	10:00 Australia High Commission 11:00 UNELCO
2020/1/25	Sat	Santo Island
2020/1/26	Sun	
2020/1/27	Mon	9:00 Dine Van Tu 13:00 AVL 15:00 UNELCO Water Pond
2020/1/28	Tue	9:00 VPMU 14:00 PASO 16:00 Local Consultant 16:00 VTO
2020/1/29	Wed	10:00 Bruten 10:30 Coral stone query 11:30 Pacific Energy
2020/1/30	Thu	9:30 New Zealand High Commission 13:00 Fletcher
2020/1/31	Fri	14:00 ADB
2020/2/1	Sat	
2020/2/2	Sun	
2020/2/3	Mon	10:00 AVL
2020/2/4	Tue	10:00 Met and Geohards Dept 11:00 Environmental Prot.
2020/2/5	Wed	10:00 Belair Airways 13:00 Air passenger survey
2020/2/6	Thu	9:00 VNSO 11:00 Belair Airways
2020/2/7	Fri	10:00 VAL 15:00 Air Vanuatu
2020/2/8	Sat	
2020/2/9	Sun	
2020/2/10	Mon	Team meeting
2020/2/11	Tue	9:50 Air Calin 14:00 Air Taxi
2020/2/12	Wed	05:30 Drone survey 08:00 VTS 09:00 Navigation Aid Survey
2020/2/13	Thu	
2020/2/14	Fri	09:00 JICA Office 10:00 Japanese Embassy
2020/2/15	Sat	14:30 Leave Port Vila
2020/2/16	Sun	Arrive Haneda

Appendix 2: List of Related Organizations

1. Government of Vanuatu

Ministry of Infrastructure and Public Utilities (MIPU)

[Director General] Mr. Harrison Luen

[Executive Officer] Mr. Samuel George

Civil Aviation Authority Vanuatu (CAAV)

[Assistant Director] Ms. Naianyu Kara

Airport Vanuatu Co. Ltd

[CEO] Mr. Jason Rakua

[Chairman] Mr. Bakoa Kaltonga

[Vice Chairman] Mr. Adrian Sinclair

[General Operation Manager] Mr. Kevin Abel

[Chief ATC] Ms. Melinda Reynolds

[Chief Engineer] Mr. Abel Dipoloa

[Manager Infrstructure] Ms. Saiuinilli Toara

Vanuatu Terminal Services (VTS)

[Export Cargo Supervisor] Mr. Jeff Yaviong

Department of Environmental Protection & Conservation

Ms. Julie Vatu

Vanuatu Ministry of Lands and Natural Resources

Mr. Kuautonga Sero

[Assistant Manager] Mr Erie Sami

Vanuatu Project Management Unit (VPMU)

[Project Manager] Mr. Jone Roqara

Vanuatu Tourism Office（VTO）

[Information & Research Officer] Ms. Michaella Arhur

Vanuatu Meteorology and Geohazards Department

[Chief of Climate] Mr. Abel Kalo

Vanuatu National Statistics Office (VNSO)

[Principal Statistician] Mr. Ben Tokal

[Senior Statisticial] Ms. Remah Arthur

2. Embassy of Japan and JICA

Embassy of Japan

[Ambassador] Ms. Harumi Katsumata

JICA Vanuatu Office

[Resident Representative Mr. Naoki Takechi

[Chief Representative] Mr. Katsuhiko Ohara

3. Donners and Foreign Organizations

Australia High Commission

[First Secretary] Ms. Kristy Dudgeion

NZ High Commission

[High Commissioner] Mr. Georgina Roberts,

[Deputy High Commissioner] Mr. Richard Dirks

Asian Development Bank (ADB)

[Manager] Ms. Lotte SCHOU-ZIBELL

4. Airlines

Air Vanuatu

[CEO] Mr. Derek Nice

[Revenue Manager] Mr. Rian Hill

Bellair Airways

[Operation Manager] Mr. Toara Karie

Air Taxi

[CEO] Ms. Julia Johnstone

Air Calin

[Sales Representative] Mr. Pascal Prestat

5. Others

UNELCO (Union Electrique Du Vanuatu) Ltd

[Technical manager] Mr. Yasuda

Dinh Van Tu Ltd

[Manager] Mr. loic Dinh

Pacoific Aviation Safety Office (PASO)

[Operation Manager] Mr. Netava Waqa

Qualao Consulting Ltd

[Managing Director] Mr. Harold Qualao

Brunet Pierre Entreprise

Ms. Chiristiane Brunet

South Pacific Tours

Mr. Hiroki Asano

Appendix 3: Permitted and Prohibited Activities in Each Zone

Zone	Permitted Activities	Prohibited Activities
Zone 1	(a) pedestrian and vehicular traffic associated with the supply of water to Port Vila; and (b) building and development associated with the supply of water to Port Vila, subject to an Environmental Impact Assessment Process.	Any activities not permitted in Zone 1 are not permitted within the boundaries of Zone 1 and this includes but is not limited to any of the following specific activities: (a) all uses not permitted in Zone 2 and 3; (b) application of fertilizers; (c) application of herbicides and pesticides; (d) quarries, cemeteries, landfill sites; (e) settlement or treatment ponds; (f) any works, activities, settlements or facilities other than those which are strictly necessary for the operation, surveillance and maintenance of the water collection and treatment facilities; (g) pedestrian and vehicular traffic; (h) all kinds of agricultural use; (i) collection of water from the river; (j) construction of permanent or temporary facilities other than those which are necessary for water business activities (such as the production and the treatment of water) ; (k) public roads; (1) livestock activities; and (m) storage and dumping of any product other than those which are strictly necessary for the operation, surveillance and maintenance of the water collection and treatment facilities.
Zone 2	(a) non intensive agriculture or horticulture; and (b) unsealed roads.	Any activities not permitted in Zone 2 are not permitted within the boundaries of Zone 2 and this includes but not limited to any of the following specific activities: (a) all uses which are not permitted in Zone 3. (b) the following uses: (i) excessive use of fertilizers; (ii) use of herbicides and pesticides; (c) surface and underground works such as : (i) soil excavation works; (ii) construction of facilities used for infiltration of waste water or storm water; (iii) digging of ponds or water holes, prospection and drilling activities, quarries, mining and cemeteries ; (iv) cutting down of any trees or bush clearing with hand machinery or fire ; (v) earthworks which alter the plant cover and leave the bare soils; (vi) tailings ponds, treatment ponds, agriculture ponds; (vii) parking areas, sporting fields and campsites. (d) storage and discharge of: (i) household wastes, garbage, industrial wastes, radioactive products and any solid, liquid and gaseous products; and (ii) chemical products, hydrocarbons and flammable liquids and products used for industrial processing and retail activities. (e) installing pipes for: (i) domestic and industrial waste water; and (ii) hydrocarbons and liquid or gaseous chemical products

		(f) sewage of: (i) human waste; (ii) industrial waste and wash water; (iii) agricultural or farming effluents, in particular slurry; (g) construction of: (i) facilities or fences which may impede the water flow or which may alter the stream's longitudinal or sectional area; (ii) extension of existing residential houses even for temporary purposes; (iii) camping and bivouac sites; (iv) treatment plants or any effluents treatment facilities of any nature; (v) animal treatment facilities (such as animal pools, spraying lanes); (vi) car washing areas and garages; (vii) any commercial or industrial activities including storage of equipment and materials; (viii) farming facilities (such as stock yards, silos, manure storage areas); and (ix) grazing for more than 1.5 livestock head per hectare.
Zone 3	(a) non intensive agriculture or horticulture; (b) sealed roads; (c) low density settlement subject to the standardized construction and maintenance of the septic tanks;	Any activities not permitted in Zone 3 are not permitted within the boundaries of Zone 3 and this includes but not limited to the following specific activities: (a) excessive application of fertilizers; (b) application of herbicides and pesticides; (c) quarries, cemeteries, landfill sites; (d) settlement or treatment ponds; (e) percolation of waste water; (f) Activities using substances hazardous for water (oil refineries, steel works, chemical plants, etc.); (g) all industrial and commercial activities (such as storage facilities), mining, livestock or other activities which may alter the regime and the quality of the ground or surface waters and which do not have the prior authorization of the competent authorities; (h) intensive livestock farming (>5 head cattle per hectare); (i) sewerage treatment plants; G) residential areas, estates, government or private facilities in cases where waste water is not completely and safely sewered out of the water protection zone; (k) locations for the sale and refilling of oil, diesel, and other substances contaminating water; (l) military sites; (m) dump sites and car wrecking sites; (n) extension of existing cemetery and newly established cemetery; (o) the use of substances hazardous to water used in road hydraulic engineering (such as tar, some bitumen and cinder); (p) increase in settlement density; (q) abandonment of dead animals, waste from butchers' shops, manures, faeces and generally animal residues.

Source: Water Resources Management ACT [CAP 281] Declaration of the Matnakara Water Protection Zone (Tagabe River) Order No. 119 of 2017

Appendix 4: Calculation of Busy Hour Passengers

(1) International Passengers

Peak month and the second busiest day in the peak month were studied by the statistics from 2016 to 2019 provided by AVL as shown in Table A-1. The peak month of international passengers were in the summer (July) or in the New Year season (December and January). As the annual passengers have increased year by year, the monthly passengers have also increased. The busy day factor was from 0.0040 to 0.0055.

Table A-1 Peak Month and Busy Day Factor for International Passengers

Year	Annual Passengers	Peak Month	Monthly Passengers	Second Busiest Day	Busy Day Passengers	Busy Day Factor	
2015	227,410	January	24,545	12 Jan.	1,246	0.0055	(1/183)
2016	233,827	July	25,179	13 Jul.	1,212	0.0052	(1/193)
2017	267,991	December	28,861	20 Dec.	1,364	0.0051	(1/196)
2018	295,176	July	30,505	22 Jul.	1,282	0.0043	(1/230)
2019	327,455	July	34,599	8 Jul.	1,313	0.0040	(1/249)

Source: JICA Study Team

The average of busy day factor for last five years, which is 0.0048 (=1/207), was applied to calculate daily international passengers. The busy day passengers in the future are shown in Table A-2.

Table A-2 Busy Day International Passenger Forecast

	2025	2030	2035	2040
Annual Passengers	370,959	421,758	479,512	545,176
Busy Day Factor	0.0048	0.0048	0.0048	0.0048
Daily Passengers	1,788	2,033	2,312	2,628

Source: JICA Study Team

The busy hour factor was calculated based on the IATA definition, which is hourly profile of the second busiest day during the average week of peak month as shown in Table A-3.

Table A-3 Busy Hour Factor for International Passengers

Year	Annual Passengers	Busy Day Passengers	Busy Hour Passengers	Busy Hour Factor (H/Year)	Busy Hour Factor (H/Day)
2015	227,410	1,246	315	0.0014	0.2528
2016	233,827	1,212	474	0.0020	0.3911
2017	267,991	1,364	402	0.0015	0.2947
2018	295,176	1,282	301	0.0010	0.2348
2019	327,455	1,313	379	0.0012	0.2887

Source: JICA Study Team

The average busy hour factor of last five years, which is 0.2924, versus daily passengers was used to calculate future busy hour passengers.

Table A-4 Busy Hour International Passenger Forecast

	2025	2030	2035	2040
Daily Passengers	1,788	2,033	2,312	2,628
Busy Hour Factor	0.2924	0.2924	0.2924	0.2924
Busy Hour Passengers	523	594	676	768

Source: JICA Study Team

(2) Domestic Passengers

The busy day and busy hour domestic passengers were calculated in the same manner as the international passengers. The peak month, the second busiest day, and busy day domestic passengers of last five years are shown in Table A-5. All peak month of last five years was December.

Table A-5 Peak Month and Busy Day Factor for Domestic Passengers

Year	Annual Passengers	Peak Month	Monthly Passengers	2nd Busiest Day	Busy Day Passengers	Busy Day Factor	
2015	123,147	December	13,126	9 Dec.	466	0.0038	(1/264)
2016	126,779	December	13,861	14 Dec.	505	0.0040	(1/251)
2017	142,866	December	15,236	29 Dec.	524	0.0037	(1/273)
2018	155,204	December	16,299	28 Dec.	551	0.0036	(1/282)
2019	161,898	December	16,881	3 Dec.	624	0.0039	(1/259)

Source: JICA Study Team

The average of busy day factor for last five years, which is 0.0038 (=1/264), was applied to calculate future daily domestic passengers. The busy day passengers are shown in Table A-6.

Table A-6 Busy Day Domestic Passenger Forecast

	2025	2030	2035	2040
Annual Passengers	183,478	208,604	237,169	269,647
Busy Day Factor	0.0038	0.0038	0.0038	0.0038
Busy Day Passengers	691	786	894	1,016

Source: JICA Study Team

Busy hour factor was calculated as shown in Table A-7.

Table A-7 Busy Hour Factor for Domestic Passengers

Year	Annual Passengers	Busy Day Passengers	Busy Hour Passengers	Busy Hour Factor (H/Year)	Busy Hour Factor (H/Day)
2015	123,147	466	73	0.0006	0.1567
2016	126,779	505	78	0.0006	0.1545
2017	142,866	524	161	0.0011	0.3073
2018	155,204	551	149	0.0010	0.2704
2019	161,898	624	128	0.0008	0.2051

Source: JICA Study Team

The average busy hour factor of last five years, which is 0.2188, versus daily passengers was used to calculate future busy hour passengers.

Table A-8 Busy Hour Domestic Passenger Forecast

	2025	2030	2035	2040
Daily Passengers	691	786	894	1,016
Busy Hour Factor	0.2188	0.2188	0.2188	0.2188
Busy Hour Passengers	151	172	196	222

Source: JICA Study Team

(3) Combined International and Domestic Passengers

As shown above, peak day and peak hour of international and domestic passengers are different; however, it is necessary to calculate peak passenger of combined international and domestic passengers to calculate the requirements of facilities, which are commonly used by international and domestic passengers.

The peak month, the second busiest day, and busy day combined passengers are shown in Table A-9. Because the number of international passengers was more than the number of domestic passengers, the peak months of combined passengers were same as the international passengers.

Table A-9 Peak Month and Busy Day Factor for Total of International and Domestic Passengers

Year	Annual Passengers	Peak Month	Monthly Passengers	Second Busiest Day	Busy Day Passengers	Busy Day Factor	
2015	350,557	January	36,907	12 Jan.	1,653	0.0047	(1/212)
2016	360,060	July	36,970	16 Jul.	1,636	0.0045	(1/220)
2017	410,857	December	44,097	20 Dec.	1,763	0.0043	(1/233)
2018	450,380	July	46,224	21 Jul.	1,712	0.0038	(1/263)
2019	489,416	July	50,145	7 Jul.	1,886	0.0039	(1/259)

Source: JICA Study Team

The average of busy day factor for last five years, which is 0.0042 (=1/236), was applied to calculate future daily combined passengers. The busy day passengers are shown in Table A-10.

Table A-10 Busy Day International and Domestic Passenger Forecast

	2025	2030	2035	2040
Annual Passengers	554,437	630,362	716,681	814,823
Busy Day Factor	0.0042	0.0042	0.0042	0.0042
Busy Day Passengers	2,351	2,673	3,039	3,456

Source: JICA Study Team

The busy hour factor was calculated as shown in Table A-11.

Table A-11 Busy Hour Factor for International and Domestic Passengers

Year	Annual Passengers	Busy Day Passengers	Busy Hour Passengers	Busy Hour Factor (H/Year)	Busy Hour Factor (H/Day)
2015	350,557	1,653	331	0.0009	0.2002
2016	360,060	1,636	531	0.0015	0.3246
2017	410,857	1,763	414	0.0010	0.2348
2018	450,380	1,712	348	0.0008	0.2033
2019	489,416	1,886	389	0.0008	0.2063

Source: JICA Study Team

The average busy hour factor of last five years, which is 0.2338, versus daily passengers was used to calculate future busy hour passengers.

Table A-12 Busy Hour International and Domestic Passenger Forecast

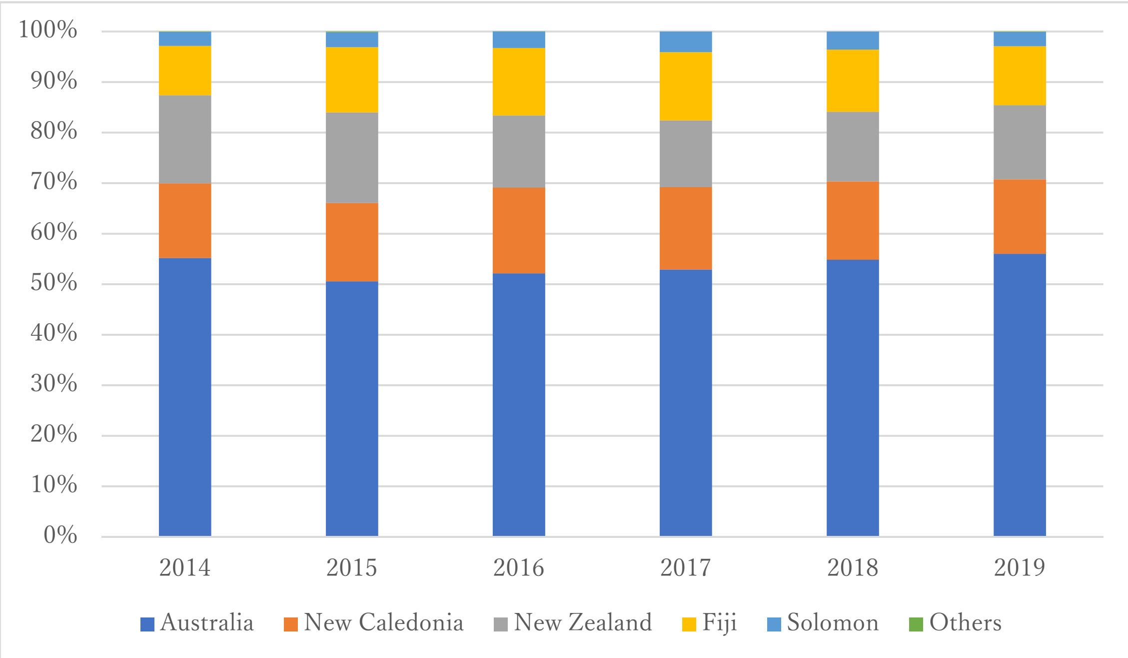
	2025	2030	2035	2040
Daily Passengers	2,351	2,673	3,039	3,456
Busy Hour Factor	0.2338	0.2338	0.2338	0.2338
Busy Hour Passengers	550	625	711	808

Source: JICA Study Team

Appendix 5: Calculation of International Aircraft Movement

1) Route Passengers

Figure A-1 shows passenger share between overseas countries and Port Vila from 2014 to 2019. The biggest share was of Australia's route, between 51% in 2015 to 56% in 2019. The second and the third positions were of New Caledonia and New Zealand's routes and the share was between 13% and 18%. The fourth position was Fiji's routes and the share was between 10% to 13%. The Solomon Island's share was between 3% and 4%. Other countries' share was very few and less than 0.1%.



Source: AVL Statistics

Figure A-1 Route Share of International Passengers from 2014 to 2019

The average share of the five countries was applied to future route passenger forecast because the share was almost stable for last six years and the trend will be presumed to be same for the future.

Table A-13 Average Share of International Passengers

Country	Share
Australia	54%
New Caledonia	16%
New Zealand	15%
Fiji	12%
Solomon Islands	3%

Source: JICA Study Team

The future route passengers are estimated by multiplying the above market share and annual passengers as shown in Table A-14.

Table A-14 Future International Passengers by Routes

Year	Share	2025	2030	2035	2040
Total		370,959	421,758	479,512	545,176
Australia	54%	200,318	227,749	258,936	294,395
New Caledonia	16%	59,353	67,481	76,722	87,228
New Zealand	15%	55,644	63,264	71,927	81,776
Fiji	12%	44,515	50,611	57,541	65,421
Solomon	3%	11,129	12,653	14,385	16,355

Source: JICA Study Team

2) Route Aircraft Movements

a) Australia Route

From Port Villa to Australia, Brisbane and Melbourne routes were operated by Air Vanuatu and Virgin Australia. Air Vanuatu operates B737-300 and B737-800 and Virgin Australia operates B737-800. Air Vanuatu plans to replace all B737 type aircraft to A220 type by 2021. There are 108 seats in A220 and 176 seats in B737-800. Of the Australia route, 70% was operated by Air Vanuatu and 30% by Virgin Australia in 2019, and it is presumed that the share will remain the same in future. The load factor of 70% is applied to calculate future aircraft movements. The annual movements of Australia route are shown in Table A-15.

Table A-15 Aircraft Movements of Australia Route

	Share	2025	2030	2035	2040
Total Passengers		200,318	227,749	258,936	294,395
Passenger by A220	70%	140,223	159,425	181,256	206,077
Seat x Load Factor		76	76	76	76
Annual Movement		1,845	2,098	2,385	2,712
Passenger by B737-800	30%	60,095	68,325	77,681	88,319
Seat x Load Factor		123	123	123	123
Annual Movement		489	555	632	718

Source: JICA Study Team

b) New Caledonia Route

Noumea is the only route from Port Vila to New Caledonia, and Air Vanuatu and Air Calin operate this route. Air Vanuatu operates this route by ATR72 and Air Calin operates A320. The share of this route was 55% by Air Calin and 45% by Air Vanuatu. According to Air Calin, there is a plan to introduce A330 aircraft in this route as A330 is operated between Japan and New Caledonia, and Air Calin plans to extend this route to Port Vila. It is also presumed that Air Vanuatu will continuously operate ATR72 in this route.

Table A-16 Aircraft Movements of New Caledonia Route

	Share	2025	2030	2035	2040
Total Passengers		59,353	67,481	76,722	87,228
Passenger by A320	70%	41,547	47,237	53,705	61,060
Seat x Load Factor		186	186	186	186
Annual Movement		223	254	289	328
Passenger by ATR72	30%	17,806	20,244	23,017	26,168
Seat x Load Factor		53	53	53	53
Annual Movement		336	382	434	494

Source: JICA Study Team

c) New Zealand Route

Auckland is the only destination to New Zealand, and Air Vanuatu operates this route by B737-300 and B737-800. As stated above, Air Vanuatu will operate A220 in the routes currently operated by B737-300 and B737-800; A220 will be operated in this route.

Table A-17 Aircraft Movements of New Zealand Route

		2025	2030	2035	2040
Passenger by A220	100%	55,644	63,264	71,927	81,776
Seat x Load Factor		76	76	76	76
Annual Movement		732	832	946	1,076

Source: JICA Study Team

d) Fiji Route

Nadi and Suva are the routes from Port Vila to Fiji and operated by Air Vanuatu and Fiji Airways. Air Vanuatu operates B737-800 and Fiji Airways operates ATR72. Share of ATR72 was 75% and that of B737 was 25%, and the same share is assumed for the future. As same as the other routes, B737 will be replaced by A220.

Table A-18 Aircraft Movements of Fiji Route

		2025	2030	2035	2040
Total Passengers		44,515	50,611	57,541	65,421
Passenger by A220	25%	11,129	12,653	14,385	16,355
Seat x Load Factor		76	76	76	76
Annual Movement		146	166	189	215
Passenger by ATR72	75%	33,386	37,958	43,156	49,066
Seat x Load Factor		53	53	53	53
Annual Movement		630	716	814	926

Source: JICA Study Team

e) The Solomon Islands Route

Honiara is the only destination in the Solomon Islands route, and Air Niugini and Solomon Airlines operate this route by B737-800 and A320, respectively. Share of Air Niugini and Solomon Airlines was 60% and 40%, and the same share was presumed in the future.

Table A-19 Aircraft Movements of the Solomon Islands Route

	Share	2025	2030	2035	2040
Total Passengers		11,129	12,653	14,385	16,355
Passenger by B737-800	70%	7,790	8,857	10,070	11,449
Seat x Load Factor		123	123	123	123
Annual Movement		63	72	82	93
Passenger by A320	30%	3,339	3,796	4,316	4,907
Seat x Load Factor		102	102	102	102
Annual Movement		33	37	42	48

Source: JICA Study Team

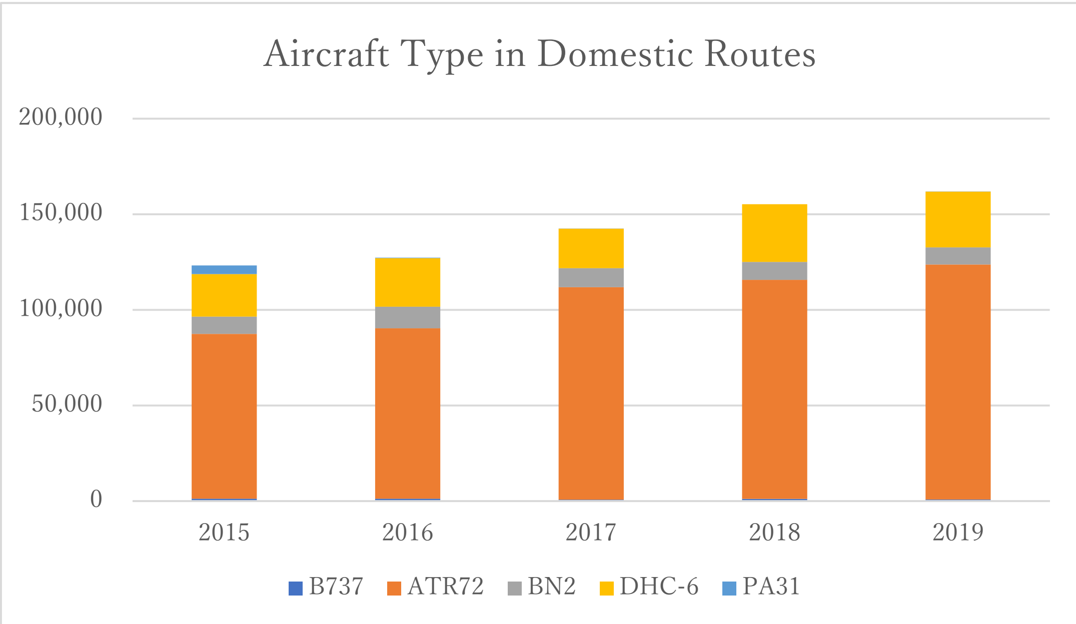
Appendix 6: Calculation of Domestic Aircraft Movement

Most of the domestic air routes were operated by turboprop aircraft such as ATR72, BN-2, DHC-6, and PA31. B737 was operated in domestic route several times, but it was only 6–13 times per year in last five years. Aircraft type shares in domestic routes are shown in Figure A-2.

Table A-20 Aircraft Type in Domestic Routes

Aircraft	Operator	Seat Capacity
ATR-72	Air Vanuatu	68
DHC-6	Air Vanuatu	16
BN-2 Islander	Air Vanuatu, Belair Airlines, and Unity Airlines	9
Piper 31	Unity Airlines	9

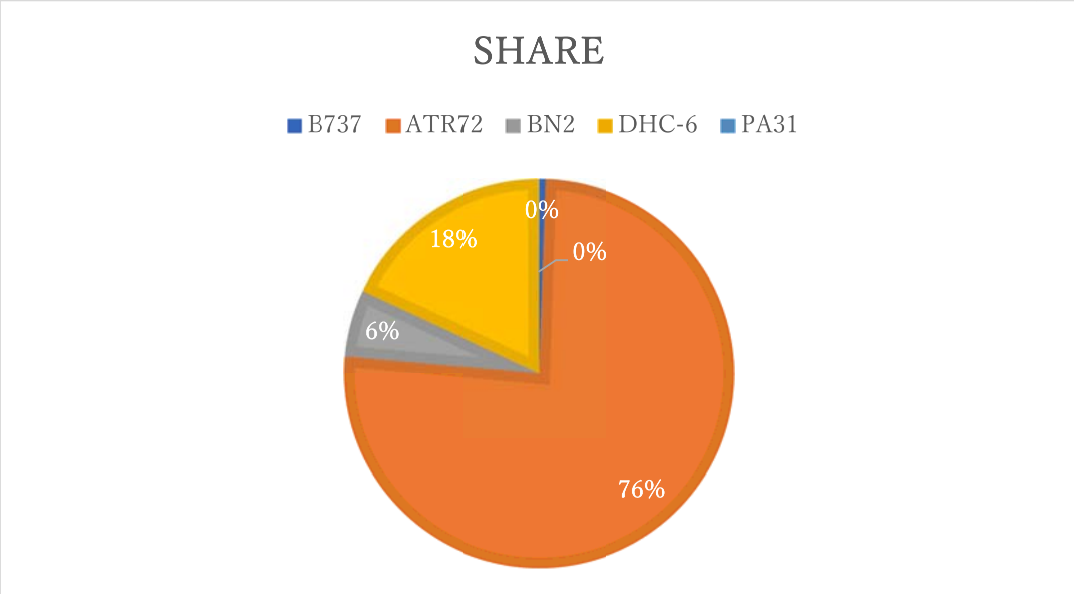
Source: JICA Study Team



Source: AVL Statistics

Figure A-2 Aircraft Type Operated in Domestic Routes from 2015 to 2019

The number of annual domestic passengers has increased, but the shares of aircraft types have remained almost same. Figure A-3 shows share of aircraft type in 2019. ATR-72 carried 76% of passengers and DHC-6 was the second, which carried 18% and BN-2 was 6%.



Source: AVL Statistics

Figure A-3 Aircraft Type Share in Domestic Route in 2019

Air Vanuatu had operated B737 aircraft in Port Vila–Santo Pekoa route and announced to increase to three flights per week from July 2020. It is presumed some parts of ATR72 flights between Port Vila and Santo Pekoa will be operated by B737 in future. In 2019, 61% of the total operation of ATR72 was in this route. Currently, 15 weekly flights are provided on average, and it is presumed that 3 flights (19.5%) among 15 flights will be operated by B737 in future. As a result, 12% of the ATR72 operation will be replaced by B737 flights. It is also presumed the share of other aircraft types will remain the same in future. Table A-21 shows annual domestic passengers by aircraft type.

Table A-21 Annual Domestic Passenger by Aircraft Type

	Share	2025	2030	2035	2040
Annual Passengers		183,478	208,604	237,169	269,647
B737	12%	22,017	25,032	28,460	32,358
ATR-72	64%	117,426	133,507	151,788	172,574
DHC-6	18%	33,026	37,549	42,690	48,536
BN-2	6%	11,009	12,516	14,230	16,179
Total		22,017	25,032	28,460	32,358

Source: JICA Study Team

Future aircraft movements were calculated by applying the above aircraft share to the annual domestic passengers and dividing by the number of seats. The future load factor of 70% is assumed for the calculation. Results of the calculation are shown in Table A-22.

Table A-22 Annual Domestic Aircraft Movement

	2025	2030	2035	2040
B737	179	203	231	263
ATR-72	2,467	2,805	3,189	3,626
DHC-6	2,949	3,353	3,812	4,334
BN-2	1,747	1,987	2,259	2,568
Total	7,163	8,144	9,259	10,527

Source: JICA Study Team

Appendix 7: Calculation of Facilities in Passenger Terminal Building

Table A-23 Calculation Formula of IATA Standard

	Year 2030			Year 2040			Remarks
	Int'l	Dom.	Comb.	Int'l	Dom.	Comb.	
a: Number of peak hour originating passengers	297	123	313	384	123	404	Int'l: Half value of the demand forecast, Dom.: Seats of B737-800 (176 seats)*0.7 (load factor)
b: Number of peak hour landside transfer passengers	0	0	0	0	0	0	
c: Number of peak hour departing passengers	297	123	313	384	123	404	Half value of the demand forecast
d: Number of peak hour terminating passengers	297	123	313	384	123	404	
e: Number of peak hour terminating and Int'l/Dom. transfer passengers	297	123	313	384	123	404	
f: Proportion of passengers to be customs checked	100%	-	-	100%	-	-	
g: Time of first passenger at gate lounge (mins. before STD)	50	50		50	50		
i: Proportion of long haul departing passengers during peak hour	100%	0%	-	100%	0%	-	
k: Proportion of short haul departing passengers during peak hour	0%	100%	-	0%	100%	-	
m: Maximum number of seats on largest aircraft handled at gate in question	291	176	-	291	176	-	A330-900neo: 291 seats B737-800: 176 seats
o: Number of visitors - Originating passengers	1	0.5	0.8	1	0.5	0.8	
o: Number of visitors - Terminating passengers	1	0.5	0.8	1	0.5	0.8	
p: Proportion of passengers using car/taxi - Originating passengers	80%	80%	80%	80%	80%	80%	
p: Proportion of passengers using car/taxi - Terminating passengers	80%	80%	80%	80%	80%	80%	
q: Proportion of passengers arriving by wide-body aircraft during peak hour	50%	50%	-	50%	50%	-	
r: Proportion of passengers arriving by narrow-body aircraft during peak hour	50%	50%	-	50%	50%	-	
s: Maximum number of seats on largest aircraft handled at airport	291	176	-	291	176	-	
t1: Average processing time per passenger at check-in desk (mins.)	2.0	2.0	2.0	2.0	2.0	2.0	
t2: Average processing time per passenger at departure passport control (mins.)	1.3	-	-	1.3	-	-	
t3: Average processing time per passenger at arrival passport control (mins.)	1.3	-	-	1.3	-	-	
t4: Average processing time per passenger at arrival customs (mins.)	1.5	-	-	1.5	-	-	
u: Average occupancy time of departure lounge per departing long-haul passengers (mins.)	50	50	-	50	50	-	
v: Average occupancy time of departure lounge per departing short-haul passengers (mins.)	30	30	-	30	30	-	

Source: JICA Study Team

The following facilities' area and quantity are calculated using the above values.

Table A-24 Area and Quantity of the Facilities

Facility	Calculation formula	2030	2040	Remarks
1. Departure Curb (Int'l and Dom.)	L = (0.095 a p) 1.1 =	27	34	
2. Departure Concourse (Int'l and Dom.)	A = 0.75 [a (1 + o) + b] =	411	531	
3. Check-in Queueing Area (Int'l and Dom.)	A = [0.25 (a + b)] 1.1 =	86	112	
4. Check-in Desks (Int'l and Dom.)	N = [(a + b) t1 / 60] 1.1 =	12	15	Existing: 10 (Int'l), 4 (Dom.)
5. Departure Passport Control (Int'l)	N = [(a + b) t2 / 60] 1.1 =	8	10	Existing: 4
6. Security Check - Centralized (Int'l)	N = (a + b) / 300 =	1	2	Existing: 2
6. Security Check - Centralized (Dom.)	N = (a + b) / 300 =	1	1	Existing: manual
7. Departure Lounge (Int'l)	A = [c (u i + v k) / 30] 1.1 =	545	704	Existing: approx. 300 seats
7. Departure Lounge (Dom.)	A = [c (u i + v k) / 30] 1.1 =	136	136	
8. Security Check - Gate Lounge	N = 0.2 m / (g - 5) =	-	-	
9. Gate Lounge	A = m =	-	-	
10. Arrival Health Check (Int'l)	N = 3 position	-	-	
11. Arrival Passport Control Queueing Area (Int'l)	A = 0.25 (d + b) =	75	96	
12. Arrival Passport Control (Int'l)	N = [(d + b) t3 / 60] 1.1 =	8	10	
13. Baggage Claim Area (Int'l and Dom.)	A = (0.9 e) 1.1 =	310	400	
14. Number of Baggage Claim Devices - Wide Body (Int'l)	N = e q / 425 =	1	1	Existing: 1
14. Number of Baggage Claim Devices - Narrow Body (Int'l)	N = e r / 300 =	1	1	
14. Number of Baggage Claim Devices - Narrow Body (Dom.)	N = e r / 300 =	1	1	
15. Arrival Customs Queueing Area (Int'l)	A = 0.25 e f *1.1=	82	106	
16. Arrival Customs (Int'l)	N = e f t4 / 60 =	8	10	
17. Arrival Concourse Waiting Area (Int'l and Dom.)	A = [0.375 (d + b + 2 d o)] 1.1 =	323	417	
18. Arrival Curb (Int'l and Dom.)	L = (0.095 d p) 1.1 =	27	34	

Source: JICA Study Team

Other facilities' areas were calculated based on the design of the Honiara International Airport Project under construction in the Solomon Islands as shown in Table A-25.

Table A-25 Area of Other Facilities

Facility	Area (m^2) / Qty.			Remarks
		2030	2040	
Check-in Counter Area (Int'l and Dom.)	A =	134	174	W=2m/1counter, D=4.5m≤
Baggage Handling Area (Int'l and Dom.)	A =	223	290	W=2m/1counter, D=7.5m≤
Departure Passport Control Queueing Area (Int'l)	A =	75	96	Same value as No.11
Departure Passport Control Area (except Queueing Area)	A =	92	129	2counters unit (W=1.7m, D=3.2m): 4set Aisle: W=0.9m Before/after counter: D=6m
Security Area (Int'l)	A =	77	77	1unit (W=3.5m, D=10m): 2set
Security Area (Dom.)	A =	39	39	1unit (W=3.5m, D=10m): 1set
Concession Area (Int'l and Dom.)	A =	203	262	Honiara: 264m^2/(390 (Int'l peak hour pax) +61 (Dom. peak hour pax)) -> 0.59m2/pax
Toilet	A =	275	356	Honiara: 360m^2/(390 (Int'l peak hour pax) +61 (Dom. peak hour pax)) -> 0.8m2/pax
Business Lounge	A =	119	119	2m^2/pax * 320 (peak hour pax) * (47seat / 291 seat * 0.7 (load factor)) * 1.5
Quarantine Queueing Area (Int'l)	A=	75	96	Same value as No. 11
Quarantine Area (except Queueing Area) (Int'l)	A =	92	120	2counters unit (W=1.7m, D=3.2m): 4set Aisle: W=0.9m Before/after counter: D=6m
Quarantine Counter (Int'l)	N=	8	10	Same value as No. 12
Arrival Passport Control Area (except Queueing Area)	A =	92	120	2counters unit (W=1.7m, D=3.2m): 4set Aisle: W=0.9m Before/after counter: D=6m
Airline Office	A =	234	234	8.5m^2 / staff * 5 staff * 5 airlines
CIQ Office	A =	84	84	8.5m^2 / staff * 5 staff * 3 section
Health	A =	28	28	
Airport Manager's Office	A =	33	33	
Other Office and Waiting Room	A =	190	190	
PA, CCTV, FIDS Room	A =	56	56	
Police	A =	56	56	
Staircase	A =	86	86	2 nos for passengers (two-story only)
Elevator	A =	20	20	2 nos for passengers (two-story only)
Fixed Bridge (Int'l)	A =	120	120	2 nos (two-story only)

Source: JICA Study Team

The minimum required area calculating by the sum of the above values is as follows:

1) 2030 demand forecast

One-story type: 1,401 (Int'l) + 175 (Dom.) + 2,645 (Int'l and Dom.) = 4,220 m^2

Two-story type: 1,521 (Int'l) + 175 (Dom.) + 2,750 (Int'l and Dom.) = 4,445 m^2

2) 2040 demand forecast
   One-story type: 1,751 (Int'l) + 175 (Dom.) + 3,221 (Int'l and Dom.) = 5,147 m^2
   Two-story type: 1,871 (Int'l) + 175 (Dom.) + 3,327 (Int'l and Dom.) = 5,372 m^2

In addition to the above facilities, when making the actual plan, other facilities such as transfer counter, corridors, electrical and mechanical rooms, and warehouses will be added, and the area will be increased considering the column span.

Appendix 8: Calculation of Fuel Farm

Requirement of fuel storage capacity is calculated from the volume of daily consumption of fuel by air routes, the number of peak day landings, and storage period.

The following formula is used to calculate fuel requirements of each route.

Table A26 Fuel Consumption by Aircraft Type

Aircraft type	Fuel consumption (kl) X: Route distance (km) Y : Fuel Consumption (kl)
Large Jet	Y = 0.0098 X + 3.70
Small Jet	Y = 0.0041 X + 0.74
Turboprop	Y = 0.0010 X + 0.60
Small propeller	Y = 0.002 X + 0.12

Source: JCAB

Route distance used in the calculation and fuel consumption by each aircraft type are shown in Table A27.

Table A-27 International Route Distance and Fuel Consumption

Route	Distance (km)	Fuel Consumption
Australia	2,922 km	Small Jet: 0.041 x 2,922 + 0.75 = 12.7 (kl)
New Zealand	2,569 km	Small Jet: 0.041 x 2,569 + 0.75 = 11.3 (kl)
New Caledonia	606 km	Small Jet: 0.041 x 606 + 0.75 = 3.2 (kl) Turboprop: 0.0010 x 606 + 0.60 = 1.2 (kl)
Fiji	1,113km	Small Jet: 0.041 x 1,113+ 0.75 = 5.3 (kl) Turboprop: 0.0010 x 1,113 + 0.60 = 1.7 (kl)
Solomon Islands	1,472 km	Small Jet: 0.041 x 1,472+ 0.75 = 6.8 (kl) Turboprop: 0.0010 x 1,472 + 0.60 = 2.1 (kl)
Domestic	250 km	Turboprop: 0.0010 x 250 + 0.60 = 0.9 (kl) Small Propeller: 0.002 x 250 + 0.12 = 0.6 (kl)

Source: JICA Study Team

Daily fuel consumptions are calculated by multiplying the fuel consumption by each route by busy day traffic of each route by aircraft type as shown in Table A-28.

Table A-28 Daily Fuel Consumption

Route	Fuel Consumption	Busy Day Landing		Fuel Volume per Day	
		2030	2040	2030	2040
Australia	Small Jet: 12.7 (kl)	7	9	88.9	114.3
New Zealand	Small Jet: 11.3 (kl)	2	3	22.6	33.9
New Caledonia	Small Jet: 3.2 (kl)	1	1	3.2	3.2
	Turboprop: 1.2 (kl)	1	2	1.2	2.4
Fiji	Small Jet: 0 5.3 (kl)	1	1	0.53	0.53
	Turboprop: 1.7 (kl)	2	2	3.4	3.4

Solomon Islands	Small Jet: 6.8 (kl)	1	1	6.8	6.8
	Turboprop: 2.1 (kl)	1	1	2.1	2.1
Domestic	Small Jet: 0.9 (kl)	15	21	13.5	18.9
	Turboprop: 0.6 (kl)	24	34	14.4	20.4
Total				156.6	205.9

Source: JICA Study Team

As shown in Table A28, daily requirements of jet fuel in the airport in 2030 and 2040 will be 156,6 kl and 205.9 kl, respectively. In general, 7-day reserve fuel will be stored in an airport, so required capacities of the fuel farm in 2030 and 2040 are 1,100 kl and 1,440 kl, respectively. Assuming 500 kl tank will be used in the airport and practical fuel capacity of 80%, three tanks will be required in 2025 and four tanks will be required in 2035. As a result, required area of the fuel farm is 90 m × 70 m as shown in Figure A-4.

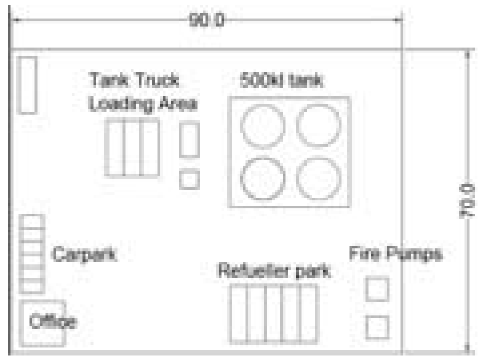
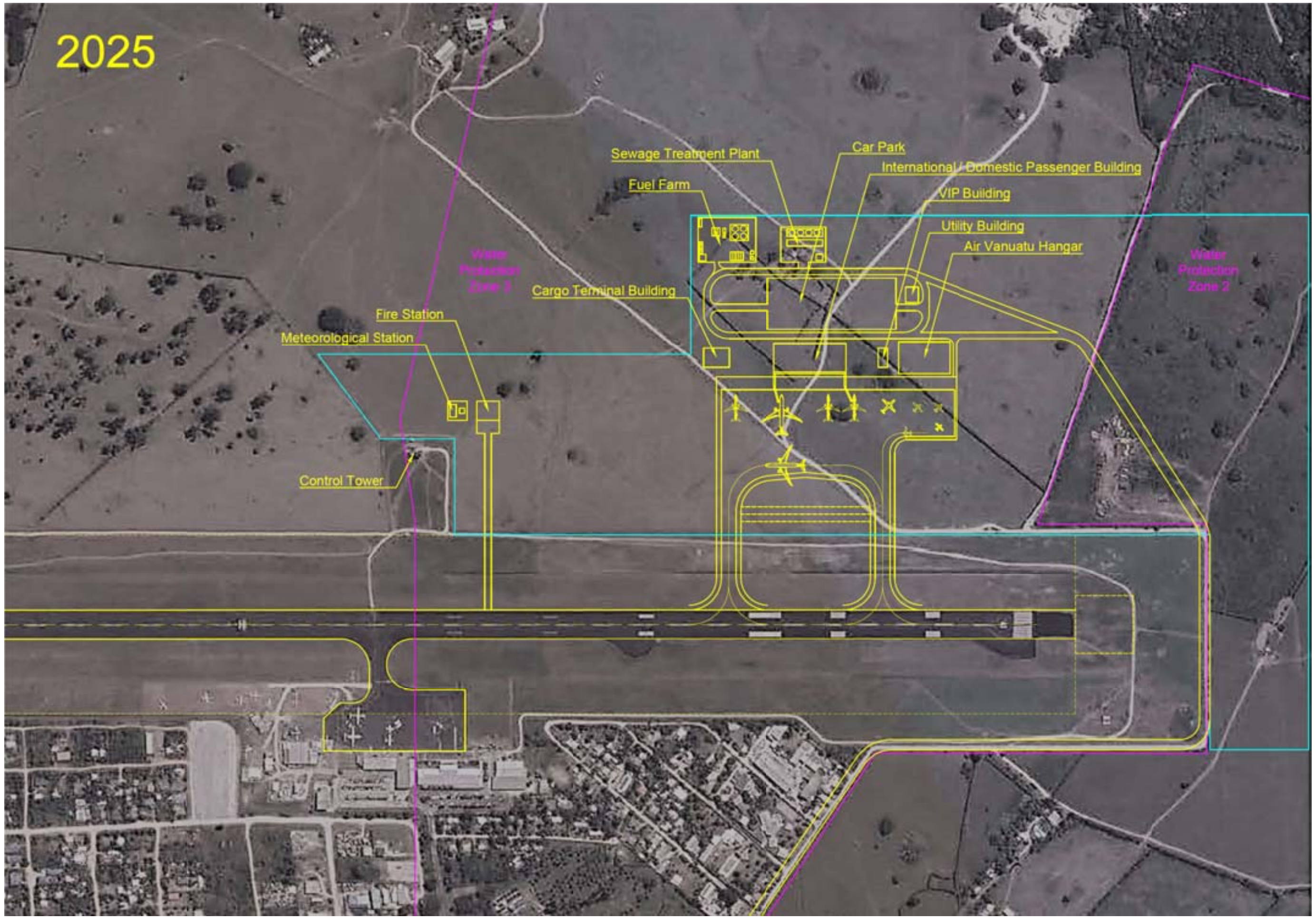
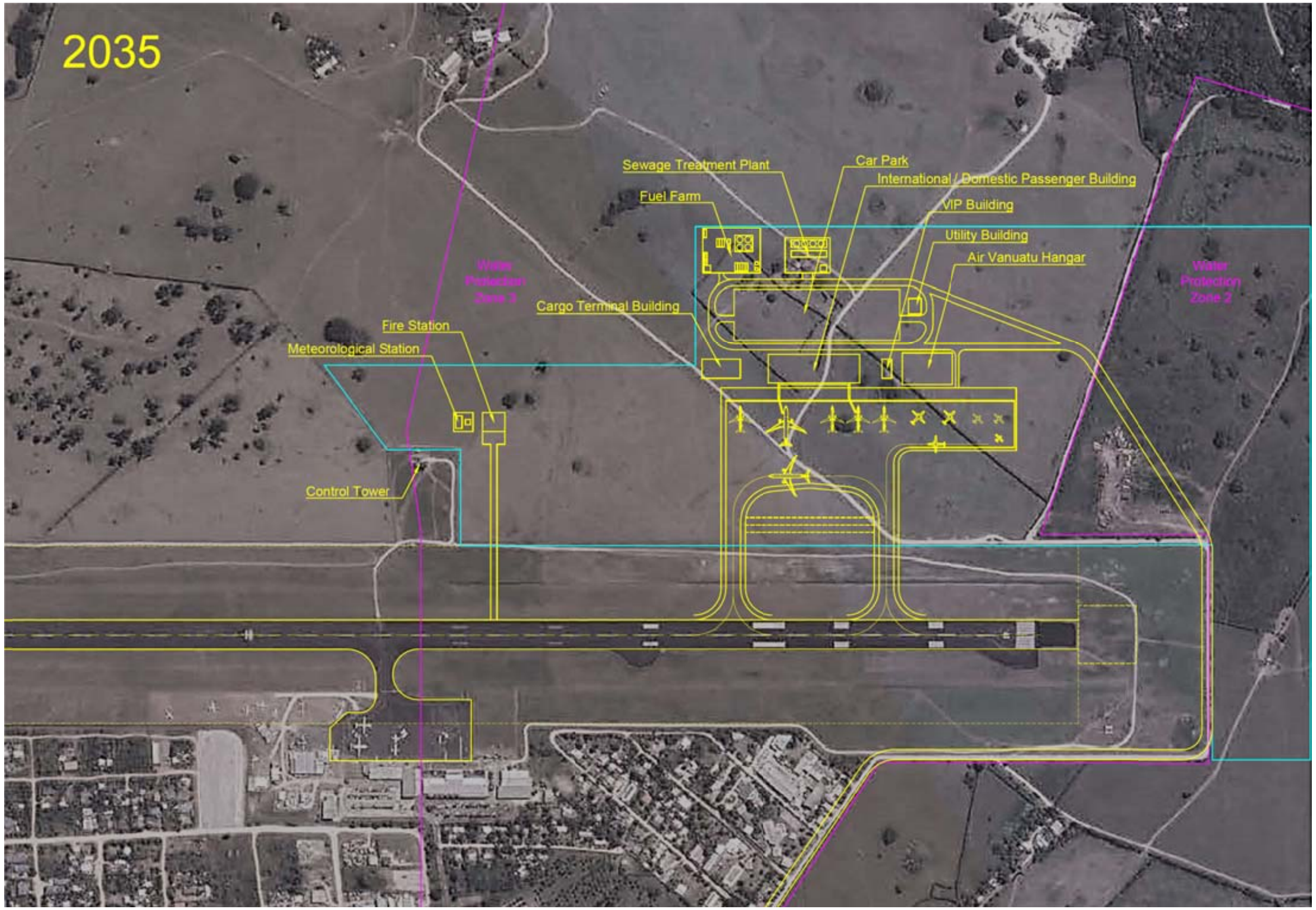


Figure A4 Layout Plan **of the Fuel Farm**

Appendix 9: Terminal Area in the Water Protection Zone

The following layout plans are prepared for the case of development in the water protection zone for reference.




2035
Sewage Treatment Plant
Car Park
International / Domestic Passenger Building
Fuel Farm
VIP Building
Utility Building
Air Vanuatu Hangar
Water Protection Zone 3
Water Protection Zone 2
Cargo Terminal Building
Fire Station
Meteorological Station
Control Tower

Appendix 10: Construction Cost Estimate

Table A-29 Construction Cost

Work Item			Qt'y	Unit	Rate (JPY)	Amount (JPY)
Building Works	Int'l/Dom. Terminal	Bldg.	8,550	m2	423,822	3,623,678,100
		Baoding Bridge	2	No.	60,000,000	120,000,000
		BHS	3	No.	15,000,000	45,000,000
		Security Equipment	1	Ls		60,000,000
		Total				3,848,678,100
	Cargo Terminal	Bldg.	1,600	m2	294,391	471,025,600
	VIP	Bldg.	450	m2	338,550	152,347,343
	Fire Station	Bldg.	1,050	m2	294,391	309,110,550
		Apron	875	m2	18,490	16,178,750
		Total				325,289,300
	Utility Building	Bldg.	480	m2	294,391	141,307,680
	MET Station	Bldg.	200	m2	294,391	58,878,200
	Total of Building Works					4,997,526,223
Major Equipment	Power supply system		1	Ls		48,807,000
	Water Reservoir & Pump		1	Ls		15,000,000
	MET Equipment		1	Ls		5,000,000
	Total of Major Equipment					68,807,000
Civil Works	Apron（Concrete)		41,725	m2	32,902	1,372,835,950
	Shoulder (Chip Seal)		2,300	m2	4,590	10,557,000
	Taxiway (Concrete)		14,000	m2	32,902	460,628,000
	Shoulder (Chip Seal)		8,600	m2	4,590	39,474,000
	GSE Road (Concrete)		9,000	m2	18,490	166,410,000
	Airside drainage (U-channel)		1,250	m	57,354	71,692,477
	Airside drainage (Pipe)		50	m	23,235	1,161,745
	Airside drainage (Calvert)		120	m	346,715	41,605,790
	Car park (Concrete)		16,000	m2	18,490	295,840,000
	Terminal Road (Concrete)		19,000	m2	18,490	351,310,000
	Landside drainage (U-channel)		1,000	m	57,354	57,353,981
	Landside drainage (Pipe)		50	m	23,235	1,161,745
	Curb Stones		3,600	m	11,273	40,583,061
	Fence		2,000	m	29,750	59,499,895
	Total of Civil Works					2,970,113,643
Airfield Lighting	Edge Light		60	No.	802,907	48,174,394
	Information board		4	No.	612,262	2,449,048
	Aerodrome beacon		1	No.	10,947,393	10,947,393
	Control System		1	Ls	11,378,176	11,378,176
	Floodlight		12	No.	9,420,404	113,044,844
	Total of Airfield Lighting					185,993,855
Outside Works	Access Road (Concrete)		18,600	m2	18,490	343,914,000
	Curb Stone		6,200	m	11,273	69,893,049
	Sidewalk (Chip Seal)		3,100	m2	4,590	14,229,000
	Street Lights		52	no	200,000	10,400,000
	Power Cable		2,250	m	12,000	27,000,000
	Water Pipe		2,250	m	13000	29,250,000
	Total of Outside Works					494,686,049
Sewage Plant	Sewage Treatment Plant					500,000,000
	Sewage Pipe		100	m	23,235	2,323,490
	Total of Sewage Plant					502,323,490
Fuel Farm	Refueling System	by Private Company				300,000,000
	Hydrant Pipe	by Private Company				200,000,000
	Total of Fuel Firm Works					500,000,000
Air Vanuatu Hangar	Air Vanuatu Hangar	by Air Vanuatu				300,000,000
Total Construction Cost						10,019,450,259