KINGDOM OF SWAZILAND

NEW INTERNATIONAL AIRPORT CONSTRUCTION PROJECT

FEASIBILITY STUDY REPORT

MARCH 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

F O R E W O R D

In response to the request of the Government of the Kingdom of Swaziland made to the Government of Japan, the present Feasibility Study on the New International Airport Construction Project has been carried out by the Japan International Cooperation Agency (JICA).

The JICA dispatched to Swaziland a preliminary survey team headed by Mr. Hiroshi Katsube of the Civil Aviation Bureau, Ministry of Transport, in July 1979, and the Feasibility Study was started in September 1979. The present Report is based on the Progress Report II of January 1980 and the Draft Report of March 1980 as well as on the subsequent study made by the team in Japan to reflect the comments of the Swazi Government.

In view of the great contribution this project is expected to make to the economic development of the Kingdom, I hope that the present study will serve to expedite implementation of the project, and that it will contribute to furthering the mutual goodwill and friendship of our two countries.

I wish to express my heartfelt appreciation for the close cooperation accorded to our study team by the officials concerned of the Government of Swaziland.

Tokyo, March 1980

Keisuke Arita
President
JAPAN INTERNATIONAL COOPERATION AGENCY
Tokyo, Japan

KINGDOM OF SWAZILAND

NEW INTERNATIONAL AIRPORT CONSTRUCTION PROJECT

FEASIBILITY STUDY

FINAL REPORT

- Table of Contents -

			Page
FOREWORD			
CONCLUSION AND SUMMARY			
CHAPTER 1		INTRODUCTION	1-1
	1.1	General	1-1
	1.2	Objective and Scope of Study ...	1-2
	1.3	Chronology and Sequences of Study	1-3
	1.4	Supervisory Committee	1-4
CHAPTER 2		BACKGROUND OF PROJECT	2-1
	2.1	Present Situation and Some Future Outlook	2-1
	2.2	Transport Sector	2-8
	2.3	Existing Matsapa Airport	2-18
	2.4	Need for a New International Airport	2-26
CHAPTER 3		SITE EVALUATION AND SELECTION	3-1
	3.1	General	3-1
	3.2	Potential Sites	3-5
	3.3	Selection of Alternative Sites ..	3-10
	3.4	Evaluation of Alternative Sites ..	3-16
	3.5	Overall Evaluation and Recommendation	3-23
CHAPTER 4		AIR TRAFFIC FORECAST	4-1
	4.1	Methodology and Conditions of Forecast	4-1
	4.2	Air Transport Demand Forecast ...	4-5

		Page
CHAPTER 5	AIRPORT PLANNING	5-1
5.1	General	5-1
5.2	Airport Facility Requirements ...	5-1
5.3	Airport Facility Plan	5-22
5.4	Airspace Use Plan	5-36
5.5	Environmental Considerations	5-45
CHAPTER 6	CONSTRUCTION SCHEDULE AND COST ESTIMATE	6-1
6.1	Construction Conditions	6-1
6.2	Civil Works	6-7
6.3	Building Works	6-15
6.4	Construction Schedule	6-15
6.5	Construction Cost Estimate	6-15
CHAPTER 7	FINANCIAL ANALYSIS	7-1
7.1	General	7-1
7.2	Estimate of Financial Costs	7-1
7.3	Estimate of Financial Benefits ...	7-3
7.4	Results of Financial Cost-Benefit Analysis	7-10
CHAPTER 8	ECONOMIC ANALYSIS	8-1
8.1	General	8-1
8.2	"Without-the-Project" Case	8-1
8.3	Economic Costs	8-2
8.4	Economic Benefits	8-5
8.5	Overall Economic Evaluation	8-10
CHAPTER 9	PROJECT IMPLEMENTATION ORGANIZATION AND NEW INTERNATIONAL AIRPORT ADMINISTRATION	9-1
9.1	Project Implementation Organization	9-1
9.2	New International Airport Administration	9-5

LIST OF APPENDICES

Appendix 1A	SCOPE OF WORK
Appendix 2A	EXISTING TERMINAL BUILDING
Appendix 3A	OBSTRUCTION CHART OF POTENTIAL SITES
Appendix 3B	GRADING PLAN OF ALTERNATIVE SITES
Appendix 3C	LONGITUDINAL SECTION OF ALTERNATIVE SITES
Appendix 5A	PROJECTED FLIGHT SCHEDULE
Appendix 5B	STAGE LENGTH-PAYLOAD RELATIONSHIP
Appendix 5C	HALF-HOURLY DISTRIBUTION OF PASSENGERS
Appendix 5D	TERMINAL AREA LAYOUT PLAN STAGE I
Appendix 5E	TERMINAL AREA LAYOUT PLAN STAGE II
Appendix 5F	PASSENGER TERMINAL BUILDING - ELEVATION/SECTION STAGE I
Appendix 5G	" - GROUND FLOOR PLAN STAGE I
Appendix 5H	" - 1ST AND 2ND FLOOR PLAN STAGE I
Appendix 5I	" - ELEVATION/SECTION STAGE II
Appendix 5J	" - GROUND FLOOR PLAN STAGE II
Appendix 5K	" - 1ST AND 2ND FLOOR PLAN STAGE II
Appendix 5L	FIRE/RESCUE STATION, MAIN POWER SUBSTATION CARGO BUILDING
Appendix 5M	AIRFIELD LIGHTING SYSTEM STAGE I
Appendix 5N	AIRFIELD LIGHTING SYSTEM STAGE II
Appendix 5P	APPROACH ROAD

Appendix 6A	RESULTS OF SOIL TESTS
Appendix 6B	LONGITUDINAL PROFILE OF RUNWAY
Appendix 6C	RUNWAY STRIP TYPICAL CROSS SECTION
Appendix 6D	DISTRIBUTION DIAGRAM OF EARTHWORK
Appendix 6E	FLEXIBLE PAVEMENT DESIGN CURVE
Appendix 6F	PAVEMENT PLAN

LIST OF TABLES

NO	TITLE	PAGE
S-1	Results of Air Traffic Forecast	vi
S-2	Outline of New Airport Facilities	vii
2.1	Land and Climate	2-2
2.2	Breakdown of Resident Population by Origin	2-3
2.3	Gross Domestic Product of Swaziland	2-4
2.4	Balance of Foreign Trade	2-5
2.5	Number of Tourists in Swaziland	2-6
2.6	Number of Tourists Staying in Hotels by Nationality	2-7
2.7	Investments in Transport Infrastructure (1978 - 1982)	2-10
2.8	Railway Traffic by Type	2-11
2.9	Railway Traffic by Commodity	2-12
2.10	Number of Scheduled Flights Serving Matsapa as of November, 1979	2-13
2.11	Matsapa Airport Traffic	2-14
2.12	Matsapa Airport Traffic (Commercial Scheduled Passengers by Route)	2-15
2.13	Matsapa Airport Traffic (Cargo/Mail by Route)	2-15
2.14	Declared Distances	2-18
2.15	Present Facilities	2-23
3.1	Comparison of Potential Sites	3-15
3.2	Construction Cost of Civil Works by Site	3-20
3.3	Economic Construction Cost	3-20
3.4	Distance from Hotel Area	3-21
3.5	Difference in Economic Costs	3-22

NO	TITLE	PAGE
4.1	Assumption of GDP Growth Rate	4-4
4.2	Estimated GDP of Swaziland	4-4
4.3	Embarking/Disembarking Passengers	4-5
4.4	Number of Passengers in 1995 and 2005	4-8
4.5	Projected Cargo/Mail Traffic of the Three Routes	4-9
4.6	Air Cargo/Mail Traffic of All Routes	4-10
4.7	Projected Cargo/Mail by Route in 1995 and 2005	4-10
4.8	Number of Flights in 1995 and 2005	4-12
4.9	Number of Small Aircraft Registered in Swaziland	4-13
4.10	Forecast of Number of Small Aircraft Registered in Swaziland	4-14
5.1	Air Transport Demand and Airport Facility Requirements	5-4
5.2	Passenger and Cargo Traffic Demand	5-10
5.3	Aircraft Types to be in Service	5-11
5.4	Projected Aircraft Movements by Route (1995)	5-14
5.5	Projected Aircraft Movements by Route (2005)	5-14
5.6	Number of Passenger Loading Apron	5-17
5.7	General Aviation Apron Area	5-17
5.8	Minimum Weather Conditions	5-39
6.1	Mean Monthly Rainfall at Mpaka	6-3
6.2	Classification of Excavation Work by Equipment	6-8
6.3	Earthmoving Quantities by Distance	6-8
6.4	Comparison of Asphalt Concrete Pavement and Cement Concrete Pavement	6-12
6.5	Construction Cost Estimate of New Airport	6-19
6.6	Annual Construction Cost Estimate	6-20
6.7	Annual Construction Cost Estimate for Stage I with Cost Escalation at 7% per annum	6-21
6.8	Annual Construction Cost Estimate for Stage I with Cost Escalation at 9% per annum	6-21
6.9	Annual Construction Cost Estimate for Stage I with Cost Escalation at 11% per annum	6-21

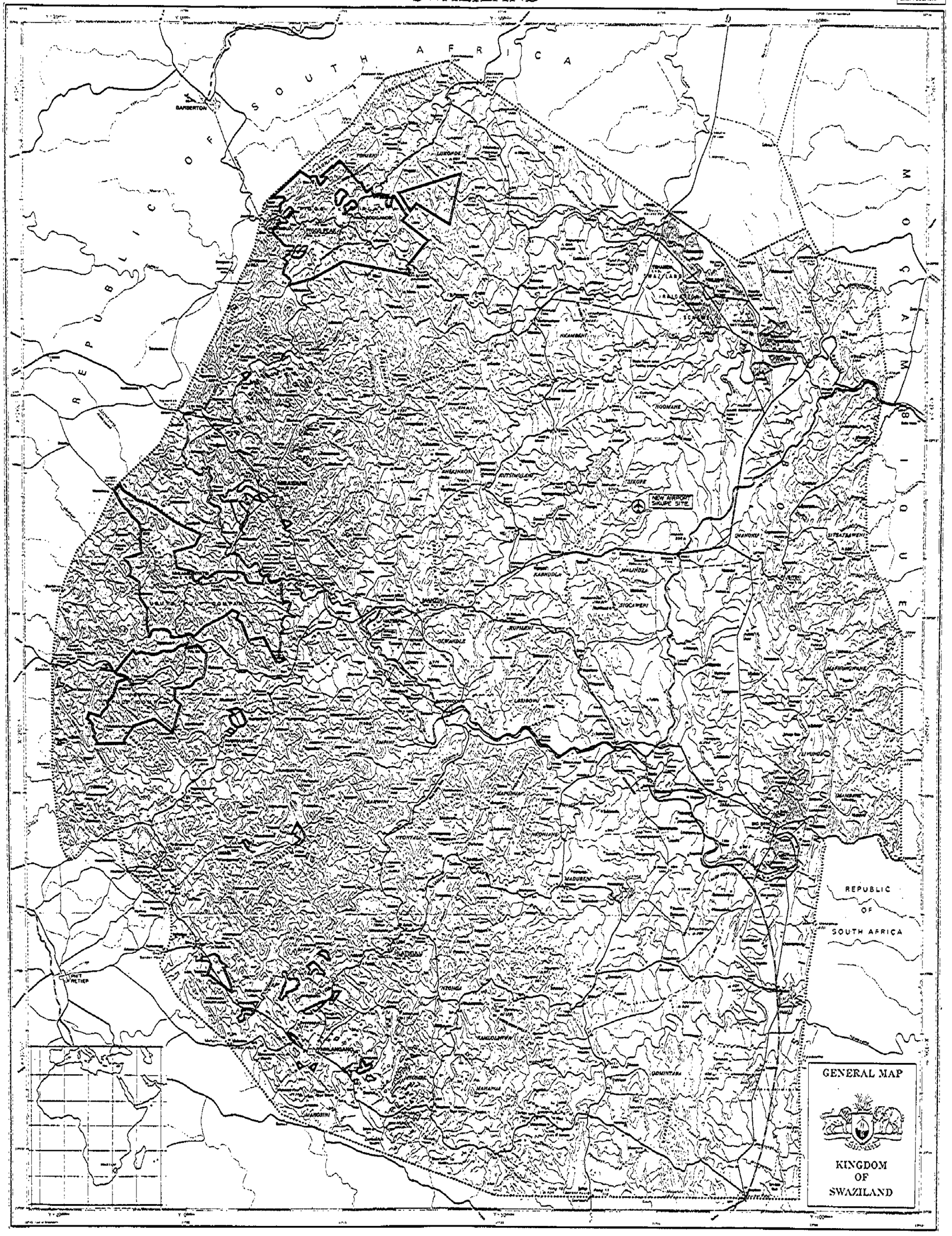
NO	TITLE	PAGE
6.10	Annual Construction Cost Estimate for Stage I with Cost Escalation at 13% per annum	6-22
6.11	Annual Construction Cost Estimate for Stage I with Cost Escalation at 15% per annum	6-22
7.1	Maintenance and Operation costs	7-2
7.2	Estimated Airport Revenues	7-5
7.3	Landing Fees and Annual Landing Times by Type of Aircraft	7-6
7.4	Parked Aircraft by Type	7-6
7.5	Night Operations by Type	7-7
7.6	Aviation Fuel Consumption	7-7
7.7	Rentable Land Area	7-8
7.8	Rentable Building Area	7-8
7.9	Parked Cars	7-9
7.10	Projected Revenues and Expenditures	7-12
7.11	Projected Funds Flow - Stage I (In 1979 Constant Price)	7-13
7.12	Projected Funds Flow - Stage I (With 11% construction cost increase p.a.)	7-14
8.1	Economic Costs of Construction	8-4
8.2	Economic Costs and Benefits Cash Flow (With Benefits to Swazis only)	8-13
8.3	Economic Costs and Benefits Cash Flow (With Benefits to Swazis and Non-Swazis)	8-14
8.4	Sensitivity Analysis on EIRR (With Benefits to Swazis only)	8-15
8.5	Sensitivity Analysis on EIRR (With Benefits to Swazis and Non-Swazis)	8-15
9.1	Recommend Manning of New International Airport Administration	9-7

LIST OF FIGURES

NO	TITLE	PAGE
S-1	AIRPORT LAYOUT AND APPROACH ROAD PLAN	xiv
S-2	AIRPORT LAYOUT PLAN - STAGE I -	xv
S-3	AIRPORT LAYOUT PLAN - STAGE II -	xvi
S-4	CONSTRUCTION SCHEDULE OF NEW AIRPORT (STAGE I)	viii
2.1	TRANSPORT SECTOR INFRASTRUCTURE	2-9
2.2	PASSENGER TRAFFIC RECORDS AT MATSAPA	2-16
2.3	PASSENGERS BY ROUTE AT MATSAPA	2-17
2.4	LOCATION OF EXISTING MATSAPA AIRPORT	2-19
2.5	MATSAPA AIRPORT LAYOUT PLAN	2-20
2.6	ADF APPROACH PROCEDURE	2-25
3.1	SEQUENCE OF SITE SELECTION STUDY	3-2
3.2	POTENTIAL SITES	3-3
3.3	MPAKA SITE	3-6
3.4	SIKUPE SITE	3-7
3.5	MPISI SITE	3-8
3.6	MOGOBI SITE	3-9
3.7	COAL SEAMS	3-12
4.1	FORECAST OF EMBARKING & DISEMBARKING PASSENGERS AT NEW AIRPORT	4-6
5.1	SEQUENCE OF FACILITY REQUIREMENTS ANALYSIS	5-3
5.2	PROJECTED AIR ROUTE NETWORK (1955)	5-12
5.3	PROJECTED AIR ROUTE NETWORK (2005)	5-13
5.4	ELECTRIC DISTRIBUTION LINE	5-30
5.5	ELECTRIC POWER DISTRIBUTION SYSTEM	5-31
5.6	PLAN OF WATER SUPPLY SYSTEM	5-33
5.7	DIAGRAM OF WATER SUPPLY SYSTEM	5-34
5.8	PLAN OF SEWAGE TREATMENT PLANT	5-35
5.9	DIAGRAMMATIC REPRESENTATION OF SEWAGE TREATMENT	5-35
5.10	VOR APPROACH PROCEDURE NO.1	5-41
5.11	VOR APPROACH PROCEDURE NO.2	5-42
5.12	ILS APPROACH PROCEDURE	5-43

NO	TITLE	PAGE
5.13	WIND ROSE (MPAKA)	5-44
5.14	WECPNL NOISE CONTOURS (Stage II Busiest Day Aircraft Movements: B 707 = 14, B 737 = 22)	5-48
5.15	WECPNL NOISE CONTOURS (Aircraft Movements: B 707 = 28, B 737 = 44)	5-49
6.1	FREQUENCY OF OCCURRENCE OF DAILY RAINFALL	6-4
6.2	RAINFALL INTENSITY - DURATION CURVE	6-5
6.3	LOCATION OF QUARRY AND RIVER SAND	6-6
6.4	DRAINAGE SYSTEM OF NEW SIKUPE AIRPORT	6-14
6.5	CONSTRUCTION SCHEDULE OF NEW AIRPORT - STAGE I	6-16
8.1	OVERFLOWING PASSENGERS' BENEFITS	8-9
9.1	PROJECT IMPLEMENTATION ORGANIZATION CHART	9-3
9.2	ORGANIZATION CHART OF MINISTRY OF WORKS, POWER AND COMMUNICATIONS	9-4
9.3	PROPOSED ORGANIZATION CHART FOR NEW INTERNATIONAL AIRPORT	9-6

SWAZILAND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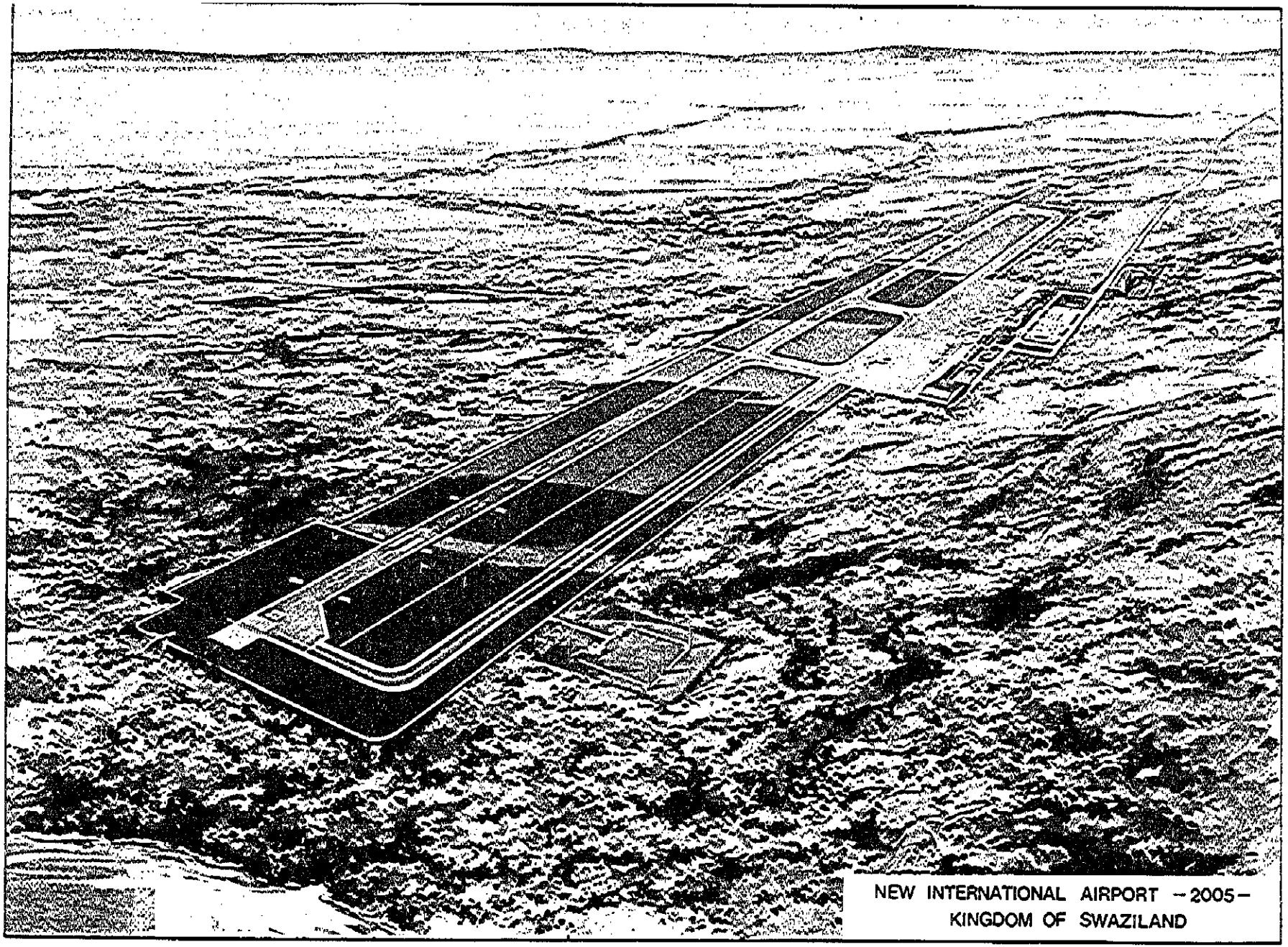
BARBERTON
PIGGS PEAK
LOBAMBA
LOMAHASHA
MBABANE
HHOHHO
MANKAYANE
NHLANGANO
SIKHUPE
NEW AIRPORT SIKUPE SITE
MANKU
SITSATSAWENI
KARHUDLA
MALINDZA
MAYOMI
MGCAWENI
KUPHUENI
EMWANDLE
LAVUMISA
EMPHINI
NYONYANE
MADUBULA
MATSAPHA
INTONJA
KAMKOLWENI
GOMINTABA
MAHAMBA
MAROSINI
REPUBLIC OF SOUTH AFRICA
GENERAL MAP
KINGDOM OF SWAZILAND



NEW INTERNATIONAL AIRPORT –2005–
KINGDOM OF SWAZILAND

CONCLUSION AND SUMMARY

CONCLUSION AND SUMMARY

CONCLUSION

The following conclusions have been reached as a result of the study of the technical, financial and economic feasibility of the New International Airport Construction Project at Sikupe, the site selected by the Government of the Kingdom of Swaziland based on the results of the JICA site selection study.

1. No significant technical difficulty is anticipated in the implementation of the Project.

2. Since the Project is financially unfeasible under the assumed airport tariff structure prepared so as not to exceed these of the neighbouring airports, it will be necessary to raise the level of the airport tariffs at an optimum timing, and to fill by government equity whatever fund shortage that may result depending on the conditions of available source of financing.

3. The economic internal rate of return of 10.5% has resulted from the cost-benefit analysis made with the cash flow of the economic costs and the direct tangible economic benefits identified in the light of the national economy. It is, therefore, concluded that the Project is economically feasible from the point of view of national economy.

4. In order to cope with the forecast future air traffic demand in Swaziland, it is strongly recommended that a new international airport be constructed at the Sikupe site for completion by the end of 1984, to replace the existing Matsapa Airport as a national gateway, as the latter suffers from serious operational safety problems.

SUMMARY

1. Introduction

The primary purpose of the present feasibility study is to make a comprehensive evaluation of the New International Airport Construction Project in Swaziland from the technical, financial and economic points of view.

The method and timing of the study proposed in the Inception Report were approved by the Government of the Kingdom of Swaziland in October 1979, and it was immediately followed in the same month by field survey and by subsequent office analysis of the detailed site selection study in Swaziland, the results of which were submitted in the form of the Progress Report I in November 1979 to the Government of the Kingdom. In December 1979 the Government selected the Sikupe site recommended in the JICA study for the construction of the new airport to replace the international functions of the existing Matsapa Airport.

The construction site thus having been determined, a comprehensive feasibility study was made, and the results thereof are made the contents of the present Final Report.

2. Background of Project

The Kindom of Swaziland has an area of 17,364 square kilometers and is situated in the south-eastern part of the African Continent, being bordered by the Republic of South Africa and the People's Republic of Mozambique.

The country's population is estimated to be approximately 520 thousand in 1976, 98% of which are Africans and the rest are Europeans and other non-Africans. The population of

African grew at a rate of 3.1% from 1966 to 1975.

Gross Domestic Product of Swaziland was 272 million Emalangeni in fiscal 1976/77, and its average annual growth rate in real terms was 7.7% in the five-year period between 1972/73 and 1976/77.

The transportation system of Swaziland comprises road, railway and air.

Aviation plays an important role in international transport of Swaziland. There exists no domestic air transport service.

The international air transport demand of the country has rapidly increased for the past 10 years. At Matsapa Airport in 1978 international air passangers amounted to 41,018 and international cargo 202 tons with an annual growth rate of 17.7% in the past 10 years and 8.5% in the latest 5 years respectively.

The existing Matsapa Airport is situated in the mountainous area and seriously suffers from operational problems including the existence of topographical obstacles in air space and insufficient runway length, etc.

The Government of the Kingdom of Swaziland, since as far back as early '70s, has felt the need to develop adequate international airport facilities to meet the modern aviation demand of the African region in compliance with ICAO standards and recommended practices. Several studies have been made to that end by ICAO, UNDP/ICAO, and by the

Netherlands Airport Consultants.

All these studies, however, invariably concluded that construction of a new airport at a site other than that of the existing Matsapa Airport was recommendable from the point of view of aviation safety. The only exception was the UNDP/ICAO study which made for the purpose of providing interim measures at the existing Matsapa Airport to cope with the aviation demand of the immediate future.

3. Site Evaluation and Selection

Site selection study was made through overall comparative evaluation of the three alternative sites of Mpaka, Sikupe and Mogobi selected out of the four potential sites.

The technical elements of the evaluation included availability of airspace and practicability of construciton, while the comparative economic evaluation was made on the basis of the major items of economic costs of the new airport development at each site.

Based on the results of overall evaluation into which was incorporated considerations on the development potentials of coal deposits, the Sikupe site was found to be the most suitable for the new international airport construction, and this site was officially selected by the Government of the Kingdom in December 1979.

4. Air Traffic Forecast

The air transport demand was forecast for a period of 1985-2005 for:

Total International Passengers,
International Passengers by Route,
International Cargo and Mail, and
Number of Small Aircraft on Register.

The present study assumed that there would be no domestic air transport demand in Swaziland. The results of the air traffic forecast are summarized in Table S-1.

GDP of Swaziland with an estimated annual growth rate of 7.0% was used in the regression analysis made to obtain the total normal traffic of international embarking and disembarking passengers in Swaziland, which was then distributed over the 13 air routes consisting of 6 existing and 7 new, in proportion to the GDP of the respective countries where the routes lead to.

Traffic induced by the reduced transport costs and time on the newly opened direct routes was calculated and added to the forecast normal traffic of each route. The number of transit passengers was also calculated and added to the above terminal traffic total to obtain the total number of passengers forecast on each route.

Forecast of cargo and mail traffic was made in very much a similar manner to that of the passenger traffic.

Table S-1 Results of Air Traffic Forecast

	1995	2005
Passengers (persons)		
Embarking & Disembarking	292,600	853,400
Transit	10,600	42,200
Total	303,200	895,600
Cargo & Mail (tons)	821	1,643
Number of Small Aircraft Registered	86	115

5. Airport Planning

Airport facility and airspace use plan of the new airport was made specifically for construction at Sikupe site, With due consideration for the results of discussions with the officials concerned of the Government of the Kingdom and in conformity with the internationally accepted standards.

The development of the new airport was planned in two stages, namely the first stage to be serviceable up to 1995, and the second and ultimate stage through the year 2005. The outline of the new airport facilities for each stage is summarized in Table S-2 and the layout plans for each stages are shown in Figs. S-1, S-2 and S-3 respectively.

Instrument approach and departure procedures at the new airport were planned in accordance with the PANS-OPS criteria (ICAO Doc. 8168/611/3).

VOR approach procedure was planned for Stage I. In Stage II where the runway is to be upgraded to precision approach runway, the ILS approach procedure was planned. The runway usability of the new airport calculated with reference to the weather minima, amounted to 97 percent for VOR approach and 99% for ILS approach.

Table S-2 Outline of New Airport Facilities

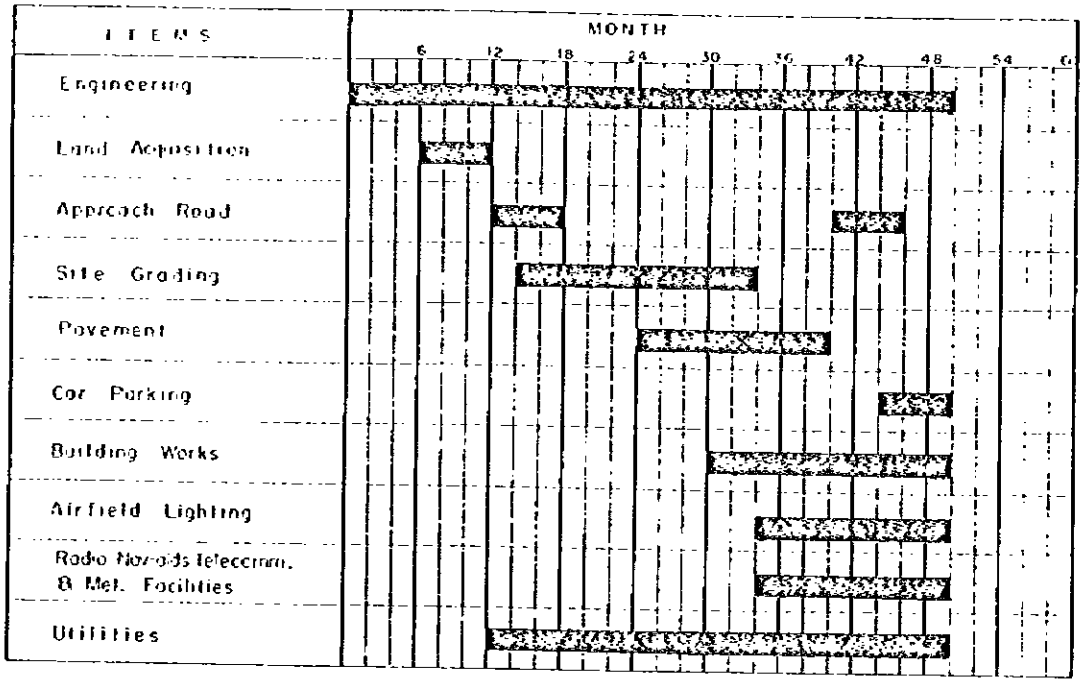
ITEM	DEVELOPMENT STAGE	STAGE I (1995)	STAGE II (2005)	REMARKS
AIRPORT BASIC DATA	Location	Sikupe		75km from Ezulwini valley
	ARP: Elevation	330m		
	Coordinate	26°20'S 31°43'E		on Runway Center
	Runway Orientation	4° - 184°		
	Airport Area	200ha		
AIR TRAFFIC DEMAND FORECAST (ANNUAL)	Passengers			
	Emb. & Disemb.	292,600	853,400	
	Transit	10,600	42,200	
	Total	303,200	895,600	
	Cargo (metric ton)			
	Inbound	575	1,150	
	Outbound	246	493	
	Total	821	1,643	
	Aircraft Movements			
	Scheduled	4,290	11,280	
	General Aviation	3,000	3,600	
	Total	7,290	14,880	
AIRFIELD FACILITIES	Runway Strip	2,570 x 300m		
	Runway	2,450 x 45m		Flexible Pavement
	Shoulder	7.5 m Width		
	Taxiway			
	Exit	2-27m width	4-27m width	Flexible Pavement
	Parallel		2,450 x 23m	
	Shoulder	10.5m width		
	Apron			
	Passenger	24,000sq.m	74,000sq.m	Flexible Pavement
	Maintenance	6,000sq.m	6,000sq.m	
	General Aviation	10,000sq.m	18,000sq.m	
	Runway-Taxiway Center Line Clearance: 195m Precision Approach CAT-I			
AERONAUTICAL TELECOMMUNICATIONS FACILITY RADIO NAVIGATIONAL AIDS		1-Set VOR/DME, NDB ILS		
METEOROLOGICAL SERVICE FACILITY AIRFIELD LIGHTING FACILITY		1-Set SALS	ALS, SALS	
BUILDINGS	Passenger Terminal	6,700sq.m	8,500sq.m	
	Cargo Terminal	-	450sq.m	
	Administration & Tower	1,100sq.m	1,100sq.m	
	Fire/Rescue Station	675sq.m	675sq.m	
	Main Power Substation	1,000sq.m	1,000sq.m	
	Others	Hanger		by Airline, General Aviation
CAR PARKING (Area)		4,700sq.m	8,000sq.m	
UTILITIES		Power, Water, Sewage Treatment, Telephone		
AIRCRAFT FUEL STORAGE		200Kl.x2	200Kl.x4	by Fuel Tank
MINIMUM WEATHER CONDITION Straight-in		-VOR (No.1)- MDA VIS 1,650ft. 2,600m	-ILS- DH RVR 1,293ft. 800m	
Take off		Visibility: 600m, Ceiling: N/A		

6. Construction Schedule and Cost Estimate

Construction schedule of Stage I development was planned as shown in Fig. S-4 and the total period required was estimated to be 50 months.

Construction period of Stage II development was estimated to be 2 years from 1994 through 1995.

Fig. S-4 CONSTRUCTION SCHEDULE OF NEW AIRPORT (STAGE I)



Construction cost of the new airport including the cost of construction works, engineering, land acquisition and physical contingency was estimated for each development stage in foreign and local currency portions without any provisions for future inflation as follows:

Stage I

Foreign Currency Portion	E 23,330,000
Local Currency Portion	E 6,817,000
Stage I Total	E 30,147,000

Stage II

Foreign Currency Portion	E 5,002,000
Local Currency Portion	E 1,813,000
Stage II Total	E 6,815,000

Conversion rate between US Dollar, Emalangeni and Yen was based on the exchange rates as of November 1979 of US$1.0=E 0.83=¥240.

7. Financial Analysis

Financial analysis was made to examine the financial profitability of the New International Airport Construction Project based on the assumption that the new airport will be operated as a self-supporting financial entity.

The annual construction costs of the Project in 1979 market price were used as the financial cost. The financial costs of annual maintenance and operation were estimated at percentage of the respective construction costs, to which were added the personnel cost calculated from the manning program of the new airport and the present governmental wage rates, and the overhead cost.

The financial benefits of the New International Airport Construction Project comprise of the operating revenues of landing charges, lighting charges, aircraft parking charges, land rental, terminal rental, passenger service charge, car parking, observation deck, entrance fees, fuel service charge and concession fees.

Financial internal rate of return (FIRR) of the Project indicated that this Project would have positive but rather low return. Even if the tariff was raised to a maximum practicable level, there expected to be some shortage of funds to balance the project cash flow that has to be satisfied one way or the other, by equity issuance, for example.

8. Economic Analysis

The economic analysis was made to evaluate the economic feasibility of the Project in terms of the economic internal rate of return resultant from the cost-benefit analysis made with the benefits identified from the view-point of national economy of Swaziland through comparison of the "With- " and the "Without-the-Project" cases.

The "Without-the-Project" case is the case in which the existing Matsapa Airport continues to be used at the present service level with no new investments, i.e.,

1) F28 is the largest aircraft that can be accommodated; and
2) The airport's capacity limit of 100,000 passengers a year will be reached at the end of 1985.

The economic cost was derived from financial costs by deducting transfers, and converting them to border prices applying the standard conversion factors and the economic wage rates.

The economic benefits and disbenefits calculated are:

1) Saving in airline flight costs due to the introduction of more efficient aircraft on the existing routes.
2) Saving in time and fare of air passengers on the new direct routes compared with those of the existing indirect routes.
3) Increased foreign exchange receipts from foreign air passengers and airlines.
4) Benefit of passengers overflowing from the existing Matsapa Airport whom the new airport will accommodate.

5) Disbenefit of increased airport access costs and time.

The economic internal rate of return (EIRR) of the Project derived from the cash flow of the economic costs and the economic benefits, the latter being analysed from the viewpoint of national economy of Swaziland, amounted to 10.5%. This value indicates that the Project is economically justified, in view of the fact that the 1980 opportunity cost of Swaziland is in the range of 9.5 - 10.0% per annum according to the Department of Economic Planning and Statistics.

Furthermore, the EIRR value resultant from the analysis involving the beneficiaries without national distinction showed as high a value as 17.4%.

Besides the qantified benefits of the Project, there are the intangible benefits of both direct and indirect nature, such as increased air safety, increased employment opportunity, spillover effect on national economy, increased convenience, increased national prestige, development of information and cultural exchange, and increased incentive to economic development, etc., among which the first three are the very important benefits of the Project which should not be overlooked.

9. Project Implementation Organization and New International Airport Administration

To ensure smooth and efficient implementation of the Project, establishmnet of an adequate organizational set up is recommended within the framework of the present governmental organizations centering around the Ministry of Works, Power and Communications.

A new administrative organization that would be necessary to ensure an efficient operation and management of the new airport was recommended, together with the required manning schedule which is based on the assumption that the new airport will be operated 15 hours a day in Stage I and 18 hours in Stage II. It is emphasized that an adequate number of staff required in the initial year of operation be made ready at least 6 months prior to the inauguration of the new airport.

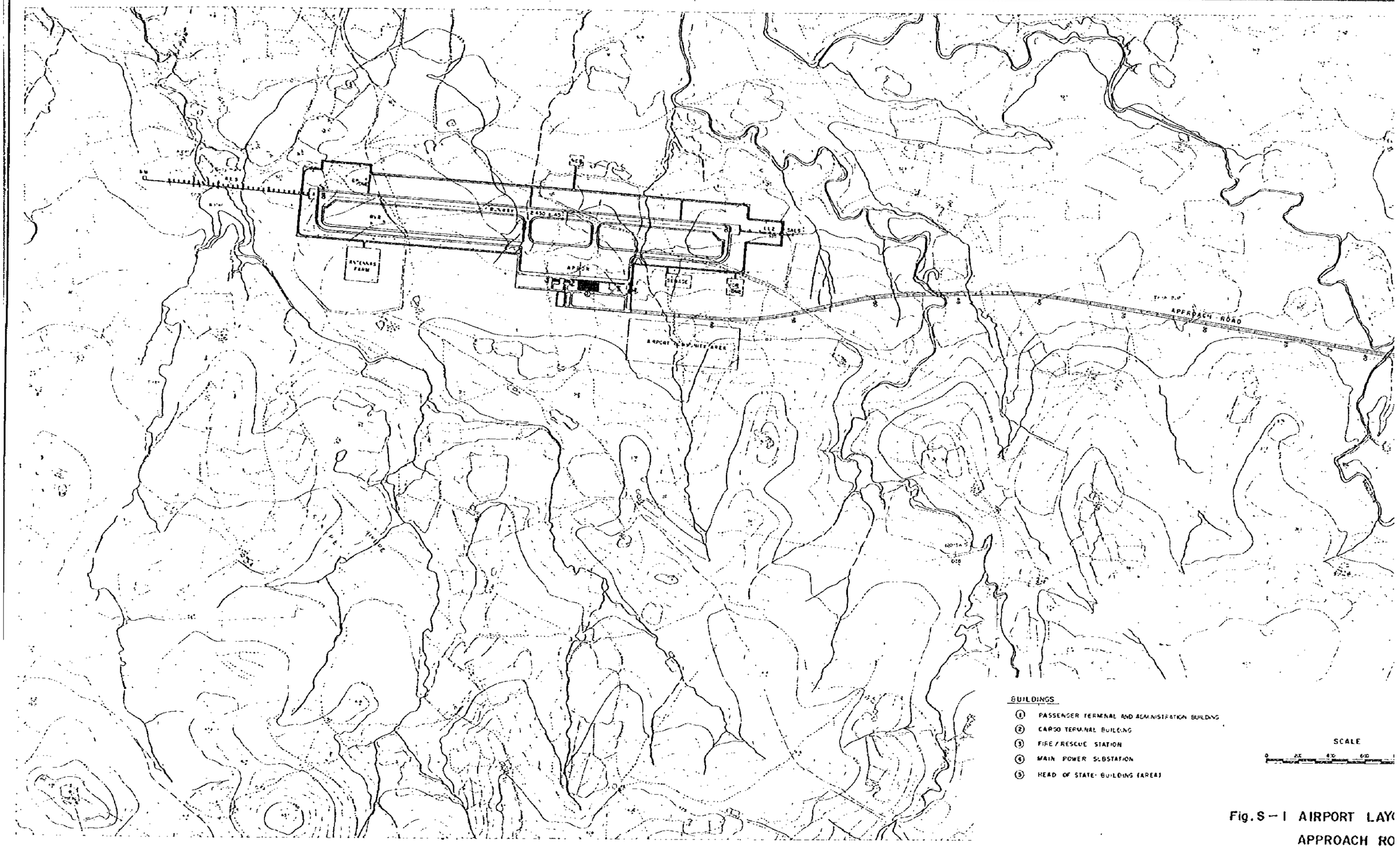


Fig. S – I AIRPORT LAY
APPROACH RO

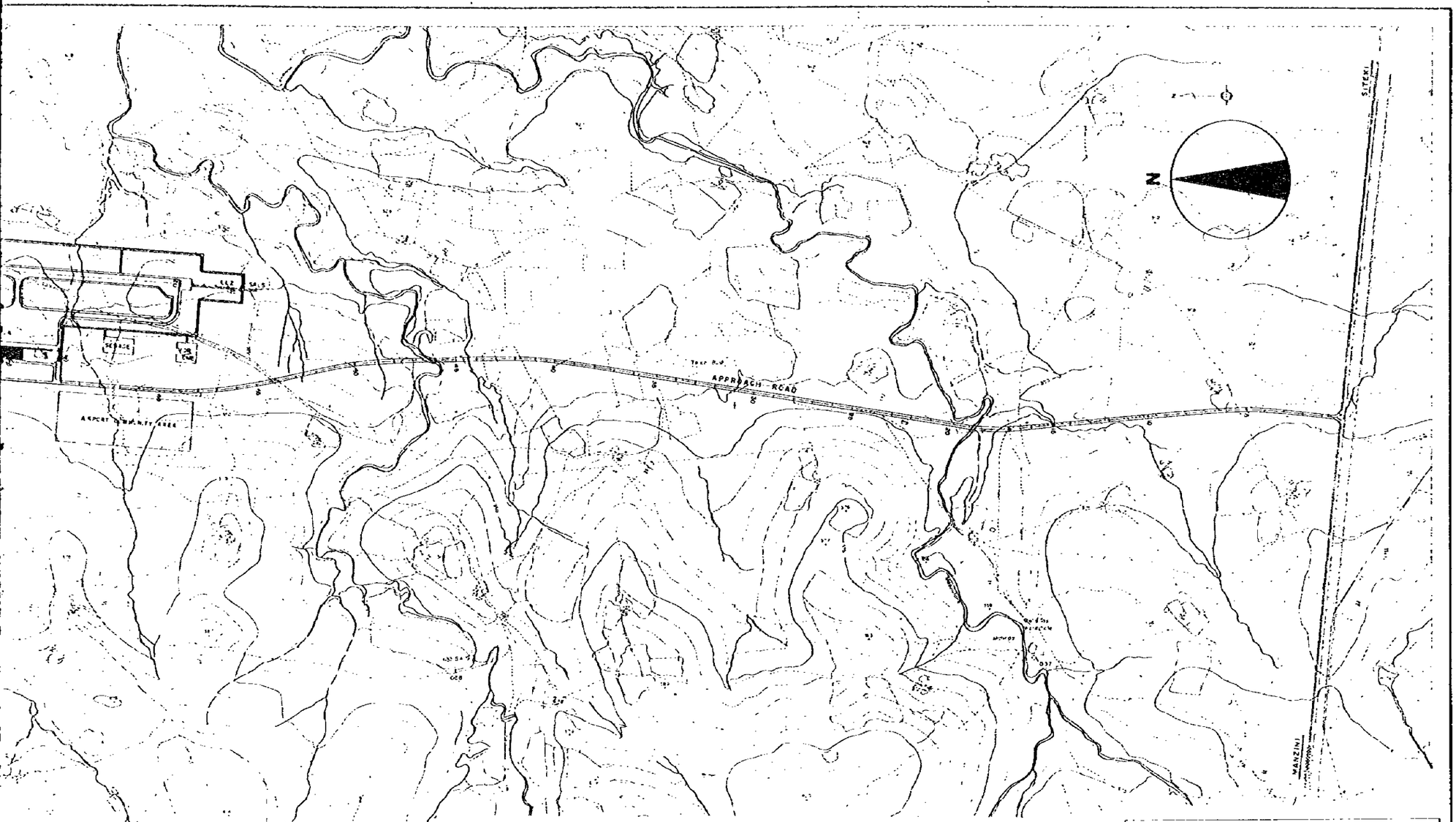


Fig. S – 1 AIRPORT LAYOUT AND APPROACH ROAD PLAN

KINGDOM OF SWAZILAND	
MINISTRY OF WORKS, POWER AND COMMUNICATIONS	
NEW INTERNATIONAL AIRPORT CONSTRUCTION PROJECT FEASIBILITY STUDY	
AIRPORT LAYOUT AND APPROACH ROAD PLAN	MAR 1980
	No 2
JAPAN INTERNATIONAL COOPERATION AGENCY	

AIRPORT DATA

AIRPORT ELEVATION	350 m
AIRPORT REFERENCE POINT (ARP)	26° 20' S
COORDINATES	31° 45' E
AIRPORT & TERMINAL NAV-AIDS	VOR
MEAN MAX TEMP OF HOTTEST MONTH	31.5°C

RUNWAY DATA

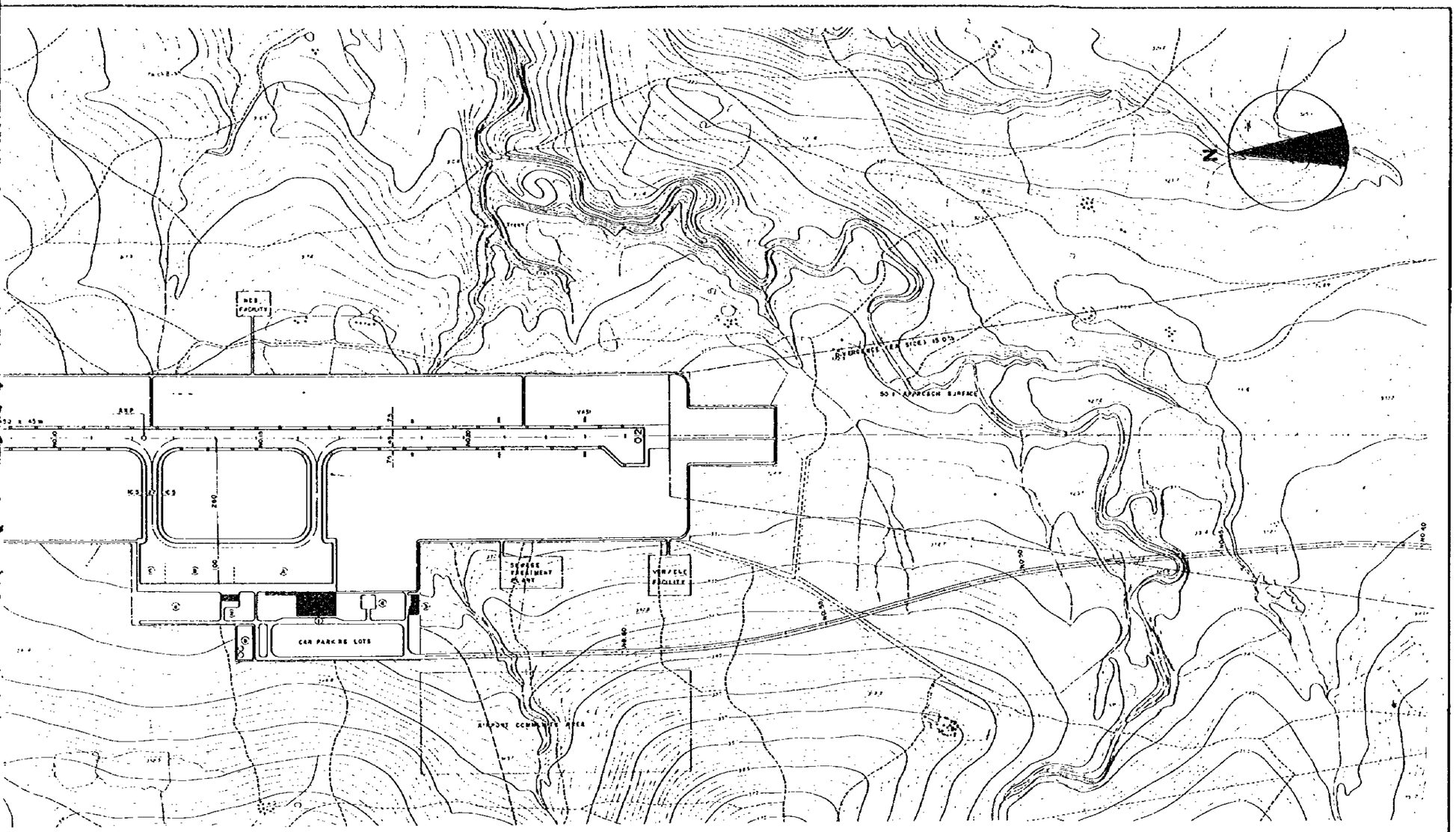
EFFECTIVE RUNWAY GRADIENT (IN %)	0.27
INSTRUMENT APPROACH RUNWAY	RUNWAY - 20
PAVEMENT STRENGTH	87/F/C/X/T
APPROACH SURFACE SLOPES	50 : 1
LIGHTING	MIRL
MARKING	ICAO STANDARDS
NAVIGATIONAL AIDS	VOR/DME SALS VASI

APRON

(A) PASSENGER
(B) GENERAL
(C) MAINTENANCE

AREA

(A) AIRCRAFT PARKING
(B) AIRCRAFT PARKING



RUNWAY DATA

EFFECTIVE RUNWAY GRADIENT (LIMIT)	0.8%
INSTRUMENT APPROACH RUNWAY	RUNWAY-20
PAVEMENT STRENGTH	87/F/CLASS
APPROACH SURFACE SLOPES	50:1
LIGHTING	HIRL
MARKING	ICAO STANDARDS
NAVIGATIONAL AIDS	VOR/DME SALS VASI

APRON

- A PASSENGER LOADING APRON
- B GENERAL AVIATION APRON
- C MAINTENANCE APRON

AREA

- D AIRCRAFT MAINTENANCE & GENERAL AVIATION AREA
- E AIRCRAFT FUEL STORAGE AREA

BUILDINGS

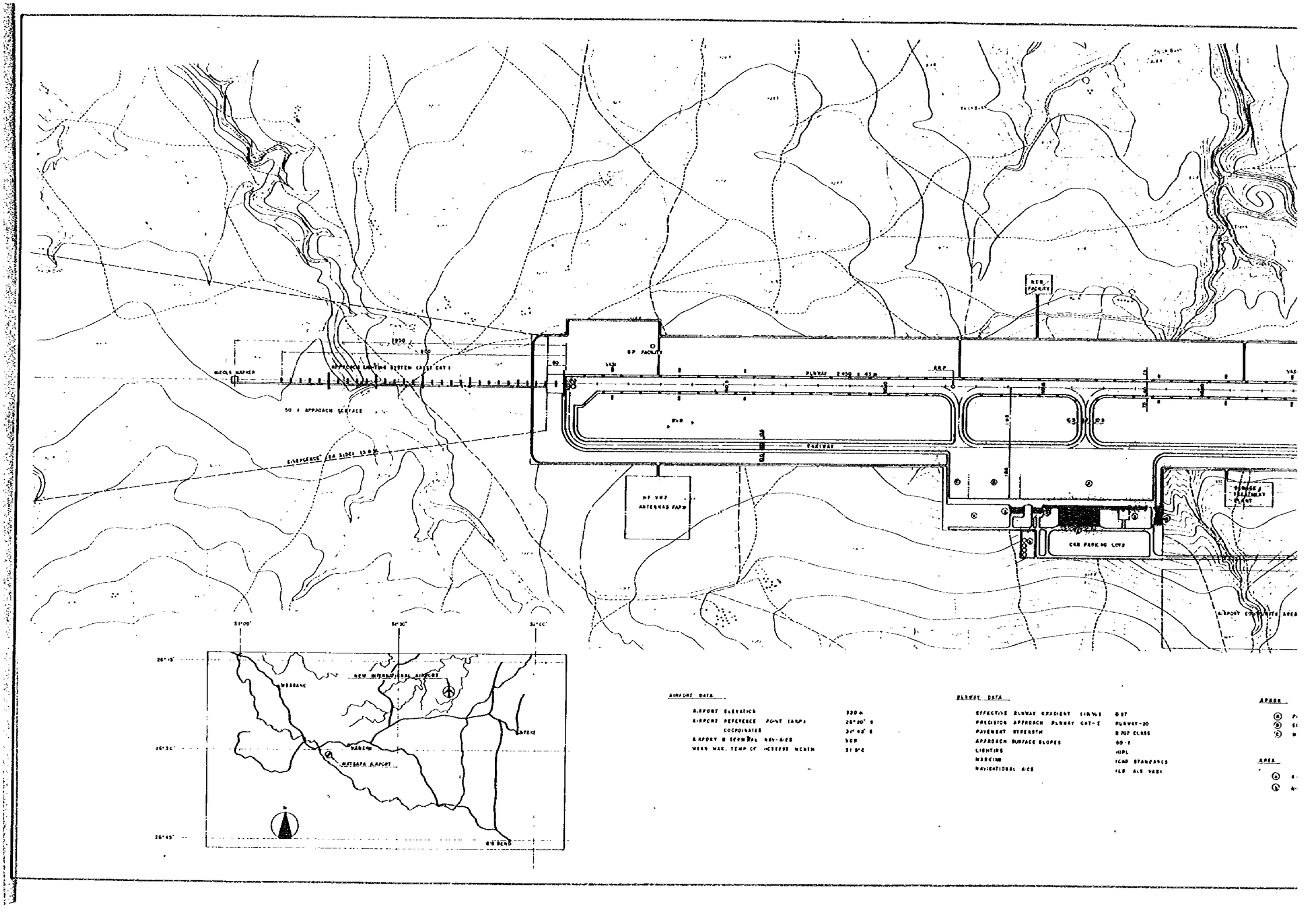
- 1 PASSENGER TERMINAL AND ADMINISTRATION BUILDING
- 2 FIRE / RESCUE STATION
- 3 MAIN POWER SUBSTATION
- 4 HEAD OF STATE BUILDING (AREA)

SCALE

0 100 200 300 400 500 M

Fig. S-2 AIRPORT LAYOUT PLAN
— STAGE I —

KINGDOM OF SWAZILAND	
MINISTRY OF WORKS, POWER AND COMMUNICATIONS	
NEW INTERNATIONAL AIRPORT CONSTRUCTION PROJECT FEASIBILITY STUDY	
AIRORT LAYOUT PLAN STAGE I (1995)	MAR 1980 No. 3
JAPAN INTERNATIONAL COOPERATION AGENCY	



AIRPORT DATA

AIRPORT ELEVATION	330 m
AIRPORT REFERENCE POINT (ARP) COORDINATES	26°30' S 31°48' E
AIRPORT & REPORTING OFFICE	MATSAPA
MEAN MAX. TEMP OF HOTTEST MONTH	31.8°C

RUNWAY DATA

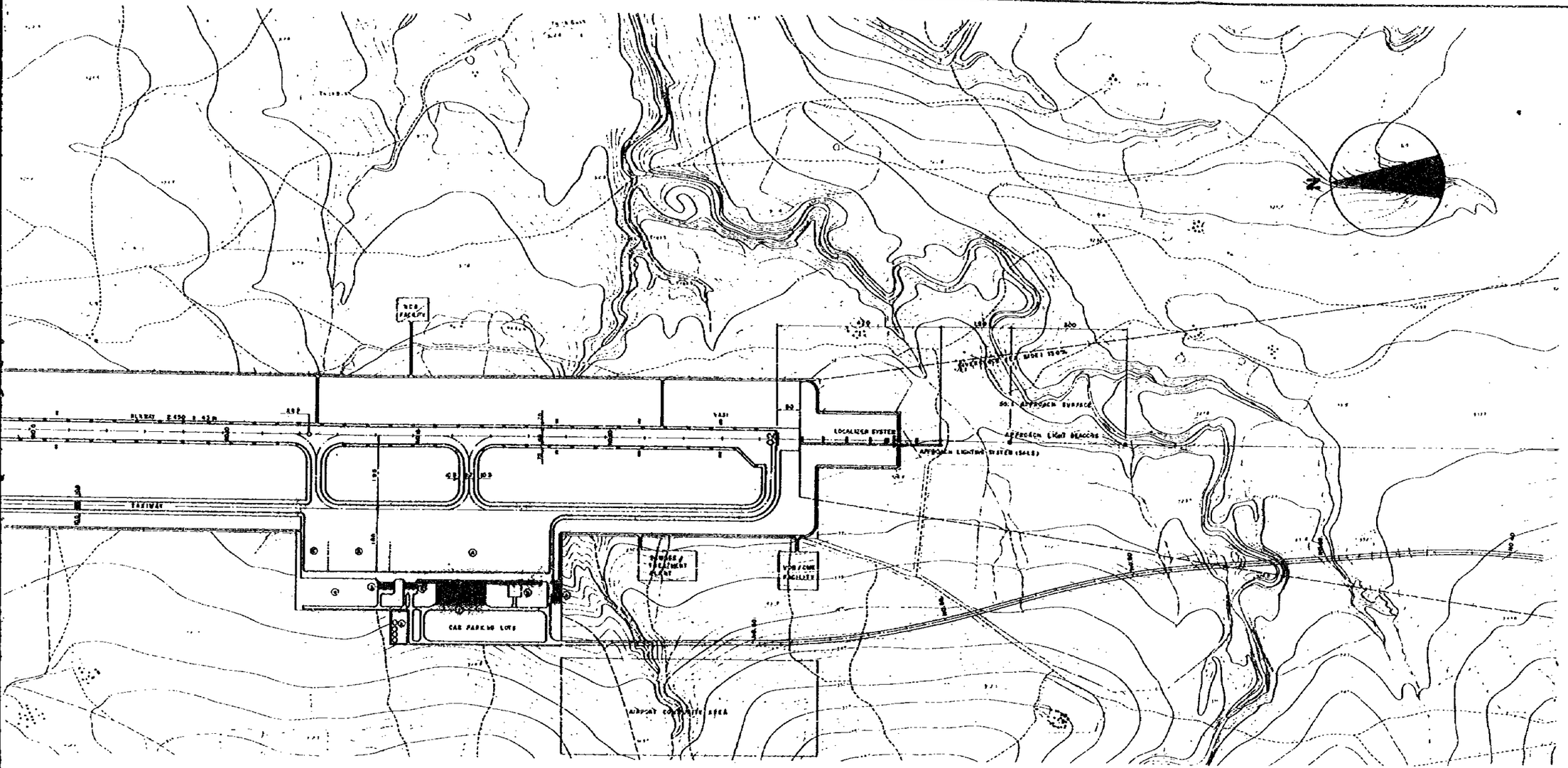
EFFECTIVE RUNWAY GRADIENT	0.8%
PRECISION APPROACH RUNWAY CAT-I	RUNWAY-20
PAVEMENT STRENGTH	B 707 CLASS
APPROACH SURFACE SLOPES	50:1
LIGHTING	HIRL
MARKING	ICAO STANDARDS
NAVIGATIONAL AIDS	ILS ALS VASI

APRON

A
B
C

AREA

A
B



DATA

PORT ELEVATION	888 m
PORT REFERENCE POINT (ARP)	26°20' S
COORDINATES	31° 05' E
PORT & TERMINAL NAV-AIDS	VOR
MAX. TEMP. OF HOTTEST MONTH	31.9°C

RUNWAY DATA

EFFECTIVE RUNWAY GRADIENT (1.0%)	0.2%
PRECISION APPROACH RUNWAY CAT-I	RUNWAY-20
PAVEMENT STRENGTH	B 700 CLASS
APPROACH SURFACE SLOPES	50-1
LIGHTING	ICAL
MARKING	ICAO STANDARDS
NAVIGATIONAL AIDS	ILS AVR VOR

APRON

1. PASSENGER LOADING APRON
2. GENERAL AVIATION APRON
3. MAINTENANCE APRON

AREA

4. AIRCRAFT MAINT & GENERAL AVIATION AREA
5. AIRCRAFT FUEL STORAGE AREA

BUILDINGS

1. PASSENGER TERMINAL AND ADMINISTRATION BUILDING
2. CARGO TERMINAL BUILDING
3. FIRE / RESCUE STATION
4. MAIN POWER SUBSTATION
5. HEAD OF STATE BUILDING (AREA)

SCALE

0 100 200 300 400 500 M

Fig.S-3 AIRPORT LAYOUT PLAL

— STAGE II —

KINGDOM OF SWAZILAND	
MINISTRY OF WORKS, POWER AND COMMUNICATIONS	
NEW INTERNATIONAL AIRPORT CONSTRUCTION PROJECT FEASIBILITY STUDY	
AIRORT LAYOUT PLAN STAGE II (2005)	MAR. 1980
	No. 4
JAPAN INTERNATIONAL COOPERATION AGENCY	

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 General

The Government of the Kingdom of Swaziland, since as far back as early '70s, has felt the need to improve the existing Matsapa Airport, the capital gateway to the land-locked Kingdom, by developing adequate international airport facilities there to meet the modern aviation demand of the African region. Swaziland is bordered by the Republic of South Africa and the People's Republic of Mozambique, and the Kingdom to date has heavily depended on the former for communication with the rest of the world, and also on the latter though to a lesser degree, for ocean-going cargo channelled through the Port of Maputo.

It has been a long-cherished desire and is now a top-priority national policy of the Kingdom to establish direct and reciprocal air transport service to facilitate contacts with the countries beyond the two immediate neighbors. Several studies have been made to that end, including one by ICAO made in 1970 as an inter-regional project, another by UNDP/ICAO made in 1972 as an inter-country project, and lastly one by the Netherland Airport Consultants made in 1975 with the financing by the African Development Bank. All these studies, however, invariably concluded that construction of a new airport at a site other than that of the existing Matsapa Airport was recommendable. The only exception was the UNDP/ICAO study, which was made for the purpose of providing the interior measures to meet the aviation demand of the immediate future.

After the commencement of F28 jet service by the Royal Swazi National Airways established in 1978, the possibility of developing the existing Matsapa Airport into a jet-worthy airport of international standard was seriously explored with the view to providing badly needed facility at an

earliest possible date. The Government of Swaziland, with due regard for the recommendations of earlier studies, however, decided to have a feasibility study made on the construction of a new airport, and in September 1978 made an official request to the Government of Japan to render some technical assistance in connection with the possible construction of a new international airport. In response to the request the Japan International Cooperation Agency (hereinafter referred to as JICA) a governmental agency entrusted with the matters related to international co-operation and assistance by the Government of Japan, sent a preliminary survey mission to Swaziland in July 1979 to identify the basic requirements of the new airport development, as well as the present situation and the future outlook. Discussion were also made on the Scope of Works of the Feasibility Study with the officials concerned of the Kingdom's Government.

Upon determination of the Scope of Works (Appendix 1A), the JICA officially undertook the Feasibility Study of the New International Airport Construction Project, and the work was actually started in September 1979.

1.2 Objective and Scope of Study

The objective of the present Feasibility Study is to evaluate both technical and economic feasibility of the New Airport Construction Project with due regard for the future development of economy and industry of the Kingdom.

The Scope of the Feasibility Study designed to achieve the said objective includes forecast of future air transport demands, establishing the basic facility requirements to accommodate the forecast traffic demand, recommending to the Government of the Kingdom an optimum site for the contemplated

airport development, and basic planning of the total airport facilities for each of the recommended stages of development, followed by construction scheduling and cost estimation.

The foregoing technical and physical elements of the feasibility study are followed by a detailed financial analysis and an economic analysis of the Project, altogether to form the basis of a subsequent comprehensive and overall evaluation of the Project.

1.3 Chronology and Sequence of Study

The methodology and work program of the Feasibility Study proposed by the JICA study team in the Inception Report were accepted by the Government of the Kingdom upon its presentation in October 1979. The study team immediately thereafter proceeded with the field survey and reconnaissance which lasted through November 1979 and included site selection study, data collection and discussions with the Government of the Kingdom on planning criteria.

The results of the site selection study were submitted in the Progress Report I in November 1979 with Sikupe as the recommended site. The site identified as "Triangle site" in the said Progress Report was officially selected by the Government of the Kingdom in December 1979 as the site for the new airport construction. This was followed by the home office study made in Tokyo on the basis of the findings of the field survey, the results of which were submitted in the form of the Progress Report II in January 1980, covering all of the technical elements of the Feasibility Study such as the air traffic demand forecast, the airport facility and airspace use plan, construction schedule and cost estimate.

The present Final Report has been prepared as the results of the discussions with the officials concerned of the Government of the Kingdom on the Progress Report II and the Draft Final Report in January and March 1980 respectively including the results of the financial and economic analysis of the Project.

1.4 Supervisory Committee

The Supervisory Committee established by the JICA as an advisory body to the President of JICA for the purpose of the implementation of the present feasibility study comprises the following members:

CHAIRMAN:

Hiroshi KATSUBE,	Director of Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport

MEMBERS:

Akira OTAKE,	Deputy Director of International Affairs Division, Minister's Secretariat, Ministry of Transport
Yoichi ABE,	Deputy Director of Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport
Takeshi TAZAKI,	Deputy Director of Flight Standards Division, Engineering Department, Civil Aviation Bureau, Ministry of Transport

CHAPTER 2

BACKGROUND OF PROJECT

CHAPTER 2 BACKGROUND OF PROJECT

2.1 Present Situations and Some Future Outlook

2.1.1 Geography

The Kingdom of Swaziland has an area of 17,364 square kilometers and is situated in the south-eastern part of the African Continent, around 31 degrees East and 26 degrees South. Swaziland is oval shaped, measuring 190 kilometers in north-south major axis and 145 kilometers in east-west minor axis. The land of Swaziland is divided into four strips of different elevations that run in north-south direction.

The Highveld, the western most and the highest elevated strip of the four, occupies 26% of the total national land area. The topography is rather steep, and the elevation ranges from 910 meters to 1,830 meters above sea level. The Highveld has comparatively cool winter, the temperature sometimes going below freezing point. Summer brings thunderstorm and heavy rain, and approximately 1,500 mili-meters of rain is registered each year. Mbabane, the capital, is in this area.

The Middleveld, situated the second from the west ranges in elevation from 330 meters to 1,070 meters above sea level. The climate is warmer and drier with an average annual rainfall of approximately 1,000 mili-meters. There are some areas of fairly high hills, but the topography in general is rather gently undulated and not difficult to farm. A wide variety of crops are raised here. The Middleveld contains the present airport, the Matsapa industrial area with many light industries and Manzini, one of the most modern cities of Swaziland.

The Lowveld is the third from the west and is the lowest strip of the four. It ranges from 60 meters to 730 meters above sea level. It is less hilly than the two upper velds. The climate is subtripical. It brings only about 650 mili-meters of rainfall a year and there always is a danger of drought. Irrigation system has recently been introduced in this area and sugar mill projects have been successfully developed. Considerable amount of coal deposit has also been proven throughout the area and its exploitation is being envisaged.

The Lubombo is the eastern most strip bordering with Mozambique. Though much of the Lubombo is rocky, in some areas it has a thick surface layer of rich soil. Between the Lubombo and the Lowveld lies a fertile and rather flat plateau, where irrigation is being planned and future development of agriculture is expected.

Swaziland is one of the best watered country of southern Africa. The major rivers originate in the Republic of South Africa, enter Swaziland in the Highveld, flow down across the Middleveld and out of the country through the gorges in the Lubombo. Important rivers of Swaziland are the Usutu, the Lomati, the Komati, the Umbeluzu, the Usushuwane, the Ngwempisi and the Mkondo. Almost all the streams in the Highveld have water year round, while in the Lowveld only the larger streams have water in winter.

Table 2.1 Land and Climate

Regions	Area (km^2)	Elevation (m)	Temperature (°C)	Rainfall (mm)
Highveld	5,029.5	910 - 1,830	10.8/22.6	1,016 - 2,286
Middleveld	4,597.2	330 - 1,070	15.6/25.6	762 - 1,143
Lowveld	6,416.2	60 - 730	14.9/28.9	508 - 890
Lubombo	1,321.2	270 - 820	14.1/25.0	635 - 1,016
Total	17,364.2	60 - 1,830	-	-

Source: Annual Statistical Bulletin, 1978

2.1.2 Population

Population of Swaziland is estimated to be approximately 520 thousand in 1976, 98% of which are Africans and the rest are Europeans and other non-Africans. The percentages to the national total of female population and the population under 15 and over 65 years of age are 53.3% and 50.7% respectively.

The annual growth of population of Africans showed a constant rate of 3.1% from 1966 to 1975 while population of non-Africans seems not to have increased.

Approximately 15% of the population lives in urban areas and the rest in rural areas. It can be said the population is spread generally even throughout the country, but there is a tendency of the urban population growing more rapidly than that of the rural area.

Table 2.2 Breakdown of Resident Population by Origin

Year	Africans	Europeans	Others	Total
1967	373,677	8,248	4,377	386,302
1968	384,799	8,518	4,545	397,862
1969	396,405	8,797	4,723	409,925
1970	408,479	9,087	4,910	422,476
1971	421,079	9,384	5,107	435,570
1972	434,195	9,699	5,315	449,209
1973	447,877	10,016	5,535	463,428
1974	462,178	10,347	5,756	478,281
1975	477,023	10,695	6,010	493,728
1976	482,748	7,719	4,067	494,543

Source: Annual Statistical Bulletin, 1978

2.1.3 Gross Domestic Product

Gross Domestic Product of Swaziland was E. 272.0 million in fiscal 1976/77. The 5-year average of annual GDP growth rate in real terms during 1972/73 - 1976/77 was 7.7%, and GDP per capita was about E. 550 in 1976/77.

The major contributor to the development of Swazi economy during the 1930s was exports of asbestos, large scale plantation and pulp industry in the '50s, sugar industry and iron ore mining in the '60s, and light industries and tourism in the '70s.

According to the Third National Development Plan 1978/79 - 1982/83 GDP of Swaziland is expected to grow with an annual growth rate of 7% in real terms in the 5-year plan period.

Table 2.3 Gross Domestic Product of Swaziland

(Million E.)

Fiscal Year	G. D. P.	
	Market Price	Constant Price, 1977/78
1972/73	100.1	202.3
1973/74	125.0	222.5
1974/75	161.8	239.2
1975/76	197.8	255.0
1976/77	245.0	272.0

Source: Third National Development Plan, 1978/79 - 1982/83, Government of Swaziland.

2.1.4 Foreign Trade

As stated above there are no ports and harbours in Swaziland, but the Kingdom has made the foreign trade via the port of Mozambique. Export and import accounted for 65% and 71% respectively of the gross domestic product in 1976, and foreign trade played an important role in the overall economic activities of Swaziland.

The biggest export item was sugar which accounted for 37% of all exports, followed by pulp products of 15%, asbestos of 10% and iron ore of 6%. Sugar will be the main export item for the future because sugar mill projects are successfully being implemented in the country.

As for imports, machinery accounts for 20% of the total imports, followed by the petroleum products of 12% and foods of 8%.

Swaziland had enjoyed sound balance in foreign trade until 1975, but registered deficits in 1976 and 1977 consecutively.

Table 2.4 Balance of Foreign Trade

(Unit: Thousand E.)

	1972	1973	1974	1975	1976	1977
Imports	53,309	66,624	93,443	131,099	174,084	194,810
Exports	62,976	74,216	121,500	134,176	159,049	146,265
Total	+9,667	+7,592	+28,057	+3,077	-15,035	-48,545

Sources: Annual Statistical Bulletin, 1974 - 1978

2.1.5 Tourism

Tourism industry is one of the most important foreign exchange earners for Swaziland. Its development in the future is vital for Swazi economy.

The tourism resources of Swaziland are the beautiful scenery of the land, and the cosy and free society with hospitable people who make tourists enjoy their stay in the country. At present Swaziland receives many tourists from the Republic of South Africa. The center of tourism is Ezuluwini Valley which is located about 15 kilometers east of Mbabane, where modern hotel accommodation is available with golf courses and casino. Besides the Ezuluwini Valley area there are many hotels and lodges throughout the country. There were 29 hotels in 1977 with 1,007 rooms and 2,091 beds of international standard. The average length of stay of tourists was 2.8 nights in 1977 and the hotel occupancy rate has been around 50% in recent years.

Table 2.5 Number of Tourists in Swaziland

(Unit: persons)

Purpose of Trip	1972	1973	1974	1975	1976	1977
Transit	3,140	3,182	2,674	2,123	1,662	1,312
Holiday	54,509	55,478	61,805	90,408	75,512	67,175
Business	17,882	17,704	19,731	24,871	22,150	26,387
Others	13,484	12,789	11,913	13,184	3,784	8,285
Total	89,015	89,153	96,123	130,586	108,069	103,159

Source: Annual Statistical Bulletin, 1974 - 1978

Table 2.6 Number of Tourists Staying in Hotels by Nationality

(persons)

Nationality \ Year	1972	1973	1974	1975	1976	1977
Swazi	175	319	906	1,747	2,018	2,110
South African	55,683	54,721	58,205	81,859	61,486	61,555
Portuguese	2,861	3,714	3,389	1,902	2,396	2,073
Other Africans	1,220	1,638	1,909	3,064	5,759	2,998
Other Europeans	23,356	23,946	25,621	33,076	29,835	26,666
American	3,109	2,825	2,783	3,215	2,730	2,933
Asian	496	351	917	2,230	1,815	1,949
Australian	1,240	955	1,134	1,876	1,325	1,533
Not Stated	875	684	1,259	1,599	705	1,431
Total	89,015	89,153	96,123	130,586	108,069	103,159

2.2 Transport Sector

2.2.1 General

The transport sector infrastructure of Swaziland consists mainly of;

a. 2,821 kilometers of roads (443 kilometers of which are tarred),

b. 318 kilometers of a single-line railway, and

c. an international airport, Matsapa.

Roads provide an extensive network for domestic and international movements of commodities and passengers. In particular, well-maintained road connections with South Africa contribute to the active movements of commodities and passengers between the two countries.

Railway system is export-oriented carrying export goods to the ports of Mozambique and South Africa, which are the only access to the ocean for Swaziland.

The air transport sector is young in its history, but provides limited direct access to other countries in Africa that is indispensable for this landlocked country. Considerable infrastructural improvements, however, are desirable in this sector in order to overcome the geographical and topographical handicaps.

The Governmental policy in transport sector is aimed primarily at;

a. Stimulating development of rural area by improving transport services generally, and expanding the road network in areas of high economic activity, thus

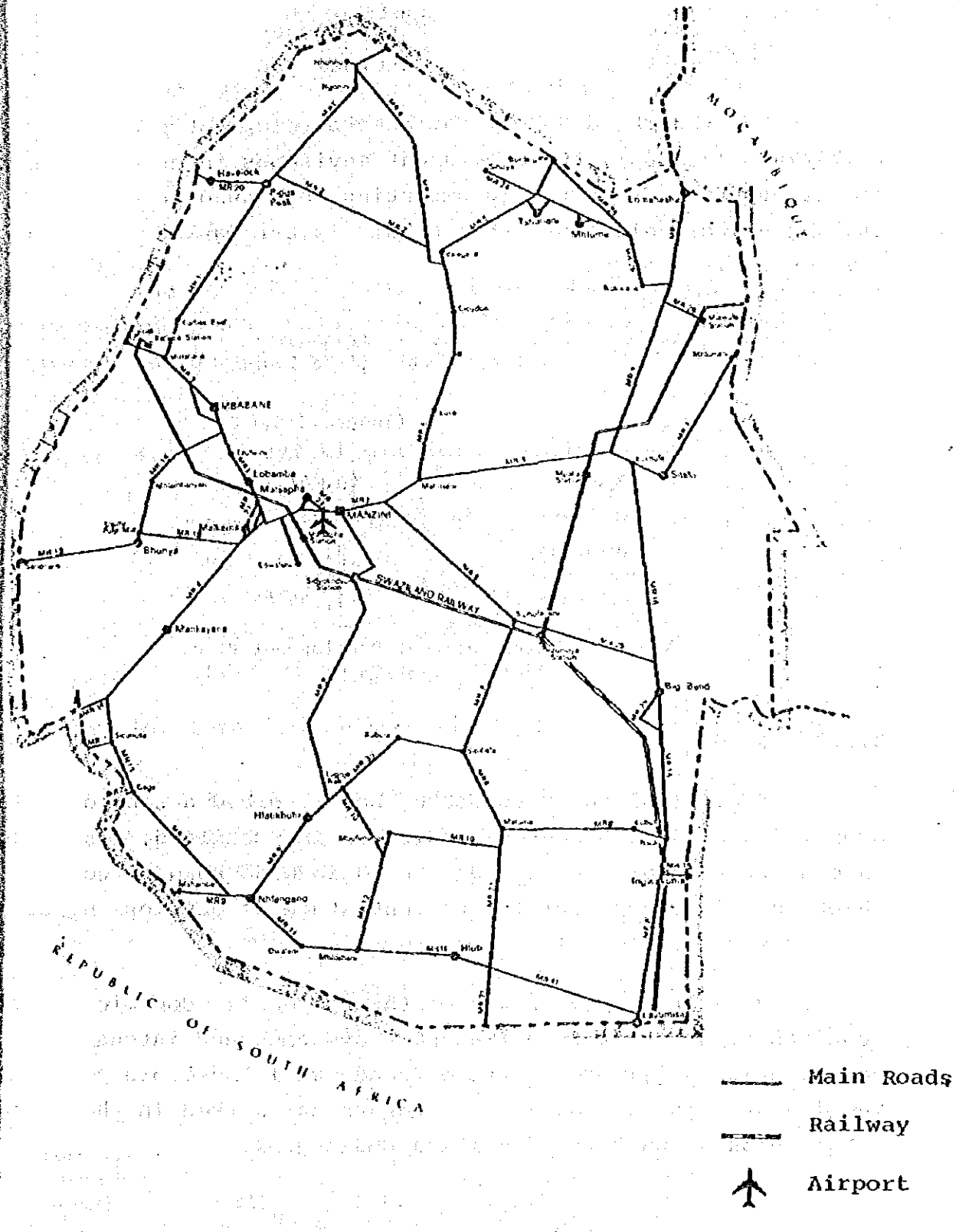


Fig. 2.1 TRANSPORT SECTOR INFRASTRUCTURE

b. Reducing the present high transport costs for both domestic and international movements, and

c. Developing new and direct access to the outer world to diversify external economic relations.

For the Third 5-Year National Development Plan (1978/79 - 1982/83), the Government envisages investments in the transport infrastructure amounting to around 80 million Emalangeni, of which more than a half is ear-marked for roads development.

Table 2.7 Investments in Transport Infrastructure (1978-1982)

	(Thousand E.)
Roads	44,241
Railways	24,369
Aviation	8,755
Total	77,365

Sources: Third National Development Plan, 1978/79 - 1982/83

2.2.2 Roads

Since 1955 the road sector has absorbed a considerable proportion of development expenditures in Swaziland, resulting in construction of a comprehensive nationwide road network, which is fairly good for the present stage of development of the country.

However, rapid growth of the Kingdom's economic activit requires even better road transport systems, and intensified construction and improvements of roads will therefore continue. The investments in road infrastructure ear-marked in the Third 5-Year Plan amounts to 44 million Emalangeni.

Projects under study includes major improvements to Mbabane-Manzini road which will be the major access road for the proposed new international airport. The growth of traffic on this road is already causing congestion at peak periods and extensive improvement to this road involving the construction of a dual carriageway in parts is planned to begin in 1982/83.

2.2.3 Railways

The railway of Swaziland is export-oriented and does not provide passenger service. It links Swaziland with the ocean through the neighbouring Mozambique and South Africa as follows.

a. The 224 kilometers of railway which includes the 6-kilometer spur track at Matsapa, originates in Ngwenya in the west and on the eastern border connects with the Mozambique railway lines. It was built mainly to transport iron ore from the mine at Ngwenya to the Mozambique port of Maputo.

b. The 94-kilometer link between Phuzumoya and Golela, the rail terminus of South African Railways on the border caters for coal industry in the south and provide access to Natal's consumer markets.

Table 2.8 Railway Traffic by Type

(Unit: '000 ton)

	1973/74	1974/75	1975/76	1976/77	1977/78
Exports	2,734	2,555	2,465	1,897	1,983
Imports	171	147	142	122	140
Domestic	42	33	24	29	29
Total	2,947	2,735	2,631	2,048	2,107

Source: Third National Development Plan

Table 2.9 Railway Traffic by Commodity

(Unit: '000 tons)

	1973/74	1974/75	1975/76	1976/77	1977/78
Iron ore	2,276	2,088	1,984	1,488	1,333
Sugar	158	180	158	165	203
Pulp	121	123	127	72	122
Petro Products	87	85	98	58	99
Molasses	48	54	52	75	77
Others	257	205	202	190	273
Total	2,947	2,735	2,631	2,048	2,107

Source: Third National Development Plan

2.2.4 Air Transport

There are 21 aerodromes in Swaziland, of which Matsapa Airport is the only airport with paved runway capable of accommodating international traffic. The other smaller aerodromes have grass runways and can accommodate only small aircraft. There is no scheduled domestic air services. Matsapa Airport was inaugurated in 1961, while the scheduled commercial service was introduced in 1968.

Royal Swazi National Airways (RSNA) was established in 1978, ten years after the independence of the country. This airline operates one Fokker F28 for scheduled international service.

There are six air routes to Johannesburg, Durban, Lusaka, Maputo, Maseru and Mauritius with a total of 38 scheduled flights a week. Passenger traffic in and out of Matsapa Airport is shown in Figs. 2.1 and 2.2. Freight traffic is shown in Table 2.13.

Number of passengers embarking and disembarking at Matsapa Airport increased from 8,071 in 1968 to 41,018 in 1978 at an average annual growth rate of 17.7%. Passengers of scheduled services increased at the high rate of 29.4%

p.a. between 1968 and 1976, but levelled off after 1976. Passengers of non-scheduled commercial service increased in 1977 by 72.3% over the previous year.

The passenger load factor of scheduled service on the Johannesburg-Manzini route which carries 80% of the total air passengers was as high as 78.1% in 1976 and 79.1% in 1977, and this fact apparently was responsible for diverting the scheduled passenger demand on the Johannesburg route to non-scheduled service.

The establishment of RSNA in 1978 and introduction of Fokker F28 operation contributed to the increase in passenger carrying capacity on scheduled service especially on the Johannesburg route.

Table 2.10 Number of Scheduled Flights Serving Matsapa as of November, 1979

Routes	Flights per week	Aircraft in Service
Johannesburg	7	F28 x 3, HS748 x 4
Durban	2	F28 x 1, HS748 x 1
Lusaka	4	F28 x 4
Maputo	2	F27 x 1, DHC 6 x 1
Mauritius	1	F28 x 1
Maseru	3	F27 x 1, DHC 6 x 2
Total	19	F28 x 9, HS748 x 5 F27 x 2, DHC 6 x 3

Table 2.11 Matsapa Airport Traffic

	Commercial			Private	Total
	Scheduled	Non-scheduled	Sub-total		
1967	1,403	2,761	4,164	2,502	6,666
1968	3,327	2,745	6,072	1,999	8,071
1969	5,285	1,808	7,093	2,776	9,869
1970	7,593	3,108	10,701	3,785	14,486
1971	10,667	3,104	13,771	4,011	17,782
1972	12,707	2,302	15,010	4,670	19,680
1973	15,518	1,142	16,660	4,728	20,421
1974	19,958	2,440	22,398	3,761	26,488
1975	21,446	4,117	25,563	2,965	28,528
1976	26,097	4,203	30,300	3,188	33,488
1977	26,079	7,243	33,342	4,228	37,550
1978	27,290	10,464	37,754	3,264	41,018

Source: Annual Statistical Bulletin, 1978

Table 2.12 Matsapa Airport Traffic
(Commercial Scheduled Passengers by Route)

	Johannesburg	Durban	Maputo	Total
1970	5,736	1,681	176	7,593
1971	8,265	2,190	212	10,667
1972	9,996	2,499	256	12,751
1973	12,978	2,602	262	15,842
1974	16,497	3,062	270	19,829
1975	16,938	3,491	418	20,847
1976	19,248	4,111	2,738	26,097
1977	19,549	4,590	1,933	26,072
1978	20,240	4,920	482	27,290*

* The 1978 total includes the traffic to and from Lusaka of 1,068 passengers, Mauritius 366 and Blantyre 214.

Source: Annual Statistical Bulletin, 1978

Table 2.13 Matsapa Airport Traffic (Cargo/Mail by Route)

(Unit: kg)

	Johannesburg	Durban	Maputo	Total
1970	45,889	21,796	539	68,224
1971	90,034	14,593	1,338	105,965
1972	46,540	4,224	888	51,652
1973	127,377	5,003	1,450	133,830
1974	143,864	3,210	362	147,436
1975	154,684	8,295	742	163,721
1976	140,327	5,260	30	145,617
1977	169,513	7,681	9,899	187,093
1978	189,829	8,563	1,188	201,634*

* The 1978 total includes the traffic to and from of Lusaka 1,803 kg., Mauritius 121 kg. and Blantyre 130 kg.

Source: Annual Statistical Bulletin, 1978, except for 1978 statistics of CAB, Swaziland.

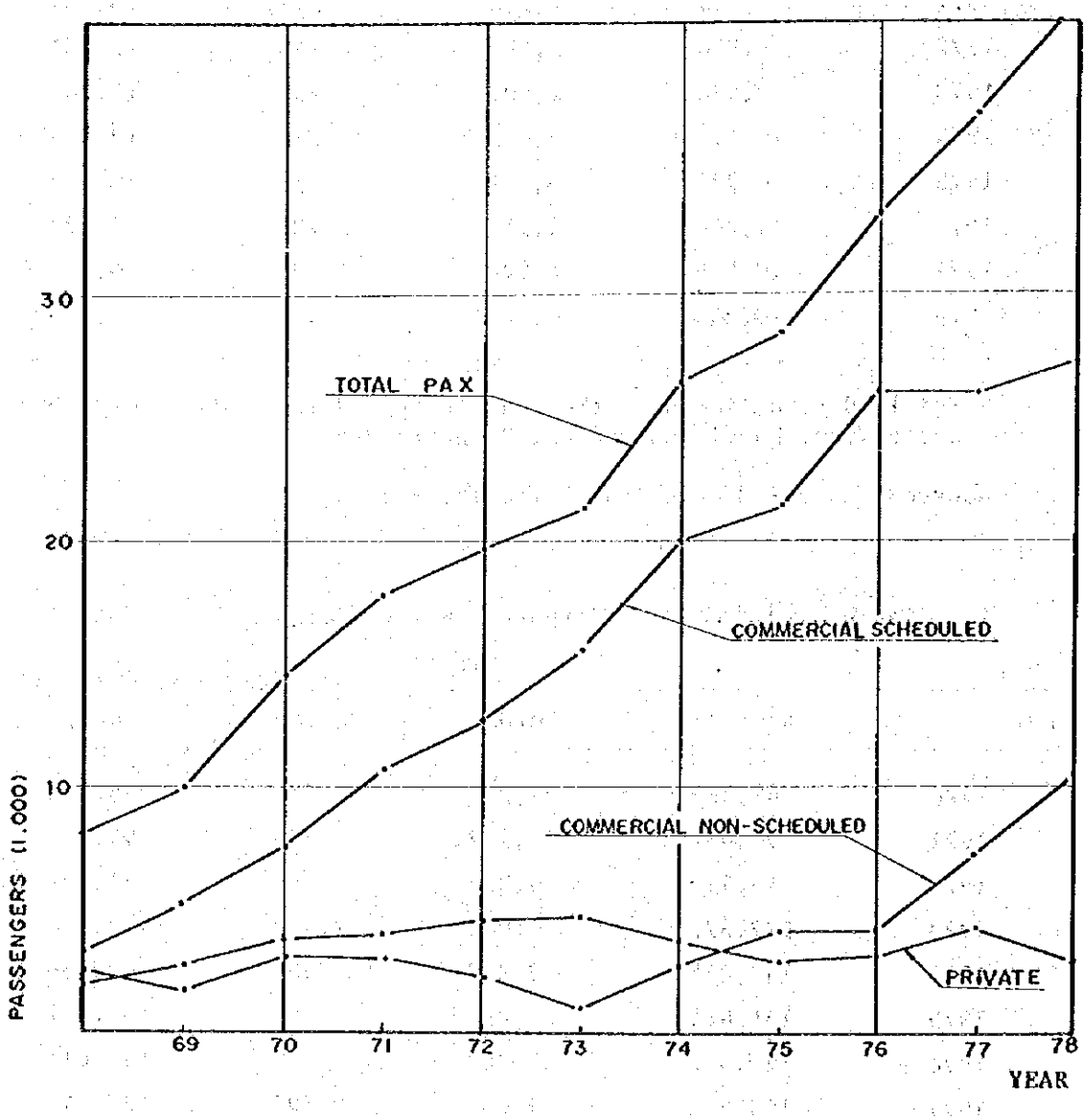


Fig 2.2 PASSENGER TRAFFIC RECORDS AT MATSAPA

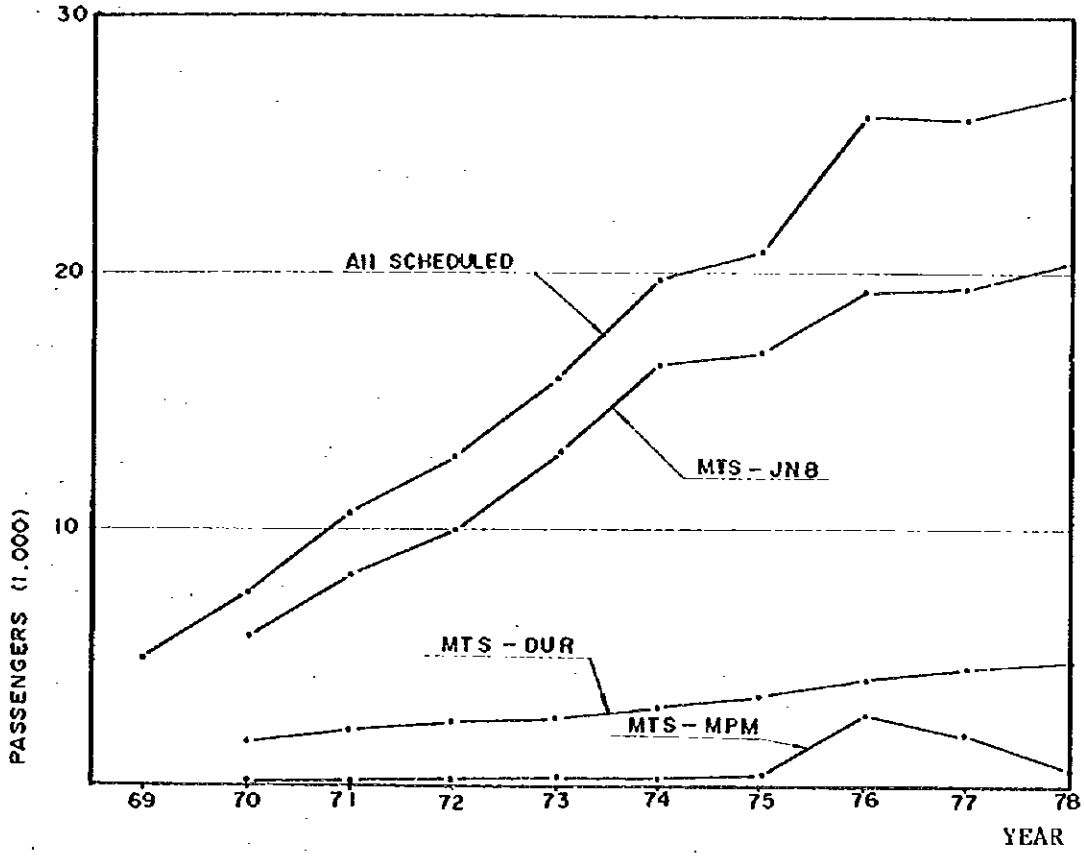


Fig 2.3 PASSENGERS BY ROUTE AT MATSAPA

2.3 Existing Matsapa Airport

2.3.1 Present Facility

The existing Matsapa airport is situated in the Middleveld, about 30 km southeast of Mbabane, the capital of Swaziland and about 10 km southwest of Manzini as shown in Fig. 2.4.

The airport layout plan is shown in Fig. 2.5. The present airport facilities are as summarized hereunder.

1) Runway

The runway is oriented 056° - 236° true bearing and has a length of 1,524 m and a width of 30 meters with bituminous pavement.

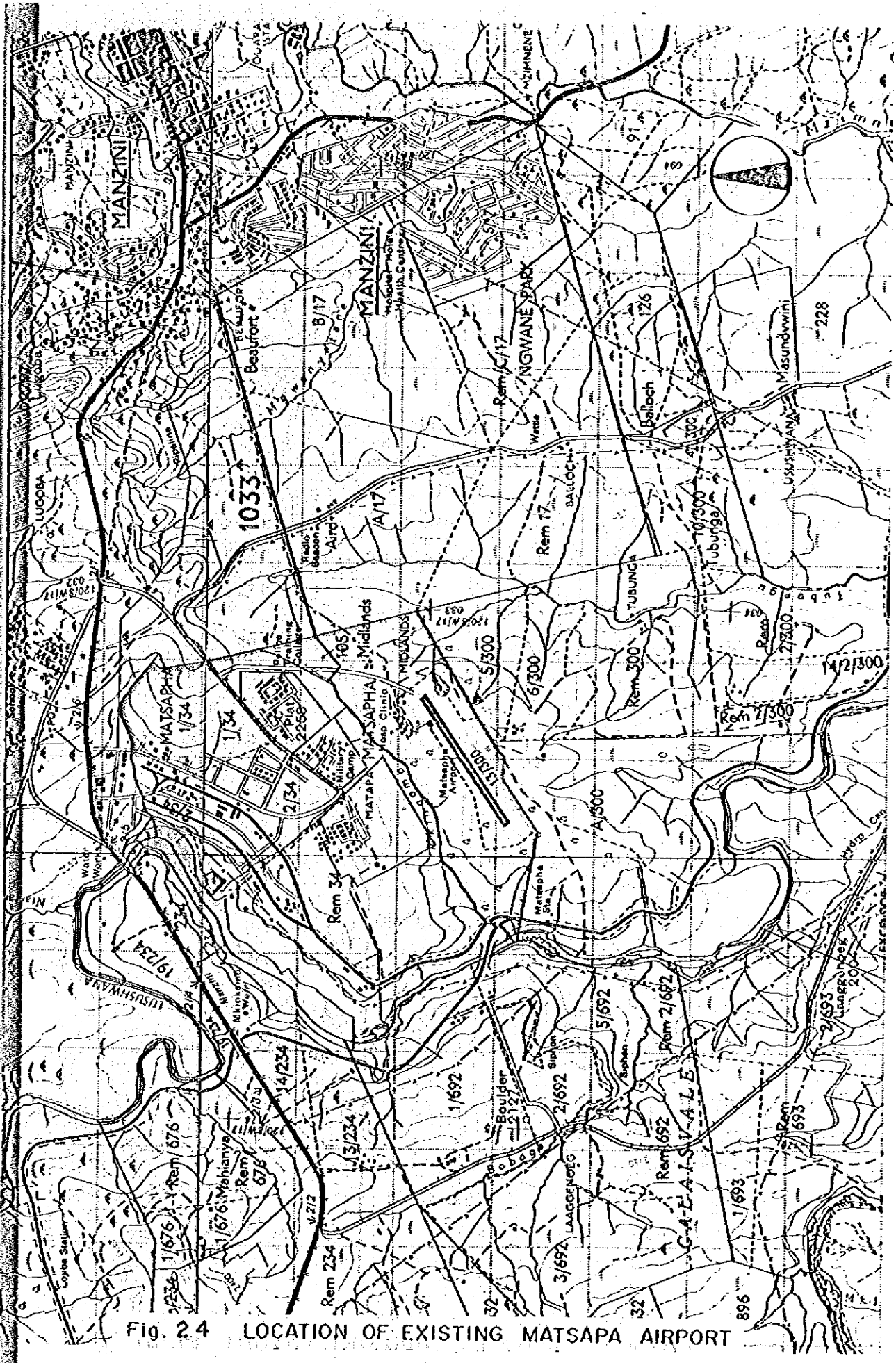
According to the A.I.P., stopway and clearway are provided on both ends of the runway, and the declared distances are as shown in Table 2.14.

Table 2.14 Declared Distances

(Unit: m)

Description	Runway	
	07	25
Stopway	27	44
Clearway	300	300
Take-off Run Available	1,524	1,524
Take-off Distance Available	1,800	1,800
Accelerate Stop Distance Available	1,550	1,568
Landing Distance Available	1,524	1,524

Source: A.I.P.


MANZINI
MATSAPHA
NGWANE PARK
Beaufort
Rem 17
Rem 34
Rem 234
Rem 676
Rem 678
Rem 692
Rem 693
1033
105
Midlands
Matsapha Airport
Boulder
Siphon
Laagenoog
Tubunga
Ballach
Masundvwini
Usushwana
Lububa
Mahlanya
Mbabane
Malkerns
Nhlangano
Lobamba
Hospital
Hotel
Police
Post Office
Radio Beacon
Aircraft
Military Camp
Motel
Shop
Church
Water
Rem 1/34
1/34
2/34
13/234
14/234
19/234
1/676
1/692
2/692
5/692
1/693
2/693
3/692
A/17
B/17
A/300
5/300
6/300
Rem 300
2/300
Rem 2/300
14/2/300
70/300
Rem 1/C/17
126
228
896
32
Fig. 2.4 LOCATION OF EXISTING MATSAPA AIRPORT

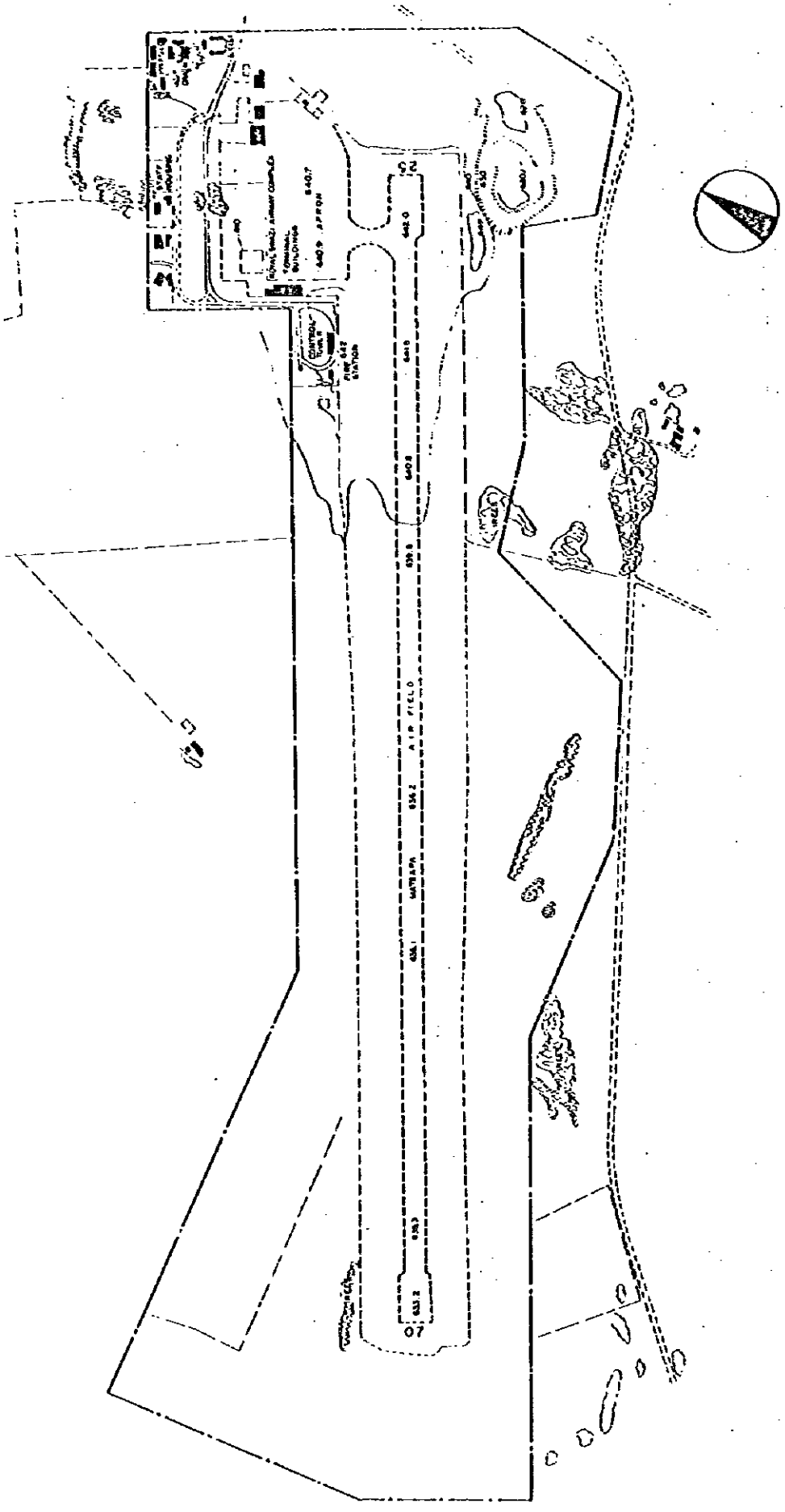


Fig. 2.5 MATSAPA AIRPORT LAYOUT PLAN

2) Taxiway and Apron

A 30-meter wide taxiway with bituminous pavement connects the runway with the apron.

The apron has an area of approximately 26,000 m^2 which can accommodate two F 28 type aircraft.

3) Terminal Building

The passenger terminal building which was expanded to the present size in 1978 is single storied with a floor area of about 800 m. Cargo handling and bonded cargo area of about 70 m^2 is included in the passenger terminal building. The floor plan is shown in Appendix 2A.

The airport administration office and control tower occupies the old terminal building with a floor area of about 180 m^2 situated on the west of the present terminal building.

4) Navigational Aids Facilities

An NDB (Non-directional beacon) with 100 NM coverage and 262.5 kHz frequency is installed at a point about 1.1 NM from the north-eastern end of the runway.

No airfield lighting system but only gooseneck flares for emergency is provided.

5) Aeronautical Telecommunications Facilities

The Matsapa Airport is in Johannesburg FIR. The area control is provided by the Johannesburg ACC, and the Matsapa Tower provides the aerodrome control and approach control services.

The Matsapa Tower has three each VHF and HF telecommunications facilities as shown in Table 2.15.

There is a teletypewriter circuit connecting to the Johannesburg ACC.

6) Fire Fighting and Rescue Facilities

The fire station with an area of 80 m^2 is located close to the control tower and is equipped as shown in Table 2.15.

7) Fuel Storage and Distribution Facilities

Aircraft fuel is transported by rail from Maputo and Durban to the Matsapa industrial area, and then to the airport by truck.

The storage tanks have a total capacity of 5,000 gallons and the fuel is distributed by hydrant system.

2.3.2 Approach Procedures

Only the ADF approach procedure is presently applied at the Matsapa Airport as shown in Fig. 2.6. The minimum descent altitude is 3,500 feet.

Table 2.15 Present Facilities

Facilities		Description
Coordinates		26° 31' 26" S
		31° 18' 40" E
Elevation		641 m
Reference Temperature		25°C
Runway	Orientation	056° - 236° (True)
	Designation	07 - 25 (Mag.)
	Dimensions	1,524 m x 30 m
	Strip	1,595 m x 150 m
	Longitudinal Slope	0.58%
	Pavement	Bitumen
	Strength	LCN 30
	Clearway	300 m (both ends)
	Stopway	RWY 07 27 m
		RWY 25 44 m
Taxiway		
	Width	30 m
	Pavement	Bitumen
	Strength	LCN 30
Apron		
	Area	26,000 m^2
	Pavement	Bitumen
	Strength	LCN 30
Terminal Building		
	Dimension	15.5 m x 51.5 m
	Depature Hall & Lounge	240 m^2
	Arrival Hall	90 m^2
	Immigration	30 m^2
	Baggage Claim Area	45 m^2
	VIP Lounge	120 m^2
	Miscellaneous	275 m^2
	Bonded Cargo Area	70 m^2
	Total Space	870 m^2

Facilities	Description	
Navigational Aids Facilities		
NDB	262.5 kHz	
Airfield Lighting	Nil	
Aeronautical Telecommunications Facilities		
VHF	118.3 MHz	(ATC)
	124.9 MHz	(ATC)
	121.7 MHz	(Emergency)
HF	2,917 kHz	
	5,680 kHz	
	6,603 kHz	
Teletypewriter	1 set (Johannesburg ACC)	
Telephone line	3 lines	
Airfield Marking	Runway Designation	
	Runway Centre Line	
	Runway Threshold	
	Taxiway Centre Line	
	Taxiway Holding Position	
	Altimeter Check Point	
Fire Fighting and Rescue Facilities		
Fire Station	80 m^2	
Vehicles	One Major Form Tender	
	One Rapid Intervension Vehicle	
	One Landrover/Rescue Car	
	One Ambulance	
Form Appliance	Foam	80 gal.
	Water	800 gal.
	Dry chemical	300 lbs.
Fuel Storage and Distribution Facilities		
Tank Yard	1,100 m^2	
Tank Capacity	Jet A1	3,000 gal.
	AVGAS	2,000 gal.
Fuel Distribution System	Hydrant	

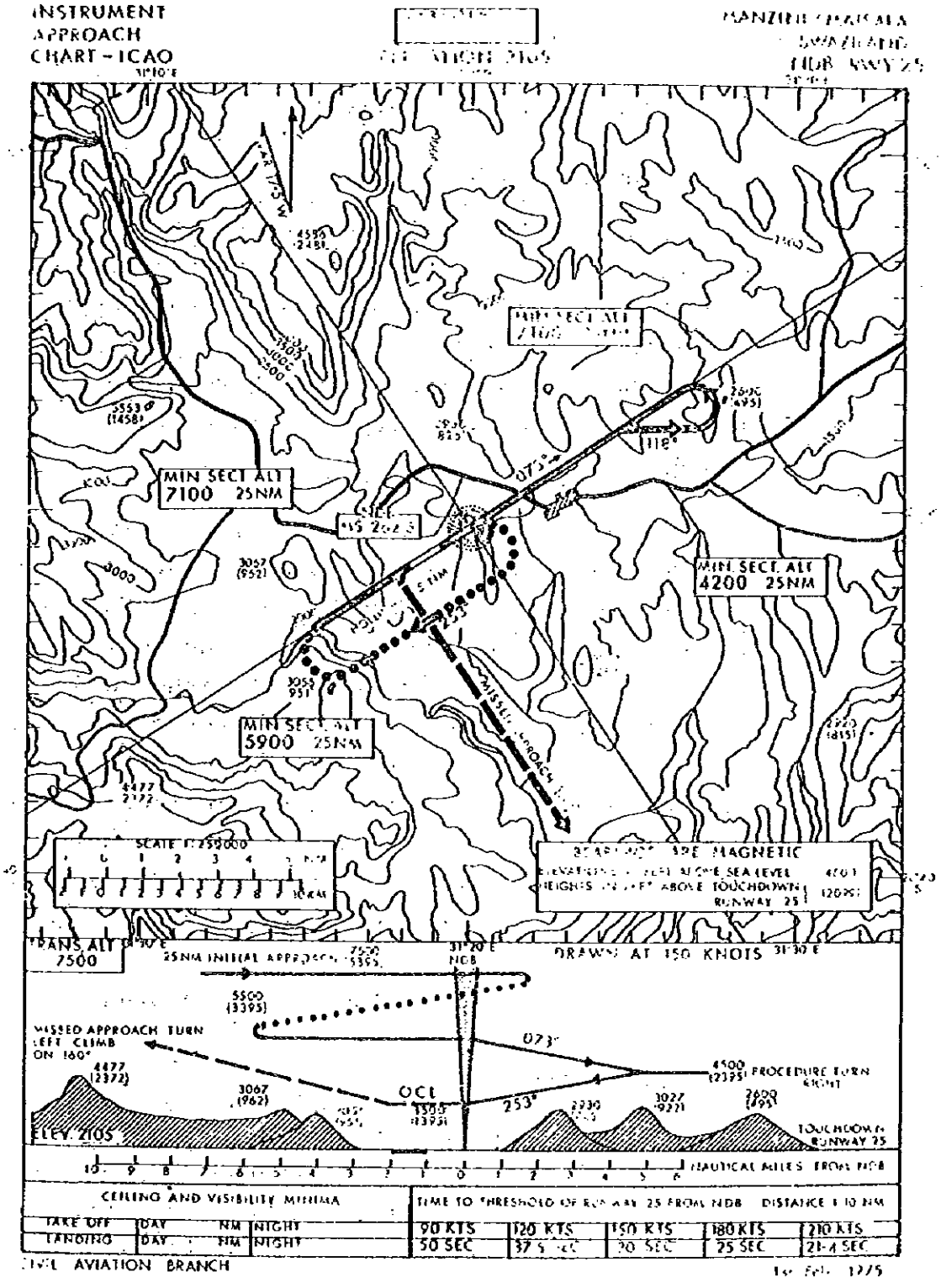


Fig. 2.6 ADF APPROACH PROCEDURE

2.4 Need for a New International Airport

2.4.1 Problems of Existing Airport

1) Limited Capacity of Facilities

a. Runway Length

Fokker F28 Type MK 3000 presently being operated by RSNA requires basic take-off runway length of 1,877 m at MSL and standard temperature and with corrections for elevation and temperature, the take-off runway length required for this aircraft at the airport amounts to 2,424 m.

In order to accommodate F28, the Civil Aviation Branch of the Ministry of Works, Power and Communications of the Kingdom (hereinafter simply called "the civil aviation authority") has provided a 300 m clearway at either end of the runway, bringing the total Take-Off Distance Available to 1,800 m as declared in the Aeronautical Information Publication of the Kingdom. Even this distance represents only 74% of the required runway length of 2,424 m as mentioned above, and severe weight restrictions would inevitably be imposed especially in hot weather for flights of long stage lengths.

b. Apron Area

The apron of Matsapa Airport can accommodate two B737 class aircraft simultaneously and there is sufficient space for the general aviation activities. The terminal configuration, however, is such that the passenger terminal building is

located at one end of the parallel-parking stands and is causing inconvenience in the movements of passengers and cargo.

c. Passenger Terminal Building

Passenger terminal building has a total floor area of only 800 m^2 including VIP room of 120 m^2, and considerable congestion is anticipated at peak hours in busy months when F28-class aircraft with 65 seats arrive with high load factors of 60% or more.
The existing 85 square metre departure lounge can hold up to 42 persons at a time, assuming that each person will occupy 2 m^2. Assuming that each passenger will bring 2/3 wellwishers, this capacity translates into 26 air passengers only, meaning that the existing departing facilities cannot accommodate more than one F28-class aircraft at a time. With an average of 2-hour stay time per aircraft and 60% utilization factor of the airport, a generally accepted factor under which no delay is expected to occur, the airport can accommodate 3.6 aircraft operations a day. With an assumed load factor of 60%, an annual capacity of this airport amounts to 100,000 passengers.

2) Non-conformity with ICAO Standards

There are several points in the airport layout that do not meet the ICAO standard and recommended practices. Among those the ones that are particularly detrimental to operational safety are the facts that the clearance between the edges of runway and apron is inadequate and that the existing control tower building penetrates 7.7 m into the transitional surface and definitely constitutes an obstacle.

3) Weather Conditions

The minimum descent altitude for the ADF approach is 3,500 ft. (1,067 m), which is 1,400 ft. above ground. This means that even if the airport is in visual meteorological conditions (1,000 ft. of ceiling and 5 km of visibility by ICAO) aircraft may not be able to clear the cloud base, hence being unable to land. Low cloud forming in the valleys of the mountains that range north-south to the west of the airport often hang over the airport especially in summer months, causing pilots to attempt somewhat unsafe landing at times. This naturally poses an operational safety problem as the civil aviation authority admits.

Furthermore, the fact that the airport is situated close to the area frequented by heavy lightning and thunder poses another problem in safety of operation, since lightning and/or thunder-storm ocurring nearby not only interferes with the functions of NDB but may even hit the aircraft operating in and out of the airport.

2.4.2 Need for a New International Airport

1) Need for a Jet-Worthy Airport

It is natural for any landlocked country to require an airport worthy of being an international gateway. In the case of Swaziland, such an airport is badly needed for the following reasons:

a. Jet aircraft have lately been introduced in increasingly more countries in Africa, and a fleet comprising solely of propeller-driven aircraft is now unable to meet the regional air transport requirements.

b. Royal Swazi National Airways Corporation has been operating jet aircraft since 1978.

c. An airport capable of accommodating commercial jet operation is indispensable for establishing reciprocal air transport agreements with the countries of the region.

2) Need for a New Airport

Generally speaking it is cheaper to improve and/or expand the existing facilities. In the case of Swaziland however, a new airport is deemed indispensable because of the following prohibitive handicaps the present airport site suffers:

a. Air space is badly limited. The mountains surrounding the airport would intrude into the final approach obstacle clearance surface and would also constitute obstruction in the missed approach area if ILS was to be provided in accordance with the ICAO standards. It is, therefore, impossible to develop the existing airport for all-weather operation in conformity with the standards and recommended practices of ICAO.

b. Matsapa airport site is situated close to the area frequented by heavy lightning and thunder which pose problems in aircraft operational safety, especially for pilots of foreign airlines who are not familiar with the weather and obstable conditions of the airport.

CHAPTER 3

SITE EVALUATION AND SELECTION

CHAPTER 3 SITE EVALUATION AND SELECTION

3.1 General

3.1.1 Sequence of Site Selection Study

Site selection study of the new airport was carried out in the sequence shown in Fig. 3.1 during the field survey period in Swaziland from October 19 through November 16, 1979.

In the initial stage of the field survey, comparative evaluation of the four potential sites (Fig. 3.2), namely Mpaka, Sikupe (called Triangle site in the Progress Report I), Mpisi and Mogobi, was made to select the alternative sites for the detailed study, duely considering such criteria as airspace availability, topographical and geological features and land use. As a result, Mpisi site was dropped as not being worthy of further detailed study due mainly to the existing obstacles to aircraft operations. Furthermore, the difficulty anticipated in acquiring the necessary land area now being privately owned added to the reason for disqualification.

Detailed study on such of the three alternative sites for the proposed new airport development followed, and evaluation was made both from the technical and economic points of view.

As a result of the comprehensive evaluation of the alternative sites, the Sikupe site was found to be the most suitable for the new international airport construction and was recommended as such to the Government of the Kingdom in the Progress Report I submitted at the final stage of the field survey in November 1979. This site was officially selected by the Government of the Kingdom in December 1979 as the site for the new airport construction.

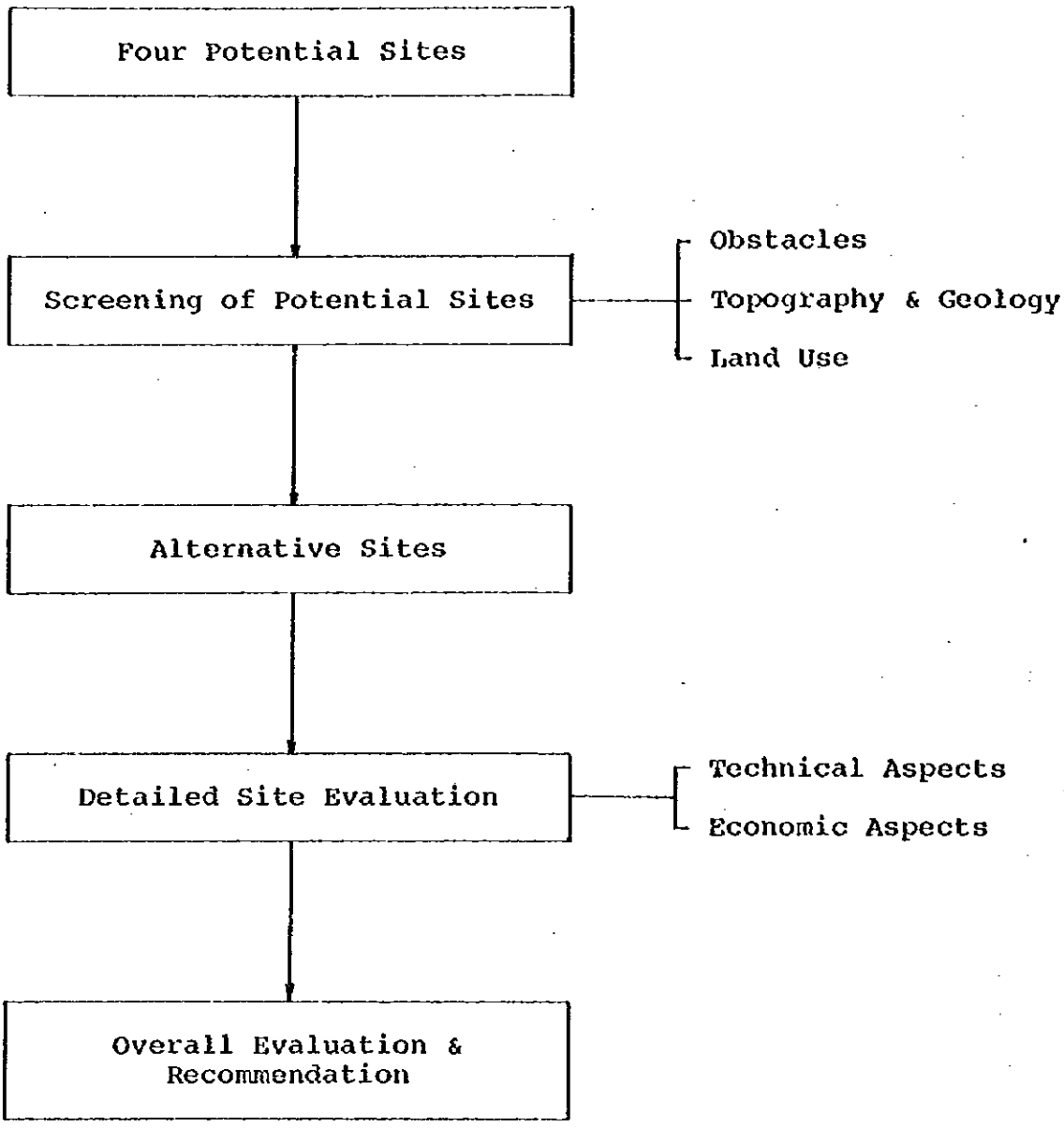


Fig. 3.1 SEQUENCE OF SITE SELECTION STUDY

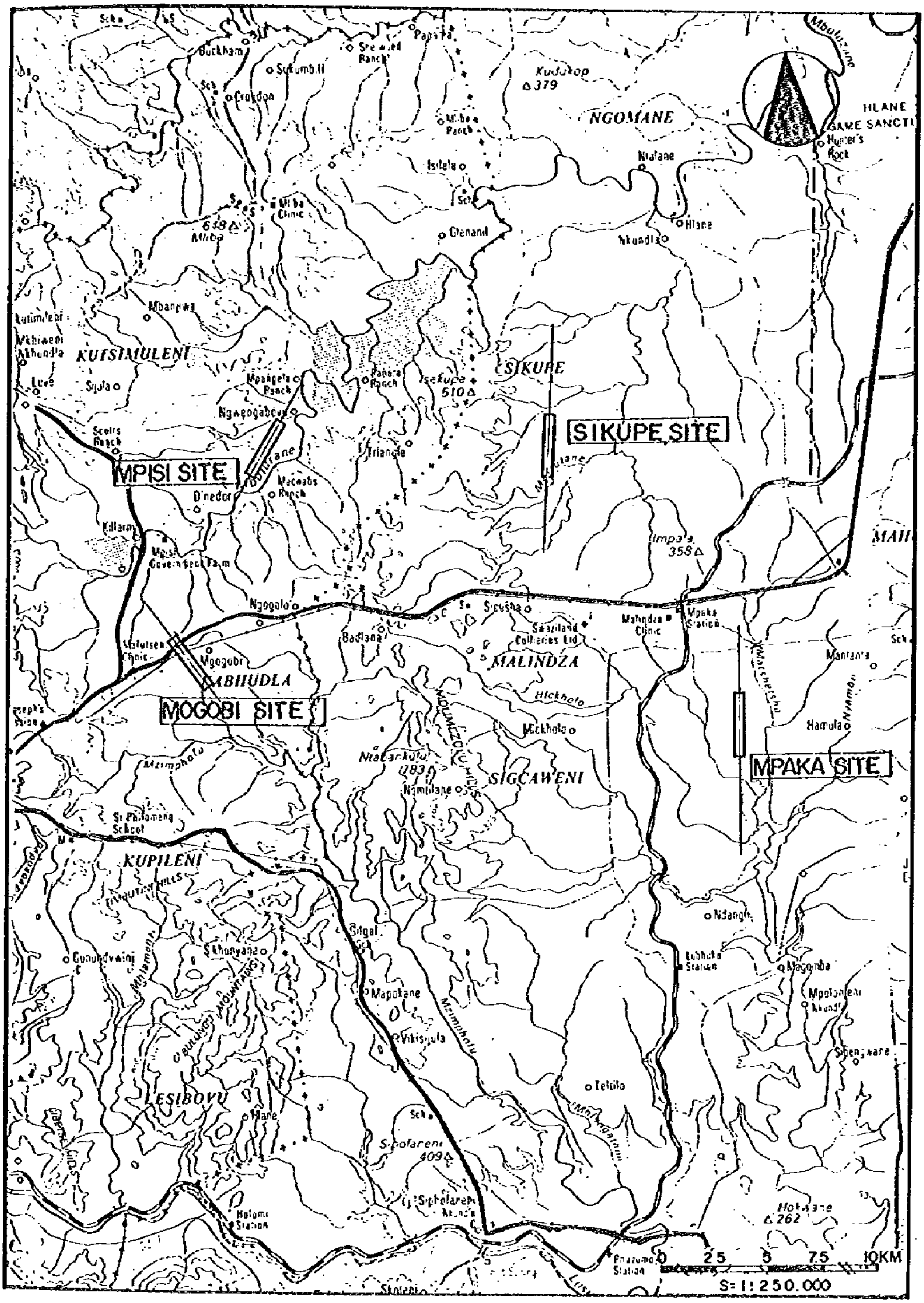


Fig 3.2 POTENTIAL SITES

3.1.2 Premises

The site selection study was conducted based on the following premises established as a result of the preliminary analyses of the data and information on hand including air traffic records, population and gross domestic product of Swaziland.

1) Air Route Network

The future air route network was assumed to consist of the routes, one to Nairobi for possible connection as necessary for Europe and Asia, to Kinshasa for North America and to Johannesburg for connection to Australia and South America.

2) Air Traffic Demand

The number of air passengers for the year 2005 was assumed to amount to one million.

3) Area and Basic Airfield Facility Requirements

The area requirements and the basic airfield facility requirements of the new airport were developed as follows for the site selection purpose on the basis of the above conditions:

Runway	3,000 m, Cat-I
Taxiway	one parallel
Airport area to be reserved	160 hectares

3.2 Potential Sites

The outline description of the four potential sites shown in Fig. 3.2 is as follows:

1) Mpaka Site

It is situated in the centre part of Lowveld, about 6 km south east of Mpaka railway station and at about 80 km of road distance from the hotel area in Ezulwini as shown in Fig. 3.3. The runway at this site is to be orientated 180° - 360° true bearing.

2) Sikupe Site

The site is situated at western edge of Lowveld, about 7 km north of main road MR3 and at about 75 km of road distance from the hotel area as shown in Fig. 3.4. The runway orientation at this site is to be 4° - 184° true bearing.

3) Mpisi Site

Situated in Middleveld, about 6.5 km north-east of the Mpisi Government Experiement Farm and at about 60 km from the hotel area as shown in Fig. 3.5, this site calls for runway orientation of 30° - 210° true bearing.

4) Mogobi Site

The site extending across the main road MR3 at its north end as shown in Fig. 3.6 is situated in Middleveld, about 3 km east of Mafutseni. The road distance from the hotel area is about 50 kilometers. The possible runway orientation at this site is 143° - 323° true bearing.

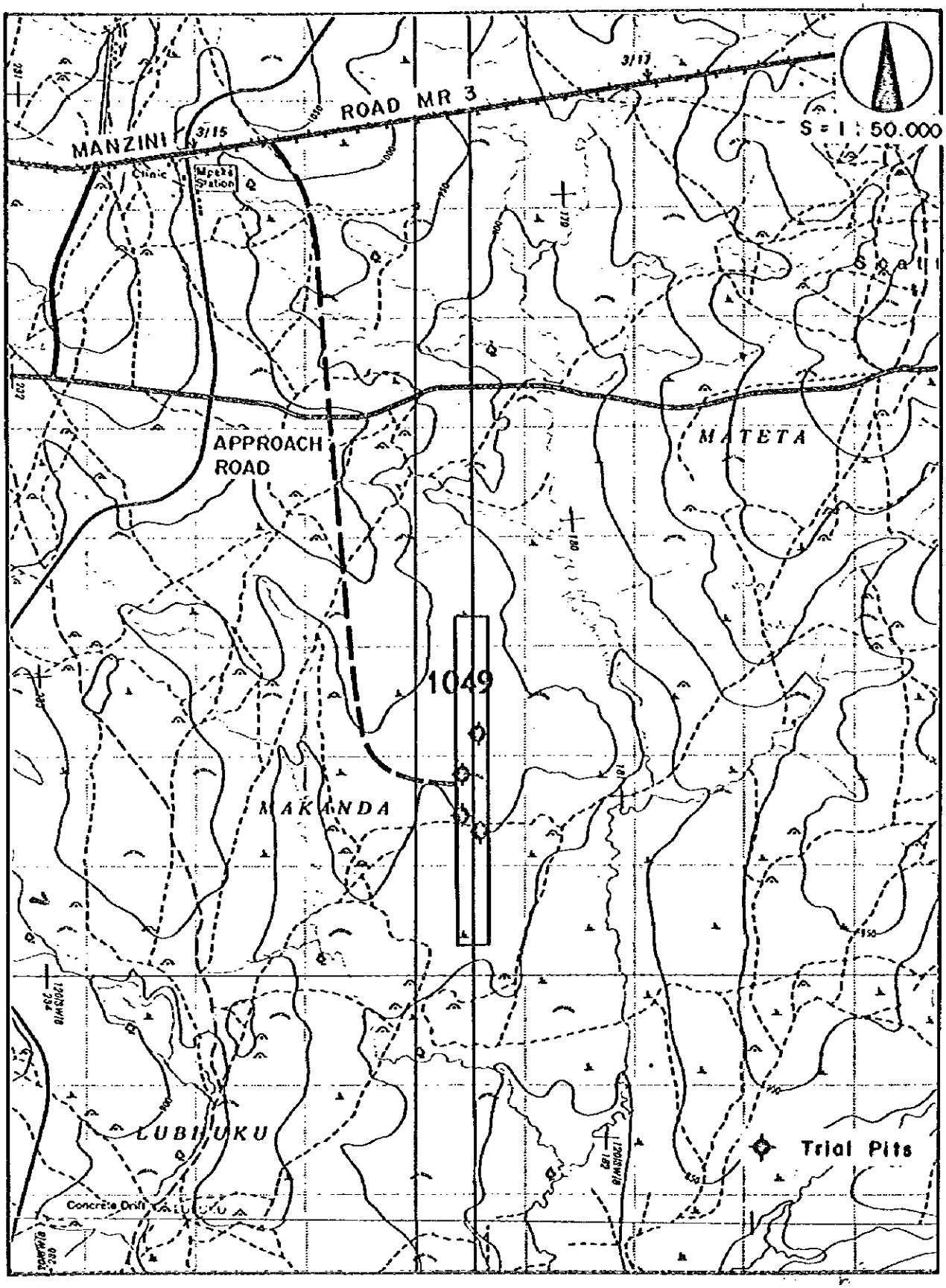


Fig. 3.3 MPAKA SITE

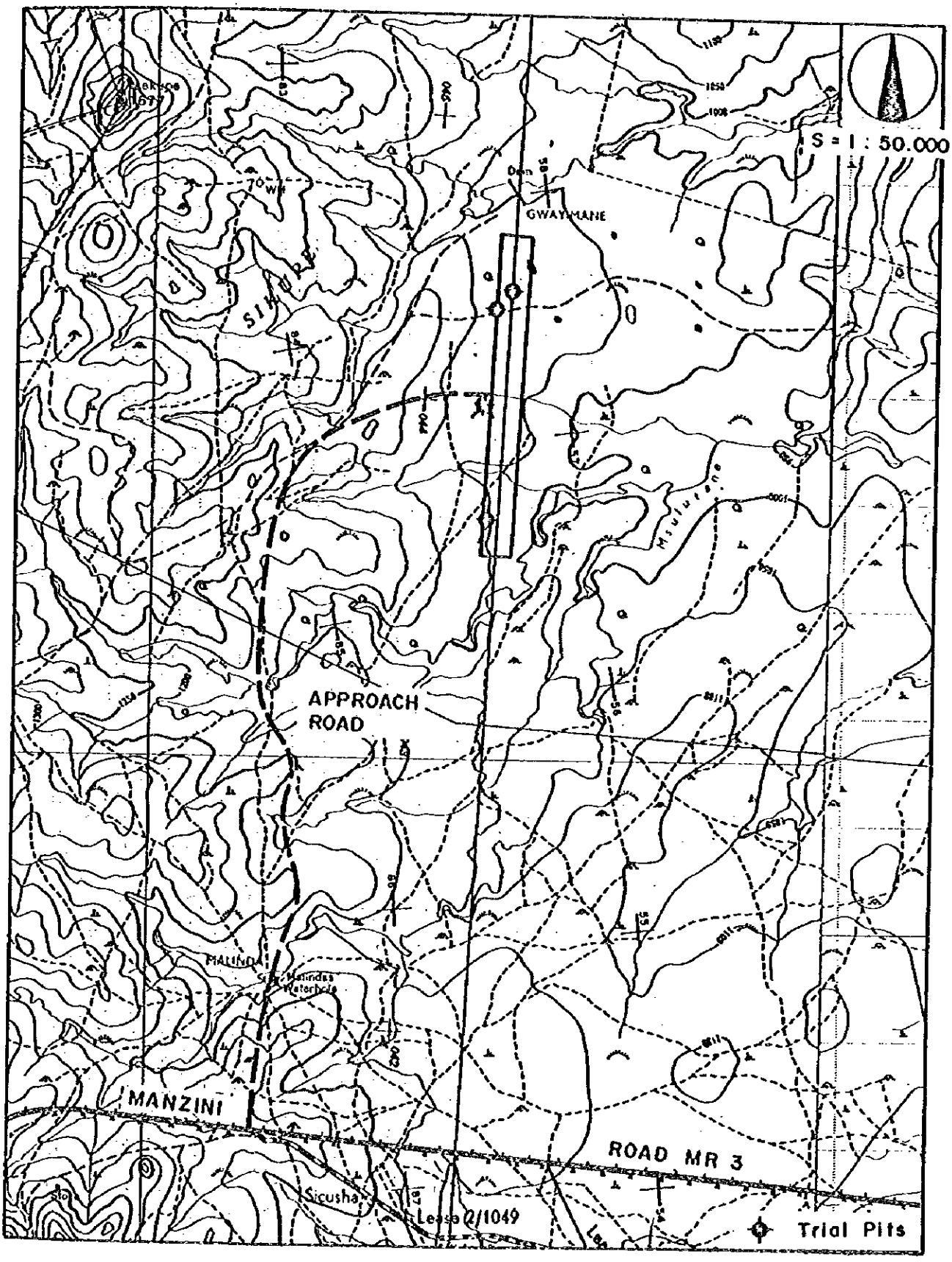


Fig. 3.4 SIKUPE SITE

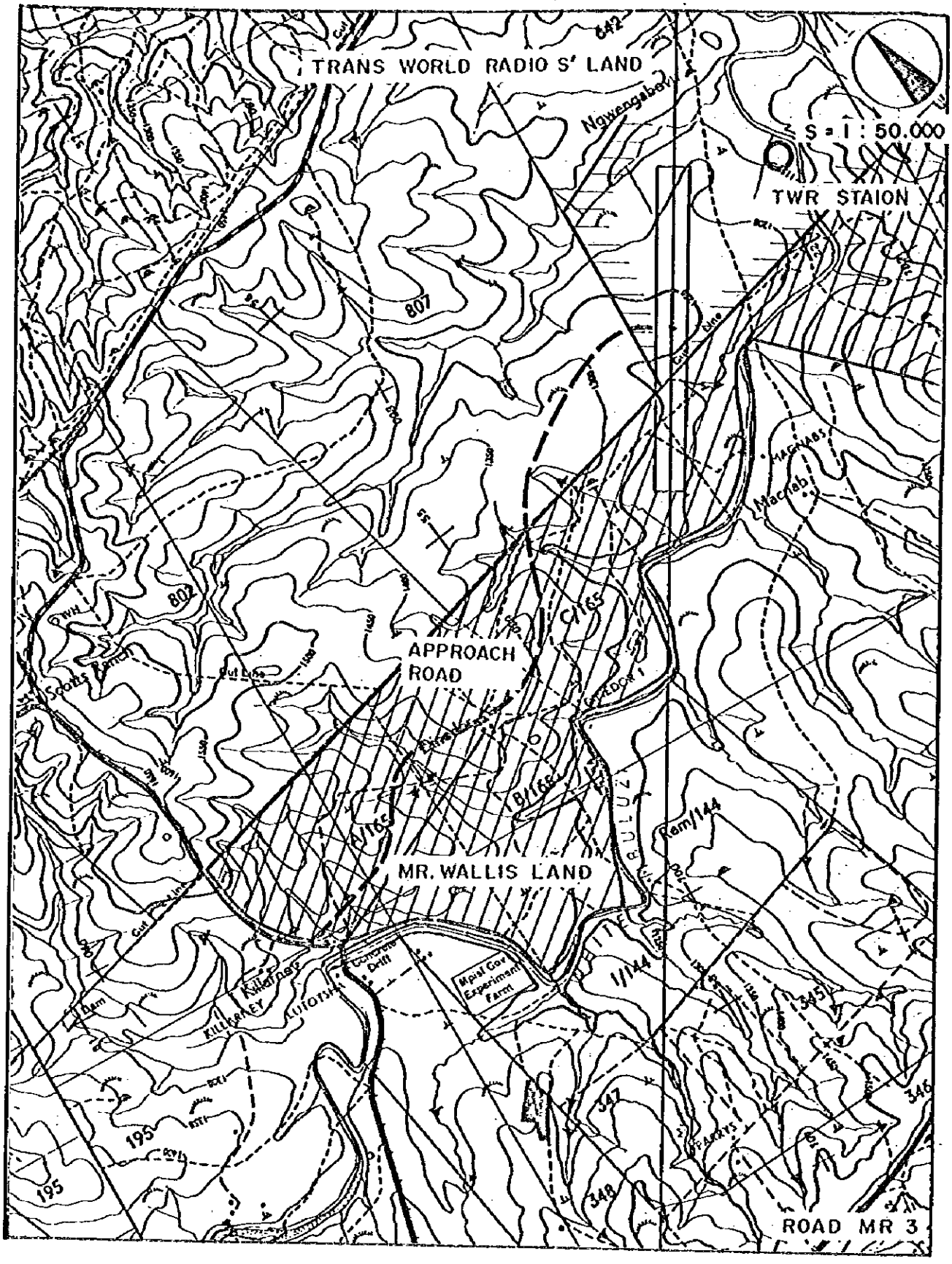


Fig. 3.5 MPISI SITE

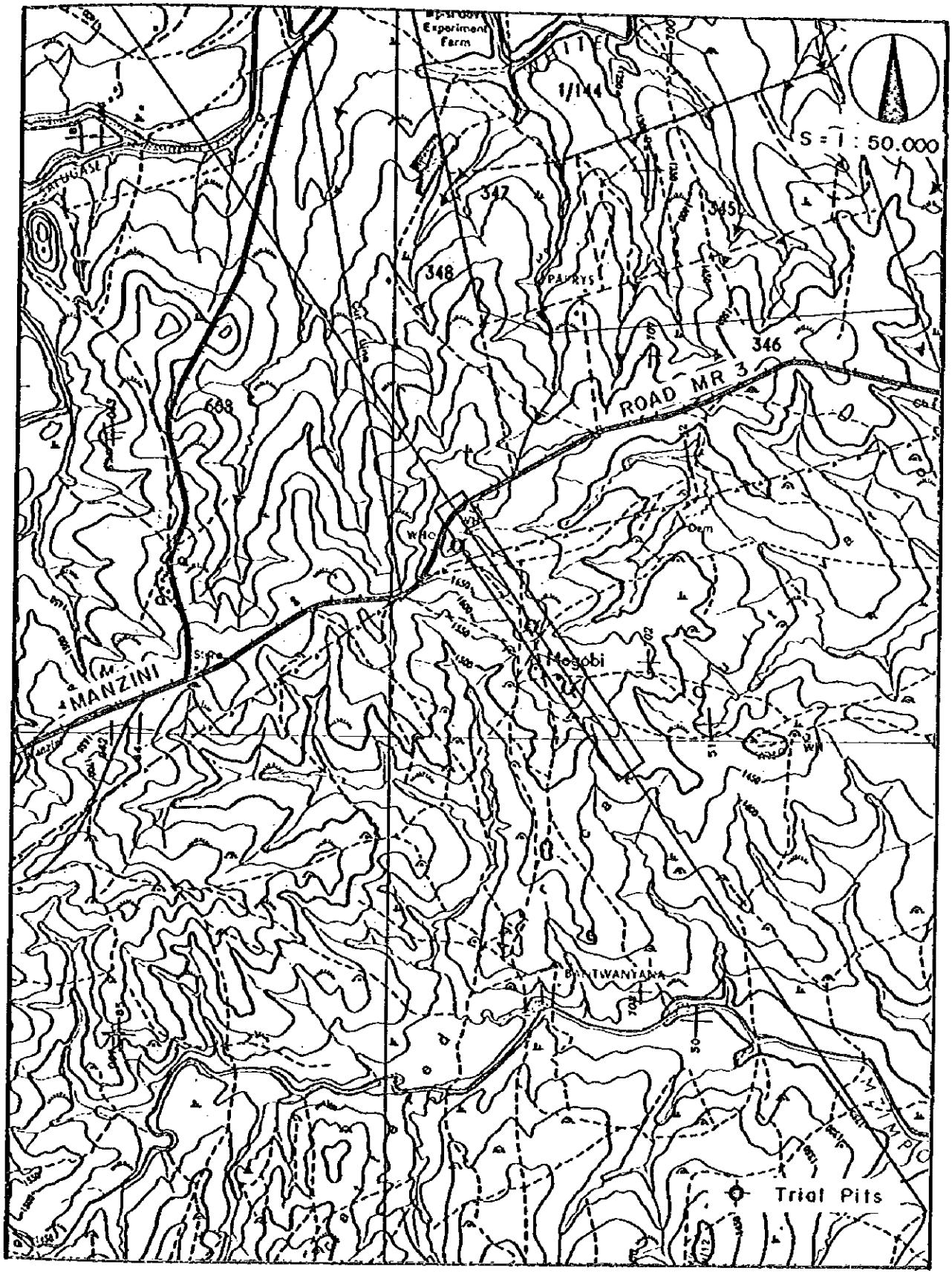


Fig. 3.6 MOGOBI SITE

3.3 Selection of Alternative Sites

Selection of the alternative sites out of the four potential sites was made in terms of availability of airspace, construction cost factors and present land use. The difference in access time and distance from the hotel area to the four sites, however, was not considered significant enough to affect either potential or induced traffic demand nor the consequent benefits of the new airport, and was, therefore, not included in the screening criteria.

3.3.1 Availability of Airspace

The possible obstacles to aircraft operation within the four obstacle limitation surfaces required for an instrument approach runway as specified in ICAO Annex. 14, namely instrument approach surface, takeoff climb surface, inner horizontal surface and conical surface, were identified with the help of the map in scale 1 : 50,000 as briefly summarized below. The obstruction charts of the four potential sites are given in Appendix 3A.

1) Mpaka Site

No obstacle is found projecting into any of the obstacle limitation surfaces.

2) Sikupe Site

There exist mountains on the west of the site projecting into the inner horizontal surface and into the conical surface by 150 m and 45 m respectively, which does not, however, seriously limit aircraft operation at this site.

3) Mpisi Site

The mountains on the east and on the west of the site project into the inner horizontal surface by 45 m and 60 m respectively. Besides, the mountains on the east and on the west of the site project into the conical surface by 115 m and 15 m respectively. Because of these obstacles this site has a very limited availability of airspace.

4) Mogobi Site

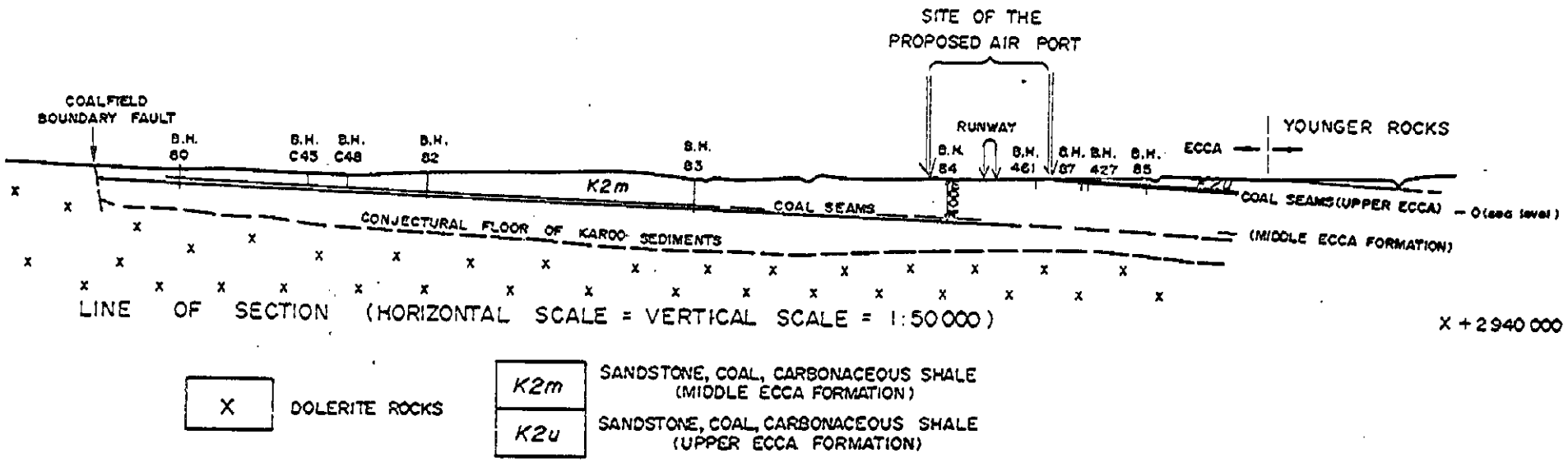
No obstacles whatsoever are found in any of the 4 surfaces.

3.3.2 Construction Cost Factor

A series of reconnaissance was made in and around each site with the help of the map in scale of 1 : 50,000 in order to identify the topographical conditions that might affect the earthwork, drainage works, accessibility from the near-by existing roads, and possible execution of counter-measures against obstacles to aircraft operation, if any. The preliminary analysis of the geological conditions of each site was also made on the basis of the information such as those supplied by Geological Survey and Mines Department and the NACO Report.

1) Mpaka Site

The elevation of the site grades down slightly toward the east with a maximum elevation range of about 50ft. The geological formation of the surface layer is of clay containing sandstone as shown in Fig. 3.7.



SOURCE : GEOLOGICAL SURVEY AND MINES DEPARTMENT

Fig. 3.7 COAL SEAMS

2) Sikupe Site

The site is generally flat with a maximum elevation range of about 50ft. The surface soil consists of clay, clayey sand and sandy loam.

3) Mpisi Site

The site has rather big undulations with a maximum elevation range of about 150ft, which will require a big amount of earthwork. The formation of the surface soil is deemed to be similar to that of Sikupe site.

4) Mogobi Site

The site has many big undulations with a maximum elevation range of about 170ft and will require the biggest amount of earthwork among the four sites. The surface soil seems to be rather thin with hard rock layers below.

3.3.3 Present Land Use

Present land use in and around each site was confirmed through field reconnaissance and the ownership of each site was identified on the basis of the information supplied by Deeds Office.

1) Mpaka Site

The site is the national property of Swaziland and is mostly covered with thorny shrubs.

2) Sikupe Site

The site is the national property of Swaziland and is mostly cultivated with some kraals.

3) Mpisi Site

The site is privately owned by Trans World Radio and Mr. Wallis, and is mostly covered with thorny shrubs.

4) Mogobi Site

The site is the national property of Swaziland and is mostly grass-covered, with some hamlets and two schools in the area.

3.3.4 Alternative Sites

The site screening mentioned above led to the conclusion that Mpisi site was not worthy of being studied further in detail due to the existence of critical obstacles to aircraft operation and was screened out, and that the other three sites be subjected to the detailed site evaluation study. Comparison of the four potential sites is given in Table 3.1.

Table 3.1 Comparison of Potential Sites

Item	Mpaka	Sikupe	Mpisi	Mogobi
Road distance from hotel area (km)	80	75	60	50
Approach road (km)	6.5	8	7	0
Runway orientation (°)	180 - 360	4 - 184	30 - 210	143 - 323
Airport elevation (FT)	900	1050	1200	1600
Present land use	Thorny bush	Cultivated	Thorny bush	Grass land
Land ownership	National	National	Private & T.W.R.	National
Topographical features	Generally flat	Generally flat	Undulated	Undulated
Geological features	Clay	Clay	Clayey sand	Sandy loam
Obstacles				
Instrument approach surface	Nil	Nil	Nil	Nil
Take-off climb surface	Nil	Nil	Nil	Nil
Inner horizontal surface	Nil	West-150m+	West-60m+ East-45m+	Nil
Conical surface	Nil	West-45m+	West-115m+ East -15m+	Nil

+ : indicates the height of obstacles projecting into each surface.