

- LEGEND**
- National road or freeway
 - Arterial road
 - Main road
 - District boundary
 - JICA project boundary
 - Buffer zone (5km)
 - Urban area or village
 - Dam
 - Perennial river
 - Non-perennial river

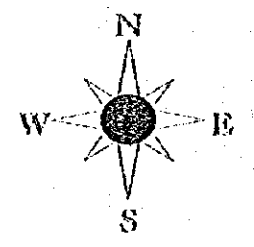


Figure 5-6

Harvest potential [$m^3/km^2/a$]

- ≥ 2500 and < 4000
- ≥ 6000 and < 10000
- ≥ 10000 and < 15000
- ≥ 15000 and < 25000
- ≥ 25000 and < 50000
- ≥ 50000

12.5 Value point for safe abstraction volume in $1000m^3/km^2/a$

Water quality class area:

- Class 0: Ideal water quality, suitable for lifetime use
- Class 1: good water quality, rare instances of negative effects
- Class 2: water safe for short term use only, common instances of negative effects with long term use
- Class 3: unacceptable water quality for domestic use, unsuitable for domestic use without treatment, consider use for livestock watering
- Class 4: unacceptable water quality for domestic use and stockwatering purposes, unsuitable for domestic use without treatment

Japan International Cooperation Agency (JICA)

EXPANSION OF THE CAPACITY OF MAGALIES WATER

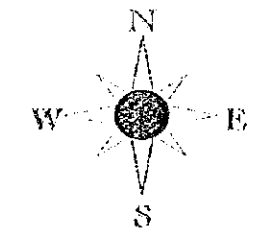
Harvest Potential and Water Quality Hazard

Scale: 1 : 850 000

Transverse Mercator (Gauss-Krüger) projection, Clarke 1880 spheroid, Central Meridian 27° East



- LEGEND**
- National road or freeway
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 - Main road
 - - - District boundary
 - - - JICA project boundary
 - ⊖ Buffer zone (5km)
 - ⊖ Urban area or village
 - ▬ Dam
 - Perennial river
 - Non-perennial river



Harvest potential (m³/km²/a)

- ≥ 2500 and < 4000
- ▤ ≥ 4000 and < 6000
- ▥ ≥ 6000 and < 10000
- ▧ ≥ 10000 and < 15000
- ▨ ≥ 15000 and < 25000
- ▩ ≥ 25000 and < 50000
- ⊞ ≥ 50000

Value point for safe abstraction volume in 1000m³/km²/a

Water quality class area:

- Class 0: ideal water quality, suitable for lifetime use
- ▤ Class 1: good water quality, rare instances of negative effects
- ▥ Class 2: water safe for short term use only, common instances of negative effects with long term use
- ▧ Class 3: unacceptable water quality for domestic use, unsuitable for domestic use without treatment, consider use for livestock watering
- ▨ Class 4: unacceptable water quality for domestic use and stockwatering purposes, unsuitable for domestic use without treatment

Japan International Cooperation Agency (JICA)

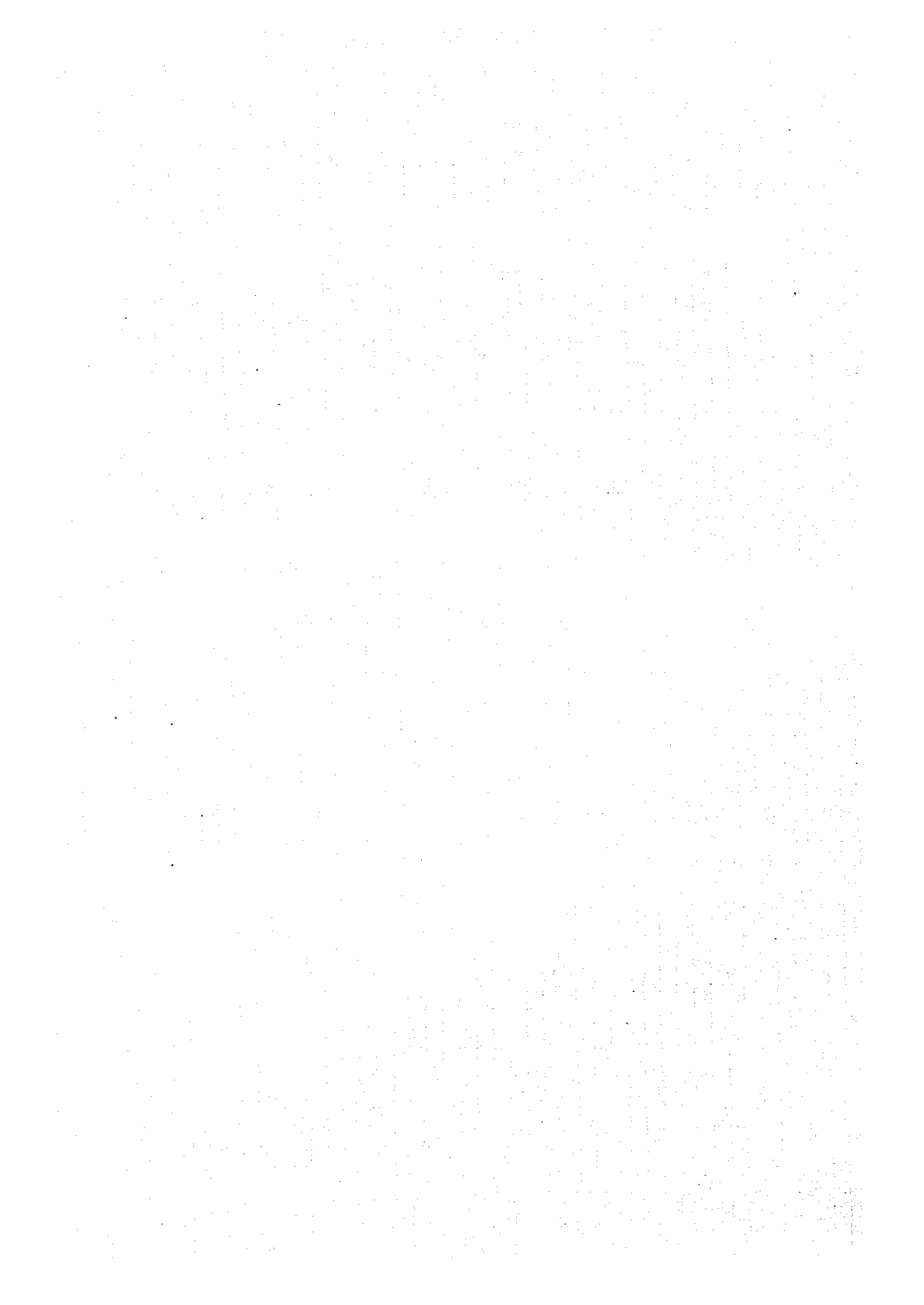
EXPANSION OF THE CAPACITY OF MAGALIES WATER

Harvest Potential and Water Quality Hazard

Scale: 1 : 850 000

Transverse Mercator (Gauss-Krüger) projection, Clarke 1880 spheroid, Central Meridian 27° East

Figure 5-6



CHAPTER 6 : WATER RELATED STUDY

CHAPTER 6 WATER RELATED STUDY

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6 WATER RELATED STUDY

6.1 Background

6.1.1 General

The objective of the inventory of existing and planned infrastructure was to establish both records and an understanding of the infrastructure and of the planning status quo within the Study Area, so as to serve as a basis for the future preliminary planning of water supply systems, and thus as a basis for the master plan of the Study Area. The location and capacities of existing bulk infrastructure as well as those of fixed planning are shown on preliminary 1:250,000 infrastructure drawing. Information in respect of components, status, operation and maintenance was collected separately for each community. The various RDP Programmes of DWAF have resulted in substantial new ongoing projects being undertaken. RDP projects are concentrating on primary water supply at this stage in order to achieve water for all by the year 2002.

Sanitation projects are still enjoying a lower profile, and can be expected to increase in number in future, once the primary water supply backlog has been largely addressed.

6.1.2 Zoning of the Study Area

As described in Section 2.1, the Study Area has been divided into three zones (Eastern, Central and Western), on the basis of the expected future management units of purification and distribution systems. Each of these zones was subdivided into water supply areas, comprising communities that receive water from a common source or sources, and water supply blocks, based on groupings of consumers which receive water through a common supply main (with branches if applicable).

6.1.3 Water Treatment Processes

The source of raw water for treatment is almost exclusively impounded water which is used either directly or indirectly through river abstraction of regulated releases. The treatment method used is generally as follows:

(1) Pretreatment

Pre-chlorination using liquid chlorine is often carried out; the addition of powdered activated carbon is practiced seasonally to cope with taste and odour problems resulting from eutrophication.

Pre-chlorination prior to treatment is widely practiced within the Study Area. Although there is the possibility of generating trihalomethanes and other disinfection byproducts, the levels of these substances detected during the sampling and analysis stage of the Study did not give cause for concern, and several of the people responsible for operating treatment facilities within the Study Area believe that there is not a problem. At present, monitoring for THM's is not carried out on a routine basis; as a result, no other information was available to determine whether or not a problem exists. It is important that the practice of prechlorination be reviewed periodically by checking the level of

THM formation.

(2) pH Control

Raw water pH is usually controlled by the addition of lime.

(3) Flocculation

Typical coagulants used are ferric chloride or poly aluminium chloride and other electrolytes. Flocculation and mixing are generally carried out using hydraulic methods such as mixing weirs or baffled channels.

(4) Sedimentation / Clarification / Flotation

Sedimentation tanks are generally of the conventional upflow type, although there are also some horizontal flow arrangements; lamella plates are used in a few instances.

At several of the larger and more modern facilities (Vaalkop, Wallmannsthal, Temba, Kudube and Brits), dissolved air flotation, (DAF), or dissolved air flotation filtration, (DAFF), is used in place of, or in addition to, the clarification stage, particularly for the treatment of algae-laden water. The process technology used at most works is sophisticated; the "Coco-DAF" units at Temba WTW, which are amongst the first examples of this type of process in the world, utilize DAF principles in conjunction with a filter media layer.

(5) Rapid Gravity Filtration

Filtration is generally carried out using conventional downflow rapid gravity filters.

(6) Disinfection

Liquid chlorine is used for final chlorination.

6.1.4 Infrastructure

Existing infrastructure and demand centers (towns, villages and mines) within the Study Area are described below. Further description is also given in supporting Report E.

6.2 Status of Existing Infrastructure

6.2.1 Western Zone

The western region includes the western portions of the Brits magisterial district, large portions of the Thabazimbi, Koster and Swartruggens magisterial districts, and the entire Mankwe, Bafokeng, Odi II and Rustenburg districts. Development within this area is largely concentrated around the Rustenburg to Brits axis, the Rustenburg to Thabazimbi axis, the southern Pilanesberg (Mogwase and Sun City) and the northern Pilanesberg (Saulspoort villages).

(1) Water Supply

(a) Raw Water

Almost the entire Western Zone and all surface water sources therein fall within the Crocodile River Basin, although substantial quantities of primary water (maximum capacity 140 Mld), are supplied to the Rustenburg district by Rand Water from the Vaal River system, via Randfontein and Barnardsvlei. Besides imported water, water for primary purposes is obtained largely from the Vaalkop Dam on the Elands River, which in turn is augmented from the Crocodile River system (Hartbeespoort and Roodekopjes Dams) via a transfer channel between Roodekopjes and Vaalkop. Primary water is also obtained from the Hex River for Rustenburg and its environs (Bospoort Dam), from the Koster River for Koster and its environs, and for Swartruggens from the Upper Elands River. Thabazimbi obtains a substantial portion of its primary water from underground sources. A portion of Western Zone comprising part of Swartruggens District, which does not include any communities of significant size, lies outside the MW ESA and falls within the Mooi catchment of the Vaal River Basin.

(b) Water Treatment

The significant water treatment works in Western Zone are shown in Table 6-1.

RW currently meets more than half of the water demand in the zone, mainly comprising water for the platinum mines in the Barnardsvlei area, and for the town of Rustenburg.

Bospoort WTW supplies a small portion of the demand of the town of Rustenburg, and is owned and operated jointly by the Rustenburg TLC and Rustenburg Platinum Mines. The works is old but fairly well maintained. Raw water quality is poor, and although the plant has a capacity of 13.7 Ml/d raw water availability rather than plant capacity, dictate treated water production. At present, Rustenburg TLC is investigating the upgrading of the treatment plant.

Vaalkop WTW is well maintained and in a very good operating condition. It only produces approximately 60 Ml/day at present and thus has ample spare capacity although that capacity has already been allocated to large industrial consumers. A further expansion is planned in the near future, to meet projected increased demand in the Rustenburg area.

(c) Distribution Network

Water from RW is supplied to the zone via the Barnardsvlei Regional Reservoir on the Magaliesberg mountain range. From this reservoir water is supplied to platinum mines of which Western Platinum is the most important, and to communities like Bapong. The main pipelines also feed Rustenburg and Thlabane. Impala Platinum is another important mine in this area. The supply to Rustenburg and Rustenburg Platinum Mines is augmented by water from Bospoort WTW. A scheme for augmentation of water to the greater Rustenburg area including the Bafokeng tribal

area, from Vaalkop via Kortbegrip is in progress.

The Vaalkop North system supplies water to Northam and Thabazimbi and to certain mines along the way. It also supplies water to the main Saulspoort/Mabeskraal pipeline, the Doornhoek pipeline, and the Mogwase/Sun City pipeline which were all previously owned and operated by NWWA but have been transferred to MW.

(2) Sanitation

Like in the other zones, sanitation schemes are limited to urban areas with only a few small schemes in the more rural areas, usually serving hospitals or other installations.

a) Rustenburg STW

Rustenburg STW is the biggest plant in the Western Zone and treats effluent from the Rustenburg area. It has a capacity of 22.5 Ml/d, is well maintained and in a good condition. Treated effluent is used for irrigation and sold to a mine.

b) Boitekong STW

A new plant was recently commissioned at Boitekong, north of Rustenburg. This plant serves Boitekong and Meriteng, and was owned by the old Transvaal Provincial Administration, but has recently been taken over by Rustenburg TLC. It has a capacity of 8 Ml/d but the loading is only about 0.4 Ml/d at present. It is well maintained and there are no operational problems at present.

c) Pilanesburg

At Sun City there is a privately owned and operated plant with 10 Ml/d capacity. At Saulspoort, oxidation ponds treat about 0.2 Ml/d of effluent from the hospital.

d) Mogwase

An activated sludge plant with a capacity of 4 Ml/d treats industrial effluent at Mogwase; at Mogwase Military Base wastewater drains to oxidation ponds. Bio-discs treat effluent from the Bafokeng Civic Centre at Mogono (about 0.64 Ml/d).

e) Monakato

A new sewage treatment works is planned for Monakato.

6.2.2 Central Zone

The Central Zone includes the eastern portion of Brits District, as well as the Odi 1, Moretele 1 and Wonderboom districts, and the portion of the Warmbaths district that falls within the Study Area. The urban and peri-urban development axis, Ga-Rankuwa- Mabopane-Winterveld-Kudube, falls into the Central Zone. All raw water sources for the Central Zone form part of the Crocodile River catchment, with potable water being supplied into peri-urban

areas in the south of the Study Area from the Vaal River System via Hartbeeshoek SR by Rand Water.

(1) Water Supply

(a) Raw Water

Raw water is abstracted from various water sources within the zone. Apart from the Rand Water supply to Akasia / Soshanguve and Mabopane / Ga-Rankuwa, all sources lie within the Crocodile River basin.

Water from Roodeplaat Dam on the Pienaars River is transferred via a canal to Wallmannsthal WTW and to Temba WTW. Leeukraal Dam on the Apies River supplies water to Kudube WTW. In future, inter-basin transfers from the Roodeplaat canal into Leukraal Dam are planned for water quality management reasons.

The small towns around Hartbeespoort Dam are supplied from local treatment works which draw water from the dam. Raw water for Brits WTW is abstracted from a weir in the Crocodile River (which is regulated by Hartbeespoort Dam). Downstream of Brits the Crocodile River flows into Roodekopjes Dam from which water is transferred to Vaalkop Dam (which is part of Western Zone) by transfer canal and potential exists for future abstraction from Klipvoor Dam downstream of the confluence of the Apies and Pienaars rivers.

(b) Water Treatment

The main water treatment works in the Central Zone are shown in Table 6-2.

1) Wallmannsthal WTW

Wallmannsthal WTW supplies water to small consumers around the Roodeplaat Dam, and although the capacity is 12 MI/d, the annual average daily output is only about 8 MI/d. The plant is in a good condition and has spare capacity.

2) Temba WTW

The same canal that feeds Wallmannsthal WTW also supplies Temba WTW to the north. Temba WTW was upgraded in 1995, and supplies water to Temba and Babelegi as well as to Warmbaths and Nylstroom. The plant is in an excellent condition.

3) Nylstroom

At Nylstroom there is a rapid gravity sand filter plant with a capacity of 4.3 MI/d; boreholes supply a further 4 MI/d to the town. The plant is in need of repair.

4) Warmbaths

Warmbaths is supplied at present with a total of 1.2 MI/d from a local treatment plant and from boreholes; the deficit is made up with water from Temba WTW.

5) Naboomspruit

Naboomspruit is located north of the Study Area, and is not supplied from treatment works within the zone. Naboomspruit experiences periodic water shortages so the possibility of extending the Temba supply to Naboomspruit was investigated before the Warmbaths / Nylstroom scheme was implemented but the cost was prohibitive. Naboomspruit is currently supplied with about 1.7 MI/d from Frikkie Geysers Dam through a slow sand filter system; this volume is augmented by an unknown amount from boreholes.

6) Kudube WTW

At Kudube WTW raw water from the Leeukraal Dam is treated. As the quality of the Apies River is poor, the possibility has been explored of using water from Roodeplaat Dam, via a future extension of the canal to Temba WTW. The Kudube works consist of an old plant (10 MI/d) and a recently completed new plant with the same capacity. Some problems were experienced with the old plant and during commissioning of the new plant, but the works is generally in a good condition. MW recently took over the works as well as staff from NWWA. Plans are under way to increase the capacity of the works further, to meet the demand created by extending the distribution network (Moretele 1 RDP Scheme).

7) Moretele 1

Two small package plants supply water from the Apies River in Moretele 1. The plants at Bosplaas and Makapanstad each have a capacity of 145 kl/d. These two plants are to be made redundant in their present positions with the current extensions to the Moretele 1 distribution network, but may be moved to alternative locations.

8) Brits WTW

Brits WTW was upgraded about 3 years ago and is in very good condition with no significant maintenance problems. The capacity is 60 MI/day but only about 35 MI/day is produced at present.

9) Rand Water

A large volume of potable water is supplied to the Central Zone by Rand Water for consumption in the urban and peri-urban areas of Rosslyn, Ga-rankuwa, Soshanguve, Mabopane, Winterveld and the surrounding communities. The capacity of the system is currently being upgraded from 140 MI/d to 300 MI/d.

(c) Distribution Network

1) Wallmannsthal

The Wallmannsthal area is served by a distribution network which partly belongs to MW (the bulk pipelines), partly to the Eastern Services Council and partly to the Department of Prisons (at Baviaanspoort).

2) Kudube / Temba

The Temba and Kudube distribution systems are interconnected at the Babelegi Service Reservoir, and water can be fed from the one system to the other. The supply to Warmbaths and Nylstroom is new. The Moretele 1 network has been expanded under a RDP Presidential Project which is partly completed, partly under construction and partly in planning.

3) Northern Odi 1 and Moretele 1

Northern areas of Moretele 1 and Odi 1 districts are currently served by groundwater, although due to quality problems and poor yields, the provision of a surface water supply is desirable. No water supply scheme exists as yet from Klipvoor Dam; the demand on the dam is small in comparison with the rest of the zone and the cost of supplying water to these thinly populated outlying areas may be prohibitive (see Supporting Report E).

4) Rand Water

RW supply water to areas of high demand such as Akasia and Ga-rankuwa, to communities such as Winterveld, and to other less densely serviced areas. RW is currently upgrading the bulk supply to the area, and is also involved with construction of reticulation networks in Winterveld and in the new Klip-Kruisfontein development area (where new service reservoirs are also being constructed).

5) Hartbeespoort

There are small individual schemes for developments around the Hartbeespoort Dam. RW has an existing pipeline which feeds water to Pelindaba but the scaling down of operations at this smaller plant means that spare capacity is available in this pipeline to supply water to towns especially on the south-eastern side of Hartbeespoort Dam.

6) Brits

Brits TLC operates a regional scheme from Brits WTW. The network currently supplies Brits and Oukasie, Sonop and Losperfontein, Damonsville, Mothutlung and Lethlabile. Current extensions to the network are to Oskraal and Madidi in the east, and northwards to Maboloka and Jericho. The network is well maintained.

(2) Sanitation

Although the Pretoria and Johannesburg metropolitan areas are located almost entirely outside the Study Area, and although the water supplied to the metropolis by RW is also from outside the Study Area, much of the effluent generated in these areas is treated at regional facilities located within the Study Area. The volume of water treated has a major impact on the quantity of water available from the Roodeplaat, Leukraal and Klipvoor dams, and future planning of regional schemes and water resource management must take the reuse of water into account.

Several major wastewater treatment works are located within the Central Zone, this being the zone with the highest population concentration, the most development and the highest primary water demand.

(a) Baviaanspoort and Zeekoeigat Works

The Baviaanspoort and Zeekoeigat Works are both owned and operated by Pretoria City Council; these plants treat water from the eastern and northern parts of Pretoria. Baviaanspoort has a capacity of 34 MI/d and Zeekoeigat a capacity of 30 MI/d and both discharge effluent into the Pienaars River upstream of the Roodeplaat Dam.

(b) Rooiwal STW

Rooiwal STW is also owned and operated by Pretoria and treats wastewater from Pretoria, Akasia and Rosslyn. The total capacity of the works is 205 MI/d; the treated effluent is discharged into the Apies River upstream of the Leeukraal Dam. All of the Pretoria City Council Works are well maintained and few operational problems are experienced.

(c) Nylstroom STW

Wastewater from the communities of Nylstroom and Phagameng drains to Nylstroom STW, which is fairly old and has a capacity of 3 MI/d. The design flow is currently exceeded by peak flows, but the works is well operated and maintained. The effluent is discharged to the Klein Nyl River.

(d) Warmbaths

Sewage in Warmbaths drains to oxidation ponds with a capacity of 3.2 MI/d and funds have been requested for upgrading.

(e) Naboomspruit STW

Naboomspruit has a small activated sludge plant with a capacity of 1.2 MI/d which is currently regularly exceeded. Treated effluent is used for irrigation. As for Nylstroom and Warmbaths, the works is owned and operated by the TLC.

(f) Babelegi STW

Effluent from the Babelegi industrial area is treated at Babelegi STW which is owned by the North West Development Corporation. It has a capacity of 8.2 MI/d and discharges treated effluent to the Apies River downstream of the Leeukraal Dam.

(g) Temba STW

Effluent from the Kudube/Temba area is treated at Temba STW which has a capacity of 4.5 MI/d. Planning is in progress to increase the capacity to 10 MI/d. Effluent is discharged to the Apies River downstream of the Leeukraal Dam.

(h) Makapanstad

At Makapanstad there is a bio-disc unit which serves a college. Both this plant and Temba STW were operated by NWWA but responsibility for operation has been transferred to MW.

(i) Klipgat STW

Klipgat STW has a total capacity of 55 MI/day and discharges effluent to the Tholwane River. It serves a regional sewerage scheme which drains water from Soshanguve, Mabopane and Garankuwa. A new extension to Winterveld will also drain to this plant. The plant was operated by NWWA but is now the responsibility of RW. A new sewerage scheme is being planned at present for the Klip/Kruisfontein development to the north of Rosslyn.

(j) Soshanguve STW

Soshanguve STW has a capacity of 5.7 MI/d and was recently upgraded and extended. It is owned and operated by Akasia/Soshanguve TLC, and discharges effluent into the Soutpanspruit, a tributary of the Pienaars River, just upstream of Klipvoor Dam.

(k) Brits STW

Brits STW was upgraded in 1993 and is in very good condition. The capacity of 8 MI/d is not yet fully utilised. Effluent is discharged to the Crocodile River. There is a separate small works with a 0.1 MI/d capacity which serves Brits Abattoir.

(l) Mothutlung

Sewage from Mothutlung drains to oxidation ponds with a capacity of 1.85 MI/d. The works is not operating effectively at present. Effluent is discharged to Rose Stream, a tributary of the Crocodile River.

(m) Letlhabile STW

Letlhabile STW serves the community of Letlhabile, and has a capacity of 2.5 Ml/d but is currently overloaded. Funds have been obtained for upgrading.

6.2.3 Eastern Zone

The Eastern Zone includes Cullinan, Bronkhorstspuit and the area formerly known as Kwandebele. The Moretele 2 District is also included in this zone, but is entirely served by groundwater at present.

(1) Water Supply

(a) Raw Water

The sources of raw water in Eastern Zone all lie within the Olifants River catchment, and include the Bronkhorstspuit (regulated by Bronkhorstspuit Dam) which supplies Bronkhorstspuit WTW and Cullinan WTW (via the Premier Weir), Loskop Dam on the Olifants River, and the Elands River (regulated by Rhenosterkop (Mkombo) Dam and Rust de Winter Dam) which supply Weltevreden WTW. Both the Elands River and the Bronkhorstspuit are tributaries of the Olifants River. Under the Kwandebele Augmentation Scheme (funded by OECF), raw water resources in Bronkhorstspuit Dam will be supplemented by inter-basin transfers from the Vaal River system (Grootdraai Dam) in the south.

To supply Moretele 2 with surface water, supplies from the Elands River (via Weltevreden WTW), Roodeplaat Dam (via Temba WTW) or abstraction from Rust de Winter Dam (via a new treatment works) may be considered for planning purposes (see Supporting Report E).

(b) Water Treatment

The main water treatment works in the Eastern Zone are shown in Table 6-3. Both the Cullinan and Bronkhorstspuit works have recently been upgraded, and are in very good condition with little or no operational problems. Weltevreden WTW is maintained and operated by DWAF (Mpumalanga Province) and apart from some delays in obtaining materials is maintained to a satisfactory standard.

(c) Distribution Network

The works at Bronkhorstspuit (in the south) and Weltevreden (in the north) are linked through the distribution system. Weltevreden WTW serves the northern parts of the former KwaNdebele area; Bronkhorstspuit WTW serves southern Kwandebele, Ekangala, Ekandustria as well as Bronkhorstspuit TLC and the surrounding communities. Cullinan WTW serves a relatively small supply area comprising the town, nearby communities, several government facilities and Premier Diamond Mine.

The Eastern Zone has an extensive bulk water supply network which is in a fair condition, although problems are experienced because preventative maintenance is not carried out on pipelines serving the Kwandebele area. Other problems include the formation of air pockets in pipelines, frequent power failures at Weltevreden, and interruptions to the raw water supply from Loskop Dam.

Only a few villages in the former Kwandebele use groundwater. In Moretele 2 District however, the population relies almost completely on groundwater. The quality is often poor and the quantity available inadequate. Groundwater supplies are supplemented in some places by water from road tankers.

(2) Sanitation

Most urban areas within this zone have water-borne sewerage: outside of the urban areas, most people use pit latrines. More than 80% of residents in the former Kwandebele use pit latrines, while the figures for Cullinan and Bronkhorstspuit districts are as high as 70%.

Wastewater treatment works in this zone are mostly small local works with no major regional facilities. The systems are summarised as follows:

(a) Siyabuswa

Siyabuswa drains to the Siyabuswa STW which employs the anaerobic activated sludge process and has a capacity of 4 Ml/d. The works is hydraulically overloaded and is owned and operated by DWAF(Mpumalanga).

(b) Tweefontein

Sewage from parts of Tweefontein drains to a small activated sludge works (375 kl/d) which is also owned and operated by DWAF (Mpumalanga). At present the flow is only about 110 kl/d and no problems are experienced.

(c) Kwamhlanga

At present Kwamhlanga drains to three oxidation ponds owned and operated by DWAF (Mpumalanga). The combined capacity of these ponds is about 1 Ml/d, and the current dry weather flow is about 700 kl/d. Effluent from this works does not conform to the minimum standards and the possibility of using the water for irrigation is being investigated.

(d) Vaalbank and Mmamethlake

A small works at Vaalbank (50 kl/d) treats sludge emptied from septic tanks, A small RBC package plant at the Mmamethlake Hospital treats about 140 kl/d.

(e) Ekangala and Ekandustria

Wastewater from Ekandustria drains to an activated sludge works with a capacity

of about 4.1 MI/d; Ekangala is served by oxidation ponds with a capacity of 2.5 MI/d. Both facilities are owned and operated by DWAF (Mpumalanga).

(f) Bronkhorstspuit

Bronkhorstspuit is served by Bronkhorstspuit STW which utilises the activated sludge process and has a capacity of 80 MI/d. The works is owned and operated by the Bronkhorstspuit TLC and is in good condition with no significant operational problems.

(g) Cullinan

At Cullinan STW, biological trickling filters are used: the works has a capacity of 1.6 MI/d. The works (which is still owned and operated by the Premier Mine) is old, and has been rehabilitated on several occasions in the past. A major refurbishment will be required soon.

(h) Rayton

The community at Rayton is served by an activated sludge works with a capacity of 500 k/d, only half of which is used at present. The plant is owned and operated by the Cullinan TLC. Upgrading of this works is required.

(i) Refilwe

The Refilwe plant is owned and operated by Cullinan TLC; some upgrading is required.

6.3 Ongoing Projects

Many new water supply and sanitation projects have been initiated as a result of money being made available from the RDP. The focus is currently on water supply, in an effort to reach the RDP goal of water to all by 2002. It is expected that sanitation will become more and more important in the future, as the expansion of reticulated water supply systems and the resultant increases in per capita water consumption results in an increase in the quantity of wastewater generated.

The most important new and ongoing projects are summarised below:

6.3.1 Western Zone

An increase in water demand in the greater Rustenburg area and the spare capacity at Vaalkop WTW initiated the Vaalkop Southern Water Supply Scheme which will link Vaalkop to Rustenburg in the south.

New bulk supplies to the villages of Bethanie, Berseba and Modikwe, and the linking of villages in the Bafokeng area to the Vaalkop Southern Water Supply Scheme, are also in planning.

6.3.2 Central Zone

Further extension of Kudube WTW is planned. The Moretele 1 Supply Scheme is currently being implemented in phases, and is partly at the planning stage and partly under construction. The increased demand will be met from Kudube WTW.

RW is upgrading the bulk supply to Soshanguve and Mabopane. New reticulation networks are being installed in Winterveld. Upgrading of Soshanguve STW is at the planning stage; a sewerage system for Klip-Kruisfontein is being investigated.

The Brits water supply scheme is being extended northwards to Oskraal and Madidi and also to Maboloka and Jericho. Extensions to the Lethlabile and Mothutlung wastewater treatment plants are being planned.

6.3.3 Eastern Zone

Augmentation of the raw water supply to this zone is being planned from the Vaal River System via Grootdraai Dam via Matla and Kendal.

Upgrading of wastewater treatment works at Cullinan and Refilwe is planned.

6.4 Water Treatment Works Performance

To assess the performance of the existing water treatment works within the Study Area, information on the historical treated water quality and the corresponding raw water data was obtained for the main water treatment works within the Study Area. The levels of compliance with RSA guidelines and WHO recommended limits for key water quality parameters (annual maximum and average concentrations (where available)) are shown in Table 6-4.

It should also be noted that most of the works routinely fail to meet the domestic water quality guidelines for domestic use therefore it is reasonable to assume that the removal of micro-pollutants which are THM precursors may also not be sufficient to avoid the generation of THM's from disinfection. The primary concern, however, must be seen as adequate disinfection and this should not be prejudiced due to concerns at limiting levels of THM.

6.4.1 Vaalkop, Cullinan, Wallmannsthal Kudube and Temba Water Treatment Works

In the case of four of the five treatment works operated by MW, the annual average and maximum values for key water quality parameters was assessed for the period 1992 to 1995. This data was available from the respective Annual Reports. In addition, the results of weekly sampling and analysis for the period April 1995 to August 1996 were also obtained to assess recent trends.

In the case of Kudube WTW which was previously operated by NWWA, water quality data was not available for the period prior to April 1996 at which stage MW took over operation and maintenance of the works. Since then, a proper sampling regime has been established; unfortunately, an annual cycle of operating conditions is not yet available to assess performance. MW have implemented a programme to address outstanding maintenance, and

have substantially reduced chemical consumption. The new process stream was handed over in July 1996 and is now said to be performing well; the old stream is being maintained in standby mode. Construction of a third 10 ML/d module is due to commence during 1997.

The levels of cadmium and lead measured during 1995 at all four works is cause for concern due to adverse health effects that are caused by long term exposure to the excessive concentrations of these metals. In addition, there is a need to improve the efficiency of iron and manganese removal in order to meet the national water quality standards. It must be noted that Temba Water Treatment Works has recently been rebuilt (work was completed in 1995), work to upgrade Wallmannsthal WTW is now ongoing following completion of the new process stream, and Cullinan WTW also underwent a major refurbishment during 1995. The historical data may therefore reflect some problems which have now been overcome by the upgrading and reconstruction work.

The following conclusions may be drawn from water quality data in the MW Annual Reports.

(1) Raw water quality data

- (a) At Vaalkop and Cullinan the figures for maximum turbidity are high (365 and 105 NTU respectively).
- (b) The waters are fairly well buffered (alkalinity is high), and so require acid addition for pH correction for coagulation (optimum pH for ferric coagulants is in the range 5.0 to 8.5 (typically 7.5)).
- (c) There are high concentrations of aluminium in all sources, probably from effluents discharged upstream of the storage reservoir. It should be determined whether this is particulate or soluble.
- (d) Very high ammonia concentration such as the 6.6 mg/l for Wallmannsthal WTW give rise to very high chlorine demand (of approximately 10 times the ammonia concentration). Nitrogen concentrations at Temba are lower than at Wallmannsthal due to progressive oxidation in the canal.
- (e) There are high concentrations of iron (and to a lesser extent manganese) recorded. It is important to establish whether this is soluble or particulate. Seasonal turning over of the storage reservoir results in higher levels of iron and manganese from March to June and from August to October. The manganese levels recorded for Temba are lower than for Wallmannsthal despite the fact that the raw water source is the same. This indicates that oxidation of manganese occurs in the channel between the two treatment works.
- (f) Cadmium and lead are also present in excessive concentrations, and again it is important to establish whether soluble or particulate metal is present in order to review treatment effectiveness and to propose improvements. The origin is probably sewage treatment works in northern Pretoria.
- (g) Nitrite levels are exceptionally high (especially for Wallmannsthal and Temba), presumably due to oxidation of ammonia.

(2) Treated water quality data

- (a) Colour removal is poor which suggests that the works are being operated at the wrong coagulation pH. The pH is probably too high and requires the addition of an acid for pH adjustment.
- (b) The pH is high unless the data is prior to final pH correction. This practice may be concerned with the use of alumina cement pipes.
- (c) The aluminium levels are very high which is probably as a result of carry-over from the raw water due to incorrect coagulation chemistry; acid dosing for pH correction is probably required.
- (d) Ammonia is present in the treated water (Wallmannsthal and Temba WTW's) so effectiveness of chlorination system and bacteriological quality should be checked.
- (e) Iron and manganese levels are too high, probably due to poor coagulation (although whether particle or soluble should be determined). Jar tests are required to determine the pH at which manganese is precipitated. The optimum pH range will depend on the raw water being treated and may be different to that for iron or aluminium removal hence a separate manganese removal treatment stage may be required. An oxidant such as chlorine, or a catalyst, may be required for manganese removal. The old plant at Temba performed badly with respect to iron removal before it was decommissioned.
- (f) Cadmium and lead concentrations should be reduced for health reasons through either lime softening or more efficient coagulation.
- (g) Nitrite levels are high due to incomplete oxidation or removal of ammonia and nitrites by chlorine (or other means such as biological treatment).

Water in the distribution network is sampled on a weekly basis and based on the analysis results, adjustments are made to the treatment process under the supervision of MW management if necessary.

6.4.2 Brits Water Treatment Works

Water quality data for this works was provided by Brits TLC and covers the period from November 1995 to April 1996; this includes period (during January and February 1996) when the area experienced some of the heaviest rain (and worst flooding) in living memory. The results reflect the fact that raw water is abstracted directly from the Crocodile River, with high colour and turbidities for this period, especially in comparison to the impounded raw water used in most of the other treatment works within the Study Area.

While the data is not representative of typical conditions, it demonstrates the ability of the plant to operate satisfactorily under the most onerous of circumstances. The water is hard and has a relatively high TDS and conductivity reflecting the problem of salination in the Crocodile River and large return flows from the PWV area.

The parameters monitored routinely at the works are mainly physical, and from the data available the plant appears to perform well. It is of concern that iron and aluminium levels are not monitored, as ferric chloride and PAC are used in the treatment process. From the data collected for other works it is likely that elements such as aluminium, cadmium, iron, lead and manganese are present in the raw water in significant quantities. The number of parameters routinely monitored should be increased to include at least these additional substances.

The level of free and residual chlorine found in the treated water, and the relatively small distribution area, indicates that disinfection is probably effective.

6.4.3 Bronkhorstspuit Water Treatment Works

Relatively few parameters are monitored at Bronkhorstspuit WTW, and few conclusions can be drawn from the limited data that is available. The peak levels of raw water turbidity (eg 269 NTU) may give rise to treatment problems. The minimum levels for free and total chlorine residual suggest that disinfection may not always be adequate, especially considering the long distance to some communities in the KwaNdebele area which are supplied from the works.

6.4.4 Bospoort Water Treatment Works

The data set for Bospoort WTW is rather small with samples for inorganic parameters taken roughly every three months. Bacteriological quality is checked monthly and the data is generally satisfactory with higher "total viable bacteria" counts coinciding mostly with periods when the chlorine residual was low.

The water is relatively hard. Aluminium levels were far in excess of the national standards for that part of the year for which data was provided. As the works uses aluminium sulphate as the coagulant, the cause may be works operation practices. Levels of iron, manganese, cadmium and lead in excess of the national guidelines were also recorded which probably reflects the poor quality of the raw water treated at the works. Steps are being taken by Rustenburg TLC and the District Council to try and re-house some of the people currently living close to Bospoort Dam to reduce pollution of the raw water source due to poor sanitation.

6.4.5 Weltevreden Water Treatment Works

Water quality data for this works is still awaited from DWAF.

Table 6-1: Water Treatment Works in Western Zone

Water Treatment Works	Existing Capacity (ML/d)	Operating Organisation	Process	Comments
Vaalkop	120.0	MW	C+F+S+DAF(part)+RGF	Upgraded in 1991
Bospoort	13.7	Rustenburg TLC	C+S(SB)+RGF	

Table 6-2: Water Treatment Works in Central Zone

Water Treatment Works	Existing Capacity (ML/d)	Operating Organisation	Process	Comments
Wallmannsthal	12.0	MW	C+F+DAF+CL(LP)+RGF (New) C+F+S/DAF+RGF (Old)	
Temba	18.0	MW	C+DAF(C)	Upgraded in 1995
Kudube	20.0	MW	C+F+S+DAFF (New) C+S(SB)+DAF+RGF (Old)	Expansion due to commence in 1997
Brits	60.0	Brits TLC	C+F+DAF+S(LP)+RGF	
Schoemansville	10.0	Hartbeespoort TLC	Not Known	

Table 6-3: Water Treatment Works in Eastern Zone

Water Treatment Works	Existing Capacity (ML/d)	Operating Organisation	Process	Comments
Bronkhorstspuit	41.0	Bronkhorstspuit TLC	C+F+DAF+RGF	New stream added recently
Cullinan	14.4	MW	C+S+RGF	New filters & refurbishment 1995
Weltevreden	60.0	DWAF	C+F+S+RGF	

Key:

C: Coagulation

S: Sedimentation in Circular Tank

S(LP): Lemella Plate Clarification

CL(LP): Lamella Plate Clarification

DAF(C): "Coco-DAF"

F: Flocculation

S(SB): Sludge Blanket Clarification

RGF: Rapid Gravity Filtration

DAF: Dissolved Air Flotation

Table 6-4 : Compliance of Treated Water with Water Quality Standards

	WHO 1993	RSA Domestic	Vaalkop WTP		Wallmannsthal WTP		Temba WTP		Cullinan WTP		Kudube WTP		Brits WTP		Bronkhorstspuit WTP		Bospoort WTP		Remarks	
	Recomm.	Guideline	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg		
Physical characteristics																				
Colour (TCU)	15	-	● ○	○ ○	● ○	○ ○	○ ○	○ ○	○ ○	○ ○	● ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	1995 1992
pH	<8.0 (PS)	6-9	○ ○ ○ ○	○ ○ ○ ○	× × ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	
Turbidity (NTU)	5.0 <1 (PS)	1.0	× × ○ ×	○ ○ ○ ○	× × ○ ○	○ ○ ○ ○	× ○ ○ ○	○ ○ ○ ○	× ○ ○ ○	× ○ ○ ○	× ○ ○ ○	× ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	⊙ ○ ○ ○	○ ○ ○ ○	⊙ ○ ○ ○	× ○ ○ ○	× ○ ○ ○	Adverse cosmetic effect. Slight risk of transmission of infectious disease.
Total Dissolved Solids (mg/l)	1,000	450	× × ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	
Conductivity (mS/m)	-	70	× × ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	○ ○ ○ ○	× × ○ ○	× × ○ ○	× × ○ ○	× ○ ○ ○	○ ○ ○ ○	Further investigation of quality at Bronkhorstspuit WTW required.
Total Hardness (CaCO ₃)	-	<100 if poss.	× × × ×	× × × ×	× × × ×	× × × ×	× × × ×	× × × ×	× ○ ○ ○	○ ○ ○ ○	× × × ×	× × × ×	× × × ×	× × ○ ○	× × ○ ○	× × ○ ○	× × ○ ○	× × ○ ○	× × ○ ○	Scaling likely.
Substances undesirable in excess (to prevent colour, taste, corrosion, etc). All concentrations are in mg/l.																				
Aluminium (Al)	0.20	0.15	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	⊙ ⊙	1995 Higher than raw water level for Temba. Discolouration & health hazard.
Ammonia (NH ₃)	1.5	-	○ ○ ○	○ ○ ○	● ● ○	● ○ ○	● ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	1995 1994 1993
Ammonia (NH ₄)	-	-	○ ○ ○	○ ○ ○	● ● ○	● ○ ○	● ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○	

Table 6-4 : Compliance of Treated Water with Water Quality Standards

	WIIO	RSA	Vaalkop		Wallmannsthal		Temba		Cullinan		Kudube		Brits		Bronkhorstspuit		Bospoort		Remarks
	1993	Domestic	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	
	Recomm.	Guideline																	
Chloride (Cl)	250	-	○	○	○	○	○	○	○	○	○	○	○	○			○	○	
Copper (Cu)	1 (a)	-	○	○	○	○	○	○	○	○	○	○	○	○			○	○	
Iron (Fe)	0.30	0.10	⊗	×	×	○	⊗	⊗	×	○							⊗	○	Not harmful but possible colour effect.
Manganese (Mn)	0.1 (c)	0.05	×	○	⊗	⊗	⊗	×	×	○							⊗	○	Possible adverse effect for taste and appearance (black slime formed). Probable cause - low level draw-off from Roodeplaat Dam
Sodium (Na)	200	-	○	○	○	○	○	○	○	○	○	○	○	○			○	○	
Sulphate (SO ₄)	250	-	○	○	○	○	○	○	○	○	○	○	○	○			○	○	
Zinc (Zn)	3	-	○	○	○	○	○	○											1992

Table 6-4 : Compliance of Treated Water with Water Quality Standards

	WHO	RSA	Vaalkop		Wallmannsthal		Tenba		Cullinan		Kudube		Brits		Bronkhorstspuit		Bospoort		Remarks
	1993	Domestic	WTP		WTP		WTP		WTP		WTP		WTP		WTP		WTP		
	Guideline	Guideline	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	
Inorganic substances of health significance. All concentrations are in mg/l.																			
Cadmium (Cd)	0.003	-	●	●	●	●	●	●	●	●							●	○	1995 Adverse health effect. 1994 1993
Copper (Cu)	2 (P) (a)	-	○	○	○	○	○	○	○	○							○	○	1995 1994
Fluoride (F)	1.5 (b)	1.0	○	○	○	○	○	○	○	○							○	○	1995 1992
Lead (Pb)	0.01	-	●	●	●	●	●	●	●	●							●	●	1995 1994 1993
Manganese (Mn)	0.5 (c)	0.05	×	○	×	×	×	×	×	○							×	○	See page 1.
Nitrate (NO ₃)	50 (d)	-	○	○	○	○	○	○	○	○	○	○	○	○			○	○	1995 1994 Nitrate/nitrite standard exceeded. 1993
Nitrite (NO ₂)	3 (d)	-	○	○	○	○	○	○	○	○							○	○	1995 1994 Nitrate/nitrite standard exceeded. 1993 Suggests pollution from sewage
Nitrite/Nitrate (N)	-	6	○	○	○	○	○	○											1992

Notes:

- (PS) Performance Standard for filtered water before disinfection.
- (P) Provisional
- (a) Level for copper 1 mg/l to prevent staining
2 mg/l on health grounds
- (b) Value must depend on climate and local conditions
- (c) Level for Manganese 0.1 mg/l to prevent staining
0.5 mg/l from toxicity effect
- (d) The sum of the concentrations of nitrite and nitrate to their respective GV'S should not exceed 1.
- (e) Unless otherwise stated data is for

Key:

- Complies with WHO Standards and RSA Domestic Water Quality Guideline level (SABS 241)
- Exceeds WHO Standard
- ×
- ⊙ Exceeds recommended limit in RSA Domestic Water Quality Guideline level (SABS 241)
- ⊙ Exceeds both recommended limit in SABS 241 and WHO Standard

1995
1994
1993
1992

**CHAPTER 7 : REVIEW OF POLICY REGARDING
SECOND TIER ROLES AND RESPONSIBILITIES**

CHAPTER 7 REVIEW OF POLICY REGARDING SECOND TIER ROLES AND RESPONSIBILITIES

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CHAPTER 7 REVIEW OF POLICY REGARDING SECOND TIER ROLES AND RESPONSIBILITIES

7.1 Scope of Review

The Engineering Consultants focused on policy as it affects the Second Tier while the Institutional Consultants focused on policy as it affects the Third Tier. For completeness however, some insight into the Local Government Transition Act of 1993 is included in this report. The work relating to the Third Tier is covered elsewhere in this report.

7.2 Review and Collection of Relevant Policy

7.2.1 White Paper on Water Supply and Sanitation

The purpose of the White Paper on Water Supply and Sanitation of November 1994 was to set out the policy of DWAF with specific regard to water supply and sanitation services. It does not address other functions of DWAF such as the management of the quantity or quality of water resources except in so far as they are relevant to the main theme.

South Africa's entire framework of government is undergoing massive transformation. In order to ensure that existing institutional capability for water supply and sanitation provision is maintained in the short term, and that the foundations of a sound institutional structure are laid for the long term, the Government has set the following institutional goals:

- (1) In the long term, the goal is that the provision of services to consumers should be the function of competent, democratic, local government supported by provincial governments. Where necessary and appropriate, Second Tier organizations (such as Water Boards) will provide bulk or regional water supply or wastewater disposal services to local authorities under the supervision of DWAF.
- (2) In the medium term, the objective of Government is to support institutional development at a local level as well as to provide financial and technical assistance for the physical development of water supply and sanitation services.
- (3) In the short term, the immediate goals are to maintain service delivery, to rationalize DWAF, to ensure smooth integration of the former homeland staff, and to transform and democratize water boards and to gear up to achieve medium term goals.

Water boards will be considered as the primary agent of DWAF in the development of water supply and sanitation services at regional level. Water boards will continue to function as non-profit making, parastatal, autonomous utilities as described in the Water Act of 1956 under the authority of the Minister of Water Affairs and Forestry.

The moral and political demand for water, however, requires immediate action. DWAF has tabled legislation which enables it to intervene on a number of fronts. One intervention mechanism is that the mandate of Water Boards will be expanded so that they can provide water supply and sanitation services to the final consumer.

(1) Water boards

Water boards were established to supply bulk water for industrial or municipal use within an area determined by the Minister. In future, water boards will be charged with fulfilling an appropriate role in the provision of services to all communities in their service areas. Water boards will perform two different roles:

- (a) Firstly, they will continue to supply water directly to organized communities and, where appropriate, to individual consumers. This may also include the provision of sanitation services where appropriate.
- (b) Secondly, they will perform a support role. They will assist in the establishment of statutory Local Water Committees and in the training of the committees to manage their own water supply and sanitation service provision. Assistance will take the form of technical, administrative and training support to Local Water Committees and local authorities.

The service areas of water boards may accordingly be divided into supply and support areas.

In order to ensure that water boards fulfill their required function in terms of the policy set out in the Water Supply and Sanitation WP and in support of the RDP, the following programme has been instituted:

- (a) In the past, persons serving on the water boards did not reflect the full spectrum of consumers of water. This is being rectified to ensure that there is proper representation of all sectors of society.
- (b) Under the previous government, the area of supply of water boards did not include homeland territories. In consequence, the area of supply of the present water boards are, in many ways, illogical and will be redefined and rationalized.
- (c) The functions of water boards need to be redefined to include supplying water to local communities where there is no local authority and to include sanitation. In addition, Water boards will need to support communities in the development and operation of small local water supply systems where bulk systems are inappropriate.
- (d) Tariff structures need to be revised in some instances, with justifiable tariff equalization where appropriate.
- (e) New water boards need to be established where they do not exist at present.

Water boards will be required to continue to function as independent financial entities on a break-even basis. This is important to ensure that they operate efficiently and effectively.

(2) Goals in terms of level of service provision

The White Paper also sets a key goal for DWAF in terms of service provision. The goal is that by spending an additional 1% of the national budget over seven years (from November 1994), a universal basic water supply and sanitation service can be provided to all citizens.

This universal basic level of water supply is described by the following parameters:

- (a) Quantity of water supply: 25 litres per person per day.
- (b) Cartage: The maximum distance which a person should have to cart water to their dwelling is 200m.
- (c) Availability: The flow rate at the outlet should not be less than 10 l/min and the water should be available on a regular daily basis.
- (d) Assurance of supply: Schemes for domestic water supply should ensure the availability of raw water for 98% of the time.
- (e) Quality: The quality of water provided as a basic service should be in accordance with generally accepted minimum standards with respect to health related chemical and microbial contaminants.
- (f) Upgradability: The desire of many communities to upgrade a basic service to provide for household connections should be taken into account.

(3) Comments on the White Paper

The White Paper is not an Act that has been passed by Parliament but is however an extremely useful document as it provides an insight into the current policy of DWAF. It is also the document that is most often quoted by DWAF officials when explaining policy.

The Water Supply and Sanitation WP supports the constitutional viewpoint that water boards or DWAF are not a replacement for local authorities and should not attempt to establish such a role. Allocating the responsibility for the provision of water and sanitation to local government is possibly the only way of ensuring democratic accountability of service agencies to the local population.

The White Paper expresses the importance of water boards remaining financially self sufficient. This implies that consumers should pay for services provided. Consumers can however, only be expected to pay the cost of services if appropriate levels of service are provided relative to the availability of capital, income and other resources to those consumers and if, through their elected officials, they had a say in the level of those services.

7.2.2 The Water Act (Act 54 of 1956)

Water boards have, with the exception of Rand Water, were all established in terms of the Water Act (Act 54 of 1956). Rand Water was established separately under the Rand Water Board Statutes Act (Act 17 of 1950).

The traditional bulk supply functions of Water Boards are defined in terms of the Water Act and comprise essentially:

- (1) Establishment, maintenance and control of schemes in order to provide and supply water for urban, industrial, and agricultural purposes to local authorities, state departments, Provincial administrations or other persons within the proclaimed area;
- (2) Establishment, maintenance and control of purification and effluent treatment plants;
- (3) The appointment of engineers, technical officers etc;
- (4) The raising of money by way of loans;
- (5) The acquisition (by purchase or lease) of office buildings, water works, reservoirs, pipelines etc;
- (6) The planning of schemes;
- (7) Entering into contracts with local authorities etc for the supply of water or for the purification or disposal of wastewater etc;
- (8) With the concurrence of the Minister, to enter into an agreement to supply water outside the area for which the Board was established, or to purify or dispose of wastewater etc;
- (9) Subject to certain provisions, to make and recover charges for water supplied;
- (10) To purchase or otherwise acquire supplies of water; and
- (11) To repair and maintain the schemes or purification / treatment works.

The role of water boards as implementer and operator of regional or bulk water and wastewater schemes, and where appropriate, taking responsibility for water resources management functions, is seen as the core functions of water boards and is not questioned.

Many experts and lay people have, however, been saying for a number of years that the water law needs to be thoroughly revised to take into account the greater scientific understanding of our surroundings as our economy and technology changes, and especially as society changes. The Minister of Water Affairs has accordingly appointed a Water Law Review Committee to review the Water Act. The first output of this committee was two drafts of the basic principles for a new water law.

Bophuthatswana was regulated under its own Act, Water Act 1998 (Bophuthatswana), and Bophuthatswana Water Supply Authority (North West Water Associated) was regulated under the Bophuthatswana Water Supply Authority Act, 1988. This clearly created a problem when the homelands were reintegrated and to provide for the rationalization of amongst others, these two Acts, the Water Laws Rationalization and Amendment Act of 1994 was passed to define, redefine and delete certain expressions of these two Acts. The Water Laws Rationalization Act enabled the functioning of NWWA in an extended area of jurisdiction and enabled other water boards (MW and RW) to function in certain areas of former Bophuthatswana.

7.2.3 White Paper on the Reconstruction and Development Programme (RDP)

The RDP is a vision for the fundamental transformation of South African society. It is the duty of government to manage this transformation. This is being done by the development of key medium and long term programmes which incorporate the basic aims of the RDP and which allow for effective management. These programmes have been launched through Presidential Projects. The projects kick-start the implementation of the RDP and provide a useful learning experience to improve the implementation strategies in a dynamic manner.

The challenge facing the Government is to facilitate and give substance to the six basic principles of the RDP. It is the combination of these principles that ensures a coherent programme. The six basic principles are as follows:

- (1) First, we require an integrated and sustainable programme.
- (2) Second, this programme must become a people driven process.
- (3) Third, this programme and this people driven process are closely bound up with peace and security for all.
- (4) Fourth, as peace and security are established, we will be able to embark upon nation building.
- (5) Fifth, nation building links reconstruction and development.
- (6) Sixth, these first five principles all depend on a thorough on-going democratization of South Africa.

The RDP White Paper reinforces the concept that the restoration and upgrading of services where they have collapsed, and the extension of services to new areas are vital preconditions for the continued legitimization of the new local authorities. Improved services must be implemented in a manner which enhances appropriate institutional changes within local authorities.

In most rural areas where the Third Tier of government does not have the capacity, Provincial Government will be encouraged to initiate a process of building local government.

Originally it was envisaged that the RDP would be coordinated by a stand alone Ministry. The RDP is however so fundamental to government policy that each of the line functionary

departments, including DWAF, are accountable for the success of the RDP in their sector. The consultative and bottom up approach to development embodied in the RDP White Paper is one of the underlying philosophies of the White Paper on Water Supply and Sanitation.

7.2.4 Draft Report on the Scope and Function of Water Boards

(1) General recommendations

A number of general recommendations have been made in the "Draft Report on the Scope and Function of Water Boards" concerning the extended function of the water boards. These recommendations are:

- (a) that a water board establish a system of communication with the communities within its area of establishment;
- (b) that water boards explain to the communities the services and capabilities that the water board can offer them;
- (c) that water boards establish procedures to be followed by the communities for their own local water committees, applications for funds, applications for technical assistance and applications for training;
- (d) that water boards make funding available to local water committees for the establishment of water supply and sanitation schemes;
- (e) that water boards provide technical assistance in the planning of any proposed local water supply or sanitation scheme;
- (f) that water boards monitor the expenditure and application of funds made available for projects;
- (g) that water boards provide appropriate training to provide the requisite managerial, administrative and technical skills to build the capacity to plan, construct, operate and maintain the water supply and sanitation schemes;
- (h) that water boards provide ongoing support and monitoring service in the future; and
- (i) that water boards are to maintain ongoing contact and communication with the communities that they serve, to provide assurance on the nature of the water supply and of any tariff changes or matters of that nature.

(2) Financial viability of water boards

The Draft Report makes the following recommendations regarding the financial viability of water boards:

- (a) Water boards should set bulk water and wastewater tariffs on a cost-recovery basis.
- (b) Services should operate on sound business principles, with the responsibility of the consumers for paying for services provided clearly defined and understood.
- (c) Water boards should function in a publicly accountable fashion as transparently as possible, particularly when relating to the issue of subsidies.
- (d) Subsidies, where applied, should be clearly identified, goal orientated and carefully targeted, so as to keep distortions to a minimum, and at a level which is sustainable whilst meeting their objectives for as long as justified.
- (e) Ideally all tariffs, including the cost of raw water charged by DWAF to the boards, should show the full cost of operating and maintaining the scheme and separately, the full cost of the capital component (in order that subsidies are transparent and to facilitate determination of life line tariffs).
- (f) The construction or refurbishment of water supply and sanitation schemes will require considerable capital input. The role that the water boards should play in raising this equity should be determined

(3) Comment

The Draft Report on the Scope and Function of Water Boards provides a vision of water boards taking positive steps to accept their responsibility for supporting local government with the provision, maintenance and operation of water services. The Draft Report envisages this support to be both of a financial and technical nature.

For water boards to successfully support local authorities in their function of providing water to communities, whilst not removing the responsibility for that function, the following actions are suggested (based loosely on the methodology set out in the Draft Report on the Scope and Function of Water Boards):

- (a) A system of communication such as an Area Planning Committee should be set up between water boards, local authorities (and their Water Committees), and Provincial Government. The local authority needs to be made unaware of the services that the Water Board can offer in order for the local authority to be able to express its needs, and in order for the water board and local authority to jointly explore ways in which those needs can be met.
- (b) The local authority, with the assistance of the Province and advised by the water board, should establish its own institutional arrangements (water sub-committee, appointment of officials, or other responsible persons such as consultants), so that there are clear lines of communication on the different matters with which local authorities and water boards have to relate.

- (c) Similarly, the water board in turn should strengthen its organizational capacity to assist local authorities and communities in expressing their requirements. This may include the appointment of officials with the prime responsibility of liaising with local government and other Third Tier structures.
 - (d) The local authority should compile, with the assistance of the Provincial Government and the water board, applications for bulk water supply, technical assistance, training and funds. These applications should be debated at a political level within the local authority structure. The technical choices will have to be presented for debate in a way that the implications, and especially the cost implications, can be easily understood.
 - (e) On approval by the elected officials within the local authority, the applications for bulk water supply, training and other forms of technical assistance should be submitted to the water board.
 - (f) The Area Steering Committee should then review the applications, and with full disclosure, approve, prioritize and programme the applications.
 - (g) On approval of an application, the water board and local authority could put in place a joint performance monitoring system to monitor progress and the application and recovery of funds.
- (4) Comment on the requirement that water boards remain financially sustainable

Financial sustainability implies striving for independence from external subsidies. Subsidy decisions should be made by political bodies. Water boards can give input to the decision but it should not be seen as the role of water boards, or within their capacity, to either raise or pay subsidies. Water boards may however be employed as agents to undertake basic services provision on a subsidized basis where the subsidies will be provided by the Central or Provincial Government to local authorities.

If local government is going to be responsible for collecting the tariffs, they should probably take responsibility for repaying the loans and should enter into some form of off-take agreement with the water board, possibly underwritten by the Provincial Government. If the water board is to collect the tariffs, it is difficult to see how the local authority will be able to fund their own administrative costs that are normally reliant on a mark up on service charges.

A model that has been suggested is that the water board take up a loan after a social compact has been established between the community (which may or may not be represented by a statutory committee), the local authority and the water board.

Such compacts should at least contain a description of roles and functions, performance standards, and recourse mechanisms.

The viability of the various funding sources and options will have to be carefully evaluated by water boards when taking over existing infrastructure and when constructing new infrastructure.

The JICA Study can be seen as a case study in which the vision provided in the Draft Report can be tested in a specific context.

7.2.5 Local Government Transition Act

The Local Government Transition Act is a product of negotiation of the Local Government Negotiating Forum and the multi-party negotiations at national level and envisages the restructuring of local government in the run up to elections which were held at local government level towards the end of 1994.

The Local Government Transition Act, Act 209 of 1993 provides for revised interim measures with a view to promoting the restructuring of local government, and for that purpose:

- (1) to provide for the establishment of provincial committees for local government in respect of forums for negotiating such restructuring of local government;
- (2) for the exemption of certain local government bodies from certain provisions of the Act;
- (3) for the establishment of appointed transitional councils in the pre-interim phase;
- (4) for the delimitation of areas of jurisdiction and the election of transitional councils in the interim phase;
- (5) for the issuing of proclamations by the administrators of the various provinces;
- (6) for the establishment of local government demarcation boards in respect of the various provinces;
- (7) and for the repeal of certain laws; and to provide for matters connected therewith.

The pre-interim phase means the period commencing on the date of commencement of this Act and ending with the commencement of the interim phase.

The interim phase means the period commencing on the day after elections are held for transitional councils and ending with the implementation of final arrangements to be enacted by a competent legislative authority.

The Act provided for the establishment of appointed transitional councils in the pre-interim phase (which is passed) and for the delimitation of areas of jurisdiction and the election of transitional councils in the interim phase.

Schedule 2 of the Act sets out the powers and duties of transitional metropolitan council. The following powers and duties are of interest to this Study:

- (1) Bulk supply of water;
- (2) Bulk sewage treatment works and main sewerage disposal pipelines for the metropolitan area;
- (3) The establishment, improvement and maintenance of other metropolitan infrastructural services and facilities;
- (4) The power to levy and claim:
 - (a) the regional services levy and the regional establishment levy,
 - (b) levies or tariffs from any transitional metropolitan substructure,
 - (c) an equitable contribution from any transitional substructure based on the gross or rates income;
- (5) The receipt, allocation or distribution of intergovernmental grants; and
- (6) The power to borrow or lend money, with the prior approval of the administrator.

The pre-interim phase has been completed in the Study Area. The boundaries of the Transitional Councils have been demarcated, the elections of the Transitional Councils has taken place and they have replaced the appointed Councils.

The Act makes provision for the constitution of Third Tier politically based multi- function services agencies along the lines of the Regional Services Councils.

The legislators clearly had in mind when writing the Act, the provision of water and sanitation services by local authorities, with bulk services being either provided by metropolitan authorities, the existing water boards, services councils (non-metropolitan areas), or the local authorities themselves.

Considering that we are in the Interim Phase, it could be deduced that it is now time for the elected Transitional Councils to build their capacity as required to carry out their duties.

7.2.6 Other Relevant Documents on the Water Supply Sector

- (1) The role of the National Department of Water Affairs and Forestry in supporting local service provision. Mr Mike Muller, DWAF.

In this document the Deputy Director General of CWSS, DWAF indicates that DWAF is mindful of the constitutional division of powers and functions and of the fact that the entire country is nominally covered by local government structures with the constitutional obligation to provide services such as water supply and sanitation "where financially and physically possible". He also explains that the current policy of DWAF is to continue to provide services where local government is, as yet, unable to do so, to

help to develop the capacity of local communities to do this, and to promote the use of financial resources to reduce the backlog in service provision.

In addition DWAF will further develop both existing and new water boards as utilities oriented to serving the needs of all residents of their areas of operation and not simply serving those with local governments capable of using the bulk supplies offered by the boards.

- (2) Private sector must not be free to water down local government. Newspaper article. Mr Mike Muller, DWAF.

In this article the Deputy Director General CWSS, DWAF cautions that the use of the private sector must not be allowed to undermine the integrity of new democratically elected local government.

- (3) Abstract from the 1993 Constitution of the Republic of South Africa.

According to the interim constitution, the responsibility for providing water and sanitation services to households and, the accountability to households, rests squarely with local government.

This presumably does not preclude the possibility of water boards from rendering services on behalf of the local authority. In essence this means that the choice of delivery should be left to the democratically elected Third Tier local government, and that water boards should only be seen to be assisting with Third Tier functions at the explicit request of the local authority and only to the extent required by the local authority. Significant commitments undertaken by local government should probably occur with the full knowledge and approval of the Provincial Government who is responsible for supporting local government and ultimately for the success of local government.

- (4) Final Draft Principles of Water Law Review for DWAF, internal discussion; and Draft Principles of Water Law Review, as released to the media; Fundamental Principles for a New Water Law, Report to the Minister on 9 January 1996 of the Water Law Review Panel

The Water Act is being rewritten. The Water Law Review Committee has invited comments on the draft principles for the new law.

The draft principles support the right of all citizens to have access to basic water services necessary to afford them a healthy environment, on an equitable and economically and environmentally sustainable basis.

- (5) Government Gazette 12 July 1995, regulations made under section 26D of the Water Act, 1956, relating to the establishment, powers, duties and functions of local water supply and sanitation committees

These regulations set out the establishment, powers, duties and functions of local water supply and sanitation committees.

Included in the powers listed for local water committees are the following:

- (a) construct or otherwise operate and maintain any water work or other facility for or in connection with the rendering of a water supply or sanitation service;
- (b) to acquire a right to a supply of water;
- (c) to render a water supply or sanitation service;
- (d) to appoint such employees etc;
- (e) to procure services of such agents, consultants and contractors etc;
- (f) to assess charges; and
- (g) to raise money.

(6) Draft of National Water Supply Regulations

This draft sets out regulations governing the activities of the local authority as well as regulations governing the relationship between the local authority and the consumer.

Subjects covered include:

- (a) making an application for a supply of water;
- (b) getting connected;
- (c) metering;
- (d) payment;
- (e) pollution of water;
- (f) restrictions on the use of water; and
- (g) technical requirements for a water installation.

(7) Water and Sanitation in Urban Areas: Financial and Institutional Review, Volume 3 - Meeting the demand for water and sanitation services: getting it right in the transition, WRC Report 571/3/94; and Water and Sanitation in Urban Areas. Financial and Institutional Review, Volume 6 - Summary Report, WRC Report 571/6/94

These documents provide the Standing Committee on Water Supply and Sanitation

(SCOWSAS) principles which should guide the choice of institutional arrangements in South Africa. The principles are:

- (a) people focused;
- (b) comprehensive;
- (c) equitable;
- (d) responsible;
- (e) sustainable;
- (f) accountable;
- (g) effective and efficient;
- (h) empowering; and
- (i) representative.

The SCOWSAS criteria for success with institutional arrangements are also provided. These criteria are:

- (a) boundaries should be clearly delineated,
- (b) effectiveness,
- (c) finances, services should operate on sound business principles,
- (d) accountability, and
- (e) environment, strategies and plans should be sensitive to the environment.

Financial and sustainability principles are also provided.

- (8) Rural Water And Sanitation Institutional Proposals - Public Consultation, March 1994, Department of Water Affairs and Forestry

The object of this public consultation document was to test some of the basic concepts proposed for the formation of the institutional framework of the Department of Water Affairs to address South Africa's rural water and sanitation problem.

- (9) Water Laws Rationalization and Amendment Act No 32 , 1994

Bophuthatswana was regulated under its own Act, Water Act 1988 (Bophuthatswana), and Bophuthatswana Water Supply Authority (North West Water Associated) was

regulated under the Bophuthatswana Water Supply Authority Act, 1988. This clearly created a problem when the homelands were reintegrated and to provide for the rationalization of amongst others, these two Acts, the Water Laws Rationalization and Amendment Act of 1994 was passed to define, redefine and delete certain expressions of these two Acts. The Water Laws Rationalization Act enabled the functioning of NWWA in an extended area of jurisdiction and enabled other water boards (Magalies and Rand Water) to function in certain areas of former Bophuthatswana.

- (10) **The Government's Responsibility for Water Supply and Sanitation - The Constitutional Position, Paper to the Water Supply and Sanitation Policy Conference, 28 and 29 July 1994.**

It is concluded that Central Government is the custodian of the country's water resources, allocating rights, establishing minimum standards and supplying services where nobody else is doing it or can do it.

Provincial Government is responsible for the execution of its commissioned Schedule 6 powers within the approval granted by Central Government for the use of water as well as the standards laid down.

Local government is bound to supply services, including water and sanitation, but within the limits and according to standards set by and with the support, where necessary, of Central Government.

- (11) **Proposed SCOWSAS Institutional Arrangements**

SCOWSAS propose that second tier institutions would cover the whole country. Water area commissions will be elected by a college representing all local interests and its function would be to advise Provincial Government, the National Water Commission, and water area authorities with regard to water and sanitation needs, policies, water allocations and subsidies.

Water area authorities would have broad responsibility to ensure that water and sanitation delivery systems are implemented. Its functions would include:

- (a) proposals for water area standards;
- (b) operation of bulk water schemes;
- (c) promote the establishment of water and sanitation organizations;
- (d) assume area responsibility for water and sanitation management;
- (e) inform the debate on tariff policy and state funding assistance;
- (f) act as agents of the National Water Auditor;

- (g) water consumer advice and information;
- (h) inter water area water resource planning and development;
- (i) water area conflict mediation;
- (j) long term water area resource planning;
- (k) water area delivery systems;
- (l) water area pollution control;
- (m) tariffs; and
- (n) water area management strategy for water and sanitation.

Interesting parallels can be drawn between water boards as envisaged by DWAF and water area authorities as envisaged by SCOWSAS.

7.3 Consultation with Government Officials for Identification of Policy

7.3.1 National, Regional, and Provincial Officials of DWAF

- (1) Ms L Colvin, Director Organizational Development, explained DWAF policy during a one day workshop on finalizing the TOR for a study on institutional matters for DWAF CWSS. Ms L Colvin has also provided insight into DWAF policy in a document co-authored with Mr L Abrahams.

Ms Colvin has highlighted that clear efforts and emphasis is being placed by government on the process of democratization and empowerment.

The DWAF approach, as translated by Ms Colvin, conforms with the principles of the constitution in that it clearly recognizes that local government carries the ultimate responsibility for service provision. Given the absence of adequate capability at local government level, it is necessary to look at interim arrangements, so long as these arrangements do not undermine local government development, and as long as there is accountability to local government.

Ms Colvin envisages that through a process involving area planning forums or other area planning structures, the needs will be identified by communities and will be brought to the attention of Third Tier structures and communicated upwards. It is important that sensitivities regarding the authority of emerging local government be recognized and that neither the First Tier or the Second Tier should be over prescriptive. The Third Tier should be informed and presented with possible options. The expression of needs should come from the communities themselves.

- (2) A discussion was held with Mr S Vogel, Regional Director of DWAF in North West Province. Mr Vogel supports the policy as set out in the document produced by Ms L Colvin and L Abrahams. He believes that, depending on affordability criteria, it will take some local government structures longer than others to assume full responsibility for service provision. It may be that it will take longer to build capacity in the poorer areas in the west of North West Province than in those areas with higher financial viability in the east of the Province. Mr Vogel envisages a role for water boards in the interim, that is until local government structures have build sufficient capacity. Water boards should provide their support in a positive energetic way. This interim period may, in some areas, last for an extended period.

Mr Vogel explained that DWAF is responsible in the final instance for water provision, and that the water boards can be seen in some regards as an extension to DWAF.

Mr Vogel also highlighted the importance of detailed demand forecasts when planning for areas of high growth, taking cognizance of the economic driving forces.

- (3) A lengthy discussion was also held at a joint sitting with Mr Pelpola (Director, RDP Implementation, CWSS), Mr P Pyke (Water Boards, CWSS), Mr van Aswegan (Mpumalanga Region), Mr H Muller (Director, Mpumalanga Region), and Mr D Davidson (Maintenance and Operations, CWSS). The discussion was then continued with Mr Pelpola.

Mr Muller and Mr van Aswegan explained that, as there are at present no Water Boards in the Kwandebele/Mpumalanga Region, and as the DWAF Regional Office has limited capacity, a policy of handing over responsibility for water supply to local government has been followed. Close contact has however been maintained with the local government authorities and water related meetings are regularly attended and advice provided.

Mr Pelpola has also indicated that not all local authority service areas are financially viable and that a subsidy reduction could be expected after Magalies took over control of the designated NWWA areas.

7.3.2 Discussions relating to the Four Provinces

A discussion was held with Mr Kruger of Department of Constitutional Development regarding the role of water boards, Provinces and local government.

It is clear that care must be taken that the functions, powers, and structure of local government should not be encroached upon or that the fundamental status, purpose or character of local government should not be compromised.

Mr Kruger was of the opinion that there was a danger that DWAF could be acting outside of the Constitution if it managed Third Tier water supply functions without accountability to local government.

Mr Kruger agreed with the statement that Local authorities can manage water and sanitation

services effectively, provided that:

- (1) that they give water and sanitation services the special attention that it deserves; and
- (2) that they can secure adequate finance to meet capital investment needs.

DWAF may currently see water board as a last resort for the delivery of services to households in the case of local government failure. Care must be taken, however, to ensure that democratically elected authority is not perceived to be usurped as a means of attaining short term goals, or that local government failure is predetermined without allowing an opportunity for local government, with the assistance of Provincial Government, to acquire the required resources.

Water supply and the management of water resources are not functions designated to the Provinces according to the interim Constitution.

The Provincial role is however, to ensure the correct functioning of local authorities, which are in turn ultimately responsible for the delivery of water supply and sanitation services.

If the Water Boards are invited by the local authority to temporarily fulfill some of the functions of the local authority and to provide water supply and sanitation services directly to the individual consumer, then the Provincial Government should be kept fully informed of such intervention.

It is also important that existing structures such as Provincial RDP forums are supported and that when water boards are involved in local authority roles and especially in capacity building and training in certain aspects of local government, that close liaison be maintained with Provincial Government, and DWAF so that the efforts are coordinated and channeled through the correct institutions.

7.3.3 Relevant representatives of regional and local governments

Meetings were held during collection of infrastructure data with a number of municipalities.

- (1) Mr J Cunniff of Rustenburg District Council explained the constitutional role of local government and was confident that capacity would be put in place to manage water services (together with other services).

Mr Cunniff's view point is set out in the following policy statement issued by his district council. "It is the policy of the District Council to obtain water in bulk from Magalies Water at agreed supply points for distribution to consumers within the constituency of the District Council. It is furthermore the policy of the District Council to consider the implementation of appropriate levels of service regarding water supply including the financing of such systems. It is also the stated objectives and policy of the District Council to take control of RDP projects as well as rural water supply projects and to relieve the Board (Magalies Water) of these functions as soon as possible."