5.3 Natural Environment

5.3.1 Flora

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	VEGETATION	5, 12	3	1	3	3	2	1	3

DATA

- The Study Area is predominantly bushveld with the following bushveld trees: *Acacia galpinii, Acacia erioloba, Acacia nigrescens, Combretum imbrebe, Spirostachys africana, Scherocarya caffra, Lannea discolor and Ficus natalensis*. The other types of vegetation which are present in this region are Turf Thornveld (which is also present on the eastern side of the Study Area on the north western banks of the Elands River), Kalahari Thornveld and Sandy Grassveld. Turf Thornveld is a naturally open thornveld, which tends to thicken as a result of poor grazing practices.

IMPACT

- The impact on the flora will be small as the proposed pipelines are along roads and other pipeline reserves where possible and this has already been disturbed from its original state.
- The impact on the flora will be more significant for the proposed water treatment works, reservoirs, elevated tanks and pump stations but these impacts will be localised within the construction area.

MITIGATION MEASURE

- Construction activities and disturbance should be limited to a minimum area of disturbance.
- After the pipelines have been laid the areas must be revegetated with grass, especially where there are slopes.
- Fill material or topsoil for rehabilitation purposes should be taken from areas which have an appropriate seed bank to help with the revegetation process

IMPACT AFTER MITIGATION

- Slight to no impact as the area is already disturbed and after mitigation the area should practically be the same as before pipeline construction. The same cannot be said for the

other structures but the impact is not seen as severe.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
B	AQUATIC FLORA	3	2	0	3	Not applicable			

DATA

- Aquatic flora will be present to a lesser or greater extent in all the dams

IMPACT

- Aquatic flora should not be affected by the proposed developments.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
C	INVASIVE AQUATIC PLANTS	3	3	0	3	Not applicable			

DATA

- There are Potamogeton and Cladophora in some of the existing canals as a result of the nutrient enrichment of the water. These plants and other smaller unicellular algae cause problems at the purification works.

IMPACT

- The proposed development options will not be impacted upon by the invasive aquatic plants in the canals.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
D	INVASIVE TERREST. PLANTS	3,5	1	2	2	3	2	0	2

DATA

- The presence of alien plant species has a number of serious ecological implications for both indigenous vegetation and the production potential of the land. The banks of

other structures but the impact is not seen as severe.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
B	AQUATIC FLORA	3	2	0	3	Not applicable			

DATA

- Aquatic flora will be present to a lesser or greater extent in all the dams

.

IMPACT

- Aquatic flora should not be affected by the proposed developments.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
C	INVASIVE AQUATIC PLANTS	3	3	0	3	Not applicable			

DATA

- There are Potamogeton and Cladophora in some of the existing canals as a result of the nutrient enrichment of the water. These plants and other smaller unicellular algae cause problems at the purification works.

IMPACT

- The proposed development options will not be impacted upon by the invasive aquatic plants in the canals.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
D	INVASIVE TERREST. PLANTS	3,5	1	2	2	3	2	0	2

DATA

- The presence of alien plant species has a number of serious ecological implications for both indigenous vegetation and the production potential of the land. The banks of

rivers are the habitats which are most affected by the presence of alien plant species. The most significant of these alien plant species are; Syringa, the grey poplar (*Populus canescens*) and the giant reed (*Arundo donax*). In places where the *Syringa* is present, it becomes the dominant canopy tree and is a serious threat to indigenous riverine vegetation and the associated fauna. The grey poplar occurs in dense thickets, which suppress indigenous vegetation, as well as blocking and narrowing river courses. The giant reed, invades water courses and tends to go largely unnoticed at the expense of the indigenous riparian vegetation.

- Few invasive terrestrial plants have been identified along the pipeline route.

- In roadside and veld habitats the following are potential invaders: Sweet prickly pear (Opentia ficus-indica), syringa (Melia azedarach), as well as lantana (Lantana camara), queen of the night (Cereus peruvianus), Jacaranda (Jacaranda mimosifolia) and sisal (Aqave sisalana).

IMPACT

- Construction activities could cause disturbance of the area, which could result in the infestation of invasives which could be transported to the area in a number of ways.

MITIGATION MEASURE

- Limited, well demarcated pipeline corridors and construction sites should be identified. Disturbed areas should be appropriately vegetated before aliens can become established and an ongoing programme should be implemented if aliens are identified.
- Fill material or topsoil for rehabilitation purposes should be taken from areas which have an appropriate seed bank and are free of aliens.

IMPACT AFTER MITIGATION

- The appropriate mitigation measures should minimise the impact of disturbance by construction.
- Seeds of invasive weeds that could be brought in with fill material could remain dormant in the soil for long periods. An ongoing weeding programme of the contaminated areas should be implemented to prevent aliens becoming established.

FLORA		SRCE	IMP
FURTHER WORK	- Follow an approved eradication programme for floral invasives. - Suitable landscaping specifications to be enforced.	9	2
ADVANTAGES	Not applicable	3	-

5.3.2 Fauna

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	MAMMALS	5	2	1	3	3	2	0	2

DATA

- See the table below for the breakdown of total number of species and red data species present within the Elands River region.

Mammal species present within the Elands River area

Region	Total no of species	Total no of red data species	Vulnerable	Rare	Indeterminate
Elands River	63	14	4	8	2
Bloed, Olifants and Moses River	57	5	3	2	-

IMPACT

- No severe impact on mammals is expected as the area is already almost developed.

A temporary impact could be poaching and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is already heavily utilised.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

FLORA		SRCE	IMP
FURTHER WORK	- Follow an approved eradication programme for floral invasives. - Suitable landscaping specifications to be enforced.	9	2
ADVANTAGES	Not applicable	3	-

5.3.2 Fauna

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	MAMMALS	5	2	1	3	3	2	0	2

DATA

- See the table below for the breakdown of total number of species and red data species present within the Elands River region.

Mammal species present within the Elands River area

Region	Total no of species	Total no of red data species	Vulnerable	Rare	Indeterminate
Elands River	63	14	4	8	2
Blood, Olifants and Moses River	57	5	3	2	-

IMPACT

- No severe impact on mammals is expected as the area is already almost developed.

A temporary impact could be poaching and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is already heavily utilised.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	BIRDS	5	2	1	2	3	3	0	2

DATA

- A large variety of bird species are found near the Elands River (250 - 300 species). There are less than 5 red data species present in all the regions, with the exception of the Upper Olifants River, where there are less than 10 red data species present.

IMPACT

- The impact is relatively low as other similar habitats exist for birds in the area. A temporary impact is envisaged for birds having nesting sites within the construction area.

MITIGATION MEASURE

- No practical mitigation measures exist to minimise noise pollution and human activities associated with construction activities.
- Limit disturbance of area as far as possible.

IMPACT AFTER MITIGATION

- Once construction is completed and the road reserve rehabilitated the loss of habitat should be alleviated.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	REPTILES & AMPHIBIANS	5	2	1	3	3	2	0	2

DATA

- There are no endangered reptile and amphibian species within the Elands River region.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	BIRDS	5	2	1	2	3	3	0	2

DATA

- A large variety of bird species are found near the Elands River (250 - 300 species). There are less than 5 red data species present in all the regions, with the exception of the Upper Olifants River, where there are less than 10 red data species present.

IMPACT

- The impact is relatively low as other similar habitats exist for birds in the area. A temporary impact is envisaged for birds having nesting sites within the construction area.

MITIGATION MEASURE

- No practical mitigation measures exist to minimise noise pollution and human activities associated with construction activities.
- Limit disturbance of area as far as possible.

IMPACT AFTER MITIGATION

- Once construction is completed and the road reserve rehabilitated the loss of habitat should be alleviated.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	REPTILES & AMPHIBIANS	5	2	1	3	3	2	0	2

DATA

- There are no endangered reptile and amphibian species within the Elands River region.

IMPACT

- A temporary impact could be poaching of tortoises and snakes and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is reasonably developed.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	FISH	5	2	1	1	Not applicable			

DATA

- No specific data have been found for the Project Area. Some of the species found in this region include: *Tilapia rendalli, Tilapia sparmanii, Clarias gariepinus, Labeo cylindricus* and *Barbus trimaculatus.*

-

IMPACT

- The abstraction of water from the dams will probably not influence fish in the dams and downstream in the rivers even if species of conservation importance do occur.
- The construction of the pipelines, reservoirs, elevated tanks and pump stations will have no impact on fish.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
e	TERRESTRIAL INVERT	3	1	1	2	Not applicable			

DATA

- No data have been collected for terrestrial invertebrates but the project will not impact on invertebrates and this is not seen as an important component.

IMPACT

- A temporary impact could be poaching of tortoises and snakes and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is reasonably developed.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	FISH	5	2	1	1	Not applicable			

DATA

- No specific data have been found for the Project Area. Some of the species found in this region include: *Tilapia rendalli, Tilapia sparmanii, Clarias gariepinus, Labeo cylindricus* and *Barbus trimaculatus.*

-

IMPACT

- The abstraction of water from the dams will probably not influence fish in the dams and downstream in the rivers even if species of conservation importance do occur.
- The construction of the pipelines, reservoirs, elevated tanks and pump stations will have no impact on fish.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
e	TERRESTRIAL INVERT	3	1	1	2	Not applicable			

DATA

- No data have been collected for terrestrial invertebrates but the project will not impact on invertebrates and this is not seen as an important component.

IMPACT

- It is envisaged that even if terrestrial invertebrates of conservation importance do occur, the impacts associated with the pipeline construction are unlikely to be significant.

-

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
f	AQUATIC INVERT COMMUNITY	3	2	1	2	Not applicable			

DATA

- No surveys have been undertaken for this study for aquatic invertebrates within the different rivers.

IMPACT

- It is envisaged that even if aquatic invertebrates of importance do occur within the river, the impacts associated with the abstraction of water from dams are unlikely to be significant.
- There will be no impact on aquatic invertebrates due to the construction activities.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
g	EXOTIC TERRESTRIAL	3	2	1	2	3	2	0	2

DATA

- No data are available, but the project will have a negligible impact on exotic terrestrial animals.

IMPACT

- During the duration of pipeline construction, there may be a danger to goats and cattle while the trenches are open. This is not seen as a major impact as not many stray animals are expected.

MITIGATION MEASURE

- Large areas of open trenches should not be left unattended or unfenced.
- The area around open trenches should be fenced off if practical and/or filled up as soon as possible.

IMPACT

- It is envisaged that even if terrestrial invertebrates of conservation importance do occur, the impacts associated with the pipeline construction are unlikely to be significant.

-

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
f	AQUATIC INVERT COMMUNITY	3	2	1	2	Not applicable			

DATA

- No surveys have been undertaken for this study for aquatic invertebrates within the different rivers.

IMPACT

- It is envisaged that even if aquatic invertebrates of importance do occur within the river, the impacts associated with the abstraction of water from dams are unlikely to be significant.
- There will be no impact on aquatic invertebrates due to the construction activities.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
g	EXOTIC TERRESTRIAL	3	2	1	2	3	2	0	2

DATA

- No data are available, but the project will have a negligible impact on exotic terrestrial animals.

IMPACT

- During the duration of pipeline construction, there may be a danger to goats and cattle while the trenches are open. This is not seen as a major impact as not many stray animals are expected.

MITIGATION MEASURE

- Large areas of open trenches should not be left unattended or unfenced.
- The area around open trenches should be fenced off if practical and/or filled up as soon as possible.

IMPACT AFTER MITIGATION

- The impact after mitigation will be low as the impact before mitigation is not deemed significant.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
h	EXOTIC AQUATIC	3	2	0	2	Not applicable			

DATA

- No data are available on exotic fish species or any other exotic aquatics. It is expected that exotic fish species do occur in some of the dams and probably also in the rivers. The project will however not have an impact on the exotic aquatic organisms.

IMPACT

- The abstraction of water from dams is unlikely to have an impact on exotic aquatic species.
- The construction activities are unlikely to have an impact on exotic aquatics.

FAUNA		SRCE	IMP
FURTHER WORK	Not applicable	3	2
ADVANTAGES	Not applicable	3	-

5.3.3 Habitat

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	CURRENT DISTURBANCE : BADLY DISTURBED	3	3	1	3	3	3	1	2

DATA

- Some of the proposed pipeline routes are within a badly disturbed area, i.e. in an existing road or pipeline reserve.

IMPACT AFTER MITIGATION

- The impact after mitigation will be low as the impact before mitigation is not deemed significant.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
h	EXOTIC AQUATIC	3	2	0	2	Not applicable			

DATA

- No data are available on exotic fish species or any other exotic aquatics. It is expected that exotic fish species do occur in some of the dams and probably also in the rivers. The project will however not have an impact on the exotic aquatic organisms.

IMPACT

- The abstraction of water from dams is unlikely to have an impact on exotic aquatic species.
- The construction activities are unlikely to have an impact on exotic aquatics.

FAUNA		SRCE	IMP
FURTHER WORK	Not applicable	3	2
ADVANTAGES	Not applicable	3	-

5.3.3 Habitat

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	CURRENT DISTURBANCE : BADLY DISTURBED	3	3	1	3	3	3	1	2

DATA

- Some of the proposed pipeline routes are within a badly disturbed area, i.e. in an existing road or pipeline reserve.

IMPACT

- The pipelines will represent a temporary disturbance of the road or pipeline reserves which should revegetate and hardly leave any scar.

MITIGATION MEASURE

- Appropriate rehabilitation procedures should be followed.

IMPACT AFTER MITIGATION

- Hardly any impact will be noticeable after rehabilitation except for manholes along the pipeline route.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	CURRENT DISTURBANCE : DISTURBED	3	3	2	2	3	2	1	2

DATA

- All the rivers within the Project Area are regulated by dams and weirs and as such are disturbed systems.

IMPACT

- Dams will probably not have much less water as most of the water extracted from the dams will be from the incremental increase of return flows from the catchment to the system. If there is less water in the dam overflow from the dam will be less frequent. The proposed project would probably not disturb the rivers downstream of the dams any further.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent, appropriate water releases for the downstream environment may be a solution.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

IMPACT

- The pipelines will represent a temporary disturbance of the road or pipeline reserves which should revegetate and hardly leave any scar.

MITIGATION MEASURE

- Appropriate rehabilitation procedures should be followed.

IMPACT AFTER MITIGATION

- Hardly any impact will be noticeable after rehabilitation except for manholes along the pipeline route.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	CURRENT DISTURBANCE : DISTURBED	3	3	2	2	3	2	1	2

DATA

- All the rivers within the Project Area are regulated by dams and weirs and as such are disturbed systems.

IMPACT

- Dams will probably not have much less water as most of the water extracted from the dams will be from the incremental increase of return flows from the catchment to the system. If there is less water in the dam overflow from the dam will be less frequent. The proposed project would probably not disturb the rivers downstream of the dams any further.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent, appropriate water releases for the downstream environment may be a solution.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	CURRENT DISTURBANCE : HARDLY ANY DISTURBANCE	Not applicable							

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	CONSERVATION STATUS OF RIVER	4	2	1	2	Not applicable			

DATA

- Changes are apparent, such as locally severe pollution, dominant alien species, major water regulations etc. in most of the Project Area. More specific data are not available at present and very little can be said about the conservation status of the specific rivers

IMPACT

- The impact of the pipelines and other surface structures on the rivers will be negligible as the construction activities and structures will not constitute a permanent disturbance to the river.
- The dams will probably not have much less water, as most of the water extracted from the dam will be from the incremental increase of return flows from the catchment to the system.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent appropriate water releases for the downstream environment may be a solution. This could however impact on the availability of water for the other downstream users.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	CURRENT DISTURBANCE : HARDLY ANY DISTURBANCE	Not applicable							

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	CONSERVATION STATUS OF RIVER	4	2	1	2	Not applicable			

DATA

- Changes are apparent, such as locally severe pollution, dominant alien species, major water regulations etc. in most of the Project Area. More specific data are not available at present and very little can be said about the conservation status of the specific rivers

IMPACT

- The impact of the pipelines and other surface structures on the rivers will be negligible as the construction activities and structures will not constitute a permanent disturbance to the river.
- The dams will probably not have much less water, as most of the water extracted from the dam will be from the incremental increase of return flows from the catchment to the system.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent appropriate water releases for the downstream environment may be a solution. This could however impact on the availability of water for the other downstream users.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

HABITAT		SRCE	IMP
FURTHER WORK	Define a suitable operating rule for dams taking into account the recreation and tourism activities as well as the downstream ecological requirements.	9	2
ADVANTAGES	The river stretches downstream of dams may improve ecologically if the instream flow requirements are met.	3	3

HABITAT		SRCE	IMP
FURTHER WORK	Define a suitable operating rule for dams taking into account the recreation and tourism activities as well as the downstream ecological requirements.	9	2
ADVANTAGES	The river stretches downstream of dams may improve ecologically if the instream flow requirements are met.	3	3

5.4 Socio-Economic/Political

5.4.1 Recreation

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	RECREATION	8	2	1	2	3	3	0	2

DATA

- Vaalkop Dam is used for recreation.

IMPACT

- If water levels in dams should drop, it may affect recreation. Most dams have varying water levels and the impact should be negligible.
- The pipelines and other surface structures will have no impact on recreation.

MITIGATION MEASURE

- Operating rules for dams should be such that the recreational activities around the dam will not be negatively influenced by the drawdown of the dam.

IMPACT AFTER MITIGATION

- The impact after mitigation measures should not be more than it is at the present drawdown rate. The confidence level is not high.

RECREATION		SRCE	IMP
FURTHER WORK	Define a suitable operating rule for the dam taking into account the recreation and tourism activities as well as the downstream ecological requirements.	9	2
ADVANTAGES	Improved management potential for dams.	9	2

5.4.2 Land Use

(Grazing, Agronomy, Mining, Industrial, Tourism, Rural, Forestry, Conservation/Wilderness etc)

5.4 Socio-Economic/Political

5.4.1 Recreation

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	RECREATION	8	2	1	2	3	3	0	2

DATA

- Vaalkop Dam is used for recreation.

IMPACT

- If water levels in dams should drop, it may affect recreation. Most dams have varying water levels and the impact should be negligible.
- The pipelines and other surface structures will have no impact on recreation.

MITIGATION MEASURE

- Operating rules for dams should be such that the recreational activities around the dam will not be negatively influenced by the drawdown of the dam.

IMPACT AFTER MITIGATION

- The impact after mitigation measures should not be more than it is at the present drawdown rate. The confidence level is not high.

RECREATION		SRCE	IMP
FURTHER WORK	Define a suitable operating rule for the dam taking into account the recreation and tourism activities as well as the downstream ecological requirements.	9	2
ADVANTAGES	Improved management potential for dams.	9	2

5.4.2 Land Use

(Grazing, Agronomy, Mining, Industrial, Tourism, Rural, Forestry, Conservation/Wilderness etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : AGRICULTURE	1, 2	1	2	2	3	2	1	2

DATA

- Parts of the pipelines may cross small areas of agricultural land.

IMPACT

- Some agricultural land will be lost if pipelines pass through it. Non-permanent crops can still be cultivated within the pipeline servitudes.

MITIGATION MEASURE

- The pipelines should be aligned so that they cross as small as possible areas of cultivated land. The area should be appropriately rehabilitated after construction.
- Appropriate compensation should be made to the land owners for the loss of crop and/or lands. This compensation should probably take the form of financial compensation.

IMPACT AFTER MITIGATION

- The impact after mitigation is small, as cultivation can continue as long as it is not permanent crops.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE : RURAL	1, 2	2	1	2	Not applicable			

DATA

- Parts of the pipelines and the reservoirs, elevated tanks and pump stations will be situated close to existing rural development.

IMPACT

- The construction sites will have to be acquired and some land loss will occur.
- During construction there will be an impact on the local residents of the rural areas. These impacts will be of a temporary nature and include noise and dust pollution and the safety of the local residents.
- A danger of physical injury exists for people and animals during construction, especially where housing is close to the construction activities.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : AGRICULTURE	1, 2	1	2	2	3	2	1	2

DATA

- Parts of the pipelines may cross small areas of agricultural land.

IMPACT

- Some agricultural land will be lost if pipelines pass through it. Non-permanent crops can still be cultivated within the pipeline servitudes.

MITIGATION MEASURE

- The pipelines should be aligned so that they cross as small as possible areas of cultivated land. The area should be appropriately rehabilitated after construction.
- Appropriate compensation should be made to the land owners for the loss of crop and/or lands. This compensation should probably take the form of financial compensation.

IMPACT AFTER MITIGATION

- The impact after mitigation is small, as cultivation can continue as long as it is not permanent crops.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE : RURAL	1, 2	2	1	2	Not applicable			

DATA

- Parts of the pipelines and the reservoirs, elevated tanks and pump stations will be situated close to existing rural development.

IMPACT

- The construction sites will have to be acquired and some land loss will occur.
- During construction there will be an impact on the local residents of the rural areas. These impacts will be of a temporary nature and include noise and dust pollution and the safety of the local residents.
- A danger of physical injury exists for people and animals during construction, especially where housing is close to the construction activities.

MITIGATION MEASURE

- Appropriate compensation should be made to the land owners for the loss of land. This compensation should probably take the form of financial compensation.
- The construction activities should be such as to minimize disturbances to the local communities.
- Proper supervision on the construction site, especially during excavations, is essential in safeguarding people and animals as the trenches may sometimes be as deep as 2,5m.
- If any blasting is needed, careful planning is essential, and even more so where work is done close to housing or grazing areas.

IMPACT AFTER MITIGATION

- The impacts should be small after mitigation but the confidence degree is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
C	TYPE : MINING AND INDUSTRIAL	1, 2	2	1	2	Not applicable			

DATA

- There are limited industrial activities within the Project Area.

IMPACT

- The proposed extension of Magalies Water will not influence the industrial activities in the Project Area.

LAND USE		SRCE	IMP
FURTHER WORK	- Work out suitable compensation measures with the affected parties for the land and/or agricultural loss. - Identify appropriate measures for minimizing impacts on the local communities.	3	2
ADVANTAGES	Not applicable	3	-

MITIGATION MEASURE

- Appropriate compensation should be made to the land owners for the loss of land. This compensation should probably take the form of financial compensation.
- The construction activities should be such as to minimize disturbances to the local communities.
- Proper supervision on the construction site, especially during excavations, is essential in safeguarding people and animals as the trenches may sometimes be as deep as 2,5m.
- If any blasting is needed, careful planning is essential, and even more so where work is done close to housing or grazing areas.

IMPACT AFTER MITIGATION

- The impacts should be small after mitigation but the confidence degree is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
C	TYPE : MINING AND INDUSTRIAL	1, 2	2	1	2	Not applicable			

DATA

- There are limited industrial activities within the Project Area.

IMPACT

- The proposed extension of Magalies Water will not influence the industrial activities in the Project Area.

LAND USE		SRCE	IMP
FURTHER WORK	- Work out suitable compensation measures with the affected parties for the land and/or agricultural loss. - Identify appropriate measures for minimizing impacts on the local communities.	3	2
ADVANTAGES	Not applicable	3	-

5.4.3 Cultural/Historical

(Archaeology, national monuments, historical areas, areas of special significance, etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : ALL	13	3	2	1	3, 13	2	1	1

DATA

- Archaeological research consisting of surveys and extensive excavations of Stone Age and Iron Age sites as well as of the recording of rock art sites has been conducted in the Magaliesberg Valley and in the Central Bankeveld during the past three decades. This region, which ecologically speaking, is situated between the Highveld in the south and the Bushveld in the north, has a rich archaeological heritage comprised of remains dating from both the prehistoric and the colonial periods of South Africa. These archaeological and historical remains include:
  - ※ Stone Age sites which may be associated with the San people and which date back thousands of years;
  - ※ Iron Age sites occupied by Bantu Groups during the past two millennia; and
  - ※ Remains dating from the previous century when the first Colonists settled in various places to the north and the west of the Magaliesberg.
- The Project Area is part of the spheres of influence of Iron Age and historical Batswana and Ndebele clans who occupied these areas for the last half a millenniam.
- In order to comply with legislation knowledge is required of the presence and of the significance of any archaeological or historical remains which may occur in these development areas and if such remains could be affected, damaged or destroyed by the proposed development activities.
- In order to comply with legislation knowledge is required of the presence and of the significance of any archaeological or historical remains which may occur in these development areas and if such remains could be affected, damaged or destroyed by the proposed development activities.

IMPACT

- From this study on the basis of the available data it cannot be stated whether or not the proposed development will have a negative impact on any cultural resources.

5.4.3 Cultural/Historical

(Archaeology, national monuments, historical areas, areas of special significance, etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : ALL	13	3	2	1	3, 13	2	1	1

DATA

- Archaeological research consisting of surveys and extensive excavations of Stone Age and Iron Age sites as well as of the recording of rock art sites has been conducted in the Magaliesberg Valley and in the Central Bankeveld during the past three decades. This region, which ecologically speaking, is situated between the Highveld in the south and the Bushveld in the north, has a rich archaeological heritage comprised of remains dating from both the prehistoric and the colonial periods of South Africa. These archaeological and historical remains include:
  - ※ Stone Age sites which may be associated with the San people and which date back thousands of years;
  - ※ Iron Age sites occupied by Bantu Groups during the past two millennia; and
  - ※ Remains dating from the previous century when the first Colonists settled in various places to the north and the west of the Magaliesberg.
- The Project Area is part of the spheres of influence of Iron Age and historical Batswana and Ndebele clans who occupied these areas for the last half a millenniam.
- In order to comply with legislation knowledge is required of the presence and of the significance of any archaeological or historical remains which may occur in these development areas and if such remains could be affected, damaged or destroyed by the proposed development activities.
- In order to comply with legislation knowledge is required of the presence and of the significance of any archaeological or historical remains which may occur in these development areas and if such remains could be affected, damaged or destroyed by the proposed development activities.

IMPACT

- From this study on the basis of the available data it cannot be stated whether or not the proposed development will have a negative impact on any cultural resources.

MITIGATION MEASURE

- Mitigation may be necessary and measures will be determined by archaeological and historical experts.

IMPACT AFTER MITIGATION

- If mitigation measures are satisfactory the impact after mitigation is low. The confidence level is not high.

CULTURAL/HISTORICAL		SRCE	IMP
FURTHER WORK	Before any construction activities can commence a Phase 1 archaeological survey of the proposed development areas should be commissioned in order to establish the nature, the extent and the significance of any archaeological or historical remains in these areas.	13	2
ADVANTAGES	Not applicable	3	-

5.4.4 Infrastructure

(Roads, Railways, Power lines, Telephone lines, pipelines, dams, canals, etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE: ROADS	3	2	2	2	3	2	1	2

DATA

- Some entrance roads may be temporarily closed as the trenches are dug and the pipeline installed.
- Where the proposed pipelines are within a road reserve there will be temporary disruptions to the road users.

IMPACT

- Access to secondary roads may be temporarily disrupted.
- Traffic will probably be inconvenienced during some stages in the construction of the

MITIGATION MEASURE

- Mitigation may be necessary and measures will be determined by archaeological and historical experts.

IMPACT AFTER MITIGATION

- If mitigation measures are satisfactory the impact after mitigation is low. The confidence level is not high.

CULTURAL/HISTORICAL		SRCE	IMP
FURTHER WORK	Before any construction activities can commence a Phase 1 archaeological survey of the proposed development areas should be commissioned in order to establish the nature, the extent and the significance of any archaeological or historical remains in these areas.	13	2
ADVANTAGES	Not applicable	3	-

5.4.4 Infrastructure

(Roads, Railways, Power lines, Telephone lines, pipelines, dams, canals, etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : ROADS	3	2	2	2	3	2	1	2

DATA

- Some entrance roads may be temporarily closed as the trenches are dug and the pipeline installed.
- Where the proposed pipelines are within a road reserve there will be temporary disruptions to the road users.

IMPACT

- Access to secondary roads may be temporarily disrupted.
- Traffic will probably be inconvenienced during some stages in the construction of the

pipelines if the road is blocked for whatever reason. This is a temporary impact.

- The construction activities may also result in the premature degradation of the existing road surface due to the increase in heavy vehicle traffic.
- Fences may be temporarily broken during construction and local residents should be aware of this in good time, in order to remove any live stock and children in those particular areas.
- It was assumed that the proposed pipelines will cross roads in certain instances. Temporary traffic deviations will be necessary and will cause traffic hazards. The road surface will have to be retarred as soon as possible after the pipes have been laid.

MITIGATION MEASURE

- Warning of the day on which the entrance roads will be blocked should be given to affected parties. Work should be expedited. Any broken fences should be replaced as soon as possible.
- No mitigation is possible for inconveniences caused to other road users.
- Degradation of the existing road should be avoided where possible, and mended where necessary.

IMPACT AFTER MITIGATION

- Inconveniences should be minimised.
- The road should be in an acceptable condition after construction.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE : POWER& TELEPHONE LINES	3	2	2	2	3	2	0	2

DATA

- Power, telephone and railway lines are within the proposed area of development and need to be considered during the final placing of the proposed developments.

IMPACT

- Disturbance of any existing infrastructure will have a temporary disruptive impact.

MITIGATION MEASURE

- Work at the construction sites should be expedited.

pipelines if the road is blocked for whatever reason. This is a temporary impact.

- The construction activities may also result in the premature degradation of the existing road surface due to the increase in heavy vehicle traffic.
- Fences may be temporarily broken during construction and local residents should be aware of this in good time, in order to remove any live stock and children in those particular areas.
- It was assumed that the proposed pipelines will cross roads in certain instances. Temporary traffic deviations will be necessary and will cause traffic hazards. The road surface will have to be retarred as soon as possible after the pipes have been laid.

MITIGATION MEASURE

- Warning of the day on which the entrance roads will be blocked should be given to affected parties. Work should be expedited. Any broken fences should be replaced as soon as possible.
- No mitigation is possible for inconveniences caused to other road users.
- Degradation of the existing road should be avoided where possible, and mended where necessary.

IMPACT AFTER MITIGATION

- Inconveniences should be minimised.
- The road should be in an acceptable condition after construction.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE: POWER& TELEPHONE LINES	3	2	2	2	3	2	0	2

DATA

- Power, telephone and railway lines are within the proposed area of development and need to be considered during the final placing of the proposed developments.

IMPACT

- Disturbance of any existing infrastructure will have a temporary disruptive impact.

MITIGATION MEASURE

- Work at the construction sites should be expedited.

IMPACT AFTER MITIGATION

- The appropriate mitigation measures should minimise the impact of disturbance during and after construction.

INFRASTRUCTURE		SRCE	IMP
FURTHER WORK	- Determine the exact route of the pipelines and location of other surface structures in relation to existing infrastructure	3	2
	- Specify suitable measures to inform the users of secondary roads timeously of the possibility of blocked access roads and broken fences.	3	3
ADVANTAGES	Not applicable	3	-

5.4.5 Population

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	POPULATION	2	2	2	1	3	1	1	2

DATA

- A comprehensive study on demographic and socio-economic conditions in the Master Plan Study Area was conducted during Phase 1 of the JICA Study. With regard to the three feasibility Project Areas, the Study concluded that there will be no future growth in population. It is foreseen that the natural growth of population in the areas will be offset by migration of an approximately equal number of people to urban areas.

IMPACT

- The construction activities will cause some disturbance and inconvenience to the people.
- Construction activities will cause a temporary influx of people which could lead to an artificial economic boom for the area. The influx of people could also lead to poaching and littering. These impacts could also include increased pressure on local resources for food and for accommodation and on community life. This impact is temporary and may not present a large impact.
- There will be some employment opportunities for local people.
- Apart from the visual impacts of construction work, there will also be a considerable level of noise, dust, vibrations and increased traffic. This could have an adverse effect

IMPACT AFTER MITIGATION

- The appropriate mitigation measures should minimise the impact of disturbance during and after construction.

INFRASTRUCTURE		SRCE	IMP
FURTHER WORK	- Determine the exact route of the pipelines and location of other surface structures in relation to existing infrastructure	3	2
	- Specify suitable measures to inform the users of secondary roads timeously of the possibility of blocked access roads and broken fences.	3	3
ADVANTAGES	Not applicable	3	-

5.4.5 Population

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	POPULATION	2	2	2	1	3	1	1	2

DATA

- A comprehensive study on demographic and socio-economic conditions in the Master Plan Study Area was conducted during Phase 1 of the JICA Study. With regard to the three feasibility Project Areas, the Study concluded that there will be no future growth in population. It is foreseen that the natural growth of population in the areas will be offset by migration of an approximately equal number of people to urban areas.

IMPACT

- The construction activities will cause some disturbance and inconvenience to the people.
- Construction activities will cause a temporary influx of people which could lead to an artificial economic boom for the area. The influx of people could also lead to poaching and littering. These impacts could also include increased pressure on local resources for food and for accommodation and on community life. This impact is temporary and may not present a large impact.
- There will be some employment opportunities for local people.
- Apart from the visual impacts of construction work, there will also be a considerable level of noise, dust, vibrations and increased traffic. This could have an adverse effect

on the inhabitants of the area close to the construction activities, as well as on the aesthetics of the area. These effects are temporary.

MITIGATION MEASURE

- The pipeline route should be aligned so as to minimise disturbances to the local population.
- Appropriate information and educational aspects regarding environmental issues should be conveyed to the workforce.
- Negotiations between the local population and the construction team should be appropriately and timeously organised.

IMPACT AFTER MITIGATION

- The social structure of the surrounding population is unlikely to be severely disrupted.

POPULATION		SRCE	IMP
FURTHER WORK	- The specific people along the pipeline routes and other surface structures that will be impacted must be identified. - The anticipated impact with reference to a temporary economic boost to the local people should be addressed.	3	2
ADVANTAGES	- The people in the Project Area will have a more assured supply of water.	3	3
	- Local people could get work during construction.	3	2

5.4.6 Interested and Affected Parties

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	INTERESTED AND AFFECTED PARTIES	2	1	2	1	3	1	1	1

DATA

- The current stakeholders in the North Mankwe area are the Rustenburg District Council, Magalies Water, Department of Water Affairs and Forestry and the local authorities. No formal local authorities are yet in place.

on the inhabitants of the area close to the construction activities, as well as on the aesthetics of the area. These effects are temporary.

MITIGATION MEASURE

- The pipeline route should be aligned so as to minimise disturbances to the local population.
- Appropriate information and educational aspects regarding environmental issues should be conveyed to the workforce.
- Negotiations between the local population and the construction team should be appropriately and timeously organised.

IMPACT AFTER MITIGATION

- The social structure of the surrounding population is unlikely to be severely disrupted.

POPULATION			SRCE	IMP
FURTHER WORK	-	The specific people along the pipeline routes and other surface structures that will be impacted must be identified.	3	2
	-	The anticipated impact with reference to a temporary economic boost to the local people should be addressed.		
ADVANTAGES	-	The people in the Project Area will have a more assured supply of water.	3	3
	-	Local people could get work during construction.	3	2

5.4.6 Interested and Affected Parties

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	INTERESTED AND AFFECTED PARTIES	2	1	2	1	3	1	1	1

DATA

- The current stakeholders in the North Mankwe area are the Rustenburg District Council, Magalies Water, Department of Water Affairs and Forestry and the local authorities. No formal local authorities are yet in place.

IMPACT

- The impacts of the project on the interested and affected parties are uncertain, however by not involving the necessary people the project could be detrimentally influenced.

MITIGATION MEASURE

- Identify and involve the interested and affected parties.

IMPACT AFTER MITIGATION

- The impact after mitigation should be negligible.

INTERESTED AND AFFECTED PARTIES		SRCE	IMP
FURTHER WORK	The interested and affected parties must be involved in the project in a public participation programme.	3	2
ADVANTAGES	More assured water supply to the Project Area.	3	-

Appendix : References

1. Consultburo and EVN, September 1996. 1:250 000 scale map on: Existing Infrastructure. Study on the expansion of the capacity of Magalies Water.

2. JICA Study Team, July 1997. The study on the expansion of capacity of Magalies Water in the Republic of South Africa (Phases 2 & 3). Interim Report.

3. MetsiQual cc, 1997. Environmental Scientist; Linda Rossouw

4. O'Keefe, J.H., 1985. The Conservation Status of South African Rivers. 1:250 000 Map, Ecosystems Programme.

5. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Appendix A. Background study: Part 1. Climate, topography and environment. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry.

6. EVN/Consultburo Joint Venture, March 1996. Study on the expansion of Magalies Water. Engineering Group Inventory Survey (Data collection phase). Appendix A. Climate, topography and environment.

7. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Appendix C. Background study: Part 3. Geology and hydrogeology. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry.

8. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Main Report. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry. 1:250 000 Topographical sheet 2528 Pretoria, 1984, third edition.

9. Consultburo, November 1994. KwaNdebele Water Augmentation Feasibility Study. The relevant environmental impact prognosis of the proposed Roodeplaat Dam option. Department of Water Affairs and Forestry, Directorate Project Planning.

10. Department of Water Affairs and Forestry, 1996. Summary of macro chemical constituents from the Hydrological Chemical Data Base.

11. Department of Water Affairs and Forestry, 1993. South African Water Quality Guidelines. Volume 1: Domestic Use.

12. Acocks, J.P.H. 1988. Veld Types of South Africa. Memoirs of the Botanical Survey of South Africa No 57. O.A. Leistner (ed), third edition. Botanical Research Institute, Department of Agriculture and Water Supply.

13. Pistorius, J.C.C.1997. Motivation for Phase I archaeological survey in Magalies Water?s intended development areas.

B.3 Minutes of Meeting

STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER ENVIRONMENTAL STUDY

MINUTES OF THE SECOND ECOLOGICAL TASK GROUP MEETING

MONDAY 20 OCTOBER 1997

AT 07:30 IN ROOM 344 RESIDENSIE BUILDING

185 SCHOEMAN STREET, PRETORIA

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1. WELCOME AND OPENING

The Chairman, Mr C Mannall, welcomed all the participants to the meeting.

2. ATTENDANCE AND APOLOGIES

Attendance

S Kadowaki	JICA Study Team, Team Leader
B Sawara	JICA Study Team
C Mannall	JICA Study Team
G V Munro	Department of Water Affairs and Forestry: Environmental Studies
S C Vogel	Department of Water Affairs and Forestry: Project Planning
J J de Vries	North West Parks Board
J de Vries	North West Parks Board
L Rossouw	MetsiQual cc

Apologies

S Davis	Department of Environment Affairs & Tourism: Mpumalanga
K R Legge	Department of Water Affairs and Forestry: Environmental Studies
D Swart	Department of Environment Affairs & Tourism: North West
R Strydom	Magalies Water

3. ACCEPTANCE OF MINUTES

The Minutes of the First Ecological Task Group Meeting were accepted.

4. ACCEPTANCE OF AGENDA

The Agenda was accepted. One additional issue was raised, that of the concerns of North West Park Board regarding development in Borakalalo National Park.

5. FEEDBACK ON STUDY ACTIVITIES

5.1 Technical component

Initially in Phase 1 of the JICA study a large area was investigated at a Master Plan level for water supply up to 2015. The villages in the Study Area were mostly unserved and relied on poor quality groundwater for potable water. Three areas were identified as priority areas to supply surface water to. They were North Mankwe, Moretele 2 and the Klipvoor Water Supply Areas. These priority areas were investigated in Phase 2, the feasibility phase, of the project. A pilot project was conducted in each of the priority areas during the current study.

Three alternative supply options were investigated for both Moretele 2 and Klipvoor Water Supply Areas. The options were briefly discussed. The most viable option for Klipvoor Water Supply Area is from a new Water Treatment Plant downstream of Klipvoor Dam. The best option for supplying water to the Moretele 2 Water Supply Area was from the Weltevreden Water Treatment Works at Mkombo Dam. Only one option was viable to supply water to the North Mankwe Water Supply Area, that of supplying water to the area from Vaalkop Water Treatment Works at Vaalkop Dam.

5.2 Environmental component

A ROIP 2 feasibility study was completed for Klipvoor FS Area. This project area was found to include an environmentally sensitive area, Borakalalo National Park, and more detailed studies were required to determine the expected impacts.

The Environmental Impact Assessment as described in the ROIP 1 Report was sufficient for the expected impacts in the Moretele 2 and North Mankwe FSAreas and no further work was done after the site investigations. More detailed project descriptions of these two areas were presented in short reports summarising the expected impacts from the proposed development.

Comments from North West Parks Board

- The Parks Board do not object to the construction of an intake pump station at the

existing weir downstream of Klipvoor Dam. However, they do object to any further development within the Park Boundaries. They appreciate the need to supply drinking water to the communities in the area, but propose that the water treatment works and regional reservoir be constructed outside the Park boundaries. Negotiations are ongoing.

Mr Vogel explained that Klipvoor Dam is a water resource that has been reserved for future use depending on economic development. It is expected that further abstractions will be made from Klipvoor Dam in future. A pump station in the Park in the short term will probably serve its purpose. It is expected that further water resource development will take place probably requiring infrastructure within the Park in future.

- There are land claims for areas of the Borakalalo National Park. This may have implications for the future development of the National Park as well as the proposed water project. The three communities involved are Bultfontein 2, Klipvoorstad and Jonathan. This issue is being investigated.

  It was pointed out that possibly the proposed water supply scheme could alleviate some of the problems with the communities by ensuring a more assured drinking water supply.

- Concern was expressed as to the draw down level of the dam during drought conditions. During droughts some of the exposed areas around the dam become muddy and can trap animals. There was an agreement between the Department of Water Affairs and Forestry and the former Bophuthatswana Government not to release water for irrigation if there is 10% water in the dam. The operating rule of the dam will have to be evaluated for the future water resource management of the system to ensure sufficient water is released for most of the time for primary use.

- Concern was also expressed regarding the danger posed by fences around the proposed infrastructure to the animals in the Park especially during game counting drives.

6. REVIEW OF ENVIRONMENTAL REPORTS

The three Project Area reports were distributed to the ETG Members for comment.

Comment was received from Mpumalanga Department of Environment Affairs & Tourism.

Their main comment was that an acceptable Environmental Management Plan for the Construction and Operational Phases should be produced, before any construction commences.

Ms Munro, DWAF: Environmental Studies, raised the following issues:

- It was stated that the impact of the abstraction for drinking water on the river downstream of the dam would be minimal. The motivation for this statement was absent.

  Motivation:
  The mean annual runoff in the catchment is 80,7 million m^3. The full supply volume of Klipvoor Dam is 43,8 million m^3. The irrigation demand from the dam is 62 million m^3per annum. The total drinking water demand can range from 1,3 to 3,4 million m^3per annum depending on the level of service supplied. This drinking water supply will be abstracted downstream of the dam and the percentage is relatively small compared to the irrigation demand.

- A commitment was required that the expected negative impacts should be mitigated and during both the detailed design stage and construction due cognisance of the need to minimise adverse impacts is required.

7. FURTHER ACTIONS

- A Project Steering Committee need to be formalised before the necessary funding becomes available. Once funding is available it is foreseen that the projects will progress rapidly.

  A meeting between all the stakeholders in the Borakalalo National Park will be organised by Ms Munroe as soon as possible. Stake holders involved include North West Parks Board, North West Province Department of Environment Affairs and Tourism, Department of Water Affairs and Forestry: Environmental Studies and Project Planning. These stakeholders will also be part of the Project Steering Committee. Issues to be addressed at this proposed meeting should include the land claims on the Park as well as future development in the Park. The issue of land claims should involve legal expertise.

- It was recommended by Mr Vogel that the environmental impact assessment reports be accepted as a basis to move forward.

- The following recommendations were made in the reports and need to be addressed before and during the detailed design phases of the project:

1. This investigation should include meetings with local communities to determine the preferences of the communities to any options or alternative developments, especially in the siting of the regional and service reservoirs.
2. The lack of sanitation facilities and the impact of increased water usage needs to be investigated.
3. Investigate the land claims issues at Borakalao National Park.
4. Liaise with all the interested and affected parties.
5. A Phase 1 archaeological survey of the proposed pipeline routes and especially the reservoir sites is recommended.
6. Compile an Environmental Management Plan for the construction phase and draw up appropriate rehabilitation guidelines to mitigate the disturbances and aesthetic impacts caused by construction of the pipelines and associated infrastructure.
7. Alert the contractor and labourers to the ecological and social impacts associated with construction activities.

8. CLOSURE

The meeting was closed at 9:00 and the Chairman thanked everyone for their attendance.

ANNEX C

FINANCIAL AND ECONOMIC

FEASIBILITY STUDY FOR NORTH MANKWE

ANNEX C : FINANCIAL AND ECONOMIC

Table C.1-1 Construction Costs and Disbursement Schedule for Case A and B

North Mankwe (Unit: ,000Rand)

Item	Total	1 1998	2 1999	3 2000	4 2001	5 2002
Case A	**45,443**	-	-	**6,364**	**38,628**	**31,633**
Bulk	*37,210*	-	-	*11,788*	*18,384*	*7,039*
- Intake and Pump Station	151	-	-	151	-	-
- Raw Water Pipeline	292	-	-	292	-	-
- WTW and Pump Station	1,574	-	-	787	787	-
- Bulk Supply Pipelines	33,891	-	-	10,167	16,946	6,778
- Regional Reservoirs	1,000	-	-	300	500	200
- Pump Stations	302	-	-	91	151	60
Retail	*8,233*	-	-	*1,647*	*4,940*	*1,647*
- Service Reservoir	1,285	-	-	257	771	257
- Reticulation Pipelines	6,746	-	-	1,349	4,048	1,349
- Standpipes	202	-	-	40	121	40
Yard Connection	-	-	-	-	-	-
Case B	**68,426**	-	-	**19,127**	**36,569**	**12,731**
Bulk	*42,007*	-	-	*13,843*	*20,718*	*7,447*
- Intake and Pump Station	280	-	-	280	-	-
- Raw Water Pipeline	292	-	-	292	-	-
- WTW and Pump Station	4,201	-	-	2,101	2,101	-
- Bulk Supply Pipelines	33,891	-	-	10,167	16,946	6,778
- Regional Reservoirs	2,784	-	-	835	1,392	557
- Pump Stations	559	-	-	168	280	112
Retail	*17,504*	-	-	*3,501*	*10,502*	*3,501*
- Service Reservoir	4,495	-	-	899	2,697	899
- Reticulation Pipelines	12,867	-	-	2,573	7,720	2,573
- Standpipes	142	-	-	28	85	28
Yard Connection	*8,915*	-	-	*1,783*	*5,349*	*1,783*
Case B-A	**22,983**	-	-	**5,692**	**13,246**	**4,045**
Bulk	*4,797*	-	-	*2,055*	*2,334*	*408*
- Intake and Pump Station	129	-	-	129	-	-
- Raw Water Pipeline	-	-	-	-	-	-
- WTW and Pump Station	2,627	-	-	1,314	1,314	-
- Bulk Supply Pipelines	-	-	-	-	-	-
- Regional Reservoirs	1,784	-	-	535	892	357
- Pump Stations	257	-	-	77	129	51
Retail	*9,271*	-	-	*1,854*	*5,563*	*1,854*
- Service Reservoir	3,210	-	-	642	1,926	642
- Reticulation Pipelines	6,121	-	-	1,224	3,673	1,224
- Standpipes	(60)	-	-	(12)	(36)	(12)
Yard Connection	*8,915*	-	-	*1,783*	*5,349*	*1,783*

Table C.1-2 : Disbursement and Project Cost for Case A and B : North Mankwe

(Unit: ,000Rand)

	Item			Total	1 1998	2 1999	3 2000	4 2001	5 2002
Case A	Total			***110,972***	***328***	***2,676***	***29,902***	***54,099***	***23,967***
	Bulk	(1)Direct Construction Cost		37,210	-	-	11,788	18,384	7,039
		(2)P&G	(1)x 15%	5,582	-	-	1,768	2,758	1,056
		(3)Base Cost	(1)+(2)	42,792	-	-	13,556	21,141	8,094
		(4)Engineering Fee	(3)x 10%	4,279	-	1,070	1,070	1,070	1,070
		(5)Miscellaneous	(1)x 2%	744	-	372	372	-	-
		(6)Institutional Support	(3)x 2.5%	1,070	214	214	214	214	214
		(7)Sub-Total	(3)+(4)+(5)+(6)	48,885	214	1,656	15,212	22,425	9,378
		(8)Physical Contingency	(3)x 15%	6,419	-	-	2,033	3,171	1,214
		(9)Price Escalation(10%/a)	(7)+(8)x	24,423	21	348	5,708	11,879	6,467
		(10)Sub-Total	(8)+(9)	30,842	21	348	7,742	15,050	7,681
		Total	(7)+(10)	79,726	235	2,004	22,954	37,475	17,059
		VAT	14%	11,162	33	281	3,213	5,246	2,388
		Grand Total		**90,888**	**268**	**2,284**	**26,167**	**42,721**	**19,447**
	Retail	(1)Direct Construction Cost		8,233	-	-	1,647	4,940	1,647
		(2)P&G	(1)x 15%	1,235	-	-	247	741	247
		(3)Base Cost	(1)+(2)	9,468	-	-	1,894	5,681	1,894
		(4)Engineering Fee	(3)x 10%	947	-	237	237	237	237
		(5)Miscellaneous		-	-	-	-	-	-
		(6)Institutional Development	(3)x 2.5%	237	47	47	47	47	47
		(7)Sub-Total	(3)+(4)+(5)+(6)	10,651	47	284	2,178	5,965	2,178
		(8)Physical Contingency	(3)x 15%	1,420	-	-	284	852	284
		(9)Price Escalation(10%/a)	(7)+(8)x	5,546	5	60	815	3,164	1,503
		(10)Sub-Total	(8)+(9)	6,966	5	60	1,099	4,016	1,787
		Total	(7)+(10)	17,617	52	344	3,276	9,981	3,965
		VAT	14%	2,466	7	48	459	1,397	555
		Grand Total		**20,084**	**59**	**392**	**3,735**	**11,378**	**4,520**
Case B	Total			***159,994***	***429***	***3,412***	***41,261***	***81,268***	***33,625***
	Bulk	(1)Direct Construction Cost		42,007	-	-	13,843	20,718	7,447
		(2)P&G	(1)x 15%	6,301	-	-	2,076	3,108	1,117
		(3)Base Cost	(1)+(2)	48,308	-	-	15,919	23,825	8,564
		(4)Engineering Fee	(3)x 10%	4,831	-	1,208	1,208	1,208	1,208
		(5)Miscellaneous	(1)x 2%	840	-	420	420	-	-
		(6)Institutional Support	(3)x 2.5%	1,208	242	242	242	242	242
		(7)Sub-Total	(3)+(4)+(5)+(6)	55,187	242	1,869	17,788	25,274	10,013
		(8)Physical Contingency	(3)x 15%	7,246	-	-	2,388	3,574	1,285
		(9)Price Escalation(10%/a)	(7)+(8)x	27,381	24	393	6,678	13,388	6,897
		(10)Sub-Total	(8)+(9)	34,627	24	393	9,066	16,962	8,182
		Total	(7)+(10)	89,814	266	2,262	26,855	42,237	18,195
		VAT	14%	12,574	37	317	3,760	5,913	2,547
		Grand Total		**102,388**	**303**	**2,579**	**30,614**	**48,150**	**20,742**
	Retail	(1)Direct Construction Cost		17,504	-	-	3,501	10,502	3,501
		(2)P&G	(1)x 15%	2,626	-	-	525	1,575	525
		(3)Base Cost	(1)+(2)	20,130	-	-	4,026	12,078	4,026
		(4)Engineering Fee	(3)x 10%	2,013	-	503	503	503	503
		(5)Miscellaneous		-	-	-	-	-	-
		(6)Institutional Development	(3)x 2.5%	503	101	101	101	101	101
		(7)Sub-Total	(3)+(4)+(5)+(6)	22,646	101	604	4,630	12,682	4,630
		(8)Physical Contingency	(3)x 15%	3,019	-	-	604	1,812	604
		(9)Price Escalation(10%/a)	(7)+(8)x	11,791	10	127	1,732	6,726	3,195
		(10)Sub-Total	(8)+(9)	14,810	10	127	2,336	8,538	3,799
		Total	(7)+(10)	37,456	111	731	6,966	21,220	8,429
		VAT	14%	5,244	15	102	975	2,971	1,180
		Grand Total		**42,700**	**126**	**833**	**7,941**	**24,190**	**9,609**
	Yard Connection	(1)Direct Construction Cost		8,915	-	-	1,783	5,349	1,783
		(2)Price Escalation(10%/a)	(1)x	4,161	-	-	590	2,482	1,089
		Total	(1)+(2)	13,076	-	-	2,373	7,831	2,872
		VAT	14%	1,831	-	-	332	1,096	402
		Grand Total		**14,907**	-	-	**2,705**	**8,928**	**3,274**
Case B-A	Bulk			11,499	35	294	4,447	5,428	1,295
	Retail			22,616	67	441	4,206	12,812	5,089
	Yard Connection			14,907	-	-	2,705	8,928	3,274
	Total			49,022	101	736	11,359	27,169	9,658

Table C.1-3 : Annual Operation and Maintenance Cost for Case A and B : North Mankwe

(Case A) Annual Water Production : 661,271 kl (Unit '000Rand)

	Bulk Water Supply						Retail Supply	Total
Item	Raw Water	Electricity	Chemicals	Salaries	Maintenance		Administration	
Unit Cost	0.24 R/kl	0.15 R/kl	0.03 R/kl	0.17 R/kl	0.05 R/kl	Sub-Total	243,000 R/year	
Escalation	0%	3%	0%	0%	0%		0%	
Year								
5	158.71	114.99	19.84	112.42	33.06	439.01	243.00	682.01
6	**158.71**	**118.44**	**19.84**	**112.42**	**33.06**	**442.46**	**243.00**	**685.46**
7	158.71	121.99	19.84	112.42	33.06	446.01	243.00	689.01
8	158.71	125.65	19.84	112.42	33.06	449.67	243.00	692.67
9	158.71	129.42	19.84	112.42	33.06	453.44	243.00	696.44
10	158.71	133.30	19.84	112.42	33.06	457.33	243.00	700.33
11	158.71	137.30	19.84	112.42	33.06	461.33	243.00	704.33
12	158.71	141.42	19.84	112.42	33.06	465.44	243.00	708.44
13	158.71	145.66	19.84	112.42	33.06	469.69	243.00	712.69
14	158.71	150.03	19.84	112.42	33.06	474.06	243.00	717.06
15	158.71	154.54	19.84	112.42	33.06	478.56	243.00	721.56
16	158.71	159.17	19.84	112.42	33.06	483.19	243.00	726.19
17	158.71	163.95	19.84	112.42	33.06	487.97	243.00	730.97
18	158.71	168.87	19.84	112.42	33.06	492.89	243.00	735.89
19	158.71	173.93	19.84	112.42	33.06	497.95	243.00	740.95
20	158.71	179.15	19.84	112.42	33.06	503.17	243.00	746.17
21	158.71	184.52	19.84	112.42	33.06	508.55	243.00	751.55
22	158.71	190.06	19.84	112.42	33.06	514.08	243.00	757.08
23	158.71	195.76	19.84	112.42	33.06	519.78	243.00	762.78
24	158.71	201.63	19.84	112.42	33.06	525.66	243.00	768.66
25	158.71	207.68	19.84	112.42	33.06	531.71	243.00	774.71
26	158.71	213.91	19.84	112.42	33.06	537.94	243.00	780.94
27	158.71	220.33	19.84	112.42	33.06	544.35	243.00	787.35
28	158.71	226.94	19.84	112.42	33.06	550.96	243.00	793.96
29	158.71	233.75	19.84	112.42	33.06	557.77	243.00	800.77
30	158.71	240.76	19.84	112.42	33.06	564.78	243.00	807.78

(Case B) Annual Water Production : 1,763,388 kl (Unit '000Rand)

	Bulk Water Supply						Retail Supply	Total
Item	Raw Water	Electricity	Chemicals	Salaries	Maintenance		Administration	
Unit Cost	0.24 R/kl	0.15 R/kl	0.03 R/kl	0.17 R/kl	0.05 R/kl	Sub-Total	513,000 R/year	
Escalation	0%	3%	0%	0%	0%		0%	
Year								
5	423.21	306.64	52.90	299.78	88.17	1,170.70	513.00	1,683.70
6	**423.21**	**315.84**	**52.90**	**299.78**	**88.17**	**1,179.90**	**513.00**	**1,692.90**
7	423.21	325.31	52.90	299.78	88.17	1,189.37	513.00	1,702.37
8	423.21	335.07	52.90	299.78	88.17	1,199.13	513.00	1,712.13
9	423.21	345.12	52.90	299.78	88.17	1,209.18	513.00	1,722.18
10	423.21	355.48	52.90	299.78	88.17	1,219.54	513.00	1,732.54
11	423.21	366.14	52.90	299.78	88.17	1,230.20	513.00	1,743.20
12	423.21	377.13	52.90	299.78	88.17	1,241.19	513.00	1,754.19
13	423.21	388.44	52.90	299.78	88.17	1,252.50	513.00	1,765.50
14	423.21	400.09	52.90	299.78	88.17	1,264.15	513.00	1,777.15
15	423.21	412.10	52.90	299.78	88.17	1,276.16	513.00	1,789.16
16	423.21	424.46	52.90	299.78	88.17	1,288.52	513.00	1,801.52
17	423.21	437.19	52.90	299.78	88.17	1,301.25	513.00	1,814.25
18	423.21	450.31	52.90	299.78	88.17	1,314.37	513.00	1,827.37
19	423.21	463.82	52.90	299.78	88.17	1,327.88	513.00	1,840.88
20	423.21	477.73	52.90	299.78	88.17	1,341.79	513.00	1,854.79
21	423.21	492.06	52.90	299.78	88.17	1,356.12	513.00	1,869.12
22	423.21	506.83	52.90	299.78	88.17	1,370.89	513.00	1,883.89
23	423.21	522.03	52.90	299.78	88.17	1,386.09	513.00	1,899.09
24	423.21	537.69	52.90	299.78	88.17	1,401.75	513.00	1,914.75
25	423.21	553.82	52.90	299.78	88.17	1,417.88	513.00	1,930.88
26	423.21	570.44	52.90	299.78	88.17	1,434.50	513.00	1,947.50
27	423.21	587.55	52.90	299.78	88.17	1,451.61	513.00	1,964.61
28	423.21	605.18	52.90	299.78	88.17	1,469.24	513.00	1,982.24
29	423.21	623.33	52.90	299.78	88.17	1,487.39	513.00	2,000.39
30	423.21	642.03	52.90	299.78	88.17	1,506.09	513.00	2,019.09

Table C.1-4: Different Local Structure Models (Retail Supply)

	Service Level A	
	Structure Model 1	**Structure Model 2**
Size	Small Community: e.g. 350 Households 2100 People	Medium: e.g. 800 Households 4800 People
Mngt.	Water Committee: - Chair person - Vice Chair - Secretary - Treasurer	Water Committee: - Chair person - Vice Chair - Secretary - Vice Secretary - Treasurer
Staff	Water Bailiff (x 2) • Part-time employee/s. • Functions may be combined.	Bookkeeper / Administrator Water Bailiff (x 2) • Part-time employee/s.
	Service Level B	
	Structure Model 3	**Structure Model 4**
Size	Small Community: e.g. 350 Households 2100 People	Medium: e.g. 800 Households 4800 People
Mngt.	Water Committee: - Chair person - Vice Chair - Secretary - Treasurer	Water Committee: - Chair person - Vice Chair - Secretary - Vice Secretary - Treasurer
Staff	Pipe / Meter Maintenance (x1) Meter Readers / Collection Officers (x 2) • Some permanent positions. Functions may be combined.	Bookkeeper / Administrator (x1) Pipe / Meter Maintenance (x2) Meter Readers / Collect. Officers (x 2) Some permanent positions.

Table C.1-5: Costing of Alternative Structure Models / Options

Stipend / Employment Cost per Position		
Role / Position	Cost (R)	
	Monthly	Annually
Water Committee:		
Chairperson	75	900
Vice Chairperson	75	900
Secretary	75	900
Vice Secretary	75	900
Treasurer	75	900
Bookkeeper / Cashier (Part-time)	500	6000
Bookkeeper / Cashier (Full-time)	2000	24000
Maintenance Worker (Part-time)	450	5400
Collections / Water Bailiff (Part-time)	200	2400

Application of Costs per Position to Structure Models		
Organisational Model	Cost (R)	
	Monthly	Annually
Model 1: Service Level A Small Community	700	8,400
Model 2: Service Level A Medium Community	1,275	15,300
Model 3: Service Level B Small Community	1,150	13,800
Model 4: Service Level B Medium Community	3,675	44,100

Table C.1-6 Administration Cost For Retail Supply : North Mankwe

Settlement/ Community	Calculated Population	Service Level A Cost (R)		Service Level B Cost (R)	
		Monthly	Annual	Monthly	Annual
1 Matiametiong	512	700	8,400	1,150	13,800
2 Mokgalwaneng	6,720	1,275	15,300	3,675	44,100
3 Modimong	1,664	700	8,400	1,150	13,800
Sub-Total of Mokgalwaneng	***8,896***	***2,675***	***32,100***	***5,975***	***71,700***
4 Mmopayane	4,480	1,275	15,300	3,675	44,100
5 Elandsfontein	2,342	700	8,400	1,150	13,800
6 Mmantserre	2,560	700	8,400	1,150	13,800
7 Mononono	9,600	1,275	15,300	3,675	44,100
Sub-Total of Sefikile	***18,982***	***3,950***	***47,400***	***9,650***	***115,800***
8 Bojating	2,240	700	8,400	1,150	13,800
9 Ramokokstad	8,122	1,275	15,300	3,675	44,100
10 Mmorogong	1,408	700	8,400	1,150	13,800
11 Leboaneng	1,376	700	8,400	1,150	13,800
Sub-Total of Ramakokstad	***13,146***	***3,375***	***40,500***	***7,125***	***85,500***
12 Mapapuite	1,382	700	8,400	1,150	13,800
13 Mogoditshane	1,318	700	8,400	1,150	13,800
14 Marapalallo	960	700	8,400	1,150	13,800
15 Mantsho	992	700	8,400	1,150	13,800
16 Makgope	870	700	8,400	1,150	13,800
17 Molorwe	1,651	700	8,400	1,150	13,800
18 Motlhabe	3,942	1,275	15,300	3,675	44,100
19 Ntsanalemetsin	909	700	8,400	1,150	13,800
20 Ngweding	870	700	8,400	1,150	13,800
21 Magalane	442	700	8,400	1,150	13,800
22 Magaong	4,781	1,275	15,300	3,675	44,100
23 Kameelboom	1,139	700	8,400	1,150	13,800
24 Ramosibitswana	109	700	8,400	1,150	13,800
Sub-Total of Klipvoor East	***19,365***	***10,250***	***123,000***	***20,000***	***240,000***
TOTAL	**60,389**	**20,250**	**243,000**	**42,750**	**513,000**

Table C.1-7 : Preliminary Tariff Setting for Case A and B North Mankwe

Bulk Water Tariff

	Annual Production	O&M Cost	Reserve for Replacement	Loan Repayment	Total	Bulk Tariff (Unit Cost)	
	(KL)	('000R)	('000R)	('000R)	('000R)	(R/KL)	
	(1)	(2)	(3)	(4)	(5)= (2)+(3)+(4)	(6)=(5)/(1)	
Case A	661,271	442.46	47.30	0	489.76	0.74	(0.90)*
Case B	1,763,388	1179.9	117.60	995.93	2293.43	1.30	

Retail Water Tariff

	Annual Water Sales	Bulk Water Purchase	O&M Cost	Loan Repayment	Total	Retail Tariff (Unit Cost)
	(KL)	('000R)	('000R)	('000R)	('000R)	(R/KL)
	(7)	(8)=(1)x(6)	(9)	(10)	(11)= (8)+(9)+(10	(12)=(11)/(12)
Case A	562,080	595.1439	243.00	0	838.1439	1.49
Case B	1,498,880	2293.43	513.00	3061.29	5867.72	3.91

	Consumption		Monthly Tariff		Share of Income	
	Average	Low-Income	Average	Low-Income	Average	Low-Income
	(kl/m/hh)	(kl/m/hh)	(R/m/hh)	(R/m/hh)	1,446R/m	337R/m
	(13)	(14)	15)=(12)x(13	16)=(12)x(14	(15)/1,216	(16)/305
Case A	4.80	4.80	7.16	7.16	0.6%	2.3%
Case B	13.06	4.80	51.11	18.79	4.2%	6.2%

Reserve for Replacement : Replacement Cost for Pumps, Interest Rate (Deposit)5%, 15years
Loan Repayment : Interest rate 8%, 20years equal repayment

* Apply Current Tariff of Vaalkop WTW 0.90R/kl as Bulk Water Tariff

Table C.1-8 : Disbursement Schedule and Project Cost for Case C : North Mankwe

(Unit: ,000Rand)

Item		Stage / Year	STAGE 1 (Service Level A) 1	2	3	4	5	Sub-Total	STAGE 2 (Upgrade) 6	7	8	9	10	Sub-Total	Total
			1998	1999	2000	2001	2002		2003	2004	2005	2006	2007		
Case C Total			***328***	***2,676***	***29,902***	***54,099***	***23,967***	***110,972***	***163***	***1,185***	***18,293***	***43,755***	***15,554***	***78,951***	***189,923***
Bulk	(1)Direct Construction Cost		-	-	11,788	18,384	7,039	37,210	-	-	2,055	2,334	408	4,797	42,007
	(2)P&G	(1)x 15%	-	-	1,768	2,758	1,056	5,582	-	-	308	350	61	720	6,301
	(3)Base Cost	(1)+(2)	-	-	13,556	21,141	8,094	42,792	-	-	2,363	2,684	469	5,517	48,308
	(4)Engineering Fee	(3)x 10%	-	1,070	1,070	1,070	1,070	4,279	-	138	138	138	138	552	4,831
	(5)Miscellaneous	(1)x 2%	-	372	372	-	-	744	-	48	48	-	-	96	840
	(6)Institutional Support	(3)x 2.5%	214	214	214	214	214	1,070	28	28	28	28	28	138	1,208
	(7)Sub-Total	(3)+(4)+(5)+(6)	214	1,656	15,212	22,425	9,378	48,885	28	213	2,576	2,850	635	6,302	55,187
	(8)Physical Contingency	(3)x 15%	-	-	2,033	3,171	1,214	6,419	-	-	354	403	70	827	7,246
	(9)Price Escalation(10%/a)	(7)+(8)x	21	348	5,708	11,879	6,467	24,423	21	203	3,352	4,416	1,124	9,116	33,539
	(10)Sub-Total	(8)+(9)	21	348	7,742	15,050	7,681	30,842	21	203	3,706	4,819	1,195	9,944	40,785
	Total	(7)+(10)	235	2,004	22,954	37,475	17,059	79,726	49	416	6,283	7,669	1,829	16,246	95,972
	VAT	14%	33	281	3,213	5,246	2,388	11,162	7	58	880	1,074	256	2,274	13,436
	Grand Total		**268**	**2,284**	**26,167**	**42,721**	**19,447**	**90,888**	**56**	**474**	**7,162**	**8,742**	**2,086**	**18,520**	**109,408**
Retail	(1)Direct Construction Cost		-	-	1,647	4,940	1,647	8,233	-	-	1,854	5,563	1,854	9,271	17,504
	(2)P&G	(1)x 15%	-	-	247	741	247	1,235	-	-	278	834	278	1,391	2,626
	(3)Base Cost	(1)+(2)	-	-	1,894	5,681	1,894	9,468	-	-	2,132	6,397	2,132	10,662	20,130
	(4)Engineering Fee	(3)x 10%	-	237	237	237	237	947	-	267	267	267	267	1,066	2,013
	(5)Miscellaneous		-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)Institutional Development	(3)x 2.5%	47	47	47	47	47	237	53	53	53	53	53	267	503
	(7)Sub-Total	(3)+(4)+(5)+(6)	47	284	2,178	5,965	2,178	10,651	53	320	2,452	6,717	2,452	11,994	22,646
	(8)Physical Contingency	(3)x 15%	-	-	284	852	284	1,420	-	-	320	960	320	1,599	3,019
	(9)Price Escalation(10%/a)	(7)+(8)x	5	60	815	3,164	1,503	5,546	41	303	3,170	10,424	4,418	18,357	23,902
	(10)Sub-Total	(8)+(9)	5	60	1,099	4,016	1,787	6,966	41	303	3,490	11,384	4,738	19,956	26,922
	Total	(7)+(10)	52	344	3,276	9,981	3,965	17,617	94	623	5,942	18,101	7,190	31,950	49,568
	VAT	14%	7	48	459	1,397	555	2,466	13	87	832	2,534	1,007	4,473	6,939
	Grand Total		**59**	**392**	**3,735**	**11,378**	**4,520**	**20,084**	**108**	**711**	**6,774**	**20,635**	**8,197**	**36,423**	**56,507**
Yard	(1)Direct Construction Cost		-	-	-	-	-	-	-	-	1,783	5,349	1,783	8,915	8,915
Connection	(2)Price Escalation(10%/a)	(1)x	-	-	-	-	-	-	-	-	2,039	7,264	2,842	12,144	12,144
	Total	(1)+(2)	-	-	-	-	-	-	-	-	3,822	12,613	4,625	21,059	21,059
	VAT	14%	-	-	-	-	-	-	-	-	535	1,766	647	2,948	2,948
	Grand Total		-	-	-	-	-	-	-	-	**4,357**	**14,378**	**5,272**	**24,008**	**24,008**

Table C.1-9 : Project Cost and Allocation for Case C : North Mankwe

(Unit: ,000Rand)

Item		Project cost		Stage 1 (RDP Grant)		Stage 2 (Loan/Own Fund)	
Total		**189,923**	**100.0%**	**110,972**	**100.0%**	**78,951**	**100.0%**
Bulk Supply	(1)Direct Construction Cost	42,007	(43.8%)	37,210	(46.7%)	4,797	(29.5%)
	(2)P&G	6,301	(6.6%)	5,582	(7.0%)	720	(4.4%)
	(3)Base Cost	48,308	(50.3%)	42,792	(53.7%)	5,517	(34.0%)
	(4)Engineering Fee	4,831	(5.0%)	4,279	(5.4%)	552	(3.4%)
	(5)Miscellaneous	840	(0.9%)	744	(0.9%)	96	(0.6%)
	(6)Institutional Support	1,208	(1.3%)	1,070	(1.3%)	138	(0.8%)
	(7)Sub-Total	55,187	(57.5%)	48,885	(61.3%)	6,302	(38.8%)
	(8)Physical Contingency	7,246	(7.6%)	6,419	(8.1%)	827	(5.1%)
	(9)Price Escalation(10%/a)	33,539	(34.9%)	24,423	(30.6%)	9,116	(56.1%)
	(10)Sub-Total	40,785	(42.5%)	30,842	(38.7%)	9,944	(61.2%)
	Total	95,972	(100.0%)	79,726	(100.0%)	16,246	(100.0%)
	VAT	13,436		11,162		2,274	
	Grand Total	**109,408**	***57.6%***	***90,888***	***81.9%***	**18,520**	***23.5%***
Retail Supply	(1)Direct Cost	17,504	(35.3%)	8,233	(46.7%)	9,271	(29.0%)
	(2)P&G	2,626	(5.3%)	1,235	(7.0%)	1,391	(4.4%)
	(3)Base Cost	20,130	(40.6%)	9,468	(53.7%)	10,662	(33.4%)
	(4)Engineering Fee	2,013	(4.1%)	947	(5.4%)	1,066	(3.3%)
	(5)Miscellaneous	-	(0.0%)	-	(0.0%)	-	(0.0%)
	(6)Institutional Development	503	(1.0%)	237	(1.3%)	267	(0.8%)
	(7)Sub-Total	22,646	(45.7%)	10,651	(60.5%)	11,994	(37.5%)
	(8)Physical Contingency	3,019	(6.1%)	1,420	(8.1%)	1,599	(5.0%)
	(9)Price Escalation(10%/a)	23,902	(48.2%)	5,546	(31.5%)	18,357	(57.5%)
	(10)Sub-Total	26,922	(54.3%)	6,966	(39.5%)	19,956	(62.5%)
	Total	49,568	(100.0%)	17,617	(100.0%)	31,950	(100.0%)
	VAT	6,939		2,466		4,473	
	Grand Total	**56,507**	***29.8%***	***20,084***	***18.1%***	**36,423**	***46.1%***
Yard Connection	(1)Direct Cost	8,915	(42.3%)	-		8,915	(42.3%)
	(2)Price Escalation(10%/a)	12,144	(57.7%)	-		12,144	(57.7%)
	Total	21,059	(100.0%)	-		21,059	(100.0%)
	VAT	2,948		-		2,948	
	Grand Total	**24,008**	***12.6%***	-	***0.0%***	**24,008**	***30.4%***

	Project cost		Stage 1 (RDP Grant)		Stage 2 (Loan/Own Fund)	
Bulk Supply	109,408	100.0%	90,888	83.1%	18,520	16.9%
Retail Supply	56,507	100.0%	20,084	35.5%	36,423	64.5%
Yard Connection	24,008	100.0%	-	0.0%	24,008	100.0%
Total	189,923	100.0%	110,972	58.4%	78,951	41.6%

Table C.1-10 : Project Costs for Case A and B at 1997 Price : North Mankwe

(Unit: ,000Rand)

Item				Year total	1 1998	2 1999	3 2000	4 2001	5 2002
Case A Total				***76,807***	***298***	***2,211***	***22,466***	***36,951***	***14,882***
Bulk	(1)Direct Construction Cost			37,210	-	-	11,788	18,384	7,039
	(2)P&G	(1)x	15%	5,582	-	-	1,768	2,758	1,056
	(3)Base Cost	(1)+(2)		42,792	-	-	13,556	21,141	8,094
	(4)Engineering Fee	(3)x	10%	4,279	-	1,070	1,070	1,070	1,070
	(5)Miscelluneous	(1)x	2%	744	-	372	372	-	-
	(6)Institutional Support	(3)x	2.5%	1,070	214	214	214	214	214
	(7)Sub-Total	(3)+(4)+(5)+(6)		48,885	214	1,656	15,212	22,425	9,378
	(8)Physical Contingency	(3)x	15%	6,419	-	-	2,033	3,171	1,214
	Total	(7)+(8)		55,303	214	1,656	17,245	25,596	10,592
	VAT		14%	7,742	30	232	2,414	3,583	1,483
	Grand Total			**63,046**	**244**	**1,888**	**19,660**	**29,179**	**12,075**
Retail	(1)Direct Construction Cost			8,233	-	-	1,647	4,940	1,647
	(2)P&G	(1)x	15%	1,235	-	-	247	741	247
	(3)Base Cost	(1)+(2)		9,468	-	-	1,894	5,681	1,894
	(4)Engineering Fee	(3)x	10%	947	-	237	237	237	237
	(5)Miscelluneous			-	-	-	-	-	-
	(6)Institutional Development	(3)x	2.5%	237	47	47	47	47	47
	(7)Sub-Total	(3)+(4)+(5)+(6)		10,651	47	284	2,178	5,965	2,178
	(8)Physical Contingency	(3)x	15%	1,420	-	-	284	852	284
	Total	(7)+(8)		12,072	47	284	2,462	6,817	2,462
	VAT		14%	1,690	7	40	345	954	345
	Grand Total			**13,762**	**54**	**324**	**2,806**	**7,771**	**2,806**
Case B Total				***110,595***	***390***	***2,819***	***31,000***	***55,507***	***20,878***
Bulk	(1)Direct Construction Cost			42,007	-	-	13,843	20,718	7,447
	(2)P&G	(1)x	15%	6,301	-	-	2,076	3,108	1,117
	(3)Base Cost	(1)+(2)		48,308	-	-	15,919	23,825	8,564
	(4)Engineering Fee	(3)x	10%	4,831	-	1,208	1,208	1,208	1,208
	(5)Miscelluneous	(1)x	2%	840	-	420	420	-	-
	(6)Institutional Support	(3)x	2.5%	1,208	242	242	242	242	242
	(7)Sub-Total	(3)+(4)+(5)+(6)		55,187	242	1,869	17,788	25,274	10,013
	(8)Physical Contingency	(3)x	15%	7,246	-	-	2,388	3,574	1,285
	Total	(7)+(8)		62,433	242	1,869	20,176	28,848	11,298
	VAT		14%	8,741	34	262	2,825	4,039	1,582
	Grand Total			**71,174**	**275**	**2,131**	**23,001**	**32,887**	**12,879**
Retail	(1)Direct Construction Cost			17,504	-	-	3,501	10,502	3,501
	(2)P&G	(1)x	15%	2,626	-	-	525	1,575	525
	(3)Base Cost	(1)+(2)		20,130	-	-	4,026	12,078	4,026
	(4)Engineering Fee	(3)x	10%	2,013	-	503	503	503	503
	(5)Miscelluneous			-	-	-	-	-	-
	(6)Institutional Development	(3)x	2.5%	503	101	101	101	101	101
	(7)Sub-Total	(3)+(4)+(5)+(6)		22,646	101	604	4,630	12,682	4,630
	(8)Physical Contingency	(3)x	15%	3,019	-	-	604	1,812	604
	Total	(7)+(8)		25,665	101	604	5,234	14,493	5,234
	VAT		14%	3,593	14	85	733	2,029	733
	Grand Total			**29,258**	**115**	**688**	**5,966**	**16,522**	**5,966**
Yard Connection	(1)Direct Construction Cost			8,915	-	-	1,783	5,349	1,783
	VAT		14%	1,248	-	-	250	749	250
	Grand Total			**10,163**	-	-	**2,033**	**6,098**	**2,033**

Case C (Cost for Up-Grading)	Year total	6 2003	7 2004	8 2005	9 2006	10 2007
Bulk	8,128	31	243	3,341	3,708	804
Retail	15,497	61	365	3,160	8,751	3,160
Yard Connection	10,163	-	-	2,033	6,098	2,033
Total	33,787	92	608	8,534	18,556	5,997

Table C.1-11 : Project Cost and Allocation for Case C at 1997 Price : North Mankwe

(Unit: ,000Rand)

Item		Project cost		Stage 1 (RDP Grant)		Stage 2 (Loan/Own Fund)	
Total		110,595	100.0%	76,807	100.0%	33,787	100.0%
Bulk Supply	(1)Direct Construction Cost	42,007	(67.3%)	37,210	(67.3%)	4,797	(67.3%)
	(2)P&G	6,301	(10.1%)	5,582	(10.1%)	720	(10.1%)
	(3)Base Cost	48,308	(77.4%)	42,792	(77.4%)	5,517	(77.4%)
	(4)Engineering Fee	4,831	(7.7%)	4,279	(7.7%)	552	(7.7%)
	(5)Miscellaneous	840	(1.3%)	744	(1.3%)	96	(1.3%)
	(6)Institutional Support	1,208	(1.9%)	1,070	(1.9%)	138	(1.9%)
	(7)Sub-Total	55,187	(88.4%)	48,885	(88.4%)	6,302	(88.4%)
	(8)Physical Contingency	7,246	(11.6%)	6,419	(11.6%)	827	(11.6%)
	Total	62,433	(100.0%)	55,303	(100.0%)	7,130	(100.0%)
	VAT	8,741		7,742		998	
	Grand Total	71,174	*64.4%*	63,046	*82.1%*	*8,128*	*24.1%*
Retail Supply	(1)Direct Cost	17,504	(68.2%)	8,233	(68.2%)	9,271	(68.2%)
	(2)P&G	2,626	(10.2%)	1,235	(10.2%)	1,391	(10.2%)
	(3)Base Cost	20,130	(78.4%)	9,468	(78.4%)	10,662	(78.4%)
	(4)Engineering Fee	2,013	(7.8%)	947	(7.8%)	1,066	(7.8%)
	(5)Miscellaneous	-	(0.0%)	-	(0.0%)	-	(0.0%)
	(6)Institutional Development	503	(2.0%)	237	(2.0%)	267	(2.0%)
	(7)Sub-Total	22,646	(88.2%)	10,651	(88.2%)	11,994	(88.2%)
	(8)Physical Contingency	3,019	(11.8%)	1,420	(11.8%)	1,599	(11.8%)
	Total	25,665	(100.0%)	12,072	(100.0%)	13,594	(100.0%)
	VAT	3,593		1,690		1,903	
	Grand Total	29,258	*26.5%*	13,762	*17.9%*	*15,497*	*45.9%*
Yard Connection	(1)Direct Cost	8,915		-		8,915	
	VAT	1,248		-		1,248	
	Grand Total	10,163	*9.2%*	-	*0.0%*	*10,163*	*30.1%*

	Project cost		Stage 1 (RDP Grant)		Stage 2 (Loan/Own Fund)	
Bulk Supply	71,174	100.0%	63,046	88.6%	8,128	11.4%
Retail Supply	29,258	100.0%	13,762	47.0%	15,497	53.0%
Yard Connection	10,163	100.0%	-	0.0%	10,163	100.0%
Total	110,595	100.0%	76,807	69.4%	33,787	30.6%

Stage 1	Bulk Supply	1st Tier	63,046	82.1%	57.0%		
	Retail Supply	1st Tier	13,762	17.9%	12.4%	1st Tier	
	Total		76,807	100.0%	69.4%	76,807	69.4%
Stage 2	Bulk Supply	2nd Tier	8,128	24.1%	7.3%	2nd Tier	
	Retail Supply	3rd Tier	15,497	45.9%	14.0%	8,128	7.3%
	Yard Connection	3rd Tier	10,163	30.1%	9.2%	3rd Tier	
	Total		33,787	100.0%	30.6%	25,660	23.2%
Total			110,595		100.0%		

Table C.2-1: Cash Flow Analysis for Bulk Supply (Case C) : North Mankwe

(1/2)

Water Demand and Tariff Forecast	Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007	11 2008	12 2009	13 2010	14 2011
							<-------- Service Level A --------						<-------- Service Level B --------			
A. Service Level																
B. Water Demand																
b-1)Population			-	-	-	-	32,512	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)Consumption	30 LCD												80 LCD			
b-3)Water Demand (AADD)	b-1) x b-2) KL/d		-	-	-	-	975	1,812	1,812	1,812	1,812	1,812	4,831	4,831	4,831	4,831
b-4)Water Demand (SPDD)	b-3) x 1.5 KL/d		-	-	-	-	1,463	2,718	2,718	2,718	2,718	2,718	7,247	7,247	7,247	7,247
b-5)Annual Water Production	b-3) x 365 KL/a		-	-	-	-	356,006	661,271	661,271	661,271	661,271	661,271	1,763,388	1,763,388	1,763,388	1,763,388
C. Bulk Water Tariff	R/KL	0.00	0.00	0.00	0.00	0.00	0.90	0.90	0.90	0.90	0.90	0.90	1.25	1.25	1.25	1.25
Income Statements (1,000R)	**Year**	**0 1997**	**1 1998**	**2 1999**	**3 2000**	**4 2001**	**5 2002**	**6 2003**	**7 2004**	**8 2005**	**9 2006**	**10 2007**	**11 2008**	**12 2009**	**13 2010**	**14 2011**
D. Revenue																
d-1) Water Sales	C.x b-5)		-	-	-	-	320	595	595	595	595	595	2,204	2,204	2,204	2,204
d-2) Revenue Total			-	-	-	-	*320*	*595*	*595*	*595*	*595*	*595*	*2,204*	*2,204*	*2,204*	*2,204*
E. Expenses	(Unit Cost)	(Real Escalation)														
e-1) Raw Water Cost	0.24 R/KL	x b-5)	-	-	-	-	85	159	159	159	159	159	423	423	423	423
e-2) O&M Cost		x b-5)	-	-	-	-	151	284	287	291	295	299	807	818	829	841
-Power	0.15 R/KL	3%	-	-	-	-	62	118	122	126	129	133	366	377	388	400
-Chemical	0.03 R/KL		-	-	-	-	11	20	20	20	20	20	53	53	53	53
-Salaries	0.17 R/KL		-	-	-	-	61	112	112	112	112	112	300	300	300	300
-Maintenance Cost and other	0.05 R/KL		-	-	-	-	18	33	33	33	33	33	88	88	88	88
e-3)Expenses Total	e-1)+e-2)		-	-	-	-	*236*	*442*	*446*	*450*	*453*	*457*	*1,230*	*1,241*	*1,252*	*1,264*
Net Operating Income			-	-	-	-	**84**	**153**	**149**	**145**	**142**	**138**	**974**	**963**	**952**	**940**
Cash Flow Statements (1,000R)	**Year**	**0 1,997**	**1 1,998**	**2 1,999**	**3 2,000**	**4 2,001**	**5 2,002**	**6 2,003**	**7 2,004**	**8 2,005**	**9 2,006**	**10 2,007**	**11 2,008**	**12 2,009**	**13 2,010**	**14 2,011**
F. Inflow																
f-1)Net Operating Income			-	-	-	-	84	153	149	145	142	138	974	963	952	940
f-2)Grant (RDP Fund)			244	1,888	19,660	29,179	12,075	-	-	-	-	-	-	-	-	-
f-3)Loan			-	-	-	-	-	31	243	3,341	3,708	804	-	-	-	-
f-4)Interest Generated	5%		-	-	-	-	-	4	12	20	28	37	46	47	48	48
f-5)Inflow Total			*244*	*1,888*	*19,660*	*29,179*	*12,159*	*188*	*404*	*3,507*	*3,878*	*979*	*1,020*	*1,010*	*999*	*988*
C. Outflow																
g-1)CAPEX+Replacement			244	1,888	19,660	29,179	12,075	31	243	3,341	3,708	804	-	-	-	-
g-2)Loan Repayment (CAPEX)			-	-	-	-	-	-	-	-	-	-	996	996	996	996
g-3)Short Term Loan Interest	7%		-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-4)Outflow Total			*244*	*1,888*	*19,660*	*29,179*	*12,075*	*31*	*243*	*3,341*	*3,708*	*804*	*996*	*996*	*996*	*996*
Surplus			**0**	**0**	**0**	**0**	**84**	**157**	**161**	**166**	**170**	**175**	**24**	**14**	**3**	**-8**
cum.			0	0	0	0	84	241	402	568	738	912	936	950	953	945
Loan outstanding																
Principal	20 years							31	276	3,640	7,639	9,054				
Interest	8%							2	22	291	611	724				
Total								33	299	3,931	8,250	9,778				

Table C.2-1: Cash Flow Analysis for Bulk (Case C) : North Mankwe (cont'd)

Water Demand and Tariff Forecast	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
A. Service Level	<----------							Service Level B								---------->
B. Water Demand																
b-1)Population	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)Consumption																
b-3)Water Demand (AADD)	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831
b-4)Water Demand (SPDD)	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247	7,247
b-5)Annual Water Production	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	
C. Bulk Water Tariff	1.25	1.31	1.31	1.31	1.31	1.31	1.37	1.37	1.37	1.37	1.37	1.44	1.44	1.44	1.44	1.44

Income Statements (1,000R)	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
D. Revenue																
d-1) Water Sales	2,204	2,310	2,310	2,310	2,310	2,310	2,416	2,416	2,416	2,416	2,416	2,539	2,539	2,539	2,539	2,539
d-2) Revenue Total	*2,204*	*2,310*	*2,310*	*2,310*	*2,310*	*2,310*	*2,416*	*2,416*	*2,416*	*2,416*	*2,416*	*2,539*	*2,539*	*2,539*	*2,539*	*2,539*
E. Expenses																
e-1) Raw Water Cost	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423
e-2) O&M Cost	853	865	878	891	905	919	933	948	963	979	995	1,011	1,028	1,046	1,064	1,083
-Power	412	424	437	450	464	478	492	507	522	538	554	570	588	605	623	642
-Chemical	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
-Salaries	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
-Maintenance Cost and other	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88
e-3)Expenses Total	*1,276*	*1,289*	*1,301*	*1,314*	*1,328*	*1,342*	*1,356*	*1,371*	*1,386*	*1,402*	*1,418*	*1,434*	*1,452*	*1,469*	*1,487*	*1,506*
Net Operating Income	**928**	**1,022**	**1,009**	**996**	**982**	**968**	**1,060**	**1,045**	**1,030**	**1,014**	**998**	**1,105**	**1,088**	**1,070**	**1,052**	**1,033**

Cash Flow Statements (1,000R)	15 2,012	16 2,013	17 2,014	18 2,015	19 2,016	20 2,017	21 2,018	22 2,019	23 2,020	24 2,021	25 2,022	26 2,023	27 2,024	28 2,025	29 2,026	30 2,027
F. Inflow																
f-1)Net Operating Income	928	1,022	1,009	996	982	968	1,060	1,045	1,030	1,014	998	1,105	1,088	1,070	1,052	1,033
f-2)Grant (RDP Fund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f-3)Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
f-4)Interest Generated	47	46	50	53	56	58	24	28	32	35	38	-	-	-	-	-
f-5)Inflow Total	*975*	*1,068*	*1,059*	*1,049*	*1,038*	*1,026*	*1,083*	*1,073*	*1,062*	*1,049*	*1,036*	*1,105*	*1,088*	*1,070*	*1,052*	*1,035*
G. Outflow																
g-1)CAPEX+Replacement		-	-	-	-	709	-	-	-	-	1,055	-	-	-	-	-
g-2)Loan Repayment (CAPEX)	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996
g-3)Short Term Loan Interest	-	-	-	-	-	-	-	-	-	-	-	18	12	6	1	-
g-4)Outflow Total	*996*	*996*	*996*	*996*	*996*	*1,705*	*996*	*996*	*996*	*996*	*2,050*	*1,014*	*1,008*	*1,002*	*997*	*996*
Surplus	**-21**	**72**	**63**	**53**	**42**	**-679**	**88**	**77**	**66**	**53**	**-1,015**	**91**	**80**	**68**	**55**	**39**
cum.	925	997	1,059	1,112	1,154	474	562	639	705	758	-257	-166	-85	-17	37	77

Loan outstanding
Principal
Interest
Total

Table C.2-2: Cash Flow Analysis for Retail Supply (Case C-1) at 1997 Price: North Mankwe

(1/4)

Water Demand and Tariff Forecast	Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007	11 2008	12 2009	13 2010	14 2011
A. Service Level							<--------		Service Level A			-------->	<--------		Service Level B	-------->
B. Water Demand																
b-1)Population			-	-	-	-	32,512	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)No. of Household			-	-	-	-	5,084	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436
b-3)No. of Yard Connection			-	-	-	-	-	-	-	-	-	-	8,492	8,492	8,492	8,492
b-4)Consumption	LCD						30	30	30	30	30	30	80	80	80	80
b-5)Water Demand	b-1) x b-4) KL/d		-	-	-	-	975	1,812	1,812	1,812	1,812	1,812	4,831	4,831	4,831	4,831
b-6)Unaccounted for water Ratio							15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
b-7)Water Billed	b-5) x 1- 6 KL/d		-	-	-	-	829	1,540	1,540	1,540	1,540	1,540	4,107	4,107	4,107	4,107
b-8)Annual Water Production	b-5) x 365 KL/a		-	-	-	-	356,006	661,271	661,271	661,271	661,271	661,271	1,763,388	1,763,388	1,763,388	1,763,388
b-9)Annual Water Sales	b-7) x 365 KL/a		-	-	-	-	302,605	562,080	562,080	562,080	562,080	562,080	1,498,880	1,498,880	1,498,880	1,498,880
C. Retail Water Tariff																
c-1)Retail Water Tariff	R/KL						1.50	1.50	1.50	1.50	1.50	1.50	2.83	2.83	2.83	2.83
c-2)Flat Rate Tariff	c-1)x 25lcdx6.4x30	R/month/Household					7.20	7.20	7.20	7.20	7.20	7.20				
c-3)Reserve for Upgrading		R/month/Household					29.00	29.00	29.00	29.00	29.00					

Income Statements (1,000R)	Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007	11 2008	12 2009	13 2010	14 2011
D. Revenue								1.49								
d-1) Water Sales (Cost Portion)			-	-	-	-	484	838	838	838	838	838	2,717	2,717	2,717	2,717
d-2) Reserve Fund / Amortisation			-	-	-	-	1,562	2,960	2,960	2,960	1,368	5	1,525	1,525	1,525	1,525
d-3)Revenue Total			-	-	-	-	*2,046*	*3,798*	*3,798*	*3,798*	*2,206*	*843*	*4,242*	*4,242*	*4,242*	*4,242*
E. Expenses																
e-1) Bulk Water Tariff	R/KL		-	-	-	-	0.90	0.90	0.90	0.90	0.90	0.90	1.25	1.25	1.25	1.25
e-2) Bulk Water Purchase	e-1)x b-8)						320	595	595	595	595	595	2,204	2,204	2,204	2,204
e-3) Maintenance & Admin. Cost							164	243	243	243	243	243	513	513	513	513
e-4) Expenses Total			-	-	-	-	*484*	*838*	*838*	*838*	*838*	*838*	*2,717*	*2,717*	*2,717*	*2,717*
Net Operating Income			-	-	-	-	**1,562**	**2,960**	**2,960**	**2,960**	**1,368**	**5**	**1,525**	**1,525**	**1,525**	**1,525**

Cash Flow Statements (1,000R)		0 1,997	1 1,998	2 1,999	3 2,000	4 2,001	5 2,002	6 2,003	7 2,004	8 2,005	9 2,006	10 2,007	11 2,008	12 2,009	13 2,010	14 2,011
F. Inflow																
f-1) Net Operating Income			-	-	-	-	1,562	2,960	2,960	2,960	1,368	5	1,525	1,525	1,525	1,525
f-2) Grant (RDP Fund)			59	392	3,735	11,378	4,520	-	-	-	-					-
f-3) Loan			-	-	-	-	-			2,686	7,438	2,573	-	-	-	-
f-4) Interest Generated	5%		-	-	-	-	-	78	227	368	409	127	3	4	5	6
f-5) Inflow Total			*59*	*392*	*3,735*	*11,378*	*6,082*	*3,038*	*3,187*	*6,014*	*9,215*	*2,705*	*1,528*	*1,529*	*1,529*	*1,530*
G. Outflow																
g-1) CAPEX+Replacement			59	392	3,735	11,378	4,520	61	365	5,193	14,849	5,193	-	-	-	-
g-2) Loan Repayment (CAPEX)			-	-	-	-	-	-	-	-	-		1,511	1,511	1,511	1,511
g-3) Short Term Loan Interest	7%		-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-4)Outflow Total			*59*	*392*	*3,735*	*11,378*	*4,520*	*61*	*365*	*5,193*	*14,849*	*5,193*	*1,511*	*1,511*	*1,511*	*1,511*
Surplus			**0**	**0**	**0**	**0**	**1,562**	**2,977**	**2,822**	**821**	**-5,634**	**-2,488**	**16**	**17**	**18**	**19**
cum.			0	0	0	0	1,562	4,540	7,362	8,183	2,549	62	78	95	113	132

Loan outstanding													49%				
CAPEX										2,686	10,339	13,739	85%				
Principal	20 years									215	827	1,099					
Interest	8%									2,901	11,166	14,838					
Affordability			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Monthly Expenditure																	
Average	68LCD	R/HH/M	0.00	0.00	0.00	0.00	0.00	36.20	36.20	36.20	36.20	36.20	7.20	36.95	36.95	36.95	36.95
Lowor Income	25LCD	R/HH/M	0.00	0.00	0.00	0.00	0.00	36.20	36.20	36.20	36.20	36.20	7.20	13.58	13.58	13.58	13.58
Inflation	0%																
Economic Growth Rate	0%	%/a															
Household Income	Average	R/month															
Lower Income	305		305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Average Income	1216		1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216
Water Purchase/Income (Affordability Check)																	
Lower Income			0.0%	0.0%	0.0%	0.0%	0.0%	11.9%	11.9%	11.9%	11.9%	11.9%	2.4%	4.5%	4.5%	4.5%	4.5%
Average Income			**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**0.6%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**

Table C.2-2: Cash Flow Analysis for Retail Supply (Case C-1) at 1997 Price : North Mankwe (cont'd)

Water Demand and Tariff Forecast	Year	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
A. Service Level		<----------							Service Level B								---------->
B. Water Demand																	
b-1)Population		60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)No. of Household		9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436
b-3)No. of Yard Connection		8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492
b-4)Consumption		80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
b-5)Water Demand	b-1) x b-4)	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831
b-6)Unaccounted for water Ratio		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
b-7)Water Billed	b-5) x 1- 6	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107
b-8)Annual Water Production	b-5) x 365	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388
b-9)Annual Water Sales	b-7) x 365	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880
C. Retail Water Tariff																	
c-1)Retail Water Tariff		2.83	2.90	2.90	2.90	2.90	2.90	2.97	2.97	2.97	2.97	2.97	3.05	3.05	3.05	3.05	3.05
c-2)Flat Rate Tariff	c-1)x 25lcd																
c-3)Reserve for Upgrading																	

Income Statements (1,000R)	Year	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
D. Revenue																	
d-1) Water Sales (Cost Portion)		2,717	2,823	2,823	2,823	2,823	2,823	2,929	2,929	2,929	2,929	2,929	3,052	3,052	3,052	3,052	3,052
d-2) Reserve Fund / Amortisation		1,525	1,524	1,524	1,524	1,524	1,524	1,523	1,523	1,523	1,523	1,523	1,519	1,519	1,519	1,519	1,519
d-3)Revenue Total		*4,242*	*4,347*	*4,347*	*4,347*	*4,347*	*4,347*	*4,452*	*4,452*	*4,452*	*4,452*	*4,452*	*4,572*	*4,572*	*4,572*	*4,572*	*4,572*
E. Expenses																	
e-1) Bulk Water Tariff		1.25	1.31	1.31	1.31	1.31	1.31	1.37	1.37	1.37	1.37	1.37	1.44	1.44	1.44	1.44	1.44
e-2) Bulk Water Purchase	e-1)x b-8)	2,204	2,310	2,310	2,310	2,310	2,310	2,416	2,416	2,416	2,416	2,416	2,539	2,539	2,539	2,539	2,539
e-3) Maintenance & Admin. Cost		513	513	513	513	513	513	513	513	513	513	513	513	513	513	513	513
e-4) Expenses Total		*2,717*	*2,823*	*2,823*	*2,823*	*2,823*	*2,823*	*2,929*	*2,929*	*2,929*	*2,929*	*2,929*	*3,052*	*3,052*	*3,052*	*3,052*	*3,052*
Net Operating Income		**1,525**	**1,524**	**1,524**	**1,524**	**1,524**	**1,524**	**1,523**	**1,523**	**1,523**	**1,523**	**1,523**	**1,519**	**1,519**	**1,519**	**1,519**	**1,519**

Cash Flow Statements (1,000R)		15 2,012	16 2,013	17 2,014	18 2,015	19 2,016	20 2,017	21 2,018	22 2,019	23 2,020	24 2,021	25 2,022	26 2,023	27 2,024	28 2,025	29 2,026	30 2,027
F. Inflow																	
f-1) Net Operating Income		1,525	1,524	1,524	1,524	1,524	1,524	1,523	1,523	1,523	1,523	1,523	1,519	1,519	1,519	1,519	1,519
f-2) Grant (RDP Fund)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f-3) Loan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f-4) Interest Generated	5%	7	8	9	10	11	12	13	14	16	17	18	20	21	23	24	26
f-5) Inflow Total		*1,531*	*1,531*	*1,532*	*1,533*	*1,534*	*1,536*	*1,536*	*1,537*	*1,538*	*1,540*	*1,541*	*1,539*	*1,541*	*1,542*	*1,544*	*1,545*
G. Outflow																	
g-1) CAPEX+Replacement		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-2) Loan Repayment (CAPEX)		1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511	1,511
g-3) Short Term Loan Interest	7%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-4)Outflow Total		*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*	*1,511*
Surplus		**20**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**29**	**30**	**28**	**29**	**31**	**32**	**34**
cum.		152	172	193	215	238	263	287	313	340	369	399	427	456	487	519	553

Loan outstanding
CAPEX
Principal 20
Interest 8%

Affordability		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Year		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Monthly Expenditure																	
Average	68LCD	36.95	37.86	37.86	37.86	37.86	37.86	38.78	38.78	38.78	38.78	38.78	39.82	39.82	39.82	39.82	39.82
Lower Income	25LCD	13.58	13.92	13.92	13.92	13.92	13.92	14.26	14.26	14.26	14.26	14.26	14.64	14.64	14.64	14.64	14.64
Inflation	0%																
Economic Growth Rate	0%																
Household Income	Average																
Lower Income	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Average Income	1216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216	1,216
Water Purchase/Income (Affordability Ch																	
Lower Income		4.5%	4.6%	4.6%	4.6%	4.6%	4.6%	4.7%	4.7%	4.7%	4.7%	4.7%	4.8%	4.8%	4.8%	4.8%	4.8%
Average Income		**3.0%**	**3.1%**	**3.1%**	**3.1%**	**3.1%**	**3.1%**	**3.2%**	**3.2%**	**3.2%**	**3.2%**	**3.2%**	**3.3%**	**3.3%**	**3.3%**	**3.3%**	**3.3%**

Table C.2-3: Cash Flow Analysis for Retail Supply (Case C-2) at 1997 Price: North Mankwe

Water Demand and Tariff Forecast	Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007	11 2008	12 2009	13 2010	14 2011
							<-------- Service Level A -------->						<-------- Service Level B -------->			
A. Service Level																
B. Water Demand																
b-1)Population			-	-	-	-	32,512	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)No. of Household			-	-	-	-	5,084	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436
b-3)No. of Yard Connection			-	-	-	-	-	-	-	-	-	-	8,492	8,492	8,492	8,492
b-4)Consumption	LCD						30	30	30	30	30	30	80	80	80	80
b-5)Water Demand	b-1) x b-4) KL/d		-	-	-	-	975	1,812	1,812	1,812	1,812	1,812	4,831	4,831	4,831	4,831
b-6)Unaccounted for water Ratio							15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
b-7)Water Billed	b-5) x 1- 6 KL/d		-	-	-	-	829	1,540	1,540	1,540	1,540	1,540	4,107	4,107	4,107	4,107
b-8)Annual Water Production	b-5) x 365 KL/a		-	-	-	-	356,006	661,271	661,271	661,271	661,271	661,271	1,763,388	1,763,388	1,763,388	1,763,388
b-9)Annual Water Sales	b-7) x 365 KL/a		-	-	-	-	302,605	562,080	562,080	562,080	562,080	562,080	1,498,880	1,498,880	1,498,880	1,498,880
C. Retail Water Tariff																
c-1)Retail Water Tariff	R/KL						1.50	1.50	1.50	1.50	1.50	1.50	3.86	3.86	3.86	3.86
c-2)Flat Rate Tariff	c-1)x 25lcdx6.4x30	R/month/Household					7.20	7.20	7.20	7.20	7.20	7.20				
c-3)Reserve for Upgrading		R/month/Household														

Income Statements (1,000R)	Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007	11 2008	12 2009	13 2010	14 2011
D. Revenue																
d-1) Water Sales (Cost Portion)			-	-	-	-	484	838	838	838	838	838	2,717	2,717	2,717	2,717
d-2) Reserve Fund / Amortisation			-	-	-	-	-	-	-	-	-	-	3,068	3,068	3,068	3,068
d-3)Revenue Total			-	-	-	-	*484*	*843*	*843*	*843*	*843*	*843*	*5,786*	*5,786*	*5,786*	*5,786*
E. Expenses																
e-1) Bulk Water Tariff	R/KL		-	-	-	-	0.90	0.90	0.90	0.90	0.90	0.90	1.25	1.25	1.25	1.25
e-2) Bulk Water Purchase	e-1)x b-8)						320	595	595	595	595	595	2,204	2,204	2,204	2,204
e-3) Maintenance & Admin. Cost							164	243	243	243	243	243	513	513	513	513
e-4) Expenses Total			-	-	-	-	*484*	*838*	*838*	*838*	*838*	*838*	*2,717*	*2,717*	*2,717*	*2,717*
Net Operating Income			-	-	-	-	-30	5	5	5	5	5	3,068	3,068	3,068	3,068

Cash Flow Statements(1,000R)	0 1,997	1 1,998	2 1,999	3 2,000	4 2,001	5 2,002	6 2,003	7 2,004	8 2,005	9 2,006	10 2,007	11 2,008	12 2,009	13 2,010	14 2,011
F. Inflow															
f-1) Net Operating Income	-	-	-	-	-	-30	5	5	5	5	5	3,068	3,068	3,068	3,068
f-2) Grant (RDP Fund)	59	392	3,735	11,378		4,520	-	-	-	-					-
f-3) Loan	-	-	-	-		-	61	365	5,193	14,849	5,193	-	-	-	-
f-4) Interest Generated 5%	-	-	-	-		-	-	-	-	-	-	-	-	-	0
f-5) Inflow Total	*59*	*392*	*3,735*	*11,378*		*4,490*	*66*	*370*	*5,198*	*14,854*	*5,198*	*3,068*	*3,068*	*3,068*	*3,069*
G. Outflow															
g-1) CAPEX+Replacement	59	392	3,735	11,378		4,520	61	365	5,193	14,849	5,193	-	-	-	-
g-2) Loan Repayment (CAPEX)	-	-	-	-		-	-	-	-	-		3,061	3,061	3,061	3,061
g-3) Short Term Loan Interest 7%	-	-	-	-		-	2	2	2	1	1	1	1	0	-
g-4)Outflow Total	*59*	*392*	*3,735*	*11,378*		*4,520*	*63*	*367*	*5,195*	*14,850*	*5,194*	*3,062*	*3,062*	*3,061*	*3,061*
Surplus	0	0	0	0		-30	3	-2	-2	-1	4	6	7	7	7
cum.	0	0	0	0		-30	-27	-24	-21	-17	-13	-7	-1	7	14

Loan outstanding													100%			
CAPEX													100%			
Principal	20 years							61	431	5,658	20,960	27,830				
Interest	8%							5	34	453	1,677	2,226				
								66	465	6,111	22,637	30,056				
Affordability		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Monthly Expenditure																
Average	68LCD R/HH/M	0.00	0.00	0.00	0.00	0.00	7.20	7.20	7.20	7.20	7.20	7.20	50.40	50.40	50.40	50.40
Lower Income	25LCD R/HH/M	0.00	0.00	0.00	0.00	0.00	7.20	7.20	7.20	7.20	7.20	7.20	18.53	18.53	18.53	18.53
Inflation	0%															
Economic Growth Rate	0% %/a															
Household Income	Average R/month															
Lower Income	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Average Income	**1216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**
Water Purchase/Income (Affordability Check)																
Lower Income	(25LCD)	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	6.1%	6.1%	6.1%	6.1%
Average Income	**(68LCD)**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.6%**	**0.6%**	**0.6%**	**0.6%**	**0.6%**	**0.6%**	**4.1%**	**4.1%**	**4.1%**	**4.1%**

Table C.2-3: Cash Flow Analysis for Retail Supply (Case C-2) at 1997 Price : North Mankwe (cont'd)

Water Demand and Tariff Forecast	Year	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
A. Service Level		<----------	----------	----------	----------	----------	----------	----------	----------	----------	Service Level B	----------	----------	----------	----------	----------	---------->
B. Water Demand																	
b-1)Population		60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390	60,390
b-2)No. of Household		9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436	9,436
b-3)No. of Yard Connection		8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492	8,492
b-4)Consumption		80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
b-5)Water Demand	b-1) x b-4)	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831
b-6)Unaccounted for water Ratio		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
b-7)Water Billed	b-5) x 1- 6	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107	4,107
b-8)Annual Water Production	b-5) x 365	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388	1,763,388
b-9)Annual Water Sales	b-7) x 365	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880	1,498,880
C. Retail Water Tariff																	
c-1)Retail Water Tariff		3.86	3.93	3.93	3.93	3.93	3.93	4.00	4.00	4.00	4.00	4.00	4.08	4.08	4.08	4.08	4.08
c-2)Flat Rate Tariff	c-1)x 25lcd																
c-3)Reserve for Upgrading																	

Income Statements (1,000R)	Year	15 2012	16 2013	17 2014	18 2015	19 2016	20 2017	21 2018	22 2019	23 2020	24 2021	25 2022	26 2023	27 2024	28 2025	29 2026	30 2027
D. Revenue																	
d-1) Water Sales (Cost Portion)		2,717	2,823	2,823	2,823	2,823	2,823	2,929	2,929	2,929	2,929	2,929	3,052	3,052	3,052	3,052	3,052
d-2) Reserve Fund / Amortisation		3,068	3,068	3,068	3,068	3,068	3,068	3,067	3,067	3,067	3,067	3,067	3,063	3,063	3,063	3,063	3,063
d-3)Revenue Total		*5,786*	*5,891*	*5,891*	*5,891*	*5,891*	*5,891*	*5,996*	*5,996*	*5,996*	*5,996*	*5,996*	*6,115*	*6,115*	*6,115*	*6,115*	*6,115*
E. Expenses																	
e-1) Bulk Water Tariff		1.25	1.31	1.31	1.31	1.31	1.31	1.37	1.37	1.37	1.37	1.37	1.44	1.44	1.44	1.44	1.44
e-2) Bulk Water Purchase	e-1)x b-8)	2,204	2,310	2,310	2,310	2,310	2,310	2,416	2,416	2,416	2,416	2,416	2,539	2,539	2,539	2,539	2,539
e-3) Maintenance & Admin. Cost		513	513	513	513	513	513	513	513	513	513	513	513	513	513	513	513
e-4) Expenses Total		*2,717*	*2,823*	*2,823*	*2,823*	*2,823*	*2,823*	*2,929*	*2,929*	*2,929*	*2,929*	*2,929*	*3,052*	*3,052*	*3,052*	*3,052*	*3,052*
Net Operating Income		**3,068**	**3,068**	**3,068**	**3,068**	**3,068**	**3,068**	**3,067**	**3,067**	**3,067**	**3,067**	**3,067**	**3,063**	**3,063**	**3,063**	**3,063**	**3,063**

Cash Flow Statements(1,000R)		15 2,012	16 2,013	17 2,014	18 2,015	19 2,016	20 2,017	21 2,018	22 2,019	23 2,020	24 2,021	25 2,022	26 2,023	27 2,024	28 2,025	29 2,026	30 2,027
F. Inflow																	
f-1) Net Operating Income		3,068	3,068	3,068	3,068	3,068	3,068	3,067	3,067	3,067	3,067	3,067	3,063	3,063	3,063	3,063	3,063
f-2) Grant (RDP Fund)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f-3) Loan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f-4) Interest Generated	5%	1	1	1	2	2	3	3	4	4	4	5	5	6	6	7	7
f-5) Inflow Total		*3,069*	*3,069*	*3,069*	*3,069*	*3,070*	*3,070*	*3,070*	*3,070*	*3,071*	*3,071*	*3,072*	*3,069*	*3,069*	*3,069*	*3,070*	*3,070*
G. Outflow																	
g-1) CAPEX+Replacement		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-2) Loan Repayment (CAPEX)		3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061	3,061
g-3) Short Term Loan Interest	7%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-4)Outflow Total		*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*	*3,061*
Surplus		**8**	**7**	**8**	**8**	**9**	**9**	**9**	**9**	**9**	**10**	**10**	**7**	**8**	**8**	**8**	**9**
cum.		22	29	37	45	54	62	71	80	89	99	110	117	125	133	141	150

Loan outstanding	
CAPEX	
Principal	20
Interest	8%

Affordability		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Year		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Monthly Expenditure																	
Average	68LCD	50.40	51.31	51.31	51.31	51.31	51.31	52.22	52.22	52.22	52.22	52.22	53.27	53.27	53.27	53.27	53.27
Lower Income	25LCD	18.53	18.86	18.86	18.86	18.86	18.86	19.20	19.20	19.20	19.20	19.20	19.58	19.58	19.58	19.58	19.58
Inflation	0%																
Economic Growth Rate	0%																
Household Income	Average																
Lower Income	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Average Income	**1216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**	**1,216**
Water Purchase/Income (Affordability Ch																	
Lower Income	(25LCD)	6.1%	6.2%	6.2%	6.2%	6.2%	6.2%	6.3%	6.3%	6.3%	6.3%	6.3%	6.4%	6.4%	6.4%	6.4%	6.4%
Average Income	**(68LCD)**	**4.1%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.3%**	**4.3%**	**4.3%**	**4.3%**	**4.3%**	**4.4%**	**4.4%**	**4.4%**	**4.4%**	**4.4%**

Table C.3-1 : NPV and FIRR Analysis for Loan (Case C-1) : North Mankwe

(Unit: '000R)

Year	Cost					Benefit			Net Benefit	Real Interest Rate and NPV		
	Loan for Bulk CAPEX	Loan for Retail	Bulk O&M Cost	Retail Admin. Cost	Total Cost	Anual Water Demand (KL)	Tariff (R/KL)	Benefit		i=3%	i=5%	i=8%
	(1)	(2)	(3)	(4)	(5)=(1)+(2)	(6)	(7)	(8)=(6)x(7)	(9)=(8)-(4)	NPV	NPV	NPV
0 1997						0	0.00	0	0			
1 1998			0	0	0	0	0.00	0	0	0	0	0
2 1999			0	0	0	0	0.00	0	0	0	0	0
3 2000			0	0	0	0	0.00	0	0	0	0	0
4 2001			0	0	0	0	0.00	0	0	0	0	0
5 2002			236	164	400	302,605	1.50	454	54	47	42	37
6 2003	31		442	243	716	562,080	1.50	843	127	106	95	80
7 2004	243		446	243	932	562,080	1.50	843	-89	-72	-63	-52
8 2005	3,341	2,686	450	243	6,720	562,080	1.50	843	-5,877	-4,639	-3,977	-3,175
9 2006	3,708	7,438	453	243	11,842	562,080	1.50	843	-10,999	-8,430	-7,090	-5,502
10 2007	804	2,573	457	243	4,077	562,080	1.50	843	-3,234	-2,407	-1,986	-1,498
11 2008			1,230	513	1,743	1,498,880	2.83	4,242	2,499	1,805	1,461	1,072
12 2009			1,241	513	1,754	1,498,880	2.83	4,242	2,488	1,745	1,385	988
13 2010			1,252	513	1,765	1,498,880	2.83	4,242	2,476	1,686	1,313	911
14 2011			1,264	513	1,777	1,498,880	2.83	4,242	2,465	1,629	1,245	839
15 2012			1,276	513	1,789	1,498,880	2.83	4,242	2,453	1,574	1,180	773
16 2013			1,289	513	1,802	1,498,880	2.90	4,347	2,545	1,586	1,166	743
17 2014			1,301	513	1,814	1,498,880	2.90	4,347	2,532	1,532	1,105	684
18 2015			1,314	513	1,827	1,498,880	2.90	4,347	2,519	1,480	1,047	630
19 2016			1,328	513	1,841	1,498,880	2.90	4,347	2,506	1,429	992	581
20 2017	709		1,342	513	2,564	1,498,880	2.90	4,347	1,783	987	672	382
21 2018			1,356	513	1,869	1,498,880	2.97	4,452	2,583	1,388	927	513
22 2019			1,371	513	1,884	1,498,880	2.97	4,452	2,568	1,340	878	472
23 2020			1,386	513	1,899	1,498,880	2.97	4,452	2,553	1,293	831	435
24 2021			1,402	513	1,915	1,498,880	2.97	4,452	2,537	1,248	787	400
25 2022	1,055		1,418	513	2,985	1,498,880	2.97	4,452	1,466	700	433	214
26 2023			1,434	513	1,947	1,498,880	3.05	4,572	2,624	1,217	738	355
27 2024			1,452	513	1,965	1,498,880	3.05	4,572	2,607	1,174	698	326
28 2025			1,469	513	1,982	1,498,880	3.05	4,572	2,589	1,132	661	300
29 2026			1,487	513	2,000	1,498,880	3.05	4,572	2,571	1,091	625	276
30 2027			1,506	513	2,019	1,498,880	3.05	4,572	2,552	1,052	591	254
Total	*9,891*	*12,697*	*29,605*	*11,639*	*63,831*			*92,729*	*28,897*	*11,694*	*5,753*	*1,038*
								FIIR=	**9.2%**			

Sensitivity Analysis

1. Tariff Collection

Factor	FIRR
60%	N.A.
70%	0.4%
80%	3.6%
90%	6.4%
100%	9.2%

2. Capital Cost(Loan)

Factor	FIRR
1.0	9.2%
1.1	7.8%
1.2	6.8%

3. O&M Cost

Factor	FIRR
0.9	10.2%
1.0	9.2%
1.2	6.6%
1.5	2.9%

4. Water Demand

Factor	FIRR
0.8	5.5%
0.9	7.3%
1.0	9.2%

Table C.3-2 : NPV and FIRR Analysis for Loan (Case C-2) : North Mankwe

(Unit: '000R)

Year		Cost					Benefit			Net Benefit	Real Interest Rate and NPV		
		Loan for Bulk CAPEX	Loan for Retail	Bulk O&M Cost	Retail Admin. Cost	Total Cost	Anual Water Demand (KL)	Tariff (R/KL)	Benefit		i=3%	i=5%	i=8%
		(1)	(2)	(3)	(4)	(5)=(1)+(2)	(6)	(7)	(8)=(6)x(7)	(9)=(8)-(4)	NPV	NPV	NPV
0	1997						0	0.00	0	0			
1	1998			0	0	0	0	0.00	0	0	0	0	0
2	1999			0	0	0	0	0.00	0	0	0	0	0
3	2000			0	0	0	0	0.00	0	0	0	0	0
4	2001			0	0	0	0	0.00	0	0	0	0	0
5	2002			236	164	400	302,605	1.50	454	54	47	42	37
6	2003	31	61	442	243	777	562,080	1.50	843	66	55	49	41
7	2004	243	365	446	243	1,297	562,080	1.50	843	-454	-369	-323	-265
8	2005	3,341	5,193	450	243	9,227	562,080	1.50	843	-8,384	-6,618	-5,674	-4,529
9	2006	3,708	14,849	453	243	19,253	562,080	1.50	843	-18,410	-14,110	-11,867	-9,210
10	2007	804	5,193	457	243	6,697	562,080	1.50	843	-5,854	-4,356	-3,594	-2,712
11	2008			1,230	513	1,743	1,498,880	3.86	5,786	4,042	2,920	2,364	1,734
12	2009			1,241	513	1,754	1,498,880	3.86	5,786	4,031	2,828	2,245	1,601
13	2010			1,252	513	1,765	1,498,880	3.86	5,786	4,020	2,738	2,132	1,478
14	2011			1,264	513	1,777	1,498,880	3.86	5,786	4,009	2,650	2,025	1,365
15	2012			1,276	513	1,789	1,498,880	3.86	5,786	3,997	2,565	1,922	1,260
16	2013			1,289	513	1,802	1,498,880	3.93	5,891	4,089	2,548	1,873	1,194
17	2014			1,301	513	1,814	1,498,880	3.93	5,891	4,076	2,466	1,778	1,102
18	2015			1,314	513	1,827	1,498,880	3.93	5,891	4,063	2,387	1,688	1,017
19	2016			1,328	513	1,841	1,498,880	3.93	5,891	4,050	2,309	1,603	938
20	2017	709		1,342	513	2,564	1,498,880	3.93	5,891	3,326	1,842	1,254	714
21	2018			1,356	513	1,869	1,498,880	4.00	5,996	4,126	2,218	1,481	820
22	2019			1,371	513	1,884	1,498,880	4.00	5,996	4,112	2,146	1,406	756
23	2020			1,386	513	1,899	1,498,880	4.00	5,996	4,096	2,076	1,334	698
24	2021			1,402	513	1,915	1,498,880	4.00	5,996	4,081	2,007	1,265	644
25	2022	1,055		1,418	513	2,985	1,498,880	4.00	5,996	3,010	1,438	889	440
26	2023			1,434	513	1,947	1,498,880	4.08	6,115	4,168	1,933	1,172	564
27	2024			1,452	513	1,965	1,498,880	4.08	6,115	4,151	1,869	1,112	520
28	2025			1,469	513	1,982	1,498,880	4.08	6,115	4,133	1,807	1,054	479
29	2026			1,487	513	2,000	1,498,880	4.08	6,115	4,115	1,746	1,000	442
30	2027			1,506	513	2,019	1,498,880	4.08	6,115	4,096	1,688	948	407
Total		*9,891*	*25,661*	*29,605*	*11,639*	*76,795*			*123,606*	*46,810*	*18,828*	*9,177*	*1,532*
									FIIR=	**9.1%**			

Sensitivity Analysis

1. Tariff Collection

Factor	FIRR
60%	N.A.
70%	2.2%
80%	4.7%
90%	6.9%
100%	9.1%

2. Capital Cost(Loa

Factor	FIRR
1.0	9.1%
1.1	7.8%
1.2	6.8%

3. O&M Cost

Factor	FIRR
0.9	9.7%
1.0	9.1%
1.2	7.5%
1.5	5.3%

4. Water Demand

Factor	FIRR
0.8	5.8%
0.9	7.4%
1.0	9.1%

C.4 Economic Analysis

1. Conversion Factor and Calculated Project Cost

Project cost which is use for economic analysis must be based on the economic price, which under perfect market circumstance without any transfer expenses such as tax.
Unskilled labour cost and fuel is assumed to be differing from the economic price in the project cost.

1. Labour Conversion Factor (LCF)

LCF= 30%

(1) Unemployment Rate

	Economic Active Population	Unemployment	Unemployment Rate				
			Total	Black	Colourd	Indians	White
North West	973,000	325,000	33.4%	37.4%	17.6%	12.6%	7.9%
Mpmalanga	1,147,000	376,000	32.8%	35.8%	27.8%	4.4%	6.0%

"Source: 1995 October Household Survey (OHS), CSS"

(2) Wage of Labour 1303 R/month

(1997 Feb. Current Price. Average Salaries and Wages and Bonuses per Month)
"Source: Labour Statistics. Employment and salaries and wages,CSS P0242.1, June 1997"

(3) Shadow Wage (Opportunity Cost) of Unskilled Labour

Labour intensive construction, as RDP project will maximise community Labour resources. Under this high unemployment circumstance, marginal cost of labour is assumed very low.
Opportunity cost of labour is estimated by economic value of domestic work as below.

Domestic Work Salaries 550R/month
Unemployed is assumed to do economic activity 5days out of 7days
550x5/7= 392.86 R/month

(4) Labour Conversion Factor (LCF)

LCF is calculated as below
Shadow Wage / Nominal Wage
392.86/1303=30%

2. Fuel Conversion Factor (FCF)

Nominal Fuel Cost including tax duty and levy and it is estimated 30% of consumer prices.
Fuel Conversion Factor (FCF) which convert nominal price to the economic price is calculated as below

FCF= 70%

Calculated project cost is estimated preliminary following the manner as below.

1) Breakdown Direct Construction Cost of each infrastructual component into four components as a) Labour, b) Material, c) Plant and d) Fuel in the same process of price adjustment formula of civil (RDP) contract.

2) Convert cost of unskilled labour and fuel using LCF and FCF respectively.

3) Calculate project cost with the multiplier.

2. Economic Benefit

Under the principle of "with" and "without" project applied in the economic analysis, an economic benefit for Cases C is measured as saving of cost for labour to be required for water cartage between residence and standpipe. In the level of yard-connection, a beneficiary is planned to consume 73 lcd or 467 litters per day per household consisting of 6.4 members on the average. Usually, community people use a polyethylene container with capacity of 20 litters and wheelbarrow for water cartage. Assuming two containers can be loaded in a wheelbarrow, it requires about 12 times round trip with average distance of 100 meters, requiring 15 minutes per trip or 180 minutes (3 hours) per day. On the other hand, it is reported that a daily unskilled labour costs around R4 to 5 per hour in rural communities, which is converted as the economic value at R1.2 to 1.5 per hour applying the labour conversion factor (LCF) as mentioned in the above. Thus, the economic benefit of the project can be worked out R3.6 per day or R108 per month per beneficial household.

Table C.4-1 Direct Construction Cost Breakdown and Converted Cost : North Mankwe

Direct Cost Breakdown

(Unit: ,000Rand)

Item	Total	Labour				Materials		Plant		Fuel	
		amount	%	(Skilled)	(Unskilled)	amount	%	amount	%	amount	%
Level A	**45,443**	**11,475**				**10,235**		**19,752**		**3,981**	
Bulk Supply	*37,210*	*9,353*				*9,000*		*15,288*		*3,570*	
- Intake and Pump Station	151	38	25%	30	8	23	15%	83	55%	8	5%
- Raw Water Pipeline	292	73	25%	58	15	73	25%	117	40%	29	10%
- WTW and Pump Station	1,574	394	25%	315	79	236	15%	866	55%	79	5%
- Bulk Supply Pipelines	33,891	8,473	25%	3,389	5,084	8,473	25%	13,556	40%	3,389	10%
- Regional Reservoirs	1,000	300	30%	240	60	150	15%	500	50%	50	5%
- Pump Stations	302	76	25%	60	15	45	15%	166	55%	15	5%
Retail Supply	*8,233*	*2,123*				*1,235*		*4,464*		*412*	
- Service Reservoir	1,285	386	30%	308	77	193	15%	643	50%	64	5%
- Reticulation Pipelines	6,746	1,687	25%	337	1,349	1,012	15%	3,710	55%	337	5%
- Standpipes	202	51	25%	10	40	30	15%	111	55%	10	5%
Yard Connection	-										
Level B	**68,426**	**17,470**				**13,682**		**32,143**		**5,130**	
Bulk Supply	*42,007*	*10,641*				*9,719*		*17,837*		*3,810*	
- Intake and Pump Station	280	70	25%	56	14	42	15%	154	55%	14	5%
- Raw Water Pipeline	292	73	25%	58	15	73	25%	117	40%	29	10%
- WTW and Pump Station	4,201	1,050	25%	840	210	630	15%	2,311	55%	210	5%
- Bulk Supply Pipelines	33,891	8,473	25%	3,389	5,084	8,473	25%	13,556	40%	3,389	10%
- Regional Reservoirs	2,784	835	30%	668	167	418	15%	1,392	50%	139	5%
- Pump Stations	559	140	25%	112	28	84	15%	307	55%	28	5%
Retail Supply	*17,504*	*4,601*				*2,626*		*9,402*		*875*	
- Service Reservoir	4,495	1,349	30%	1,079	270	674	15%	2,248	50%	225	5%
- Reticulation Pipelines	12,867	3,217	25%	643	2,573	1,930	15%	7,077	55%	643	5%
- Standpipes	142	36	25%	7	28	21	15%	78	55%	7	5%
Yard Connection	*8,915*	2,229	25%	446	1,783	1,337	15%	4,903	55%	446	5%

Converted Direct Cost

Item	Total	Labour				Materials		Plant		Fuel	
		amount	%	(Skilled)	(Unskilled)	amount	%	amount	%	amount	%
Conversion Factor				100%	30%	100%		100%		70%	
Level A	**39,540**	**6,767**				**10,235**		**19,752**		**2,787**	
Bulk Supply	*32,457*	*5,671*				*9,000*		*15,288*		*2,499*	
- Intake and Pump Station	143	32	25%	30	2	23	15%	83	55%	5	5%
- Raw Water Pipeline	273	63	25%	58	4	73	25%	117	40%	20	10%
- WTW and Pump Station	1,495	338	25%	315	24	236	15%	866	55%	55	5%
- Bulk Supply Pipelines	29,316	4,914	25%	3,389	1,525	8,473	25%	13,556	40%	2,372	10%
- Regional Reservoirs	943	258	30%	240	18	150	15%	500	50%	35	5%
- Pump Stations	287	65	25%	60	5	45	15%	166	55%	11	5%
Retail Supply	*7,083*	*1,096*				*1,235*		*4,464*		*288*	
- Service Reservoir	1,212	332	30%	308	23	193	15%	643	50%	45	5%
- Reticulation Pipelines	5,700	742	25%	337	405	1,012	15%	3,710	55%	236	5%
- Standpipes	171	22	25%	10	12	30	15%	111	55%	7	5%
Yard Connection	-										
Level B	**59,767**	**10,350**				**13,682**		**32,143**		**3,591**	
Bulk Supply	*37,002*	*6,779*		*5,124*		*9,719*		*17,837*		*2,667*	
- Intake and Pump Station	266	60	25%	56	4	42	15%	154	55%	10	5%
- Raw Water Pipeline	273	63	25%	58	4	73	25%	117	40%	20	10%
- WTW and Pump Station	3,991	903	25%	840	63	630	15%	2,311	55%	147	5%
- Bulk Supply Pipelines	29,316	4,914	25%	3,389	1,525	8,473	25%	13,556	40%	2,372	10%
- Regional Reservoirs	2,625	718	30%	668	50	418	15%	1,392	50%	97	5%
- Pump Stations	531	120	25%	112	8	84	15%	307	55%	20	5%
Retail Supply	*15,231*	*2,591*		*1,729*		*2,626*		*9,402*		*613*	
- Service Reservoir	4,239	1,160	30%	1,079	81	674	15%	2,248	50%	157	5%
- Reticulation Pipelines	10,873	1,415	25%	643	772	1,930	15%	7,077	55%	450	5%
- Standpipes	120	16	25%	7	9	21	15%	78	55%	5	5%
Yard Connection	7,533	981	25%	446	535	1,337	15%	4,903	55%	312	5%

Table C.4-2 Calculated Project Cost at 1997 Constant Price : North Mankwe (1/2)

(Unit: '000Rand)

Item				Total	1 1998	2 1999	3 2000	4 2001	5 2002
Case A	**Total**			***58,625***	***227***	***1,689***	***17,221***	***28,171***	***11,317***
	Bulk	(1)Direct Calculated Cost		32,457	-	-	10,328	16,020	6,109
		(2)P&G	(1)x 15%	4,869	-	-	1,549	2,403	916
		(3)Base Cost	(1)+(2)	37,326	-	-	11,877	18,424	7,025
		(4)Engineering Fee	(3)x 10%	3,733	-	933	933	933	933
		(5)Miscellaneous	(1)x 2%	649	-	325	325	-	-
		(6)Institutional Developme	(3)x 2.5%	933	187	187	187	187	187
		(7)Sub-Total	(3)+(4)+(5)+(6	42,641	187	1,444	13,321	19,543	8,145
		(8)Physical Contingency	(3)x 15%	5,599	-	-	1,782	2,764	1,054
		Grand Total		**48,240**	**187**	**1,444**	**15,103**	**22,307**	**9,199**
	Retail	(1)Direct Calculated Cost		7,083	-	-	1,417	4,250	1,417
		(2)P&G	(1)x 15%	1,062	-	-	212	637	212
		(3)Base Cost	(1)+(2)	8,145	-	-	1,629	4,887	1,629
		(4)Engineering Fee	(3)x 10%	815	-	204	204	204	204
		(5)Miscellaneous		-	-	-	-	-	-
		(6)Institutional Support	(3)x 2.5%	204	41	41	41	41	41
		(7)Sub-Total	(3)+(4)+(5)+(6	9,163	41	244	1,873	5,131	1,873
		(8)Physical Contingency	(3)x 15%	1,222	-	-	244	733	244
		Grand Total		**10,385**	**41**	**244**	**2,118**	**5,865**	**2,118**
Case B	**Total**			***84,860***	***300***	***2,172***	***23,943***	***42,519***	***15,926***
	Bulk	(1)Direct Calculated Cost		37,002	-	-	12,276	18,232	6,494
		(2)P&G	(1)x 15%	5,550	-	-	1,841	2,735	974
		(3)Base Cost	(1)+(2)	42,552	-	-	14,118	20,966	7,469
		(4)Engineering Fee	(3)x 10%	4,255	-	1,064	1,064	1,064	1,064
		(5)Miscellaneous	(1)x 2%	740	-	370	370	-	-
		(6)Institutional Developme	(3)x 2.5%	1,064	213	213	213	213	213
		(7)Sub-Total	(3)+(4)+(5)+(6	48,611	213	1,647	15,764	22,243	8,745
		(8)Physical Contingency	(3)x 15%	6,383	-	-	2,118	3,145	1,120
		Grand Total		**54,994**	**213**	**1,647**	**17,882**	**25,388**	**9,865**
	Retail	(1)Direct Calculated Cost		15,231	-	-	3,046	9,139	3,046
		(2)P&G	(1)x 15%	2,285	-	-	457	1,371	457
		(3)Base Cost	(1)+(2)	17,516	-	-	3,503	10,510	3,503
		(4)Engineering Fee	(3)x 10%	1,752	-	438	438	438	438
		(5)Miscellaneous		-	-	-	-	-	-
		(6)Institutional Support	(3)x 2.5%	438	88	88	88	88	88
		(7)Sub-Total	(3)+(4)+(5)+(6	19,706	88	525	4,029	11,035	4,029
		(8)Physical Contingency	(3)x 15%	2,627	-	-	525	1,576	525
		Grand Total		**22,333**	**88**	**525**	**4,554**	**12,612**	**4,554**
	Yard	(1)Direct Calculated Cost		7,533	-	-	1,507	4,520	1,507
	Connection	***Grand Total***		**7,533**	-	-	**1,507**	**4,520**	**1,507**
Level B-A									
	Bulk			6,755	26	202	2,779	3,081	666
	Retail			11,948	47	281	2,436	6,747	2,436
	Yard Connection			7,533	-	-	1,507	4,520	1,507
	Total			26,236	73	483	6,722	14,348	4,609

Table C.4-2 Calculated Project Cost in 1997 Constant Price : North Mankwe (2/2)

(Unit: ,000Rand)

Item				total	6 2003	7 2004	8 2005	9 2006	10 2007
Case C(Higher Service Potion)				*26,236*	*73*	*483*	*6,722*	*14,348*	*4,609*
	Bulk	(1)Direct Calculated Cost		4,545	-	-	1,948	2,211	385
		(2)P&G	(1)x 15%	682	-	-	292	332	58
		(3)Base Cost	(1)+(2)	5,226	-	-	2,241	2,543	443
		(4)Engineering Fee	(3)x 10%	523	-	131	131	131	131
		(5)Miscellaneous		91	-	45	45	-	-
		(6)Institutional Developme	(3)x 2.5%	131	26	26	26	26	26
		(7)Sub-Total	(3)+(4)+(5)+(6)	5,971	26	202	2,443	2,700	600
		(8)Physical Contingency	(3)x 15%	784	-	-	336	381	66
		Grand Total		6,755	26	202	2,779	3,081	666
	Retail	(1)Direct Calculated Cost		8,149	-	-	1,630	4,889	1,630
		(2)P&G	(1)x 15%	1,222	-	-	244	733	244
		(3)Base Cost	(1)+(2)	9,371	-	-	1,874	5,623	1,874
		(4)Engineering Fee	(3)x 10%	937	-	234	234	234	234
		(5)Miscellaneous		-	-	-	-	-	-
		(6)Institutional Support	(3)x 2.5%	234	47	47	47	47	47
		(7)Sub-Total	(3)+(4)+(5)+(6)	10,542	47	281	2,155	5,904	2,155
		(8)Physical Contingency	(3)x 15%	1,406	-	-	281	843	281
		Grand Total		11,948	47	281	2,436	6,747	2,436
	Yard	(1)Direct Calculated Cost		7,533	-	-	1,507	4,520	1,507
	Connection	***Grand Total***		7,533	-	-	1,507	4,520	1,507

Table C.4-3 : EIRR Analysis (Case C-1) : North Mankwe

EIIR= 5.5% (Unit: '000R)

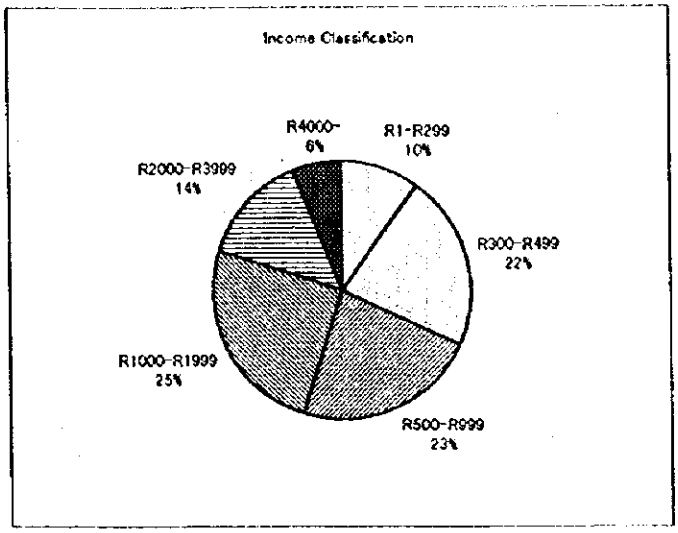
Year	Calculated Cost				Benefit			Net Benefit	Real Interest Rate and NPV		
	CAPEX	Bulk O&M Cost	Retail Admin. Cost	Total Cost	Higher Service Beneficiaries (Household)	Economic Value of Cartage (R/month)	Benefit		i=3%	i=5%	i=8%
	(1)	(2)	(3)	(4)=(1)+(2)+(3)	(5)	(6)	(8)=(5)x(6)x12m	(9)=(8)-(4)	NPV	NPV	NPV
0 1997					0	108	0	0			
1 1998	227	0	0	227	0	108	0	(227)	(221)	(217)	(211)
2 1999	1,689	0	0	1,689	0	108	0	(1,689)	(1,592)	(1,532)	(1,448)
3 2000	17,221	0	0	17,221	0	108	0	(17,221)	(15,759)	(14,876)	(13,670)
4 2001	28,171	0	0	28,171	0	108	0	(28,171)	(25,030)	(23,177)	(20,707)
5 2002	11,317	0	0	11,317	0	108	0	(11,317)	(9,762)	(8,867)	(7,702)
6 2003	73	0	0	73	0	108	0	(73)	(61)	(54)	(46)
7 2004	483	0	0	483	0	108	0	(483)	(393)	(344)	(282)
8 2005	6,722	0	0	6,722	0	108	0	(6,722)	(5,306)	(4,550)	(3,632)
9 2006	14,348	0	0	14,348	0	108	0	(14,348)	(10,996)	(9,249)	(7,177)
10 2007	4,609	0	0	4,609	0	108	0	(4,609)	(3,430)	(2,830)	(2,135)
11 2008		1,230	513	1,743	8,492	108	11,006	9,262	6,691	5,416	3,972
12 2009		1,241	513	1,754	8,492	108	11,006	9,251	6,489	5,152	3,674
13 2010		1,252	513	1,765	8,492	108	11,006	9,240	6,292	4,900	3,398
14 2011		1,264	513	1,777	8,492	108	11,006	9,228	6,101	4,661	3,142
15 2012		1,276	513	1,789	8,492	108	11,006	9,216	5,916	4,433	2,905
16 2013		1,289	513	1,802	8,492	108	11,006	9,204	5,736	4,217	2,687
17 2014		1,301	513	1,814	8,492	108	11,006	9,191	5,561	4,010	2,484
18 2015		1,314	513	1,827	8,492	108	11,006	9,178	5,391	3,814	2,297
19 2016		1,328	513	1,841	8,492	108	11,006	9,165	5,227	3,627	2,124
20 2017		1,342	513	1,855	8,492	108	11,006	9,151	5,067	3,449	1,963
21 2018		1,356	513	1,869	8,492	108	11,006	9,137	4,911	3,279	1,815
22 2019		1,371	513	1,884	8,492	108	11,006	9,122	4,761	3,118	1,678
23 2020		1,386	513	1,899	8,492	108	11,006	9,107	4,614	2,965	1,551
24 2021		1,402	513	1,915	8,492	108	11,006	9,091	4,472	2,819	1,434
25 2022		1,418	513	1,931	8,492	108	11,006	9,075	4,334	2,680	1,325
26 2023		1,434	513	1,947	8,492	108	11,006	9,058	4,200	2,548	1,225
27 2024		1,452	513	1,965	8,492	108	11,006	9,041	4,070	2,422	1,132
28 2025		1,469	513	1,982	8,492	108	11,006	9,023	3,944	2,302	1,046
29 2026		1,487	513	2,000	8,492	108	11,006	9,005	3,821	2,188	967
30 2027		1,506	513	2,019	8,492	108	11,006	8,987	3,702	2,079	893
Total	84,860	27,120	10,260	122,240			220,113	97,873	28,750	4,383	(15,299)

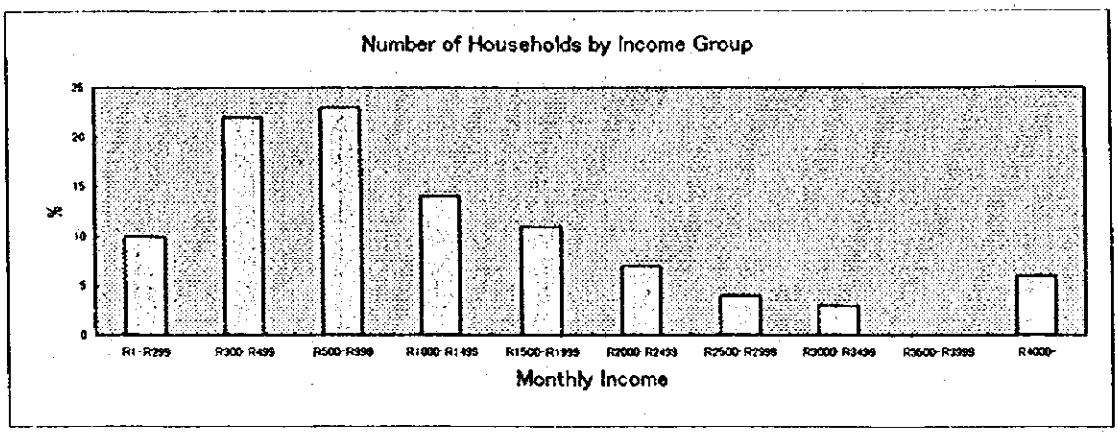
Figure C.5-1 : Income Classification : North Mankwe

1. Monthly Household Income

(R/month)

Income	%	Average
R1-R299	10%	161
R300-R499	22%	370
Lower	**32%**	**305**
R500-R999	23%	712
R1000-R1995	25%	1,334
Middle	**48%**	**1036**
R2000-R3995	14%	2,436
R4000-	6%	4,659
Higher	**20%**	**3,103**
Total	**100%**	**1,216**





2. Household Income by Occupation

Income	Total	Employee	Driver	Worker	Self Empl.	Salary	Teacher	Pensioner	Other
R1-R299	10	3	0	1	4	0	0	1	1
R300-R499	22	2	0	0	5	1	0	14	0
Lower	32	5	0	1	9	1	0	15	1
R500-R999	23	14	0	2	0	4	0	3	0
R1000-R1995	25	19	1	1	0	4	0	0	0
Middle	48	33	1	3	0	8	0	3	0
R2000-R3995	14	12	0	0	1	0	0	0	1
R4000-	6	2	0	0	2	0	0	0	2
Higher	20	14	0	0	3	0	0	0	3
Total	**100**	**52**	**1**	**4**	**12**	**9**	**0**	**18**	**4**

Source: Questioner Survey by JICA Study Team (1997)