

Aftercare Study on
the National Water Master Plan

KANGEMA (1/1)

Urban Water Supply
System Survey

General

Name of Urban Centre : Kangema

Organisation/Water Undertaker : NWCPG

District : Murang'a Location: Kanyenyaini

Map (1/50,000) Ref. no : 134/2

Co-ordinates X 36° 58' Y S 00° 40'

Drainage Sub-basin : 4BD

Existing facilities:

Source : South Mathiyoia river

Type of Intake : Furrow Elevation : 1710m AOD

Raw water system : Gravity

H: m Dia : 150mm 800m

Treatment Process :

Full separate units. 1 N° receiving basin and mixing channels- sedimentation tank and filter combined then to 2N° reservoirs where it is chlorinated then pumped to town tank- the whole system is past its lifespan -built in 1950

Designed Capacity : 400m³/day year 1984

Treated water/Distribution system -

Area covered: 4 km²

Distribution mains (80mm and above):

Total length :

UFW (Estimated) : m³/d

Consumers - Total no : 605 year 1997

Working Meters:

Metered : 568

Unmetered : 37

Water production : 150 m³/d

Remark : Seldom government chemist takes sample to test for water analysis and bacterial tests

Service area population : 2,000 (Approx.)

Population served : 600

Financial/Revenue 1997

O & M costs : Kshs 1,167,346(Salary and Chemical), 2,860,575

Revenue earned : Kshs

Revenue collected : Kshs 601,314-00

Rehabilitation required/costs

i) T works

Kshs Estimated
25,000,000

ii) Distribution improvements and rainwater pipes

60,000,000

Total

85,000,000

Future development plan

Source :

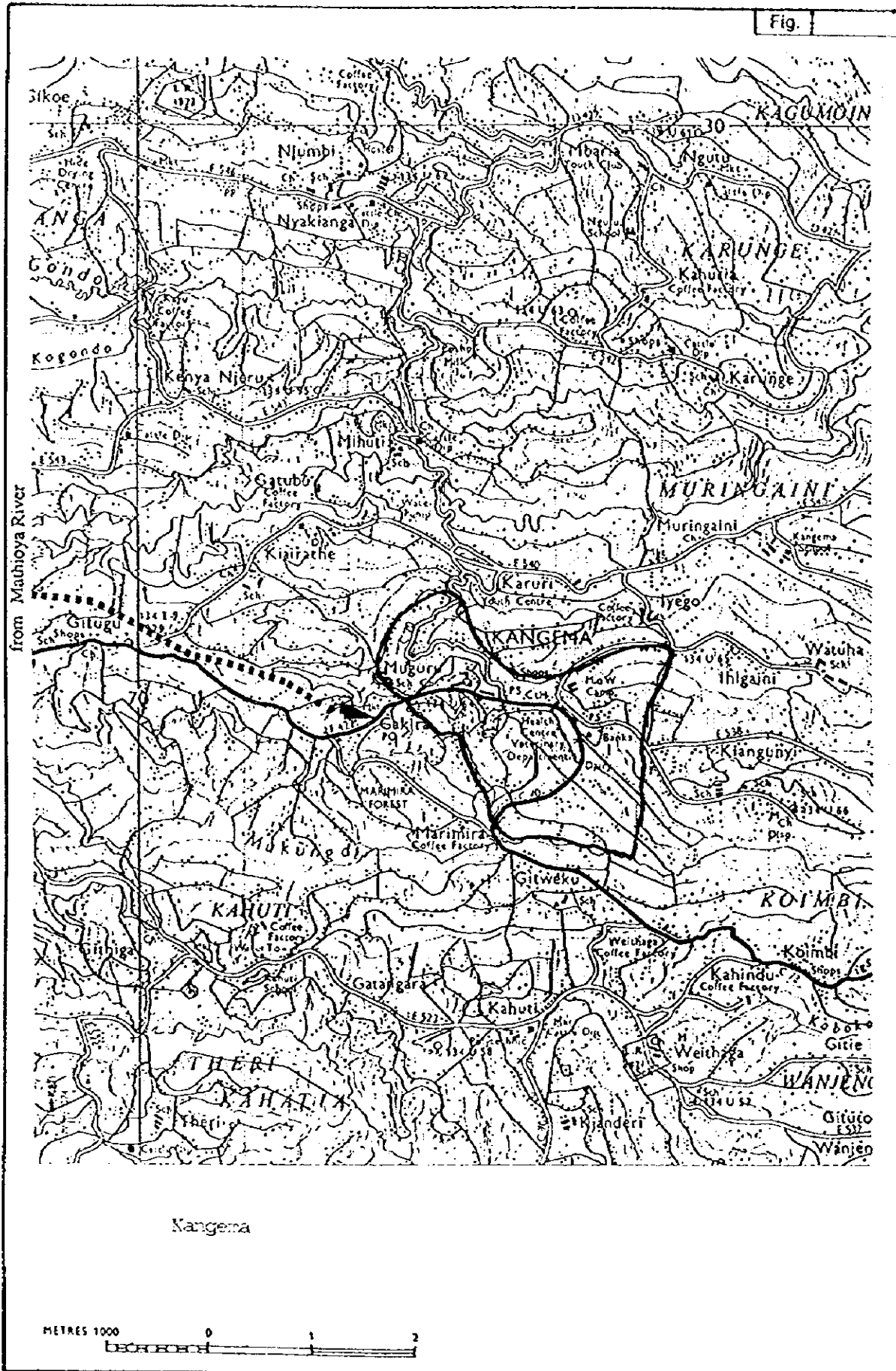
Treatment : Capacity : m³/d

Design year :

Design population :

Remarks

Treatment works are too old. pumping of raw water is expensive, it is consuming most of the carrying



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MURAMG'A (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Murang'a*
 Organisation/Water Undertaker : *MOWR*
 District : *Murang'a* Location: *Murang'a*
 Map (1/50,000) Ref. no : *135/1* Co-ordinates *X 37° 07' Y S 00° 43'*
 Drainage Sub-basin : *4BD*

Existing facilities: *1. Kahawe river 2. Mathiya river 3. Borehole 4 N° -abandoned*

Source : Type of Intake : Elevation : *m*
 Raw water system : *Pumping* H : *(2)116* Dia : *(2) 200 (1) 300mm*

Treatment Process : *Full separate units. Coagulation basin - 92m², filter 2.7m, diam. 3.0m deep clear water tank 2045m³. Alum soda chlorine is used for treatment all standard test are*

Designed Capacity :

Treated water/Distribution system - Area covered:
 Distribution mains (80mm and above): *200mm to mm*
 Total length : *1.13km*

UFW (Estimated) : *m³/d*
 Consumers - Total no : *2672 year 19 Working Meters:*
 Metered : *2672*
 Unmetered :

Water production : *2,000 m³/d -1996* Remark :
 Service area population : *56,000*
 Population served : *24,000*

Financial/Revenue 1996 figures
 O & M costs : *Kshs 5,123,407*
 Revenue earned : *Kshs 9,895,437*
 Revenue collected : *Kshs 8,337,201*

Rehabilitation required/costs

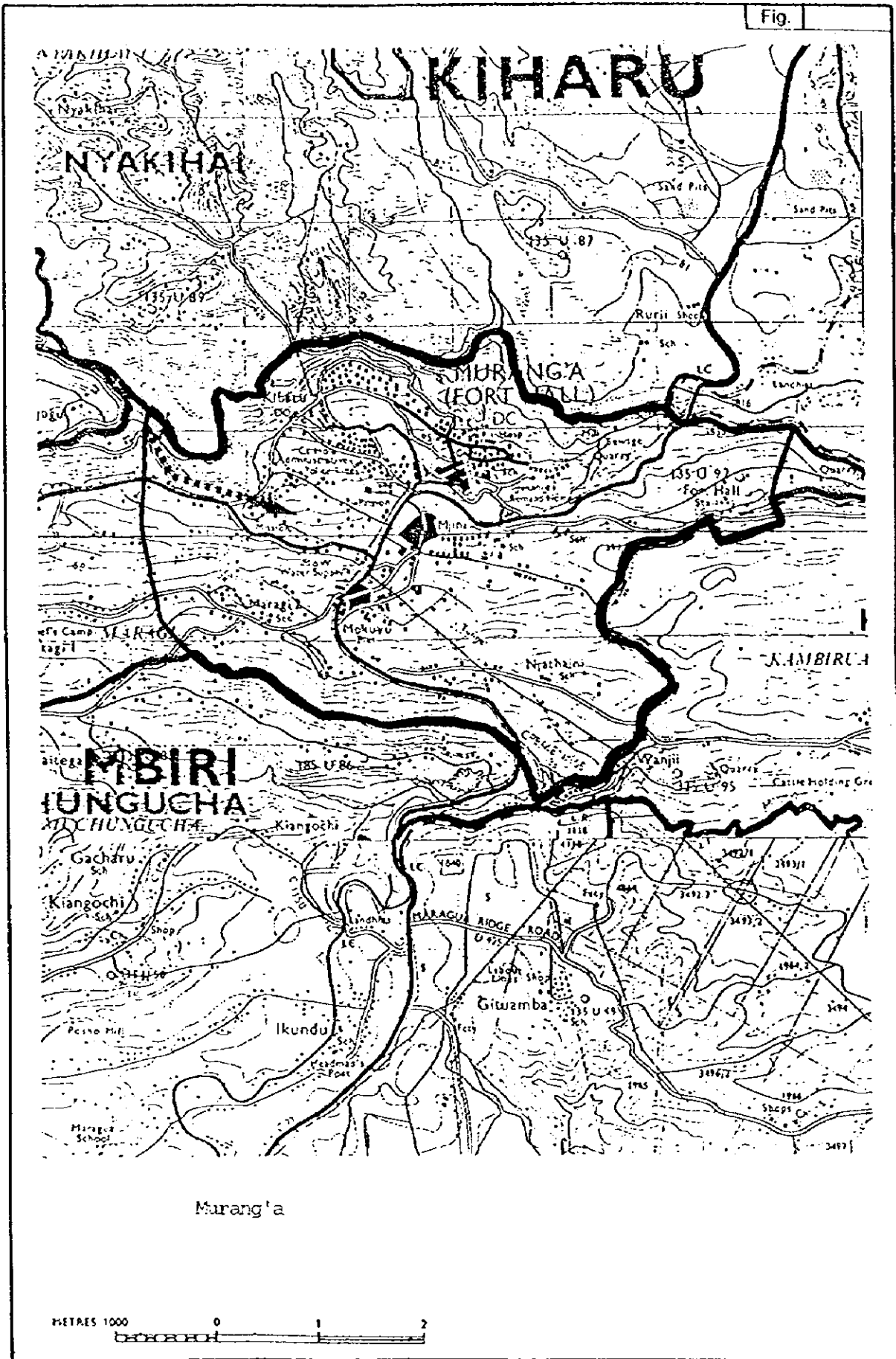
i) <i>5 km of rising main 225m diam.</i>	Kshs Estimated
ii) <i>Intake</i>	<i>20,000,000</i>
iii) <i>Improvements to treatment units</i>	<i>10,000,000</i>
	<i>6,000,000</i>
Total	<i>36,000,000</i>

Future development plan

Source :
 Treatment : Capacity : *m³/d*
 Design year :
 Design population :

Remarks

Due time scheme being on dumping system large portion of earning about 2,000,000 pre year goes for power consumption.



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MARAGUA (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Maragua*

Organisation/Water Undertaker : *MOWR*

District : *Maragua* Location: *Maragua*

Map (1/50,000) Ref. no : *135/3*

Co-ordinates *X 37° 08' Y S 00° 46'*

Drainage Sub-basin : *4BF*

Existing facilities: *Borehole C3385*

Source: *Borehole*

Type of Intake : *B/H* Elevation : *m*

Raw water system : *Pumping*

H: *m* Dia : *150mm*

Treatment Process : *None*

Designed Capacity: *96 m³/day*

Treated water/Distribution system

Area covered: *km²*

Distribution mains (80mm and above): *80 mm to 1 mm*

Total length : *km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *183*

Metered : *14*

Unmetered : *169*

Working Meters: *14*

Water production : *15 m³/d*

Remark :

Service area population : *12,000 - 1996*

Population served : *6,200 - 1996*

Financial/Revenue:

O & M costs : *Ksh 368,474 (1995)*

Revenue earned : *Kshs 152,970 (1995)*

Revenue collected : *Kshs 143,931 (1995)*

Rehabilitation required/costs

Kshs Estimated

1) Rehabilitation of boreholes.

300,000,

Total

300,000

Future development plan

Source : *Maragua river*

Treatment : *Full conventional*

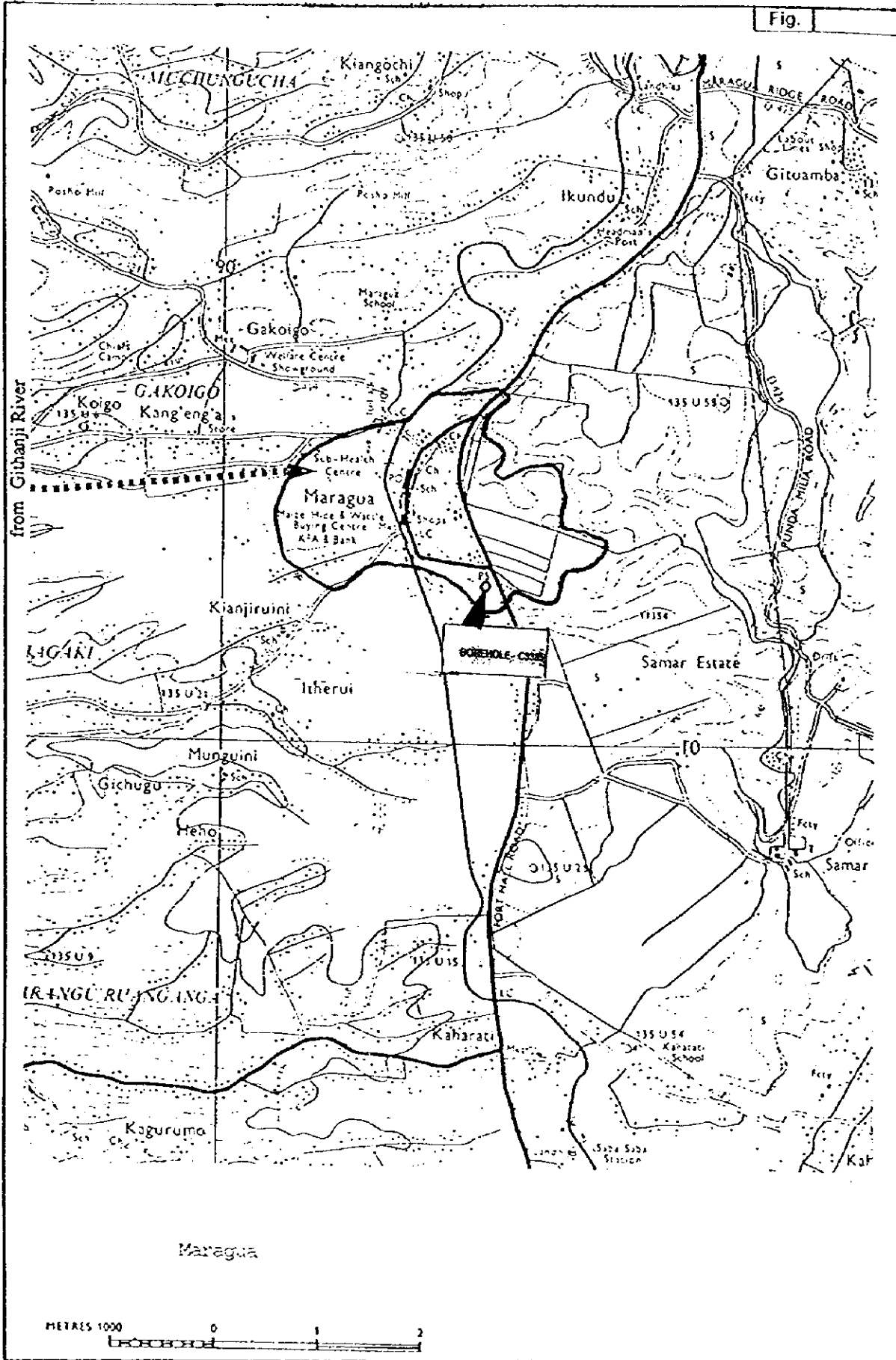
Capacity : *1,200 m³/d*

Design year : *1998*

Design population: *12,000*

Remarks

In addition to the existing borehole, the old one was rehabilitated last year but the yield was unsatisfactory.



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MAKUYU (1/1)

Urban Water Supply
System Survey

General

Name of Urban Centre : Makuyu

Organisation/Water Undertaker : Punda Milia Farmers Co-operative

District : Maragua

Location : 235.1 Makuyu

Map (1/50,000) Ref. no : 135/3

Co-ordinates X : 37° 11' E

Y : 00° 53' S

Drainage Sub-basin :

Existing facilities

Source : Boreholes - 2 No.

Type of Intake :

Elevation : m

Raw water system : Pumping

H : m

Dia : mm

Treatment Process : No Treatment

Designed Capacity : m³/d

Treated water/Distribution system -

Area covered : 6.0 km²

Distribution mains (80mm and above): mm to mm

Total length : km - Maximum pipe dia. is 40mm

UFW (Estimated) : m³/d

Consumers - Total no : 310

Working Meters:

Metered : 170

Unmetered : 140

Water production : 360 m³/d

Remark :

Service area population : 24,000

Population served : 600

Financial/Revenue

O & M costs :Kshs

Revenue earned :Kshs

Revenue collected :Kshs

Rehabilitation required/costs

Estimated Cost

Kshs

i)

ii)

Total

Future development plan

Source :

Treatment : Capacity : m³/d

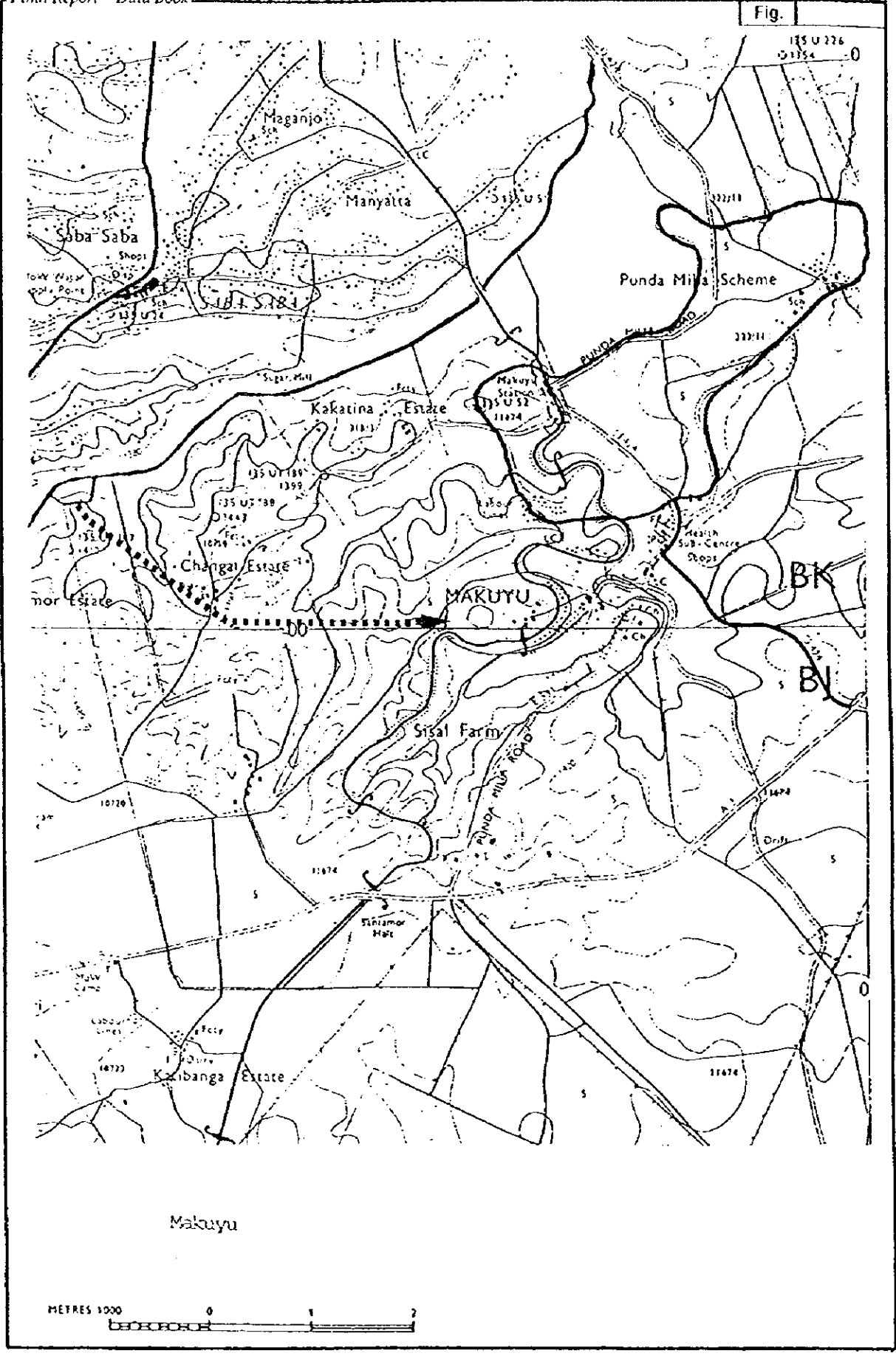
Design year :

Design population :

Remarks

The supply for Makuyu Urban is from 2 No. boreholes, owned by Punda Milia Farmers Co-operative. The existing source is not adequate to meet the demand of the growing urban population. Final Design for an alternative source (Earth Dam) was carried out in 1991 but the project has not been implemented.

Fig.



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OL KALOU(1/1)

Urban Water Supply
System Survey

General

Name of Urban Centre : *Ol Kalou*

Organisation/Water Undertaker : *MOWR*

District : *Nyandarua* Location:

Map (1/50,000) Ref. no : *119/4*

Co-ordinates *X 36° 22' Y S 00° 16'*

Drainage Sub-basin : *2GB*

Existing facilities:

Source : *Borehole - total 4N° 2N° ok*

Type of Intake : *B/H* Elevation : *m*

Raw water system : *Pumping*

H : *m* Dia : *100-80mm*

Treatment Process : *Partly- Chlorination only- dozed manually daily testing rarely*

Designed Capacity :

Treated water/Distribution system -

Area covered: *4 km²*

Distribution mains (80mm and above): *50mm to mm*

Total length : *6000 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *390 year 1996*

Working Meters: *100*

Metered : *390*

Unmetered :

Water production : *220 m³/d*

Remark :

Service area population : *10,000*

Population served : *9,060*

Financial/Revenue

O & M costs : *Kshs 653,500 (average)*

Revenue earned : *Kshs 1,459,920 - billed 1996*

Revenue collected : *Kshs 1,140,260*

Rehabilitation required/costs

i) *Treatment works*

10,000,000

ii) *Distribution mains improvement*

20,000,000

Total

30,000,000

Future development plan

Source :

Treatment : Capacity : *m³/d*

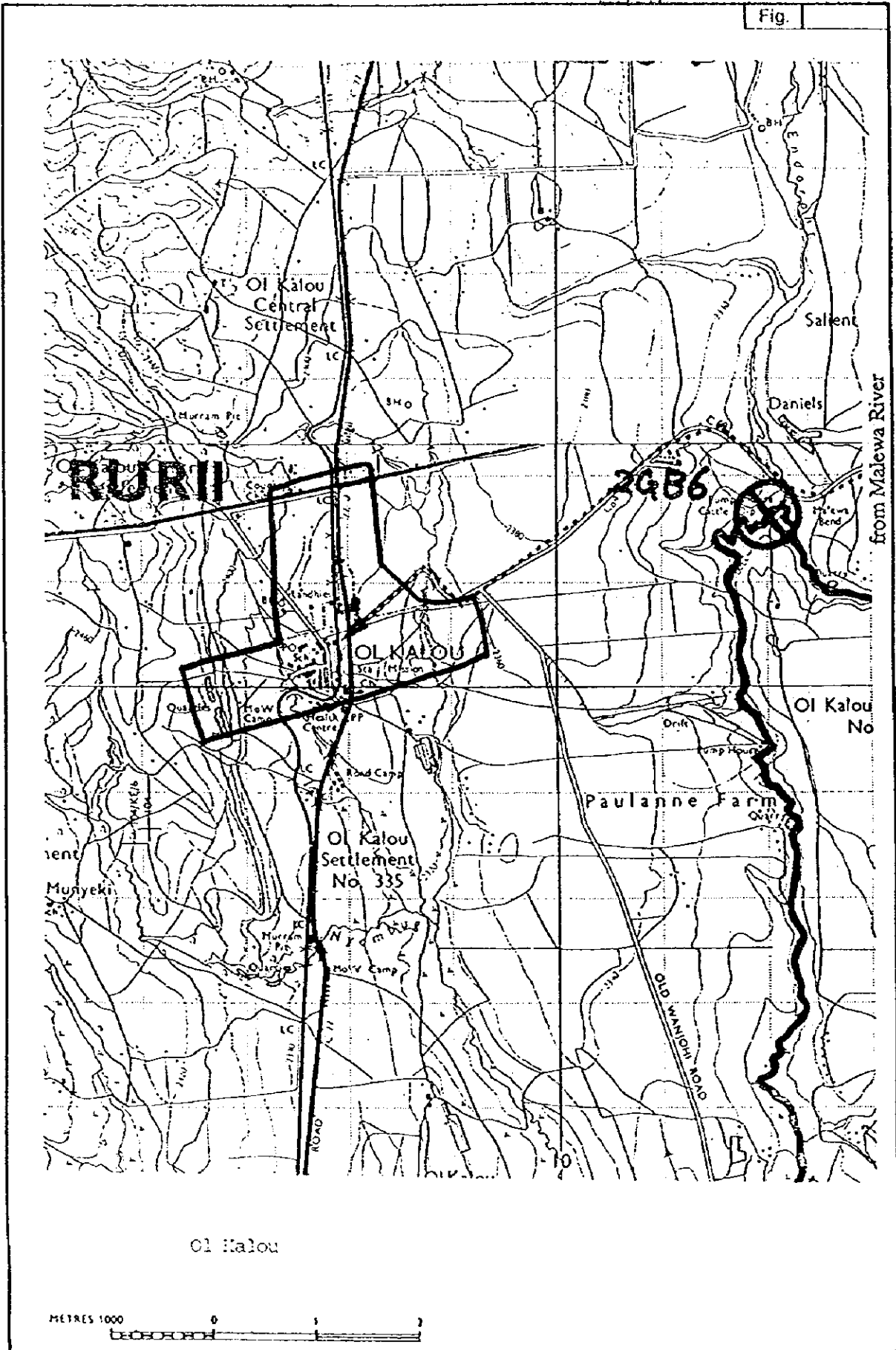
Design year :

Design population :

Remarks

Of the four boreholes only two are operational No C3779 and C3784. Water is pumped to distribution 150m³ tank from where it is reticulated to consumers. Most of them are on communal points

Fig.



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KARATINA (1/1)

Urban Water Supply
System Survey

General

Name of Urban Centre : *Karatina*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Nyeri* Location : *Karatina*
 Map (1/50,000) Ref. no : *121/3* Co-ordinates X : *37° 08' E* Y : *00° 28' S*
 Drainage Sub-basin : *4BA*

Existing facilities

Source : *Ragati River* Type of Intake : *Weir* Elevation : *About 1800 m*
 Raw water system : *Gravity* H : *3 m* Dia : *280 mm*
 Treatment Process : *Full Conventional Treatment*
 Treatment Works Components: *1 No. Receiving Basin, 2 No. Mixing Chambers, 2 No. Sedimentation Tanks and 3 No. Filters. Some tests are carried out about monthly. Residual Chlorine test is done twice daily. Dosing is done by gravity pipe*
 Designed Capacity : *m³/d*
 Treated water/Distribution system - Area covered : *37 km²*
 Distribution mains (80mm and above): *280 mm to 63 mm*
 Total length : *15.34 km*

UFW (Estimated) : *m³/d*
 Consumers - Total no : *1195 (1996)* Working Meters:
 Metered : *1195*
 Unmetered :

Water production : *1300 m³/d* Remark :
 Service area population :
 Population served : *14,533*

Financial/Revenue - 1996

O & M costs :Kshs *2,026,750*
 Revenue earned :Kshs *5,508,204 Billed*
 Revenue collected :Kshs *4,412,082*

Rehabilitation required/costs

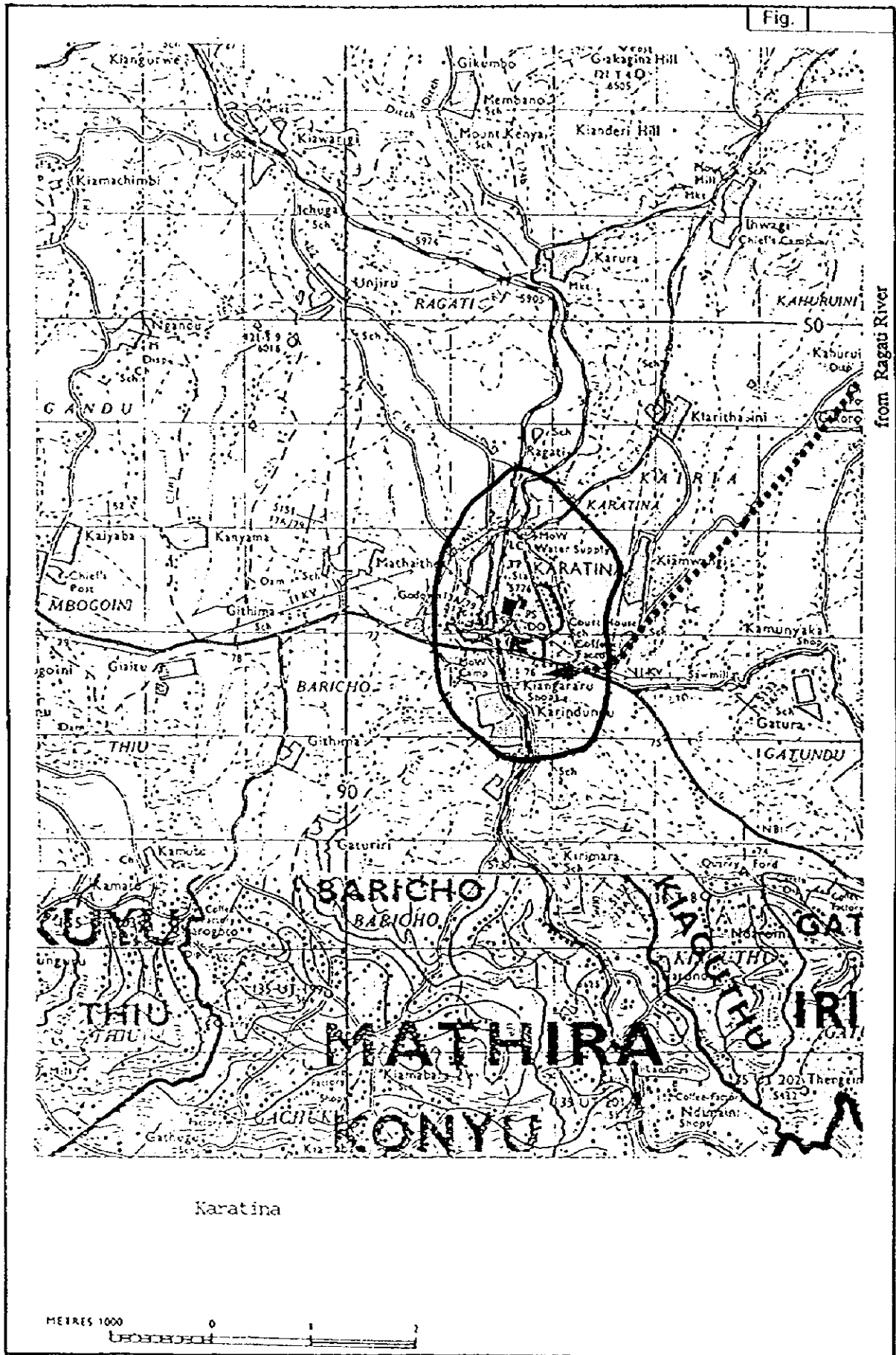
i) <i>Testing and dosing equipment</i>	Estimated Cost	Kshs
ii) <i>Distribution system rehabilitation</i>		<i>250,000</i>
iii) <i>Treatment works repairs and metering equipment</i>		<i>25,000,000</i>
iv) <i>Additional tanks</i>		<i>6,500,000</i>
		<i>3,000,000</i>
	Total	<i>34,750,000</i>

Future development plan

Source :
 Treatment : Capacity : *m³/d*
 Design year :
 Design population :

Remarks

Recent extension to supply two main areas has been done.



from Ragati River

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OTHAYA (1/1)

Urban Water Supply
System Survey

URBAN WATER SUPPLY - SUMMARY SHEET

21

General

Name of Urban Centre : *Othaya (Urban form part of geate othaya rural water supply built in 1978)*
 Organisation/Water Undertaker : *NWCPC*
 District : *Nyeri* Location:
 Map (1/50,000) Ref. no : *134/2* Co-ordinates *X 36° 57' Y S 00° 32'*
 Drainage Sub-basin : *4BA*

Existing facilities:

Source : *Borehole - Gikira river (Othaya urban connec.* Type of Intake : *Weir* Elevation : *2399m*
 Raw water system : *Gravity* H : *157m* Dia : *250mm*

Treatment Process : *Partial - Only chlorination done for main scheme at edge of Aberdares (Chlorination chamber).*

Designed Capacity : *4640m³/day*
 Treated water/Distribution system -

Area covered: *8 km² for Othaya urban*
 Distribution mains (80mm and above): *1 50mm to 80 mm*
 Total length : *12.6km*

UFW (Estimated) : *m³/d*
 Consumers - Total no : *467*
 Metered : *467*
 Unmetered : *None*

Working Meters:

Water production : *700 m³/d*
 Service area population : *14,000*
 Population served :

Remark : *Water production is effected due to non function or vandalism of apportaenaces*

Financial/Revenue

O & M costs : *Kshs 425,774*
 Revenue earned : *Kshs 1,200,000 billed*
 Revenue collected : *Kshs 1,080,000*

Rehabilitation required/costs

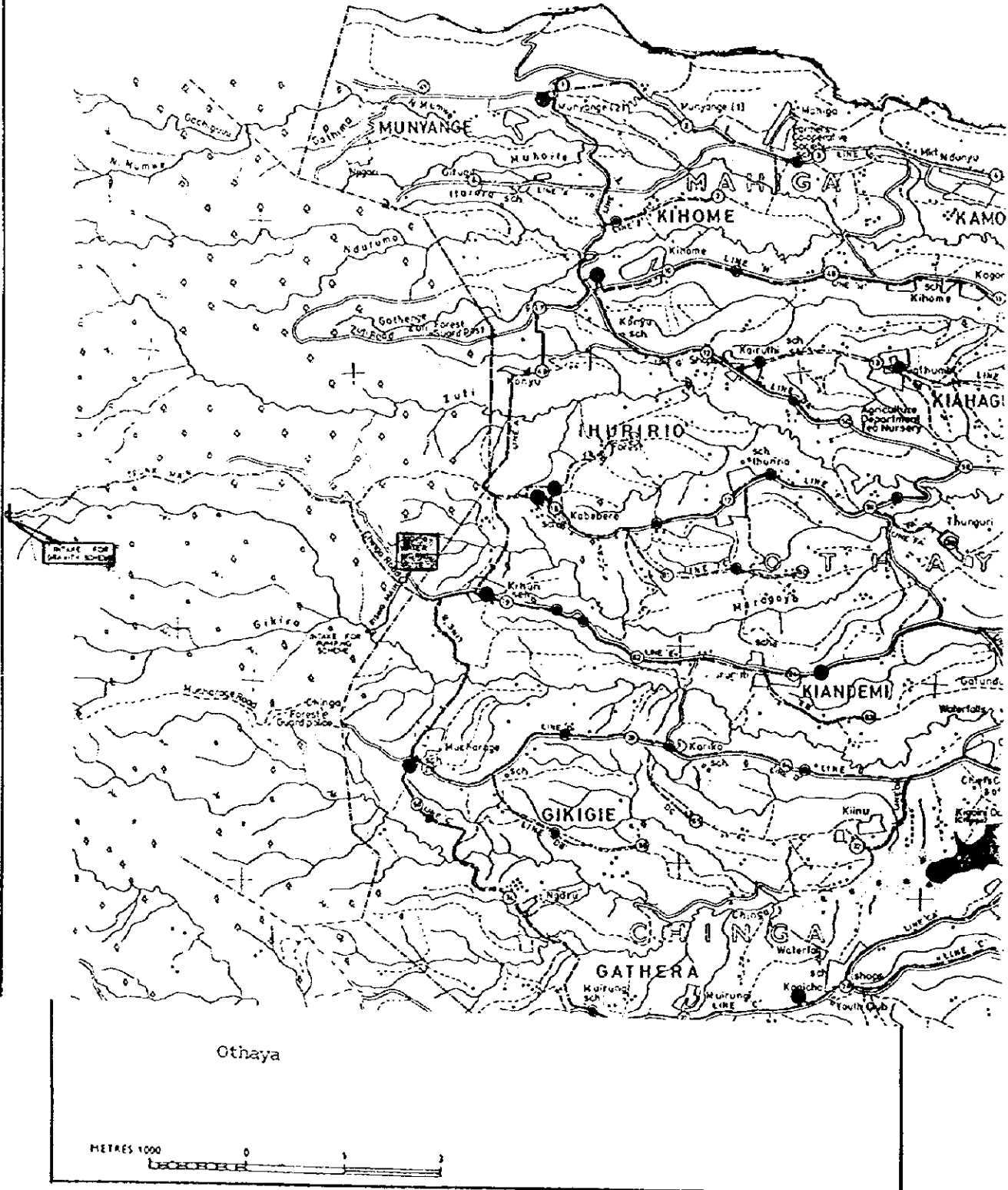
	Kshs Estimated
<i>i) Access road 6km</i>	<i>10,000,000</i>
<i>ii) Intake screens</i>	<i>200,000</i>
<i>iii) Additional main intake to Othaya</i>	<i>14,000,000</i>
<i>iv) Full treatment</i>	<i>15,000,000</i>
Total	<i>39,200,000</i>

Future development plan

Source :
 Treatment : *Full* Capacity : *m³/d*
 Design year :
 Design population :

Remarks

Mostly the rehabilitation items mentioned will be sufficient to supply current and future demand.



MBP
PARTNERS
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MANGAT, I.B. PATEL AND PARTNERS. Consulting Engineers, Nairobi, Kenya

**Aftercare Study on
the National Water Master Plan**

NYERI (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Nyeri*

Organisation/Water Undertaker : *Nyeri Municipal Council*

District : *Nyeri* Location: *Nyeri*

Map (1/50,000) Ref. no : *120/4*

Co-ordinates *X 36° 57' Y S 01° 24'*

Drainage Sub-basin : *4AC*

Existing facilities: *1.Chania intake W/S-6km 2.Ethwa intake on Chania river -W/S of Nyeri town respectively.*

Source : *2No. -both on Chania*

Type of Intake : *Weirs*

Elevation : *1950m and 1780m*

Raw water system : *Pumping*

H : *124 m*

Dia : *150mm twin , Dia.300-150mm*

Treatment Process : *Full conventional.*

Both sources of raw water deliver to one treatment work plant where full treatment and quality controls are carried out. Flow is also measured for in/out and 4 zones by meters.

Designed Capacity :

Treated water/Distribution system -

Area covered: *20 km²*

Distribution mains (80mm and above): *150mm and 80 mm*

Total length : *22.8km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *5848 - 1996*

Working Meters: *5848*

Metered : *5848*

Unmetered :

Water production : *7,000 m³/d 1996*

Remark :

Service area population : *11,590 -1997*

Population served :

Financial/Revenue

O & M costs : *Kshs 11,377,431 - power and salaries*

Revenue earned : *Kshs 38,935,012*

Revenue collected : *Kshs 13,619,396*

Rehabilitation required/costs

Kshs Estimated

i) Intake

4,000,000

ii) Storage

8,000,000

iii) Distribution system extension

60,000,000

iv) Treatment works

60,000,000

Total

132,000,000

Future development plan - 2010

Source : *Chania river*

Treatment : *Conventional*

Capacity : *16,670*

m³/d

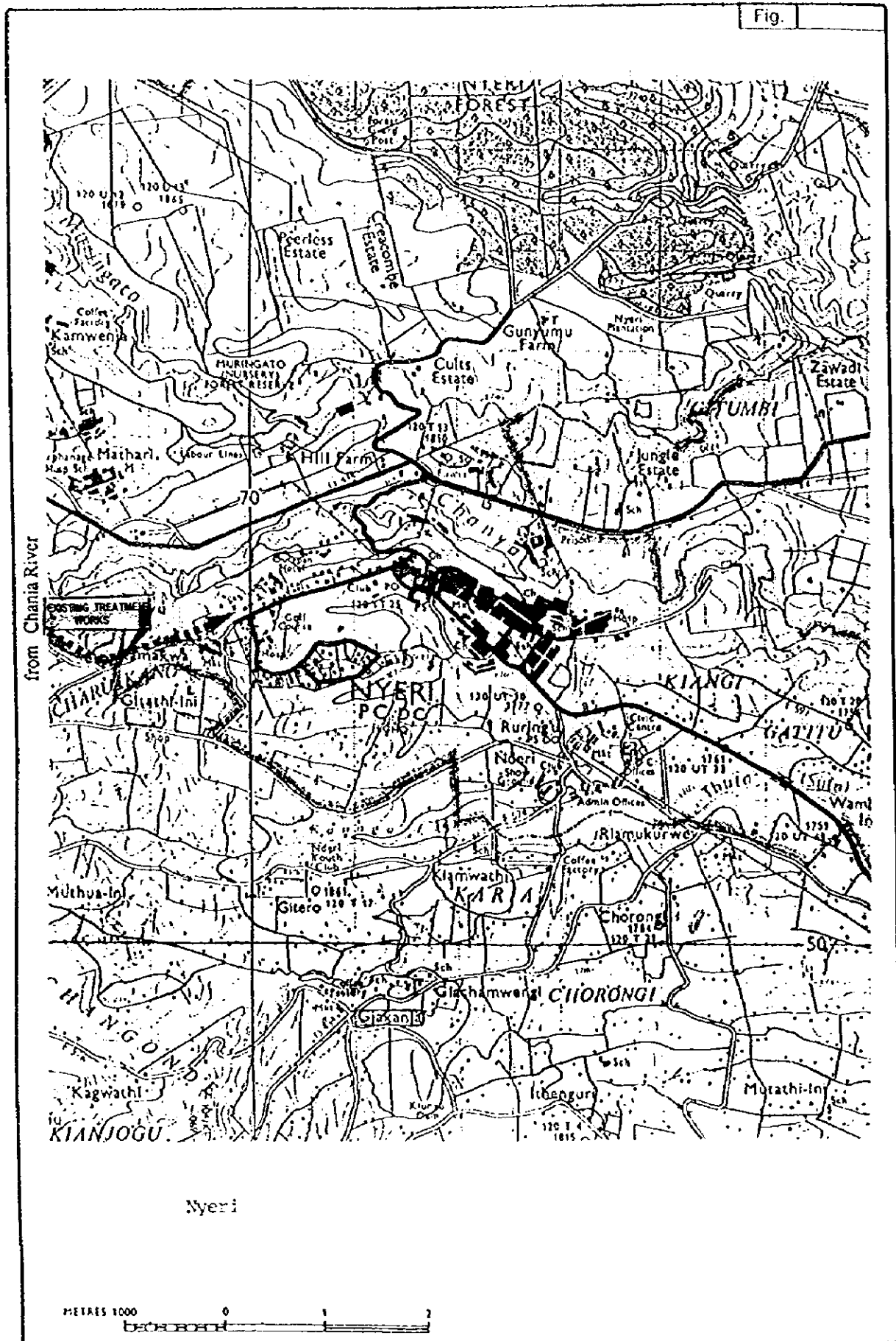
Design year :

Design population: *170,290 (for year 2010), 228,860(for year 2020)*

Remarks

Feasibility studies were prepared by H.P Gaufl in 1997

Fig.



**Aftercare Study on
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MARIAKANI (1/1)

General

Name of Urban Centre : *Mariakani*
 Organisation/Water Undertaker : *NWCPC*
 District : *Kilifi* Location : *Mariakani*
 Map (1/50,000) Ref. no : *197/4* Co-ordinates X : *39° 22' E* Y : *03° 49' S*
 Drainage Sub-basin : *3MB*

Existing facilities
 Source : *Mzima Springs* Type of Intake *Pipeline* Elevation : *213 m (offtake)*
offtake 678 m (source)
 Raw water system : *Booster pumping* H : *20 m* Dia : *100 + 150 mm*
 Treatment Process *Preventive chlorination is carried out at source. Mzima Springs water is considered to be well mineralised.*

Designed Capacity : m^3/day
 Treated water/Distribution system - Area covered : $30 km^2$
 Distribution mains (80mm and above): $100 mm$ to $150 mm$
 Total length : $36 km$

UFW (Estimated) : m^3/d
 Consumers - Total no : *1009* Working Meters: *Data not available.*
 Metered : *1009*
 Unmetered :

Water production : $1200 m^3/d$ Remark :
 Service area population : *19,109*
 Population served : *12,600*

Financial/Revenue

O & M costs :Kshs *190,360*
 Revenue earned :Kshs
 Revenue collected :Kshs *5,389,068*

Rehabilitation required/costs

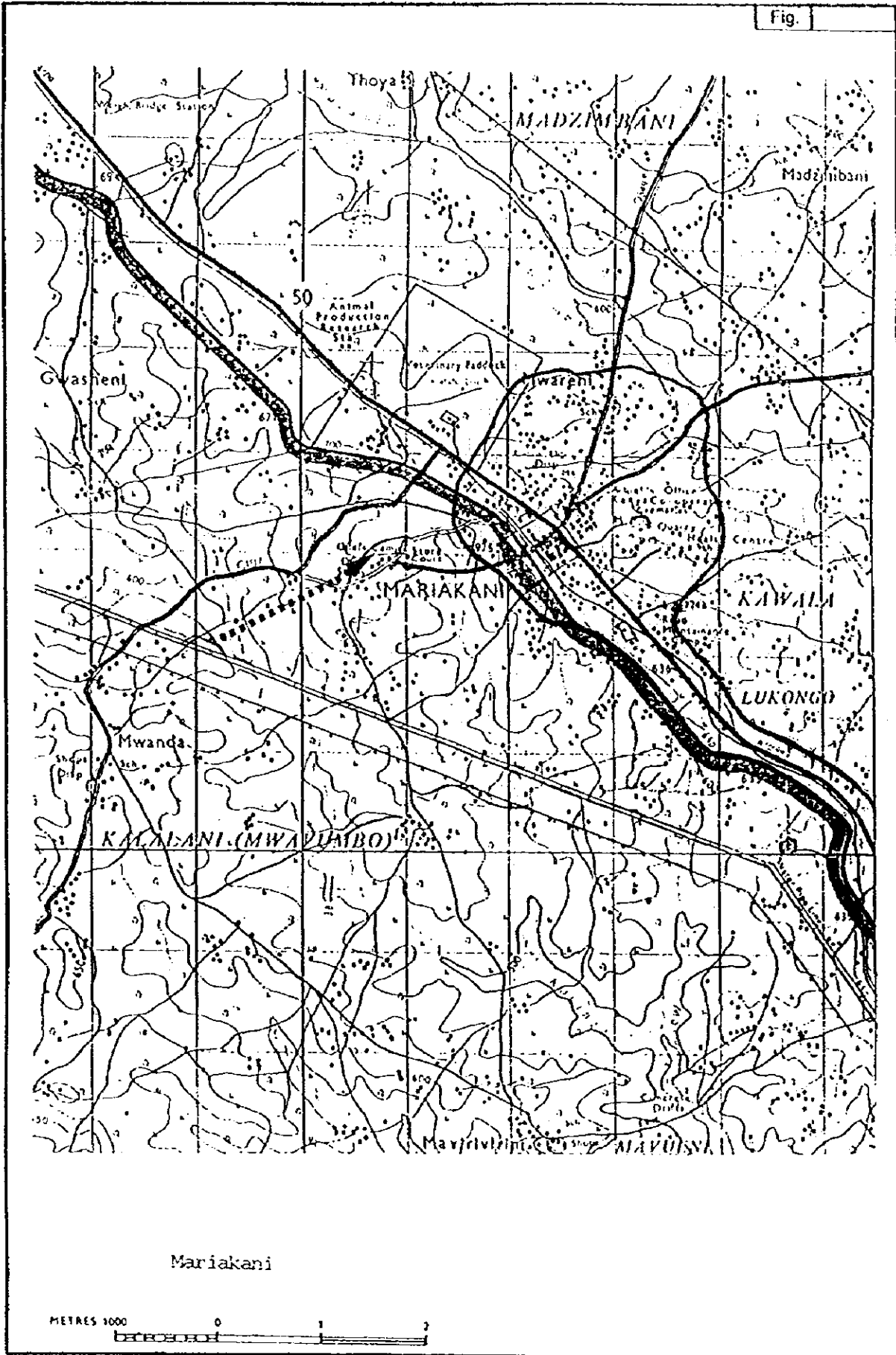
i) <i>80mm AC pipeline requires replacement - 10 km.</i>	Kshs <i>5,000,000</i>
ii) <i>Rehabilitation of appurtenances and structures</i>	<i>1,000,000</i>
iii)	
iv)	
v)	
vi)	
Total estimated cost	<i>6,000,000</i>

Future development plan

Source : *Mzima Pipeline*
 Treatment : *Chlorination* Capacity : *5,460* m^3/d
 Design year : *2020*
 Design population : *38,100*

Remarks

Mariakani off-take also supplies consumers along the Mariakani-Mazeras road. Future design will also include Kaloieni and Gotani areas with pumping in between. Under the Second Mombasa and Coastal Water Supply Project booster pumping can be eliminated considering the fact that a direct off-take from Mzima pipeline offers a water head of 231 m. This would be sufficient to supply to a proposed reservoir (2,500 m³) from where it can be gravitated into the network.



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KILIFI (1/1)

General

Name of Urban Centre : *Kilifi*
 Organisation/Water Undertaker : *NWCPC*
 District : *Kilifi* Location : *Tezo*
 Map (1/50,000) Ref. no : *198/2* Co-ordinates X : *39° 50' E* Y : *03° 37' S*
 Drainage Sub-basin : *3LA*

Existing facilities

Source : *Sabaki River* Type of Intake *Pipeline off-* Elevation : *60 m*
 Raw water system : *Pumping* H : *m* Dia : *300 mm*
 Treatment Process :

Full Conventional Treatment Works at Baricho. This T/Works also serves Malindi, North Mainland and Mombasa Island. The clear water from T/Works is pumped into the Sabaki Pipeline off which Kilifi is served. There are 2 No. off-takes from Sabaki Pipeline, one serving South Kilifi and other serving North.

Designed Capacity : *m³/day*

Treated water/Distribution system - Area covered : *approx. 120 km²*
 Distribution mains (80mm and above): *80 mm to 300 mm*
 Total length : *220 km (including transmission lines)*

UFW (Estimated) : *27%*

Consumers - Total no : *2733*
 Metered : *2733*
 Unmetered :

Working Meters:

Water production : *4300 m³/d*

Remark :

Service area population : *73,000 (1995)*

Population served : *30,710*

Financial/Revenue

O & M costs : *Kshs 296,465.50 (vehicle & Chemical only)*

Revenue earned : *Kshs*

Revenue collected : *Kshs 10,148,731 (1996)*

Rehabilitation required/costs

	Kshs
i) <i>Kilifi Reservoir - new</i>	<i>30,000,000</i>
ii) <i>Matsangoni elevated tank</i>	<i>1,000,000</i>
iii)	
iv)	
v)	
vi)	
Total estimated cost	<i>31,000,000</i>

Future development plan

Source : *Malindi Pipeline*

Treatment : *Full Conventional treatment Capacity : 28,120 m³/d*

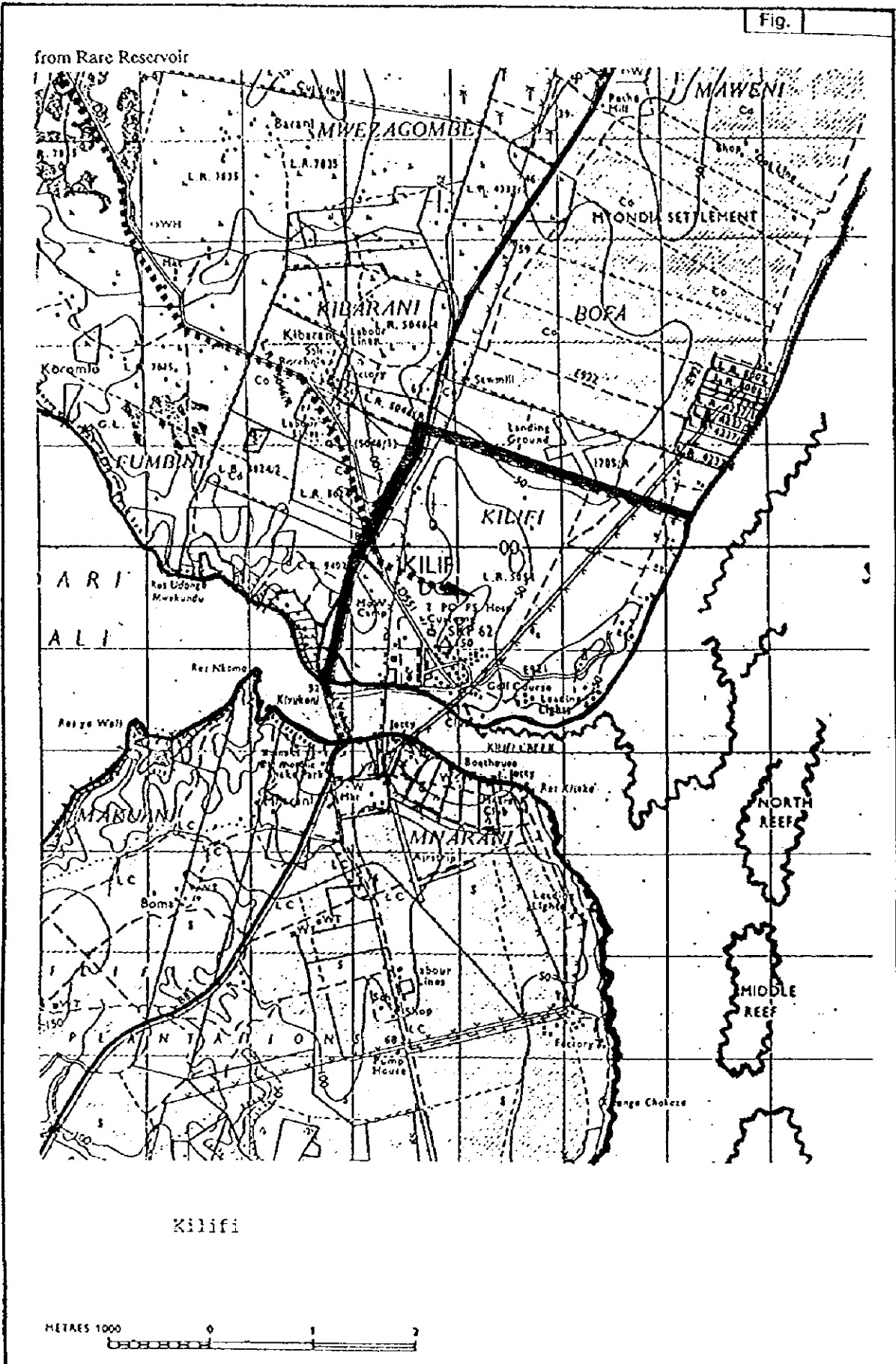
Design year : *2020*

Design population : *215,900*

Remarks

At present, supply is irregular due to frequent breakdowns at the T/Works as well as along the Sabaki Pipeline. The 3,500m³ reservoir located in Kilifi Town is in state of disrepair and the supply is connected directly to the distribution network. Under the Second Mombasa and Coastal Water Supply Project, it is proposed to supply Kilifi from Kakuyuni reservoir, located east of Baricho T/Works. This, with construction of a new reservoir in town will alleviate the recurring shortages experienced at the moment.

Fig.



METRES 1000 0 1 2

**Aftercare Study on
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MALINDI (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Malindi*

Organisation/Water Undertaker : *National Water Conservation & Pipeline Corporation*

District : *Malindi* Location : *Malindi Town*

Map (1/50,000) Ref. no : *193/1* Co-ordinates X : *40° 08'* Y : *S 03° 15'*

Drainage Sub-basin : *3LB*

Existing facilities

Source : *Sabaki River* Type of Intake : *Well* Elevation : *m*

Raw water system : *Pumping* H : *m* Dia : *mm*

Treatment Process : *Full Conventional Treatment at Baricho Treatment Works. This Treatment Works also serves Kilifi, North Mainland and Mombasa Island. The clear water is pumped to Kakuyuni Reservoir near the Baricho T/Works from where it is gravitated to Malindi and other areas*

Designed Capacity :

Treated water/Distribution system - Area covered : *5.0 km²*
Distribution mains (80mm and above): *600 mm to 150 mm*
Total length : *91.23 km (including transmission lines)*

UFW (Estimated) : *m³/d*

Consumers - Total no : *4810*

Metered : *4810*

Unmetered : *-*

Working Meters: *4,810*

Water production : *- See remarks below*

Remark :

Service area population :

Population served : *141,299*

Financial/Revenue

O & M costs :Kshs *352,276 (Vehicles only). In the past couple of years HP Gauff Consulting Engineers*

Revenue earned :Kshs *have been assisting NWCP in Billing & Revenue Collection. Data*

Revenue collected :Kshs *39,976,729 - 1996 available with Consultants*

Rehabilitation required/costs

	Estimated Cost	Kshs
i) Replace the 1.5 km 150mm dia. AC with uPVC		1,500,000
ii) Rehabilitate/replace 2 No. booster pumps		2,000,000
iii) Replace the 3.0 km 100mm dia. AC with uPVC		2,000,000
Total		5,500,000

Future development plan

- The future source for Malindi will still be River Sabaki and more water will be available once Mombasa gets served from an alternative source

Source :

Treatment : Capacity : *m³/d*

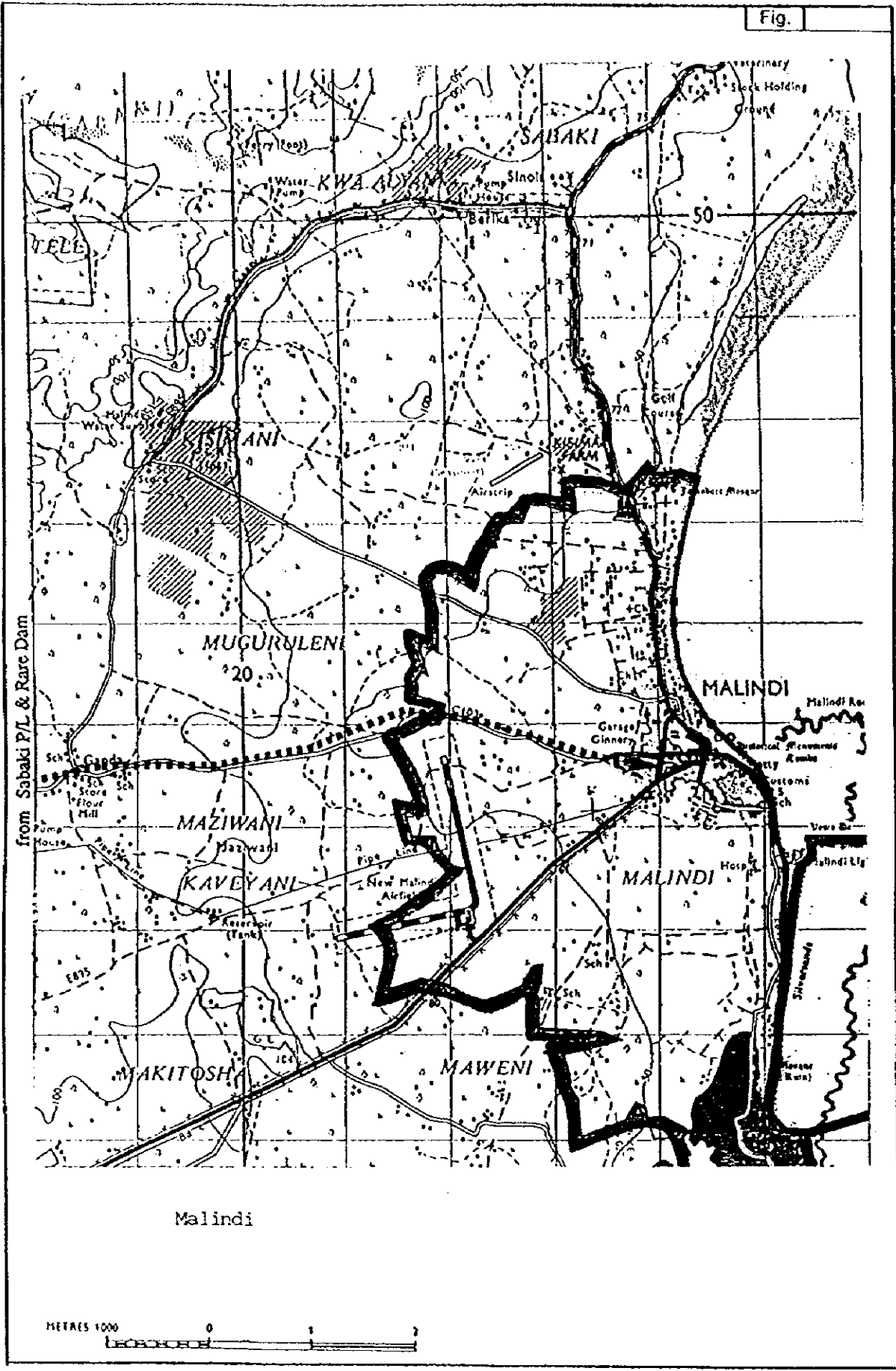
Design year :

Design population :

Remarks

*Since the Malindi Water Supply was augmented in mid 1980's and designed for 2005, no other studies have been carried out since then. The source for water supply to Malindi Township is Baricho Intake on Sabaki River. At Baricho Treatment Works, two distribution systems apply. One is pumping treated to Kakuyuni Reservoir (*m³*) from where it is gravitated to Malindi and rural areas along its route. The main feeding Malindi is designed to cater for 15,985 m³/d. The other system from Baricho Treatment Works involve in pumping treated water into Baricho Pipeline which feeds Kilifi, North Mainland of Mombasa and Mombasa Island. The main bottleneck experienced in supply of water is the shortfall in production at Baricho Treatment Works as well as frequent breakdown of raw water pumps.*

Fig.



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the National Water Master Plan**

MAMBRUI (1/1)

General

Name of Urban Centre : *Mambui*

Organisation/Water Undertaker : *Community*

District : *Malindi*

Location : *Magarini*

Map (1/50,000) Ref. no : *193/1*

Co-ordinates X : *40° 08' E* Y : *03° 05' S*

Drainage Sub-basin : *3HD2*

Existing facilities

Source : *Wells - 2 No.*

Type of Intake : Elevation : *A few metres above sea level*

Raw water system : *Pumping*

H : *6.7 m* Dia : *50 mm*

Treatment Process : *None*

Designed Capacity : *18 m³/hr*

Treated water/Distribution system -

Area covered : *2.0 km²*

Distribution mains (80mm and above): mm to mm

Total length : km

UFW (Estimated) : m³/d

Consumers - Total no : *157*

Working Meters:

Metered : *-*

Unmetered : *157*

Water production : *207 m³/d*

Remark : *Water production and financial data retained by H.P. Gauff, Consulting Engineers*

Service area population : *3,000*

Population served : *2,100*

Financial/Revenue

O & M costs :Kshs

Revenue earned :Kshs *180,500*

Revenue collected :Kshs *109,800*

Rehabilitation required/costs

i) *4 No. new submersible pumps*

ii) *1 No. storage tank (elevated)*

iii) *FRO doser*

Estimated Cost	Kshs
	<i>400,000</i>
	<i>1,000,000</i>
	<i>250,000</i>
Total	<i>1,650,000</i>

Future development plan

Source : *Wells / Boreholes*

Treatment : *Chlorination* Capacity : *300 m³/d*

Design year : *2008*

Design population : *7,000*

Remarks

Mambui Water Supply is run by the local community, financed by nominal water sales and well-wishers. The scheme was constructed by Self Help groups and without much technical support. No proper feasibility was carried out and at present, the demand has outstripped the distribution network design, though production is considered adequate. Quality of raw water is quite good but minimum chlorination is necessary to prevent any outbreak of diseases.

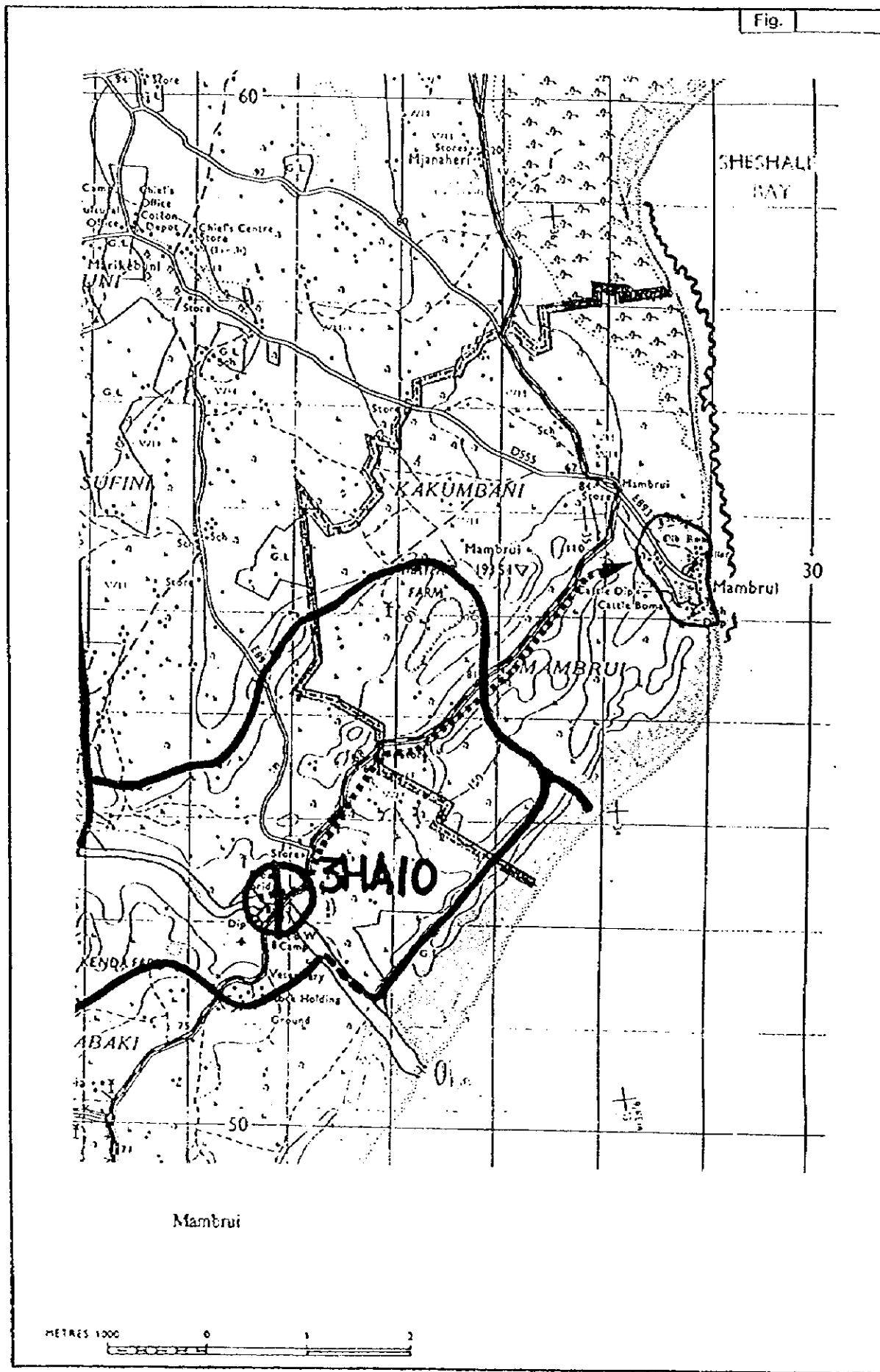


Fig.

METRES 1000 0 1 2

**Aftercare Study on
the National Water Master Plan**

WATAMU (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Watamu*

Organisation/Water Undertaker : *National Water Conservation & Pipeline Corporation*

District : *Malindi* Location : *Gede*

Map (1/50,000) Ref. no : *193/3*

Co-ordinates X: *40° 01' E* Y: *03° 21' S*

Drainage Sub-basin :

Existing facilities

Source : *Malindi Pipeline*

Type of Intake : *Pipeline Offtake*

Elevation : m

Raw water system :

H : m Dia : mm

Treatment Process :

Designed Capacity :

Treated water/Distribution system -

Area covered : km²

Distribution mains (80mm and above): *600 mm to 200 mm*

Total length : *49.42 km*

UFW (Estimated) : m³/d

Working Meters: *1,250*

Consumers - Total no : *1250*

Metered : *1250*

Unmetered : -

Water production : m³/d

Remark : *Water production and financial data retained by H.P. Gauff*

Service area population :

Population served :

Financial/Revenue

O & M costs :Kshs

Revenue earned :Kshs

Revenue collected :Kshs

Rehabilitation required/costs

Estimated Cost

Kshs

i) *Replacement of 10.0 km of 80mm AC pipe*

3,000,000

Total

3,000,000

Future development plan

Source :

Treatment : Capacity : m³/d

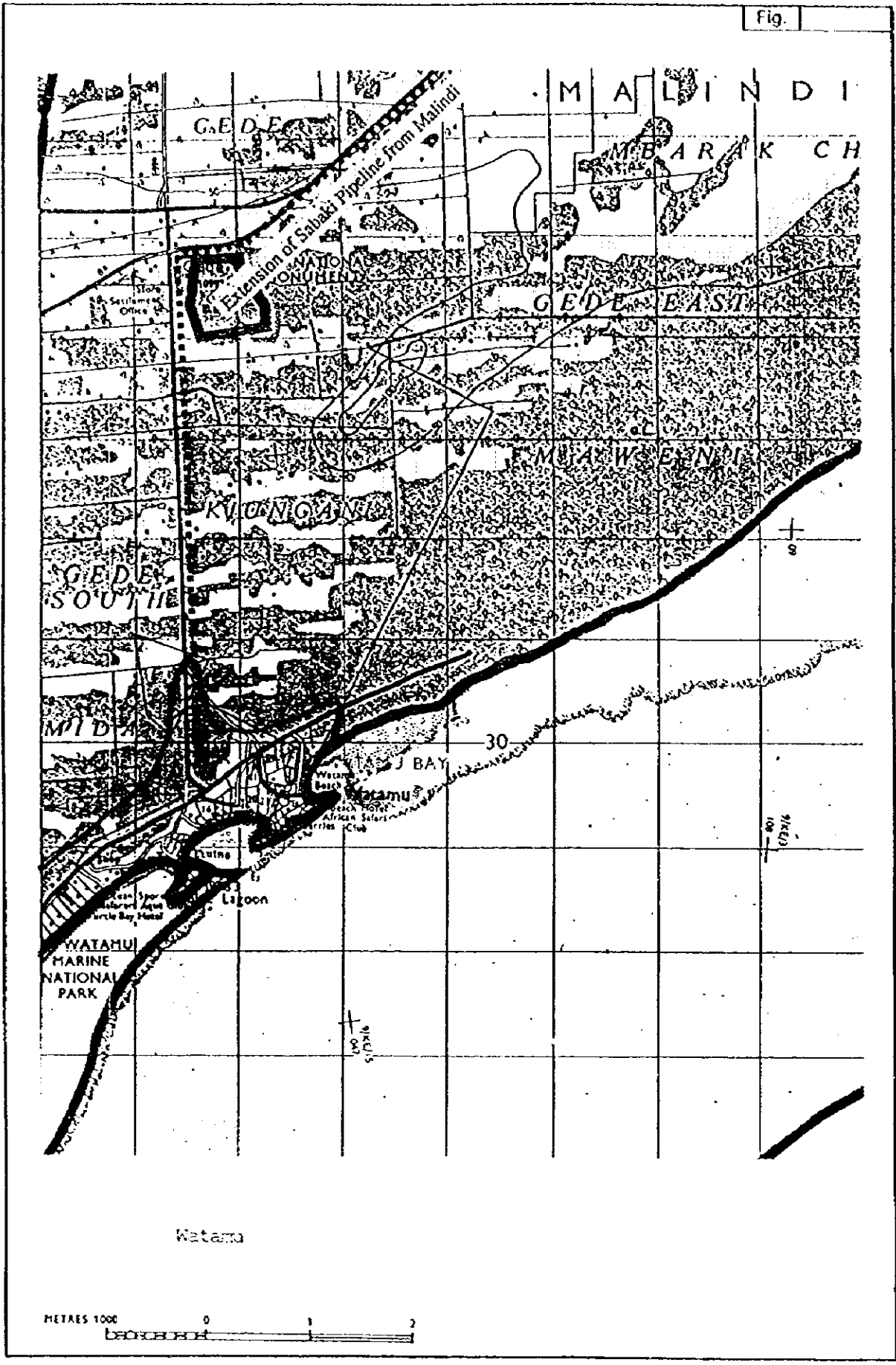
Design year :

Design population :

Remarks

Watamu Water Supply was connected to the Malindi pipeline in 1989 and thereafter no future development plan has been developed.

Fig.



**Aftercare Study on
the National Water Master Plan**

KWALE (1/1)

General

Name of Urban Centre : Kwale
 Organisation/Water Undertaker : National Water Conservation & Pipeline Corporation
 District : Kwale Location : Shimba North
 Map (1/50,000) Ref. no : 200/2 Co-ordinates X : 39° 26' E Y : 04° 11' S
 Drainage Sub-basin : 3MC

Existing facilities

Source : Marere Springs Type of Intake : Pipeline Offtake Elevation : 160 m
 Raw water system : Pumping (2 No. In-line Booster Stations) H : 297 m Dia : 150 mm
 Treatment Process :

Chlorination is carried out at the Marere headworks, as the raw water quality is quite good

Designed Capacity : Marere Springs - 7,000 m³/day

Treated water/Distribution system - Area covered : 4.0 km²
 Distribution mains (80mm and above): 80 mm to 200 mm
 Total length : 47 km (including transmission lines)

UFW (Estimated) : 81%

Consumers - Total no : 452 Working Meters: 452

Metered : 452

Unmetered : -

Water production : 520 m³/d - 1995

Service area population : 4,300 - 1995

Population served : 2,100

Remark : Population served is calculated as a proportion of water produced against water demand.

The UFW obtained from UFW studies carried out by Seureca-Mangat, 1995

Financial/Revenue

O & M costs :Kshs 202,022 (chemicals + fuel only)

Revenue earned :Kshs

Revenue collected :Kshs 1,977,797

Rehabilitation required/costs

	Estimated Cost	Kshs
i) New Reservoirs - 1500 m ³		20,000,000
ii) New Pump Stations - 2 No. (Madabara)		6,000,000
iii) Replacement of Old Pipework - 75mm dia. - 150mm dia.		2,000,000
Total		28,000,000

Future development plan

Source : Marere Springs

Treatment : Chlorination Capacity : 2,090 m³/d (Township requirement)

Design year : 2020

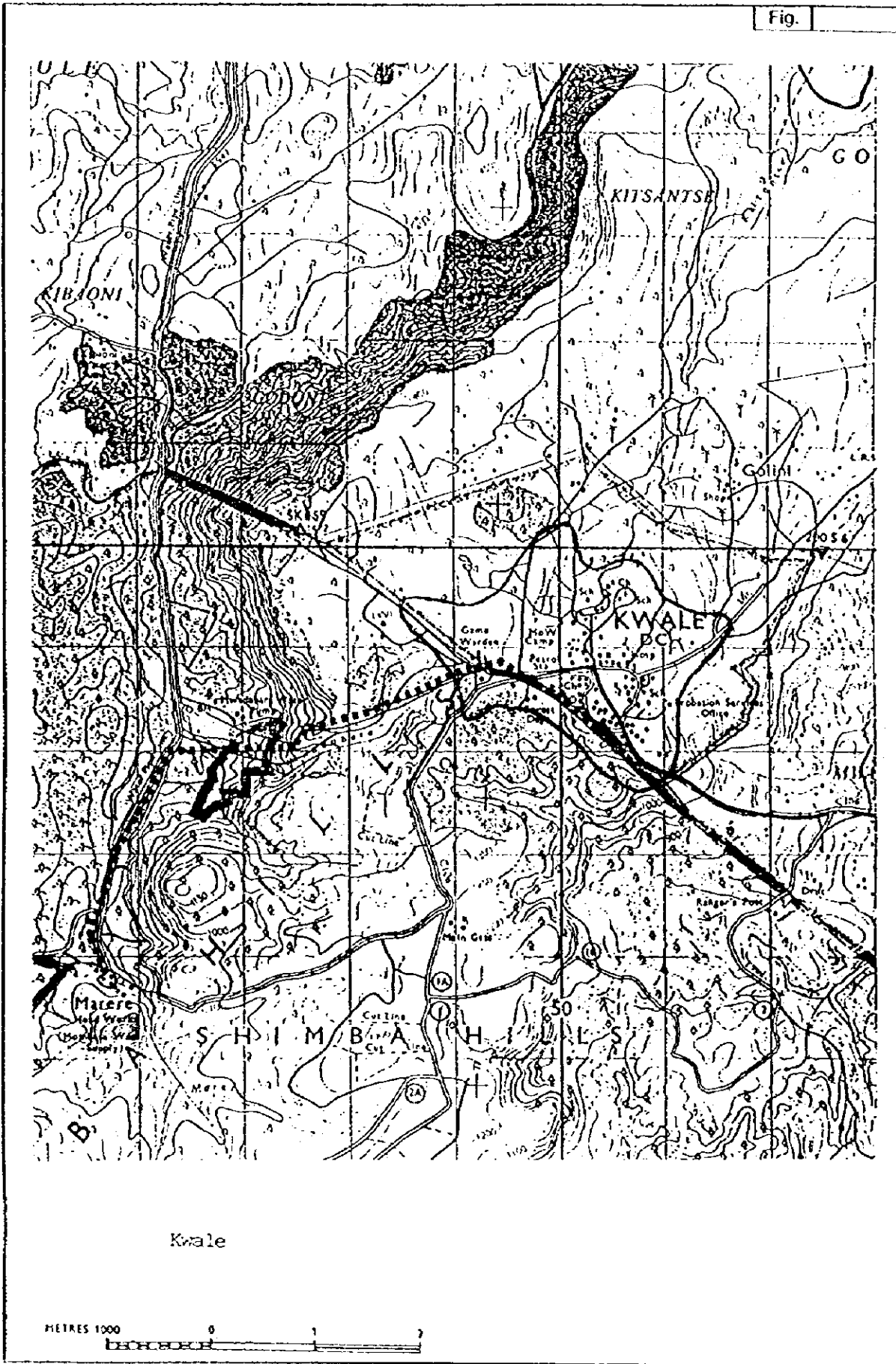
Design population : 8,811

Remarks

The scheme had two booster pumping units but only one is currently operating. The main problems experienced are related to reliability of supply. This is due to frequent pump breakdowns, bursts and leaks along the pumping mains, lack of logistics and difficult access to the sites.

Pemba Dam used to supplement flow into the Marere pipeline, but due to pressure filters failure in 1983, this source has since been abandoned. Rejuvenating this source may increase the flow into Marere pipeline by 4,000 m³/d. Kwale is part of study under Second Mombasa & Coastal Water Supply which is funded by the World Bank.

Fig.



**Aftercare Study on
the National Water Master Plan**

KINANGO (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : Kinango

Organisation/Water Undertaker : National Water Conservation & Pipeline Corporation

District : Kwale Location : Kinango South

Map (1/50,000) Ref. no : 200/2 Co-ordinates X : 39° 17' E Y : 04° 09' S

Drainage Sub-basin :

Existing facilities

Source : Marere Pipeline

Type of Intake : Pipeline Offtake

Elevation : 137 m

Raw water system : Pumping

H : m Dia : 150 mm

Treatment Process :

Only chlorination at Marere headworks is carried out since the raw water from the Springs is of good quality

Designed Capacity :

Treated water/Distribution system -

Area covered : 1.0 km²

Distribution mains (80mm and above): 100 mm

Total length : 10 km

UFW (Estimated) : m³/d

Consumers - Total no : 340

Working Meters: Data not available

Metered : 340

Unmetered : -

Water production : 440 m³/d (Offtake pipeline capacity)

Remark : Production calculated from pump capacity of 10 m³/hr working for 22 hrs/day

Service area population : 5,321 (1995)

Population served :

Financial/Revenue

O & M costs :Kshs 46,271 (Chemicals + fuel only)

Revenue earned :Kshs

Revenue collected :Kshs 1,064,966

Rehabilitation required/costs

Estimated Cost Kshs

i) 2,500 m³ Reservoir at Kidziamonzo

20,000,000

ii) Rehabilitation / New Pump Station at Kibaoni

3,100,000

iii) Rehabilitation of Pipelines

1,400,000

Total

24,500,000

Future development plan

Source : Marere Pipeline

Treatment : Chlorination Capacity : 1,880 m³/d

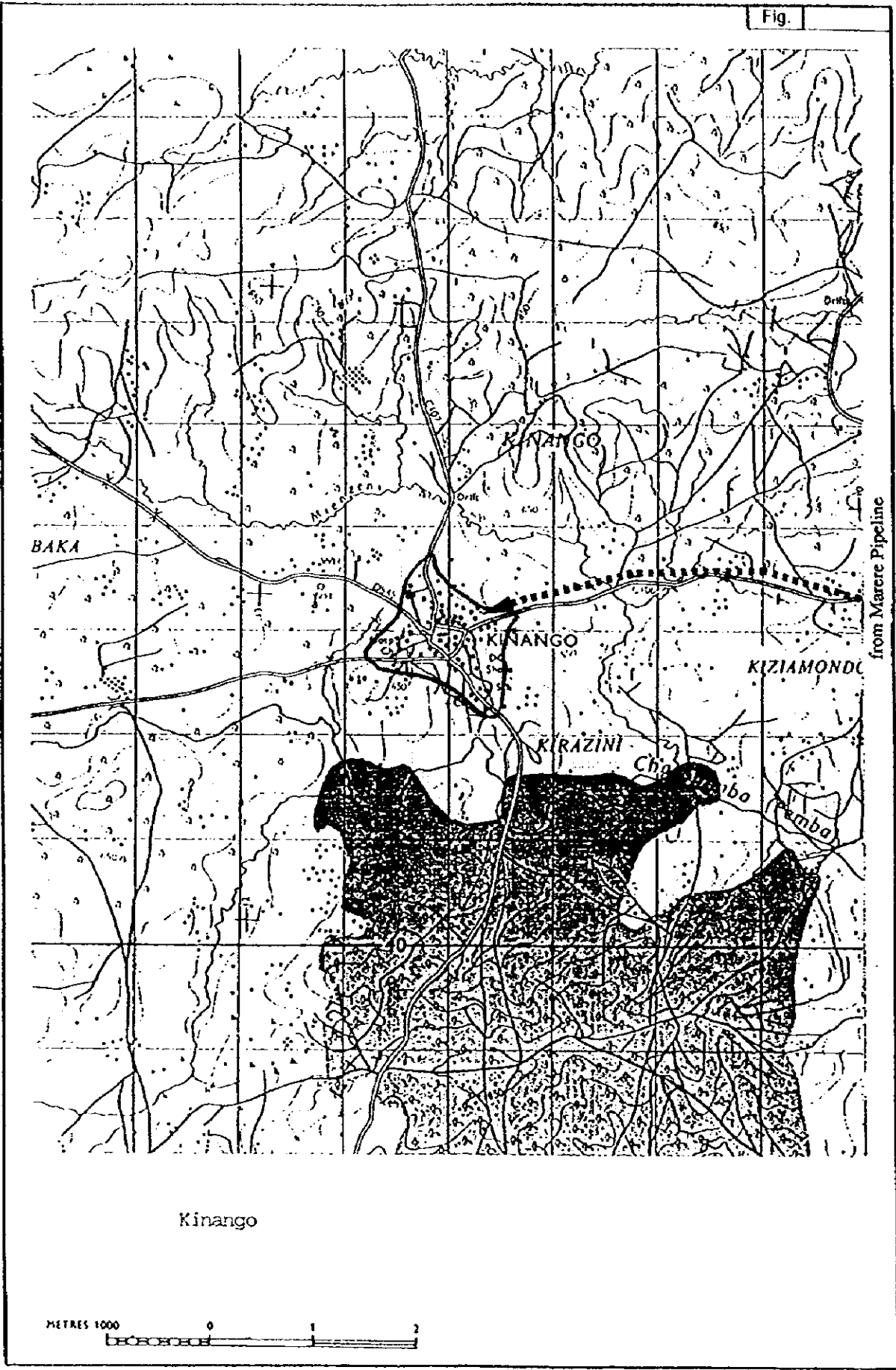
Design year : 2020

Design population :

Remarks

The Marere pipeline serves Kwale and part of South Mainland too. If the Marere headworks were exploited to its full and supply confined to Kwale and South Mainland, the demand would be met satisfactorily.

Fig.



General

Name of Urban Centre : *Msambweni*

Organisation/Water Undertaker : *Ministry of Water Resources*

District : *Kwale*

Location : *Msambweni*

Map (1/50,000) Ref. no : *200/4*

Co-ordinates X : *39° 27' E*

Y : *04° 30' S*

Drainage Sub-basin : *3K*

Existing facilities

Source : *2 No. Wells*

Type of Intake : *Pumping* Elevation : *10 masl*

Raw water system : *Pumping*

H : *30 m* Dia : *100 mm*

Treatment Process :

Only chlorination is carried out since the water is considered okay for domestic use. The existing FRO doser is non-functional and manual chlorination is effected

Designed Capacity : *624 m³/d*

Treated water/Distribution system -

Area covered : *km²*

Distribution mains (80mm and above): *80 mm to 100 mm*

Total length : *4.0 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *240*

Working Meters: *Data not available*

Metered : *240*

Unmetered : *-*

Water production : *520 m³/d - 1998*

Remark : *Pumping is carried out for 20 hrs per day*

Service area population : *25,000 - 1996*

Population served : *12,000 - 1996*

Financial/Revenue

O & M costs :Kshs *1,056,000 - 1996*

Revenue earned :Kshs *936,000 - 1996*

Revenue collected :Kshs *720,000 - 1996*

Rehabilitation required/costs

i) *A new storage tank*

5,000,000

ii) *Replacement of partial distribution*

5,000,000

iii) *Replacement of the FRO doser*

350,000

Total

10,350,000

Future development plan

Source : *Msambweni Dam*

Treatment : *Full Chemical* Capacity : *1300 m³/d*

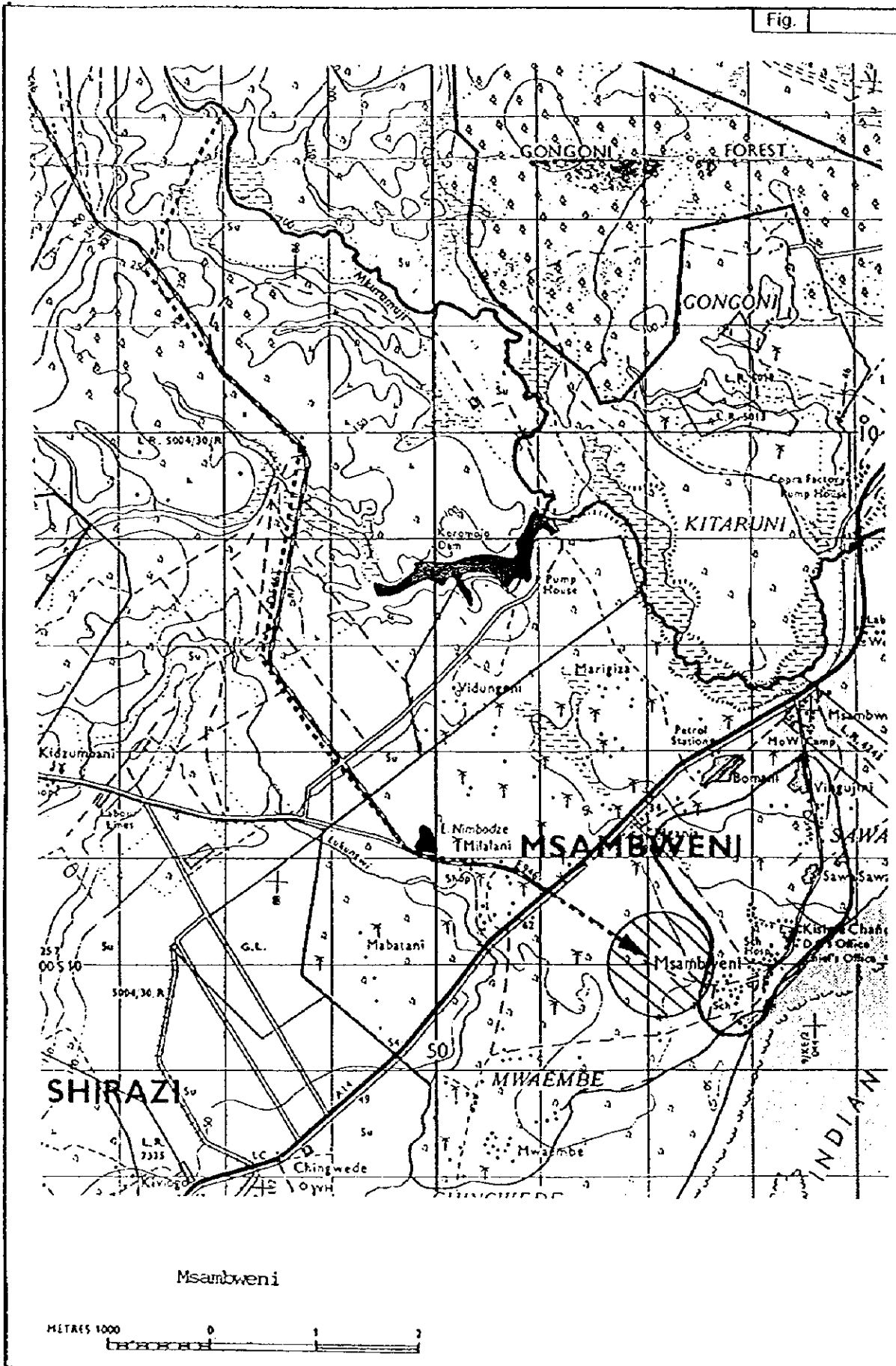
Design year : *1997*

Design population : *12,000*

Remarks

The proposal was never implemented, now past its target year. No new study has been carried out thereafter. The current scheme was initially constructed to serve the hospital and local administration, but with the rapid growth of the trading centre in recent times, the demand has outstripped the supply.

Fig.



**Aftercare Study on
the Natloal Water Master Plan**

LUNGA LUNGA (1/1)

General

Name of Urban Centre : *Lunga Lunga*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Kwale* Location : *Lunga Lunga*
 Map (1/50,000) Ref. no : *202/1* Co-ordinates X : *39° 05' E* Y : *04° 35' S*
 Drainage Sub-basin : *3K*

Exsting facilities

Source : *Boreholes* Type of Intake : *Pumping* Elevation : *10 m*
 Raw water system : *Pumping* H : *50 m* Dia : *100 mm*
 Treatment Process :

No treatment is carried out at present. Chlorination used to be done but has been discontinued due to doser breakdown

Designed Capacity :

Treated water/Distribution system -
 Area covered : *2 km²*
 Distribution mains (80mm and above): *80 mm*
 Total length : *6 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *28*
 Metered : *28*
 Unmetered : *-*

Working Meters:

Water production : *220 m³/d*

Remark : *Production calculated from pump capacity of 10 m³/hr working for 22 hrs/day*

Service area population :

Population served :

Financial/Revenue

O & M costs :Kshs *246,000*

Revenue earned :Kshs

Revenue collected :Kshs

Rehabilitation required/costs

	Estimated Cost	Kshs
i) <i>Storage tank</i>		<i>5,000,000</i>
ii) <i>Rehabilitation of pumping units</i>		<i>800,000</i>
iii) <i>Distribution network</i>		<i>800,000</i>
iv) <i>Meters</i>		<i>200,000</i>
	Total	<i>6,800,000</i>

Future development plan

Source : *Mwajewa Boreholes*

Treatment : *Full Conventional Treatment*

Capacity : *1000 m³/d*

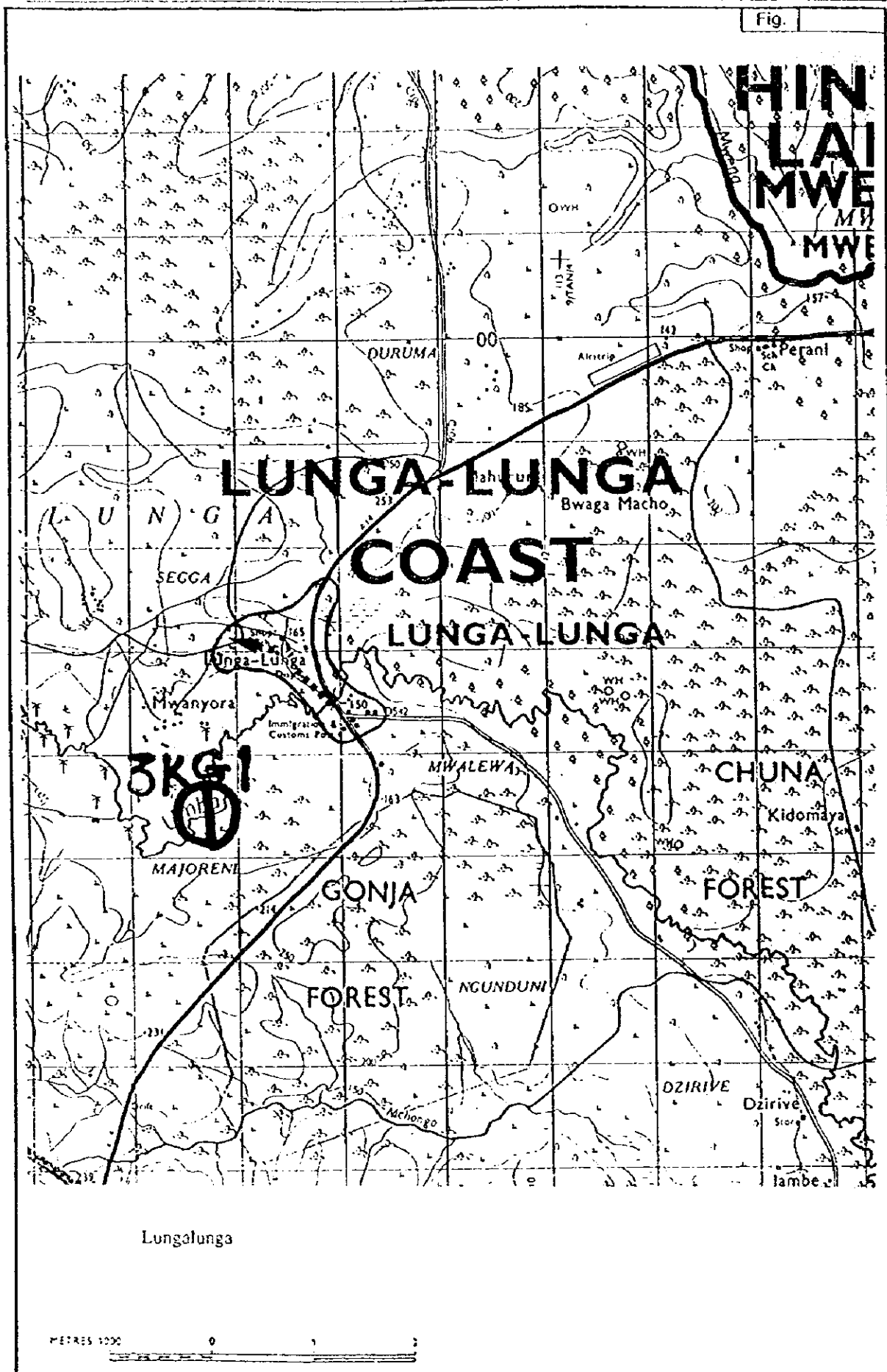
Design year : *2017*

Design population : *5,000*

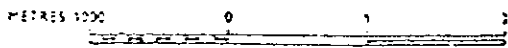
Remarks

The scheme is in bad state at present and is only intermittently operational due to lack of regular maintenance. It was under rehabilitation for the last half of 1997, but the pumping units remain to be replaced.

Fig.



Lungalunga



**Aftercare Study on
the National Water Master Plan**

WITU (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Witu*

Organisation/Water Undertaker : *German Government Aid Agency (GTZ)*

District : *Lamu* Location: *Witu*

Map (1/50,000) Ref. no : *179/4*

Co-ordinates *X 40° 25' Y S 02° 24'*

Drainage Sub-basin : *4GG*

Existing facilities:

Source: *2 No shallow wells*

Type of Intake : *Wells*

Elevation : *20m*

Raw water system : *Pumping - 2No @ 7m³/hr*

H : *60 m*

Dia : *25mm*

Treatment Process : *None*

Water is pumped from the wells - Served untreated directly to administration offices police lines and co-operative staff. Rest of population draws water by hand pumps or directly from shallow wells.

Designed Capacity:

Treated water/Distribution system -

Area covered: *3 km²*

Distribution mains (80mm and above): *mm to mm*

Total length : *km*

UFW (Estimated) : *m³/d*

Consumers - Total no :

Metered :

Unmetered :

Working Meters:

Water production : *85 m³/d*

Remark : *Witu Water Supply serves a section of government offices only.*

Service area population : *3,273*

Population served : *1,220*

Financial/Revenue

O & M costs : *Ksh 57,600 fuel cost*

Revenue earned : *Kshs*

Revenue collected : *Kshs*

Rehabilitation required/costs

i) *Extension to distribution system*

ii) *Treatment works*

iii) *Storage reservoirs*

Kshs Estimated

10,000,000

16,000,000

4,000,000

Total

16,000,000

Future development plan

Source : *Shallow wells*

Treatment : Capacity : *m³/d*

Design year :

Design population:

Remarks

The witu Water Supply was constructed in 1996 with aid of GTZ. At present, it serves only the Government administrative area only. The distribution network requires expansion to serve the outer areas and take full advantage of the higher production capacity.

Fig.



**Aftercare Study on
the National Water Master Plan**

LAMU (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Lamu*

Organisation/Water Undertaker : *MOWR*

District : *Lamu* Location:

Map (1/50,000) Ref. no : *180/4*

Co-ordinates *X 40° 53' Y S 02° 17'*

Drainage Sub-basin : *4KB*

Existing facilities:

Source : *Borehole - Shallow well 20 N°*

Type of Intake : *Wells* Elevation : *20m*

Raw water system : *Pumping (8 N° pumps)*

H : *60m* Dia : *50/100mm*

Treatment Process : *Chlorination only - Chlorination is done at the well by dozer. From well water 450m³ distribution tank is by 2 stage pumping. From this water tank, water is distributed to consumers in Lamu.*

Designed Capacity :

Treated water/Distribution system -

Area covered: *km²*

Distribution mains (80mm and above): *1 50mm and 80 mm*

Total length : *6km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *1315*

Metered : *1315*

Unmetered :

Working Meters:

Water production : *575 m³/d*

Remark :

Service area population : *20,000*

Population served : *5,000*

Financial/Revenue - 1996

O & M costs : *Kshs 6,321,245*

Revenue earned : *Kshs 1,053,440*

Revenue collected : *Kshs 816,427*

Rehabilitation required/costs

i) *Replacement of Asbestos pipes*

Kshs Estimated

24,000,000

ii) *Storage tank*

5,000,000

iii) *Distribution network*

10,000,000

Total

39,000,000

Future development plan

Source : *Additional shallow wells.*

Treatment : *Chlorination*

Capacity : *3,000 m³/d*

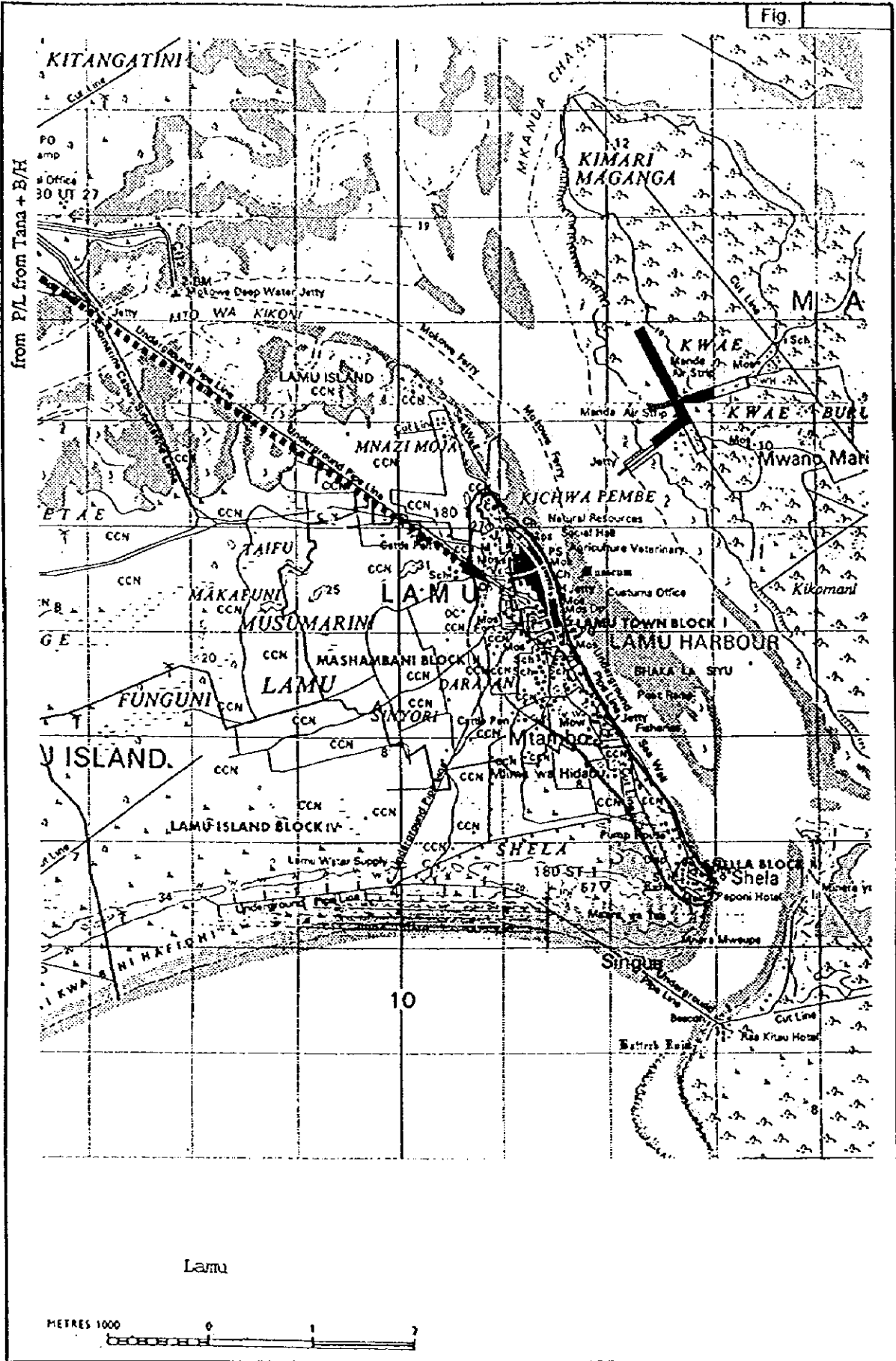
Design year :

Design population : *10,000*

Remarks

The above future development is desired by the District Water Engineer (DWE) - it is not planned.

Fig.



**Aftercare Study on
the National Water Plan**

MOMBASA TOWN (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Mombasa Town*

Organisation/Water Undertaker : *National Water Conservation & Pipeline Corporation*

District : *Mombasa* Location : *Mombasa*

Map (1/50,000) Ref. no : *201/1*

Co-ordinates X : *39° 40' E* Y : *04° 00' S*

Drainage Sub-basin : *3MD1*

Existing facilities

Source : *Mzima Springs + Sabaki River*

Type of Intake : *Weir, Pumping* Elevation : *678m, 60m*

Raw water system : *Gravity/Pumping*

H : m Dia : *900/600 mm - From Changamwe to Island
700mm from Nguu Tatu to Island*

Treatment Process :

Supply from Changamwe Reservoir is chlorinated at Changamwe while Sabani supply undergoes full conventional treatment at Baricho Treatment Works

Designed Capacity : *35,000 m³/d (Mzima Springs) and 35,000 m³/d (Baricho Treatment Works)*

Treated water/Distribution system -

Area covered : *12 km²*

Distribution mains (80mm and above): *75 mm to 375 mm*

Total length : *67 km*

UFW (Estimated) : *20% m³/d*

Consumers - Total no : *19,894*

Working Meters:

Metered : *19,894*

Unmetered : -

Water production : *18,200 m³/d - 1998*

Remark :

Service area population : *138,300 - 1995*

Population served : *138,300 - 1995*

Financial/Revenue

O & M costs : *Kshs 704,670 (Chemical + fuel only)*

Revenue earned : *Kshs*

Revenue collected : *Kshs 148,192,085*

Rehabilitation required/costs

Estimated Cost Kshs

i) *Bulk meter after Nguu Tatu*

90,000

Total

90,000

Future development plan

Source : *Mzima Pipeline*

Treatment : *Chlorination* Capacity : *44,900 m³/d*

Design year : *2020*

Design population :

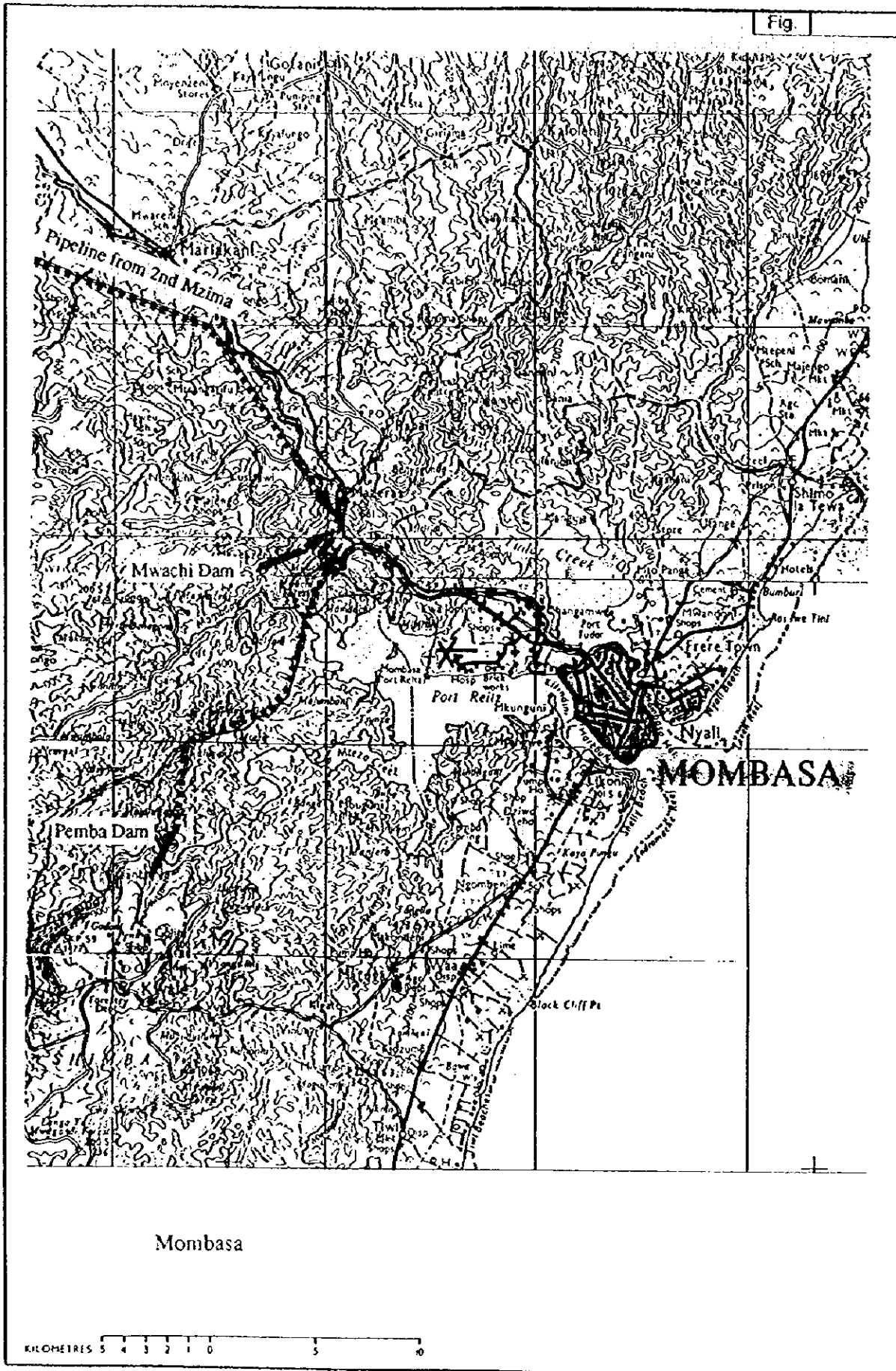
Remarks

At present, Mombasa gets its water from both Mzima and Sabaki but it is proposed that in future only Mzima Springs will supply Mombasa Town.

Mombasa is served from two separate sources, namely Mzima Springs and Sabaki River. The Mzima Springs gravity transmission trunk main (ranging from 530mm to 760mm in diameter) terminates at Changamwe reservoir (29,700 m³) disinfection is effected before it is gravitated into the Island distribution network.

The Sabaki Pipeline system emanates from Baricho Treatment Works and involves pumping clear water into Sabaki Pipeline upto Nguu Tatu reservoir (27,100 m³), which serves both North Mainland and Island.

At present, Mombasa Island is supplied with 13,600 m³/d and 4,600 m³/d from Mzima Pipeline and Sabaki Pipeline respectively. This collective supply of 18,200 m³/d is well below the Island's current demand of 56,000 m³/d. Under the Second Mombasa & Coastal Water Supply Project, it is envisaged that Mombasa Island will wholly be supplied by the Mzima pipeline system (incl. 2nd Mzima pipeline) and Sabaki pipeline will be dedicated to Malindi, Watamu, Kilifi and North Mainland.



**Aftercare Study on
the National Water Master Plan**

TAVETA (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : Taveta

Organisation/Water Undertaker : National Water Conservation & Pipeline Corporation

District : Taita Taveta Location : Taveta

Map (1/50,000) Ref. no : 188/3

Co-ordinates X : 37° 39' E Y : 03° 25' S

Drainage Sub-basin : 3J

Existing facilities

Source : Njoro Springs

Type of Intake : Direct abstraction

Elevation : 726 m

Raw water system : Pumping

H : 76.3 m Dia : 250 mm

Treatment Process : Preventative Chlorination

Since Njoro Springs water is considered to be potable without need for chemical treatment, chlorination is done to disinfect water before distribution to the consumers. The grit chamber before the clear water tank acts as a sedimentation basin too.

Designed Capacity : 124.2 m³/hr

Treated water/Distribution system -

Area covered : km²

Treated water is pumped to a high level reservoir from where distribution takes place

Distribution mains (80mm and above): 60 mm to 250 mm

Total length : 26.2 km (including distribution to rural areas)

UFW (Estimated) : m³/d

Consumers - Total no : 879

Working Meters: 879

Metered : 879

Unmetered : -

Water production : 1600 m³/d

Remark : Service area population is calculated using growth rate of 5.4%, 1979 being base year with a population of 16,992

Service area population : 43,790

Population served :

Financial/Revenue

O & M costs :Kshs 99,060 per annum (chemicals + fuel only)

Revenue earned :Kshs

Revenue collected :Kshs 8,077,360 per annum

Rehabilitation required/costs

Estimated Cost Kshs

i) 2 No. 150mm dia. sluice valves

100,000

ii) Elevated tank walkway

250,000

iii) Doser - FRO type

150,000

Total

500,000

Future development plan

Source :

Treatment : Capacity : m³/d

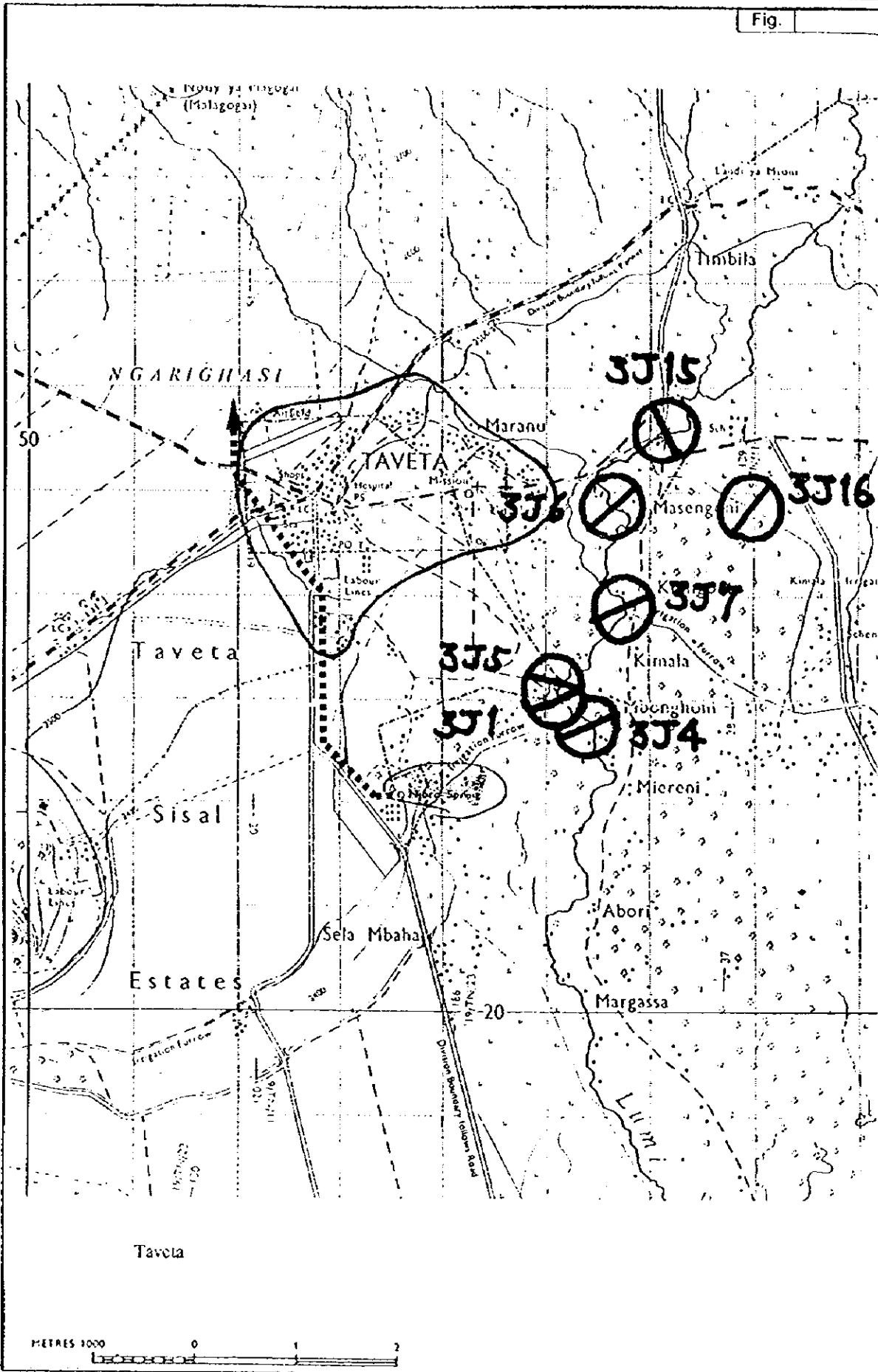
Design year :

Design population :

Remarks

No technical studies carried out for expansion of the water supply. Taveta water supply feeds Taveta Township and beyond. Since it's commissioning, no serious problems have been reported. The financial status of Taveta Water Supply is compiled in Voi including that for Manyani, Taveta and Mackinon Road, thus difficulty in assessing for each Scheme Area.

Fig.



**Aftercare Study on
the National Water Master Plan**

VOI (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : Voi

Organisation/Water Undertaker : National Water Conservation & Pipeline Corporation

District : Taïta Taveta Location : Voi

Map (1/50,000) Ref. no : 190/3

Co-ordinates X : 38° 33' E Y : 03° 24' S

Drainage Sub-basin : 3LA

Existing facilities

Source : Mzima Pipeline

Type of Intake : Pipeline Offtake

Elevation : 540 m

Raw water system :

H : 595 m Dia : 250 mm

Treatment Process : Preventative Chlorination - 2.5 mg/day - Displacement Doser

Designed Capacity :

Treated water/Distribution system -

Area covered : 9.0 km²

Distribution mains (80mm and above): 80 mm to 150 mm

Total length : 13 km

UFW (Estimated) : m³/d

Consumers - Total no : 1594 (1997)

Working Meters: Data not available

Metered : 1594

Unmetered : -

Water production : 2700 m³/d

Remark : The Scheme Manager said that water production is obtained from individual meters since the bulk meter is not functioning

Service area population : 4,800

Population served : 4,000

Financial/Revenue

O & M costs :Kshs 375,305

Revenue earned :Kshs

Revenue collected :Kshs 18,847,173 (1996)

Rehabilitation required/costs

i) Realignment of 3.1 km 200mm dia. AC pipe

5,000,000

ii) New displacement doser

250,000

iii) 2 No. 50mm dia. air valves

90,000

iv) Bulk meter

80,000

Total

5,420,000

Future development plan

Source : Mzima Pipeline

Treatment : Chlorination Capacity : 9590 m³/d

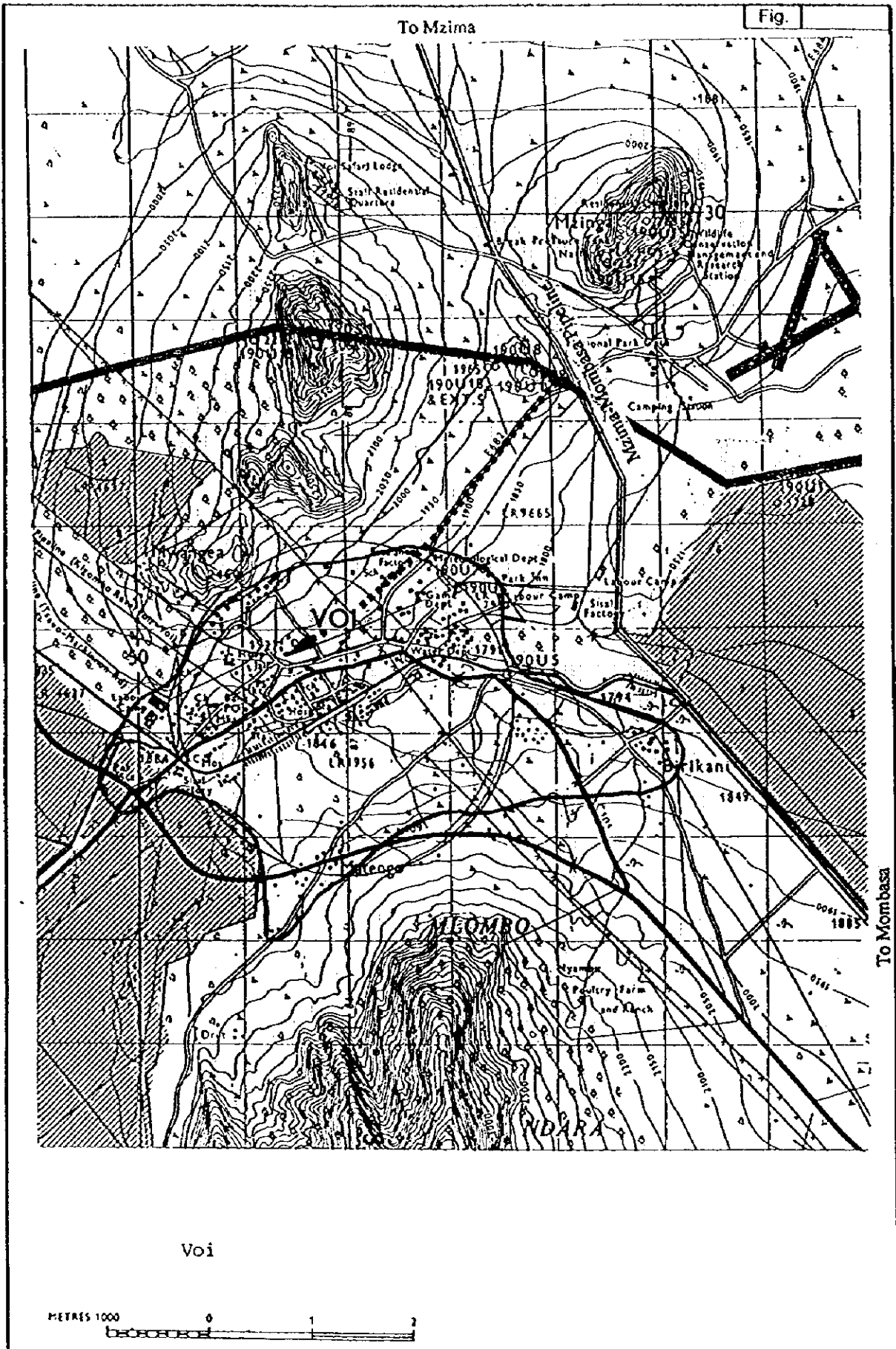
Design year : 2020

Design population : 72,200

Remarks

Voi was previously being supplied from Kigombo Dam, sited on the Mrura Range. This was operated by the Kenya Railways and has long since ceased to supply water to Voi.

The town's supply is inadequate to cater for the demand. This is largely due to the transmission pipeline outliving its design life. More pumping power will be required to deliver the extra water upto the high level tank and extensions to distribution network.



**Aftercare Study on
the National Water Master Plan**

WUNDANYI (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Wundanyi*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Taita Taveta* Location : *Werugha*
 Map (1/50,000) Ref. no : *189/4* Co-ordinates X : *38° 21' E* Y : *03° 25' S*
 Drainage Sub-basin : *3LA*

Existing facilities

Source : *Rivers (2 No.)* Type of Intake : *Direct abstraction & Weir* Elevation : *1420 m*
 Raw water system : *Pumping & Gravity* H : *m* Dia : *100 mm*
 Treatment Process :

There are two sources with their own T/Works. The Wundanyi Town Intake is a direct abstraction which is pumped to the T/Works. The Wesu Intake is weir type and raw water gravitates to the Wesu T/Works. The clear water is then transmitted to a high level reservoir and thereafter gravitated into the Town Distribution. Also see Remarks for Treatment Process.

Designed Capacity : *30 m³/hr and 32 m³/hr*

Treated water/Distribution system - Area covered : *12 km²*
 Distribution mains (80mm and above): *80 mm to 100 mm*
 Total length : *17.5 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *1001*

Metered : *1001*

Unmetered : *-*

Working Meters: *80%*

Water production : *1232 m³/d*

Remark : *Water production obtained from individual meters since the bulk meter is not functioning*

Service area population :

Population served :

Financial/Revenue

O & M costs :Kshs *2,168,964 - 1997*

Revenue earned :Kshs *2,636,450 - 1996*

Revenue collected :Kshs *2,564,763 - 1996*

Rehabilitation required/costs

	Estimated Cost	Kshs
i) <i>Intakes need desilting</i>		<i>100,000</i>
ii) <i>Diesel engines for the pumps require rehabilitation</i>		<i>500,000</i>
iii)		
iv)		
	Total	<i>600,000</i>

Future development plan

Source :

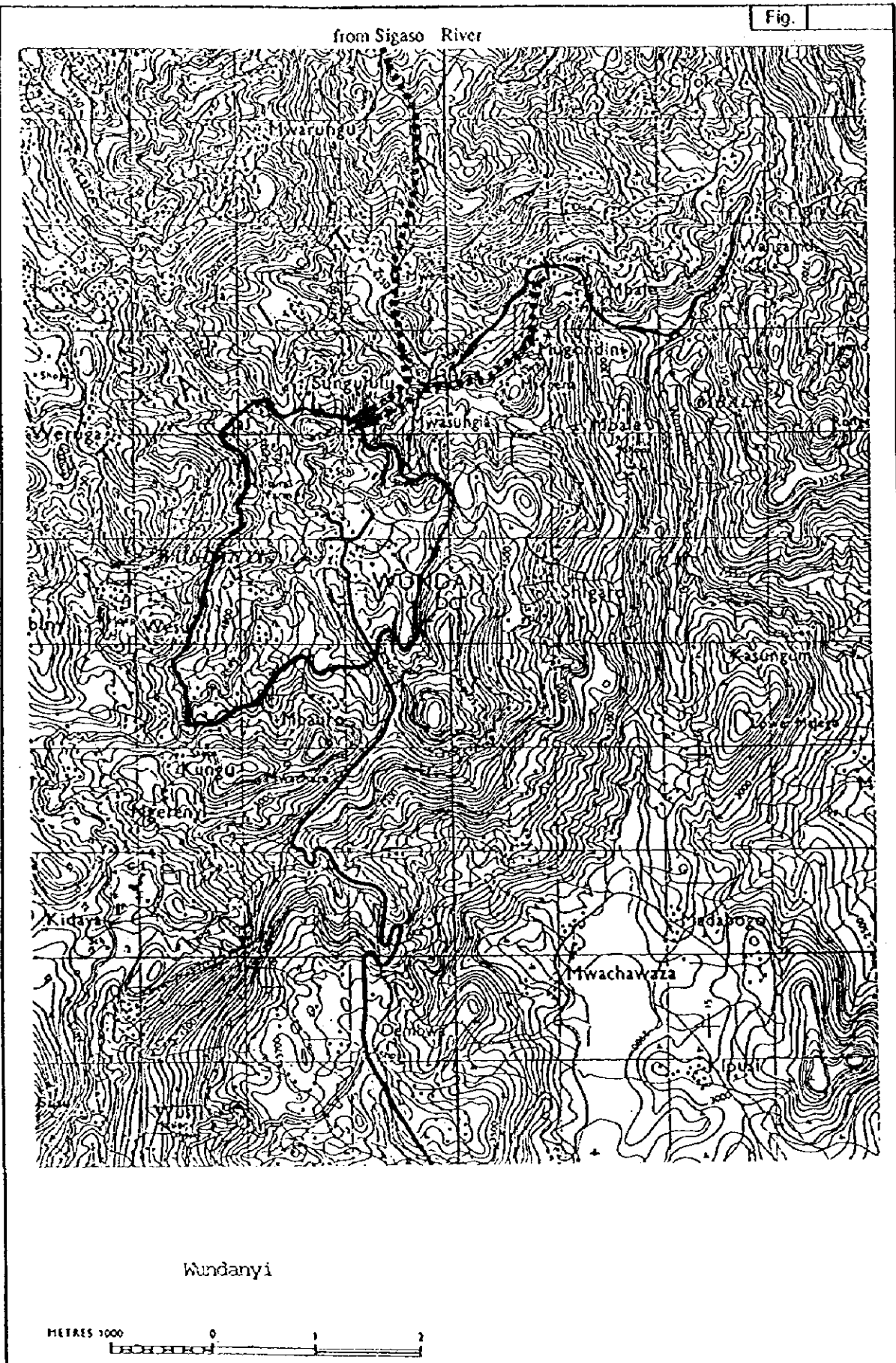
Treatment : Capacity : *9590 m³/d* - *Other information not given*

Design year :

Design population :

Remarks

Since the latest works were done in 1985, no plans for future development have been carried out to date. Dosage rates for the Wundanyi T/Works are:- Alum = 46 kg/day, Soda Ash = 35 kg/day and Chlorine = 3.2 kg/day. Wesu T/Works was built in 1957 while the Wundanyi T/Works was constructed in 1985. Both Works are of similar design and capacity. They involve full conventional treatment process, i.e. Coagulation, Sedimentation, Filtration and Disinfection.



**Aftercare Study on
the National Water Master Plan**

BURA (1/1)

General

Name of Urban Centre : *Bura*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Garissa* Location : *Bura*
 Map (1/50,000) Ref. no : *154/2* Co-ordinates X : *39° 53' E* Y : *01° 13' S*
 Drainage Sub-basin : *4GE*

Existing facilities

Source : *Tana River* Type of Intake : *Sump* Elevation : m
 Raw water system : *Pumping* H : *10 m* Dia : *80 mm*
 Treatment Process : *Composite Sedimentation/Filtration Unit*
Coagulation, Flocculation, Sedimentation, Filtration and disinfection in the clear water tank.

Designed Capacity : *480 m³/d*
 Treated water/Distribution system -
 Area covered : km²
 Distribution mains (80mm and above): *80 mm to 80 mm*
 Total length : *1.4 km*

UFW (Estimated) : m³/d
 Consumers - Total no :
 Metered :
 Unmetered :

Water production : *288 m³/d* Remark :
 Service area population :
 Population served :

Financial/Revenue

O & M costs :Kshs
 Revenue earned :Kshs
 Revenue collected :Kshs

Rehabilitation required/costs

	Kshs
i) <i>Pump House</i>	<i>500,000</i>
ii) <i>New 80 mm pipeline</i>	<i>900,000</i>
iii) <i>Fencing - perimeter</i>	<i>200,000</i>
iv) <i>Rehabilitation of reservoirs</i>	<i>20,000</i>
v) vi)	
Total estimated cost	<i>1,620,000</i>

Future development plan

Source : *River Tana*
 Treatment : Capacity : m³/d
 Design year :
 Design population :

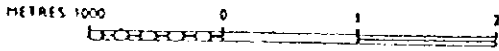
Remarks

The current water supply is non-functional since the river has shifted course, the intake point needs to be relocated. This happened before the 1997 floods which has made the situation even worse.

Fig.



Bura+Madogo



**Aftercare Study on
the National Water Master Plan**

HOLA (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Hola*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Tana River* Location : *Zabani*
 Map (1/50,000) Ref. no : *155/3* Co-ordinates X : *40° 04' E* Y : *01° 30' S*
 Drainage Sub-basin : *4GF*

Existing facilities

Source : *Tana River* Type of Intake *Pontoo* Elevation : *60 m*
 Raw water system : *Pumping* H : *10 m* Dia : *80 mm*
 Treatment Process : *Conventional*

The 1950's built T/Works has since outlived its design life. Water is at present passed through the T/Works without sufficient treatment. Though chlorine, Alum and Soda Ash is dosed, they are not allowed enough retention times to act effectively.

Designed Capacity :

Treated water/Distribution system - Area covered : *4 km²*
 Distribution mains (80mm and above): *80 mm to 150 mm*
 Total length : *10.2 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *410*
 Metered : *410*
 Unmetered : *-*

Working Meters: *No information*

Water production : *228 m³/d (1995)*

Remark :

Service area population : *15,000*

Population served : *9,000*

Financial/Revenue

O & M costs : *Kshs 1,805,430 (1996)*

Revenue earned : *Kshs*

Revenue collected : *Kshs 504,320 (1996)*

Rehabilitation required/costs

	Kshs
i) <i>Generator Set</i>	<i>2,000,000</i>
ii) <i>Submersible pump</i>	<i>500,000</i>
iii) <i>Pump Hse</i>	<i>400,000</i>
iv) <i>Full T.Works</i>	<i>5,300,000</i>
v) <i>2 No. Reservoirs</i>	<i>3,000,000</i>
vi) <i>Distribution (reservoirs & Pipelines)</i>	<i>14,000,000</i>
Total estimated cost	<i>25,200,000</i>

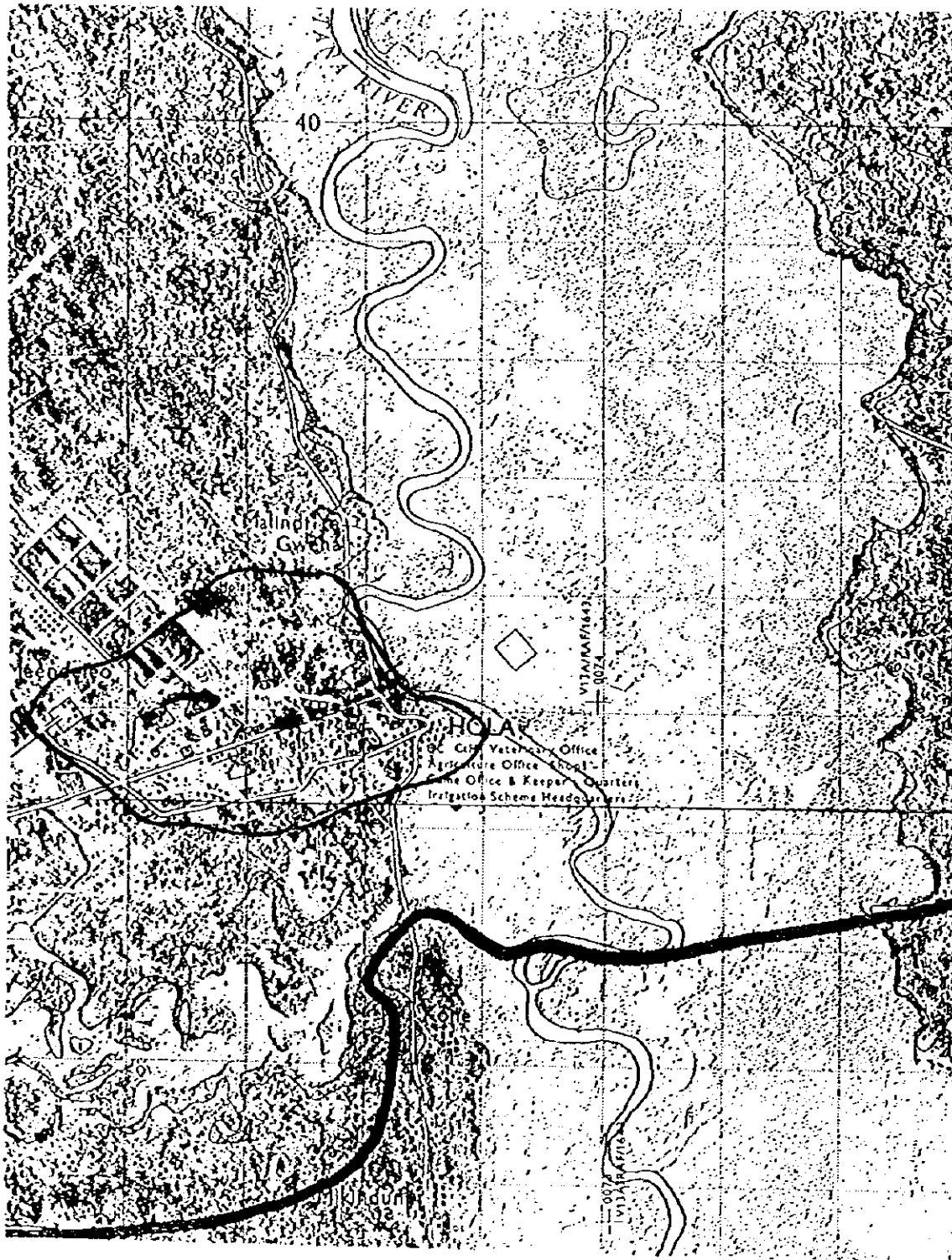
Future development plan

Source : *Tana River*
 Treatment : *Full Chemical Capacity : 4187 m³/d*
 Design year : *2010*
 Design population : *35,830*

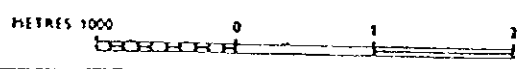
Remarks

Hola Water Supply is outdated and requires a new T/Works and augmentation/rehabilitation of the distribution network. Hola does not get power from the National Grid and thus generators are used resulting in very high costs. Cholera and typhoid cases reported during heavy rains largely due to ineffective treatment. Shortages of chemicals during rainy seasons due to inaccessibility by road.

Fig.



Hola



**Aftercare Study on
the National Water Master Plan**

GARSEN (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : Garsen
 Organisation/Water Undertaker : Ministry of Water Resources
 District : Tana River Location : Bihisa
 Map (1/50,000) Ref. no : 179/3 Co-ordinates X : 40° 09' E Y : 02° 16' S
 Drainage Sub-basin : 4GG

Existing facilities

Source : Tana River Type of Intake : Elevation : 16 m
 Raw water system : Pumping at 50m³/hr H : m Dia : 63 mm
 Treatment Process :
 Full conventional treatment, i.e. Coagulation, sedimentation, filtration and disinfection. Chlorine was dosed at 2ppm.

Designed Capacity : m³/day
 Treated water/Distribution system - Area covered : km²
 Distribution mains (80mm and above) : - mm to - mm
 Total length : - km

UFW (Estimated) : m³/d
 Consumers - Total no : - Working Meters:
 Metered : -
 Unmetered : -

Water production : - m³/d
 Service area population :
 Population served :
 Remark : The above details under existing facilities were in existence before the supply was washed away by floods in 1989.

Financial/Revenue

O & M costs :Kshs
 Revenue earned :Kshs
 Revenue collected :Kshs

Rehabilitation required/costs

i)
 ii)
 iii)
 iv)
 v)
 vi)

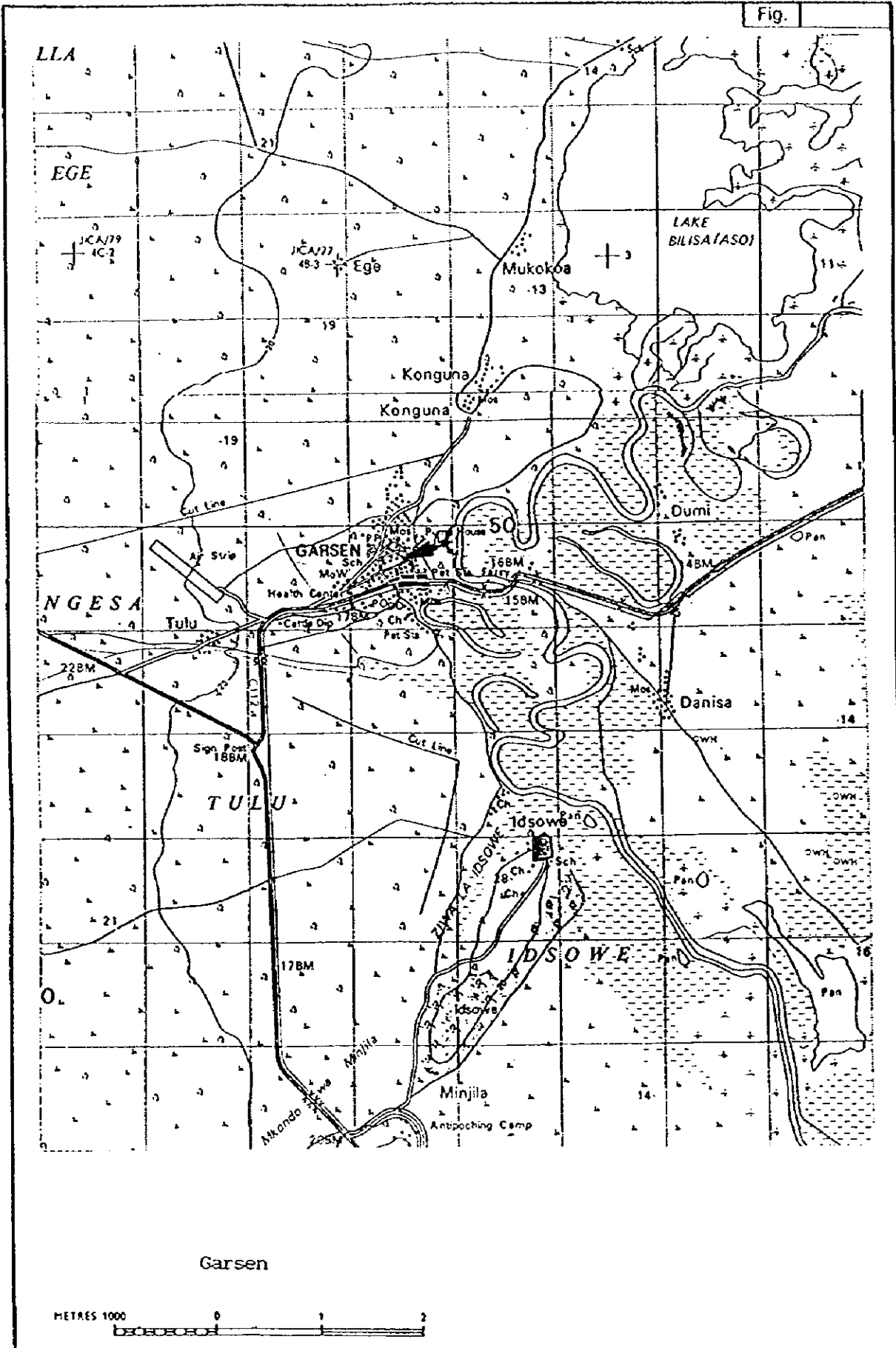
Total estimated cost

Future development plan

Source :
 Treatment : Capacity : m³/d
 Design year :
 Design population :

Remarks

Garsen Water Supply was swept away by floods in 1989 and no rehabilitation works have been carried out since then. The nearby Tana River was the source with abstraction rate of 50m³/hr then. A full treatment works existed and is currently in state of disrepair.
 Garsen township with projected population of 11,700 by 2010, is in urgent need of a new water supply. Presently, the residents fetch water from Tana River for their own consumption.



**Aftercare Study on
the National Water Master Plan**

RUNYENJES (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Runyenjes*
 Organisation/Water Undertaker : *Municipal council of Runyenjes*
 District : *Embu* Location: *Runyenjes*
 Map (1/50,000) Ref. no : *123/3* Co-ordinates *X 37° 34' Y S 00° 24'*
 Drainage Sub-basin : *4EC*

Existing facilities:

Source : *Ena river* Type of Intake : *Weir* Elevation : *1540m*
 Raw water system : *Gravity* H : *m* Dia : *150mm twin*
 Treatment Process : *None*

Designed Capacity :
 Treated water/Distribution system - Area covered: *15 km²*
 Distribution mains (80mm and above): *150mm and 80 mm*
 Total length : *10.5km*

UFW (Estimated) : *m³/d*
 Consumers - Total no : *840 - 1996* Working Meters: *All consumers are of flat rates.*
 Metered :
 Unmetered : *840*

Water production : *m³/d* Remark : *No measurement for water production.*
 Service area population : *4,500*
 Population served :

Financial/Revenue - 1996

O & M costs : *Kshs 65,480 - Salary and repairs*
 Revenue earned : *Kshs 302,740*
 Revenue collected : *Kshs*

Rehabilitation required/costs

	Kshs Estimated
i) Intake works	4,000,000
ii) Raw water main augmentation	6,000,000
iii) Treatment works	12,000,000
iv) Distribution system	60,000,000
Total	82,000,000

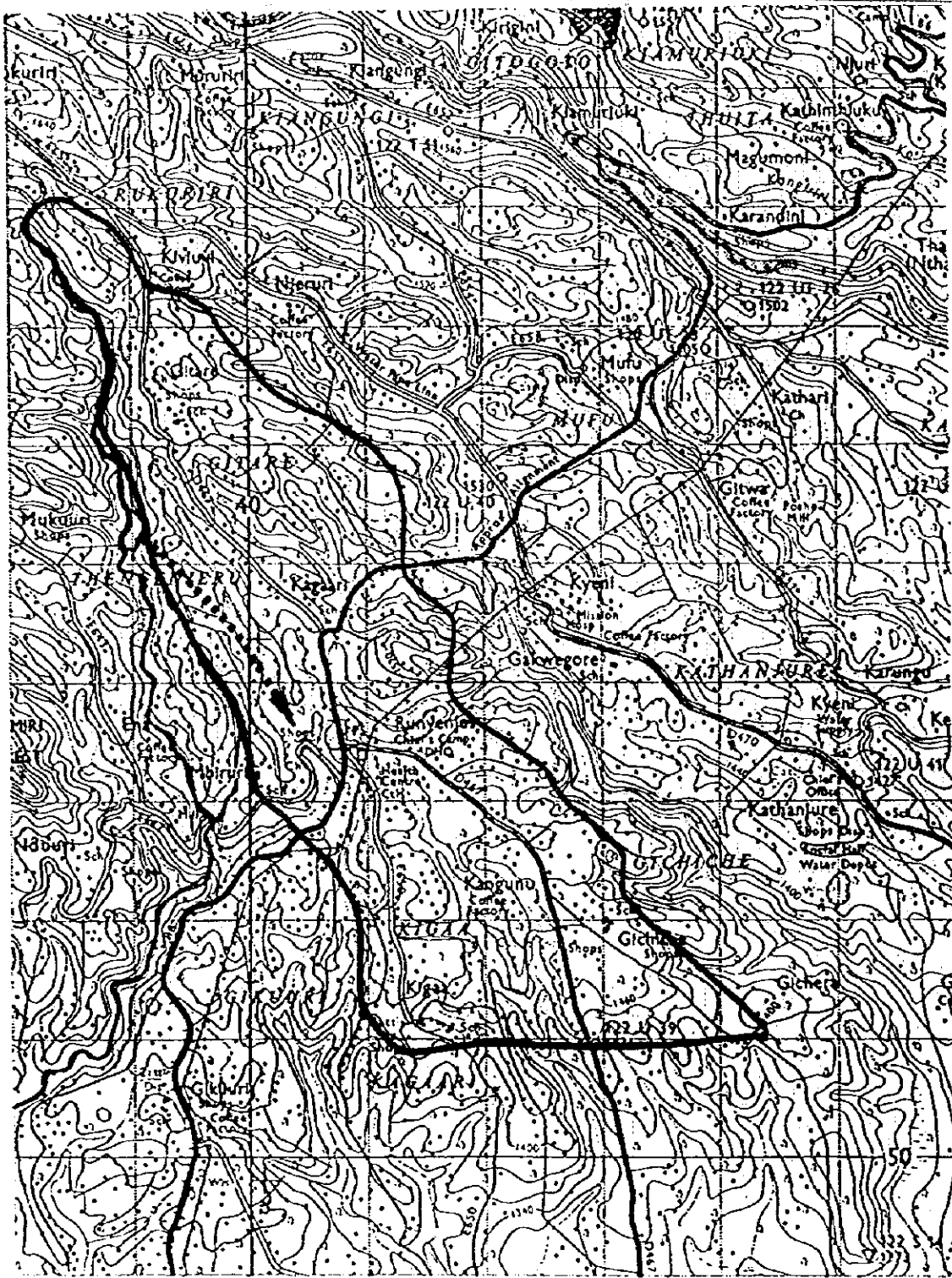
Future development plan

Source : *Ena river*
 Treatment : *Full* Capacity : *m³/d*
 Design year :
 Design population:

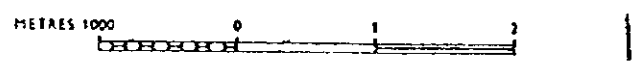
Remarks

The supply system needs re-design covering larger area. Raw water main requires re-routing for improved flow. Full treatment works are required.

Fig.



Ruyenyjes



**Aftercare Study on
the National Water Master Plan**

SIKAGO (1/1)

General

Name of Urban Centre : *Siakago*
 Organisation/Water Undertaker : *Ministry of Water Resources*
 District : *Embu* Location : *412.1 Nthawa*
 Map (1/50,000) Ref. no : *136/1* Co-ordinates X : *37° 38' E* Y : *00° 34' S*
 Drainage Sub-basin :

Existing facilities

Source : <i>Pipeline Offtake</i>	Type of Intake :	Elevation : m
Raw water system :	H : m	Dia : mm
Treatment Process : <i>Full Conventional Treatment</i>		
<i>Chemical Dosed - Alum, Soda Ash and Chlorine (TCL)</i>		
Designed Capacity : <i>m³/d</i>		
Treated water/Distribution system -	Area covered : <i>2 km²</i>	
	Distribution mains (80mm and above): <i>80 mm to 100 mm</i>	
	Total length : <i>km</i>	

UFW (Estimated) : *m³/d*
 Consumers - Total no : *72*
 Metered : *72*
 Unmetered : *Nil*

Working Meters:

Water production : *196 m³/d*
 Service area population :
 Population served : *8,000*

Remark : *Water production data is for
Siakago Rural Water Supply*

Financial/Revenue

O & M costs :Kshs
 Revenue earned :Kshs
 Revenue collected :Kshs

Rehabilitation required/costs

- i)
- ii)
- iii)
- iv)

Estimated Cost Kshs

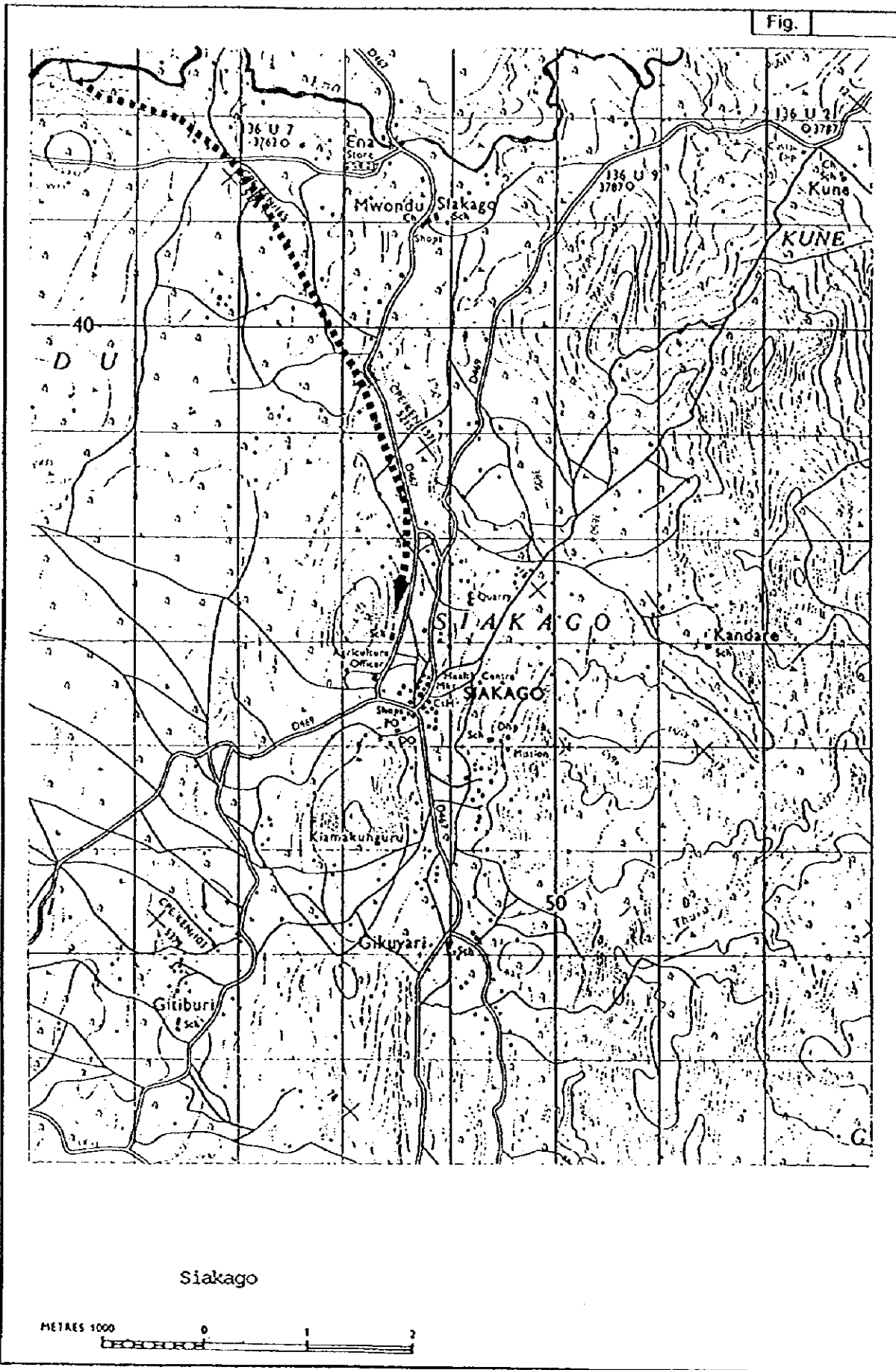
Total

Future development plan

Source :
 Treatment : Capacity : *m³/d*
 Design year :
 Design population :

Remarks

Siakago urban does not have its own source of water supply and it is supplied from Siakago Rural Water Supply scheme whose source is Ena River. The existing source is not adequate to meet the demand of the area being served.



**Aftercare Study on
the National Water Master Plan**

EMBU (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Embu*

Organisation/Water Undertaker : *NWCPC*

District : *Embu* Location: *Embu*

Map (1/50,000) Ref. no : *135/2*

Co-ordinates *X 37° 27' Y S 00° 31'*

Drainage Sub-basin : *4DC*

Existing facilities:

Source : *Offtake from Embu water supply line*

Type of Intake : *Pipeline offta* Elevation : *1425 m*

Raw water system : *Gravity*

H: *m* Dia : *2 No. 150mm+1No. 80mm from 350mm main*

Treatment Process : *7 No. composite basins at Kapengazi intake - chlorination only at Rupengazi intake - raw water is also supplied to some area from this intake.*

Designed Capacity :

Treated water/Distribution system -

Area covered:*31km² for whole area covered by the Embu supply project)*

Distribution mains (80mm and above): *300mm and 100 mm*

Total length : *40.4 km*

UFW (Estimated) : *m³/d*

Consumers - Total no : *4691*

Working Meters:

Metered : *4691*

Unmetered :

Water production : *7,305 m³/d - 1994*

Remark : *No data available.*

Service area population : *30,000*

Population served :

Financial/Revenue - 1996

O & M costs : *Kshs 2,081,700 - 1995*

Revenue earned : *Kshs 10,425,000 - 1995*

Revenue collected : *Kshs 11,370,946 - 1994*

Rehabilitation required/costs

i) *Renovation and extension of distribution system*

Kshs Estimated

45,000,000

ii) *Repair storage existing and construction of additional tanks*

5,000,000

Total

50,000,000

Future development plan

Source : *Kapengazi and Rupengazi rivers*

Treatment : Capacity : *m³/d*

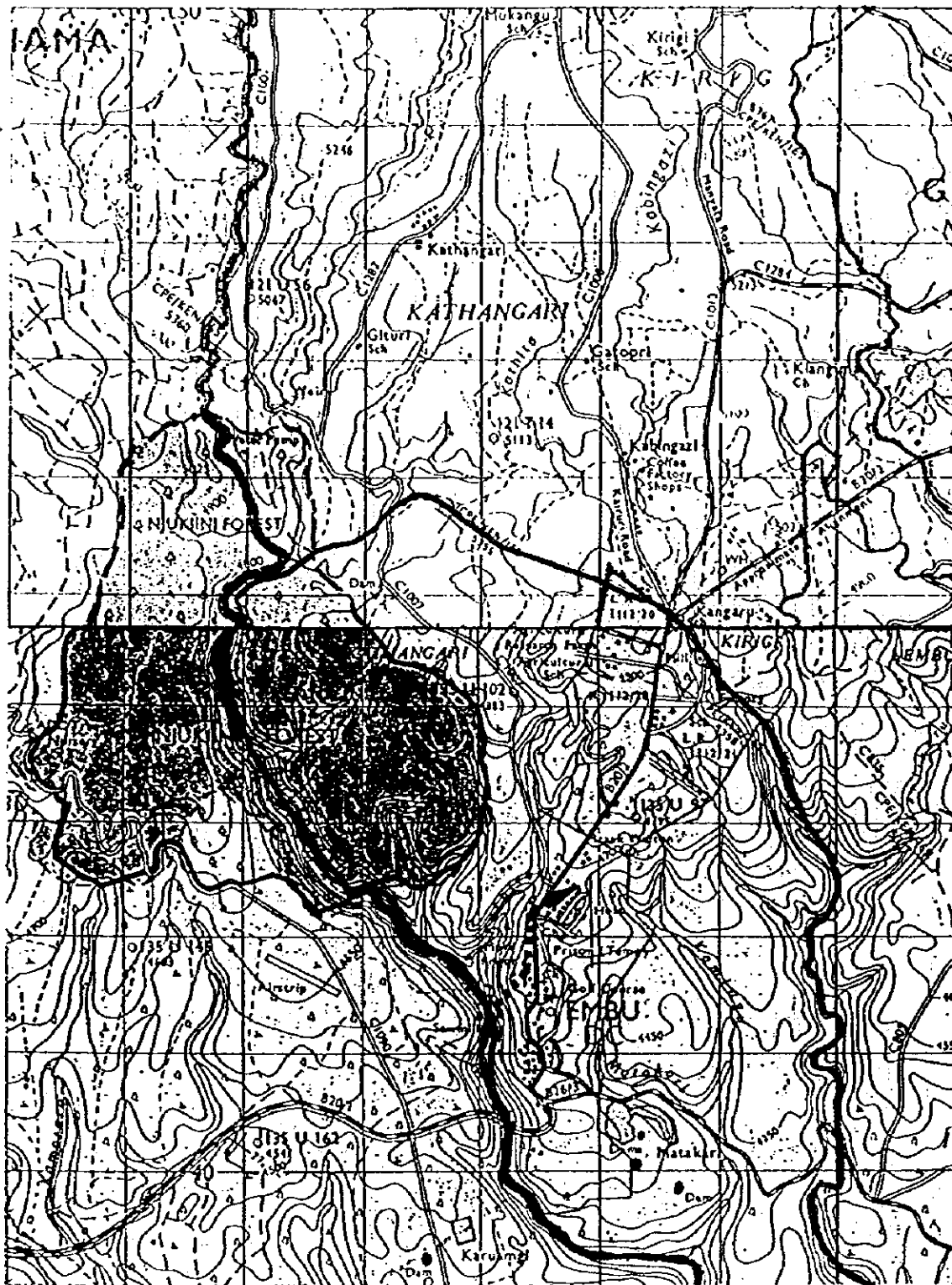
Design year :

Design population:

Remarks

Embu Water Supply also serves other urban/trading centres.

Fig.



Emba



**Aftercare Study on
the National Water Master Plan**

ISIOLO (1/1)

**Urban Water Supply
System Survey**

General

Name of Urban Centre : *Isiolo*

Organisation/Water Undertaker : *MOWR*

District : *Isiolo* Location: *Isiolo*

Map (1/50,000) Ref. no : *108/1*

Co-ordinates *X 37° 35' Y N 00° 21'*

Drainage Sub-basin : *5DA*

Existing facilities:

Source : *Offtake from - Ewaso Nyiro water supply* Type of Intake : *Pipe offtake* Elevation : *335m*

Raw water system : *Gravity* H: *m* Dia : *250mm*

Treatment Process : *Full conventional treatment of Ewaso Nyiro water supply , 1No. receiving basin , 4No. mixing chamber , 2No. sedimentation tanks , 3No. filters , 2No. clear water tanks.*

Designed Capacity :

Treated water/Distribution system -

Area covered: *18km² of Isiolo urban*

Distribution mains (80mm and above): *250mm to 80 mm*

Total length : *32.2km*

UFW (Estimated) : *m³/d 1996*

Consumers - Total no : *2771*

Metered : *2771*

Unmetered :

Working Meters: *No data available*

Water production : *4356m³/d 1996*

Service area population : *40,000*

Population served : *36,000*

Remark :

All details are for Ewaso Nyiro water supply which is also supplying water to other market centres and towns

Financial/Revenue - 1996

O & M costs : *Kshs 9,440,300*

Revenue earned : *Kshs 112,807,502*

Revenue collected : *Kshs 12,538,935*

Rehabilitation required/costs

i) *Intake works*

ii) *Treatment works*

iii) *Distribution renovation and extension*

iv) *Storage facilities*

Kshs Estimated

76,000,000

50,000,000

25,000,000

5,000,000

Total

156,000,000

Future development plan

Source : *Ewaso Nyiro river*

Treatment : *Conventional*

Design year : *2020*

Design population: *60,000*

Capacity : *10,000 m³/d*

Remarks