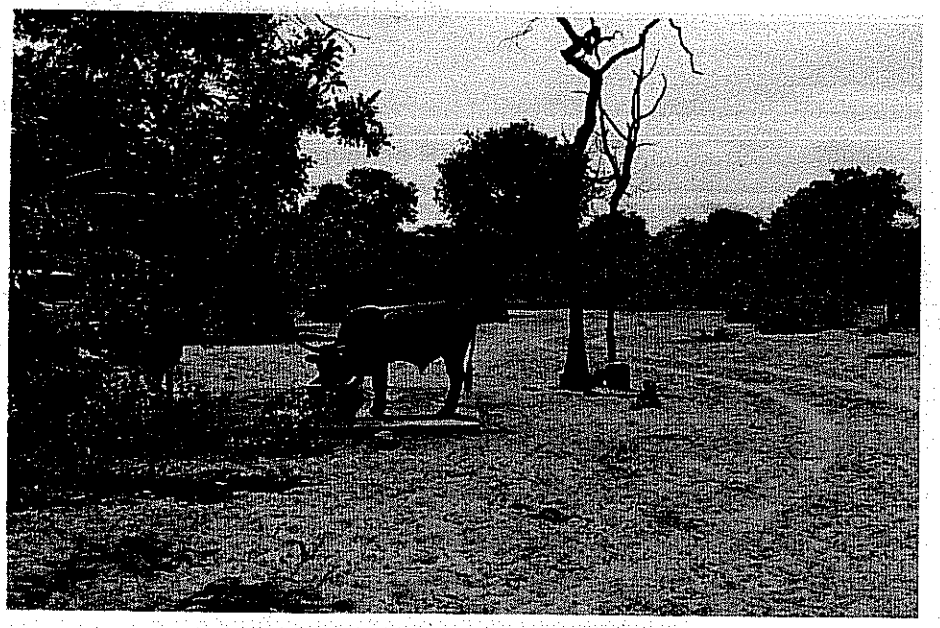
REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND RURAL DEVELOPMENT

REGIONAL RURAL WATER SUPPLY DEVELOPMENT PLAN FOR THE KAVANGO REGION

FINAL REPORT



ADDENDUM TO VOLUME 1

STATE OF THE ENVIRONMENT

GUIDELINES FOR THE DEVELOPMENT OF RANGELAND

LEGAL ISSUES

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1.1 BIOPHYSICAL OVERVIEW

1.1.1 CLIMATE

1.1.1.1 Rainfall

The Kavango Region receives rainfall of approximately 450 – 600 mm annually, increasing generally from south to north. As in all semi-arid climates, there is significant variation in these figures from year to year, but generally 70% of years receive more than 500mm (Yaron et al 1992)[31]. Spatial variations are also considerable: for instance, during the 1985-86 season, Tondora received only 504 mm of rain, while Lupala only 50 km away got 1273 mm (Kirkwood 1994)[16].

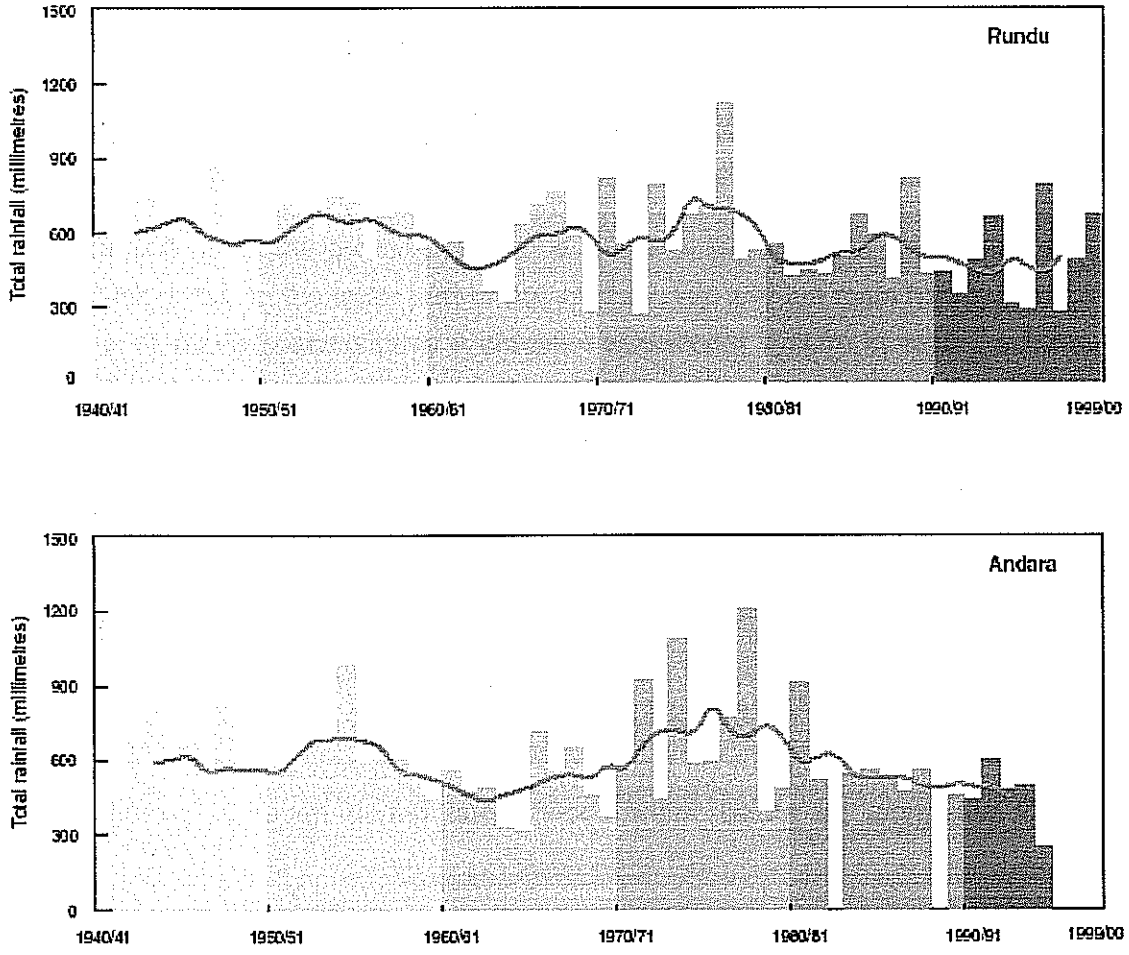


Figure 1: *Annual total rainfall at Rundu and Andara from 1940 to 2000, and the 5-year moving average. (RAISON, el Obeid and Mendelsohn 2001)[22].*

The rainy season is generally from December to March, with 80% of the rains falling during this period (Hennessy 1997[13], el Obeid and Mendelsohn 2001)[22]. The region usually receives between 50 and 60 days of rain per year (DWA Research Division, 1992)[9]. In the 60-year period of rainfall monitoring at Rundu, an average of 29 days of the year received more than 5mm of rain, and these were mostly from December to March (el Obeid and Mendelsohn 2001)[22].

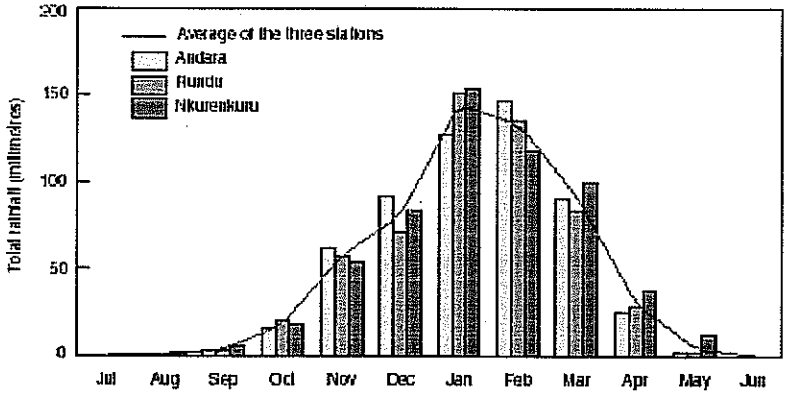


Figure 2: *Average rainfall per month at Andara, Rundu and Nkurenkuru. (From el Obeid and Mendelsohn 2001)[22].*

Variability of rainfall within the growing season is critical to the timing of agricultural activities. For instance, lack of rain in the latter part of the season may ruin the main harvest completely. The uncertainty of rainfall necessitates a complex agricultural system in order for farmers to maximise their chances of achieving reasonable yields.

1.1.1.2 Evaporation and Runoff

Characteristic of the semi-arid climate is the high rate of potential evaporation (approximately 2000 mm/annum), which has the effect of considerably reducing the amount of rain that is usable for plants. Furthermore the sandy soils are quick to drain any water that falls on the surface, so that soil moisture is very low. There is almost no surface runoff into the Okavango River from Namibia, although during large floods water backs up along the Omuramba Omatako.

1.1.1.3 Temperature

Temperatures are generally mild to hot, although nights are cold in winter. Frosts do occur very rarely and they are usually confined to the lower ground alongside the Okavango River and omiramba.

Winter days are generally clear and sunny, and experience the greatest range in temperatures as heat is lost at night and quickly gained during the day. At Rundu, the mean minimum temperature between the months of May and August lies between 5° and 10° C, while the mean maximum is well above 20° C.

The heat of summer begins to be felt in early September, when mean maximum temperatures lie in the low 30s. Cloudy skies typical of the rainy season moderate the higher temperatures of summer, so that mean maximum temperatures are usually highest in October, lying in the range 32 - 35 °C. Maximum temperatures drop slightly in January and February, although the mean maximum temperature was 36°C in January 1995, which was a particularly dry season. Daily maximum temperatures in summer can reach 41°C.

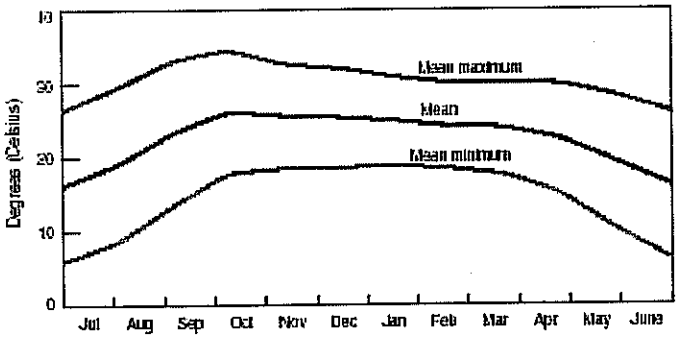


Figure 3: *Average daily maximum, mean and minimum temperatures each month at Rundu. (From el Obeid and Mendelsohn 2001)*[22].

1.1.1.4 Winds

Wind speeds are generally low and in most months it is completely calm for over half the time. The general pattern is that wind speeds are very low in the evening, at night and in the early morning, and peak at about midday and in the early afternoon at about 12 km/hour (el Obeid and Mendelsohn 2001)[22]. Violent squalls often accompany thunderstorms.

1.1.1.5 Climate Variability

The important characteristic of the climate in this semi-arid region is variability. Rainfall, humidity, temperature and evaporation rate are linked components of the daily weather, so extremes in the one are reflected in the other climatic conditions at the time. While general patterns in the weather are discernable, such as those described above, the variations, and particularly the extreme conditions such as very heavy rains or a severe drought, can have an impact felt for years, that far outlasts their short duration.

1.1.2 DRAINAGE

1.1.2.1 The Okavango River

The most conspicuous and important drainage feature of the region is the perennial Okavango River on the northern border of the country. The entire Okavango River Basin is shown in **Figure 4**.

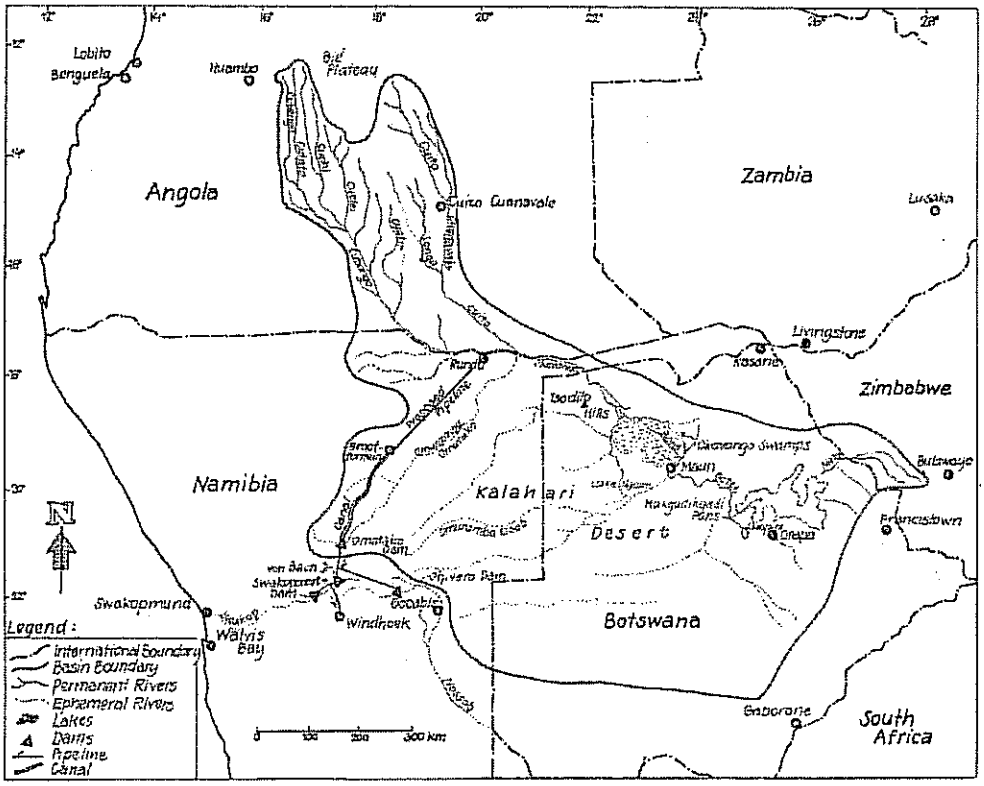


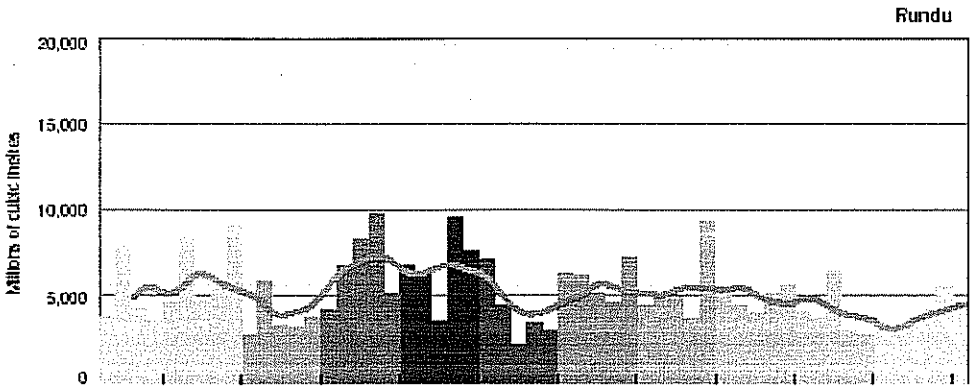
Figure 4: *The Okavango River Basin. The proposed pipeline from Rundu is not yet built and is not a priority for present bulk water supply in Namibia. (From Pallett 1997).*

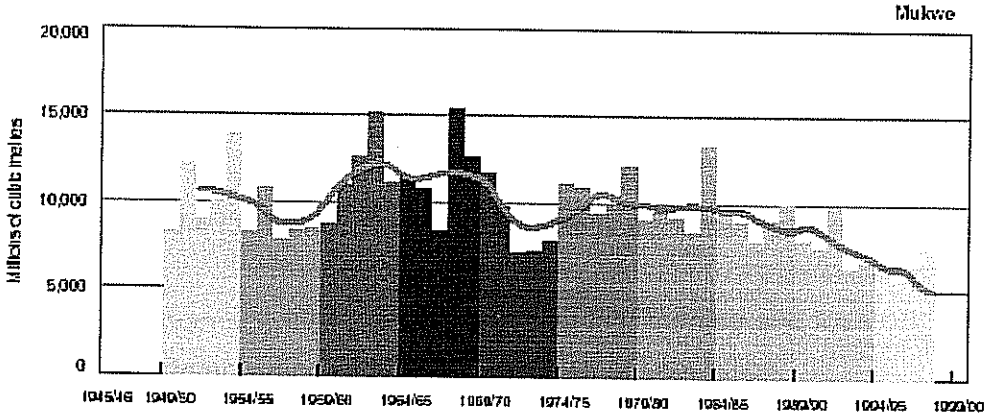
The Okavango River drains three countries, Angola, Namibia and Botswana, but almost the entire runoff of the basin is generated in the Angolan Highlands. Called the Rio Cubango in Angola, it meets the Namibian border at Katwitwi and then meanders through a floodplain that is 2 - 6 km wide and slightly depressed below the level of the surrounding woodlands. A second tributary, the Rio Cuito, joins the Okavango River near Nyangana Mission, about 100 km downstream of Rundu. This tributary provides about half the total annual runoff of the whole river, and it has a more even flow rate and later flood peak than the Cubango. The area of the confluence of the two rivers is characterised by extensive floodplains and a section of permanent swamp (Bethune 1991[2], DWA Research Division 1992)[9].

Where the Okavango runs along the border it is a large, sluggish, low-gradient river. Summer floods, starting from about September in Angola, usually reach Namibia in January or February and inundate large areas within the valley. The floodwaters continue to rise until April, and then take several months to recede. High water is usually three to four times higher than the lowest levels in November, and the river carries 4 - 6 times more water at this time than in the winter months (Bethune 1991)[2]. During low flow periods the water is confined to the main channel which is seldom more than 100 m wide and less than one metre deep in places.

In the north-eastern arm of Kavango the river cuts through the narrow finger of Namibia's Caprivi Strip and then enters Botswana where it empties into the Okavango Delta.

Figure 5: *Graphs of annual runoff of the Okavango River, measured at Rundu (ie runoff from the Rio Cubango only) and at Mukwe (ie runoff from both Rio Cubango and Cuito). Each year is measured from October to September the following year. The orange line shows the 5-year moving average. (From el Obeid and Mendelsohn 2001)*[22]





1.1.2.2 Omiramba

The negligible slope of Kavango combined with high permeability of the soil produce very little surface drainage. Within the limited catchments of ephemeral river courses, locally known as omiramba (singular omuramba), horizontal drainage does occur after heavy rains to produce surface flow, although this is always of short duration and is generally blocked by vegetation, thickets and sediments in the river courses.

In areas that lack omiramba, rainfall is absorbed directly into the soil or may accumulate in pans in shallow depressions (Hennessy 1997)[13].

The main tributary of the Okavango on Namibian soil is the Omuramba Omatako, with its headwaters between Okahandja and Otjiwarongo. Its contribution to flow in the Okavango is now zero as it is extremely unlikely to reach the main stem of the river (Bethune 1991)[2]. Even during the largest flow recorded this century, in 1979, the floodwater failed to reach the Okavango River, and it seldom flows further north than Kanovlei, just south of the Kavango border (Bethune 1991[2], Bethune and Skelton 1984)[27]. Annual floodwaters in the Okavango river can push up into the channel of the Omatako for several kilometers, forming an important and productive backwater at Ndonga (Bethune 1991[2], DWA Research Division 1992)[9].

1.1.3 TOPOGRAPHY

The Kavango Region appears superficially to be a uniform environment dominated by plains of unconsolidated sands sloping gradually northwards to the perennial Okavango River. On closer inspection it is actually an intricate mosaic of small-scale variations in topography, soils and vegetation. Three dominant features are responsible for the patterns that are found:

- Aeolian processes in the geological past that have sculpted the land into long, low east-west oriented dunes;
- Incision by the Okavango River and other less significant ephemeral channels;
- Recent human activities - mostly land clearing, burning and livestock farming - that have considerably modified the natural cover of vegetation.

The area lies between 1000 and 1200 m above sea level and has no outstanding features of relief. The low height of dunes (rarely more than about 10m above the adjacent valleys) and the fact that they are clothed in bush and woodland makes them appear as gentle undulations.

Western Kavango is characterised by extensive parallel dunes oriented east-west and overlying calcrete surfaces. The dunes are stabilised by vegetation. In the north the dunes are more widely spaced and lie on a relatively deeper sand mantle, while towards the south they lie on a shallower sand mantle and are more narrowly spaced. In the south, where the sand covering over the calcrete is thinner, pans commonly occur in the dune streets. The western dune system gradually loses its distinctive morphology towards the east.

The south-western corner of Kavango intersects the northern tip of a broad flat pediplain where calcretes are exposed or lie near the surface. The pediplain thins out to the north and east.

Sand plains cover extensive areas of northern, north-eastern and central Kavango. The depth of sand increases generally to the north and east, as does the extent to which the sands have been worked and reworked by wind. Surface drainage features are imperceptible or non-existent over large parts of the northern sand plains.

A broad, indistinct sandy plateau in central Kavango marks the divide between eastern-draining omiramba and the largest omuramba, the north-draining Omuramba Omatako.

The eastward draining omiramba have incised into the underlying calcretes at increasing depths towards the east, with the result that their valleys tend to get narrower eastwards.

1.1.4 SOILS

Soils and vegetation of the Kavango have recently been assessed (Interconsult 2000) for the Profile of the Kavango Region that is currently being compiled by the Research and Information

Services of Namibia (RAISON)[22]. The work done by Interconsult covered the area of Kavango as defined from 1992 – 1998, ie it excluded the north-eastern arm of the Region extending into the Caprivi Strip. The soils in the latter area are described in the Environmental Profile and Atlas of Caprivi (Mendelsohn and Roberts 1997).

Aeolian, Tertiary-age sands of the Kalahari Basin comprise the substrate of most of Kavango. Small-scale variations in texture and composition occur as a result of in-situ processes and sedimentary reworking.

The Natural Resource Mapping exercise undertaken for the compilation of the Kavango Profile in 1999-2000 included a thorough analysis of soils in the Region, to much greater detail than is required here. The classification system used in the report follows the FAO World Soil Resources Report (1988).

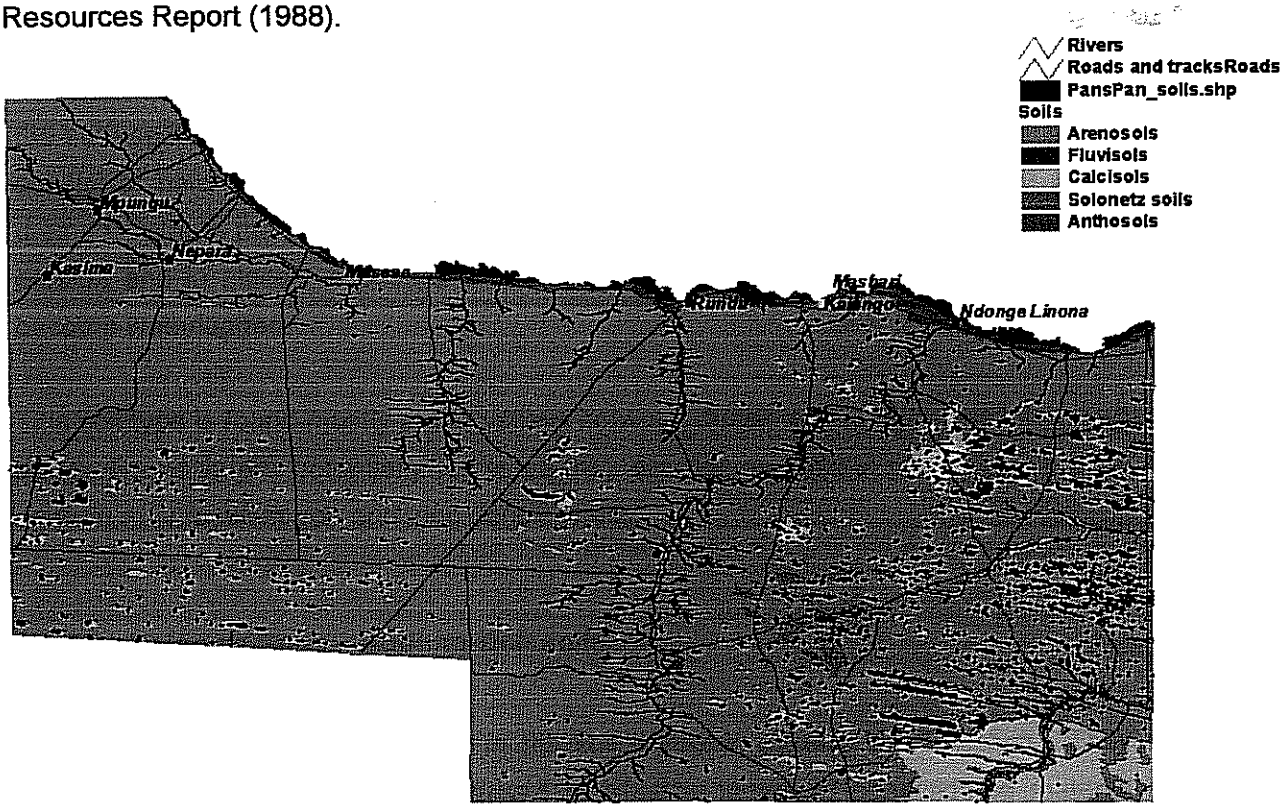


Figure 6 : *Soils of the Kavango Region (Altogether fifteen distinct soil types are recognised, classified into five groups)*

Arenosols	–	predominantly sand
Calcisols	–	soils possessing a calcium-rich horizon
Solonetz soils	–	sodium-rich soils
Fluvisols	–	loamy flood-plain soils
Anthosols	–	soils significantly modified by human activities

1.1.4.1 Arenosols

These soils are predominantly sand to a depth of at least one metre and show no other outstanding properties or horizons. The dominant size fraction is fine, indicating the aeolian nature of the parent material. Clay and silt fractions make up less than 10% of the composition. The soils are generally uniform throughout their depth, without any soil profile development and lacking a crust on the surface. They are highly permeable and storage of water is low within the rooting depth of most plants. Infiltration rates are high and runoff minimal, and they therefore have low erodibility.

1.1.4.2 Calcisols – Soils with a calcium-rich layer

The most prominent feature of soils of this type is the translocation of calcium carbonate from the surface horizons to an accumulation layer at depth. This layer may be soft and powdery or consist of hard concretions, often cemented together as calcrete. Calcisols are mostly well drained. Where the surface layers are silty infiltration may be hindered resulting in sheet-wash erosion and in places, exposure of the calcrete. Where calcretes are shallow the soil may become waterlogged.

This soil type is found mostly in the valleys between dunes and is often associated with surface pans. Calcisols are potentially fertile as they are rich in mineral nutrients, although the high calcium may result in iron and zinc deficiencies.

1.1.4.3 Solonetz Soils – Sodium-rich soils

Soils of this type possess sodium in the soil matrix in excess over calcium. They occur in conditions of impeded drainage caused by shallow layers of consolidated material such as shallow calcrete. The high proportion of sodium ions in the soil is toxic to many salt-sensitive plants and may limit the uptake of essential plant nutrients in salt-tolerant plants.

This soil type is found in a localised area in the divide between the Omuramba Omatako and the eastward flowing Nhoma and Kaudom omiramba.

1.1.4.4 Fluvisols – Loamy floodplain soils

These soils occur on the floodplain of the Okavango River, and they are periodically wet in all or part of the profile due to seasonal flooding. A broad area adjacent to the active river course receives fresh sediment annually, so is regularly rejuvenated. This area is used for wet season cropping and dry season grazing. Although not infertile, these soils are not highly productive.

1.1.4.5 Anthrosols – Modified soils

Adjacent to the main Okavango River channel, in an area up to 2 - 6 km away, the floodplain is no longer seasonally inundated. Soils here are similar in texture to the adjacent fluvisols but are significantly modified by the intensive dryland and irrigated cultivation practiced on them. The surface horizons have been physically mixed by ploughing, chemically altered by the addition of organic materials, and leached by irrigation water. They are generally deficient in potassium.

1.1.5 VEGETATION

Much of the vegetation in the Kavango consists of broad-leafed, deciduous woodlands that vary according to topography and the nature of the soils that support them. As previously mentioned, the mosaic nature of the vegetation makes graphic representation difficult, but broad types can be recognised. They are represented in the map on the next page (**Figure 7**, from el Obeid and Mendelsohn 2001)[22].

The distribution of vegetation types in the Kavango Region is determined primarily by the climatic gradient of decreasing rains from north to south, and by topography with its associated substrate conditions. Overriding these are the impacts of fire, bush clearing and heavy grazing, which introduce changes to the plant communities.

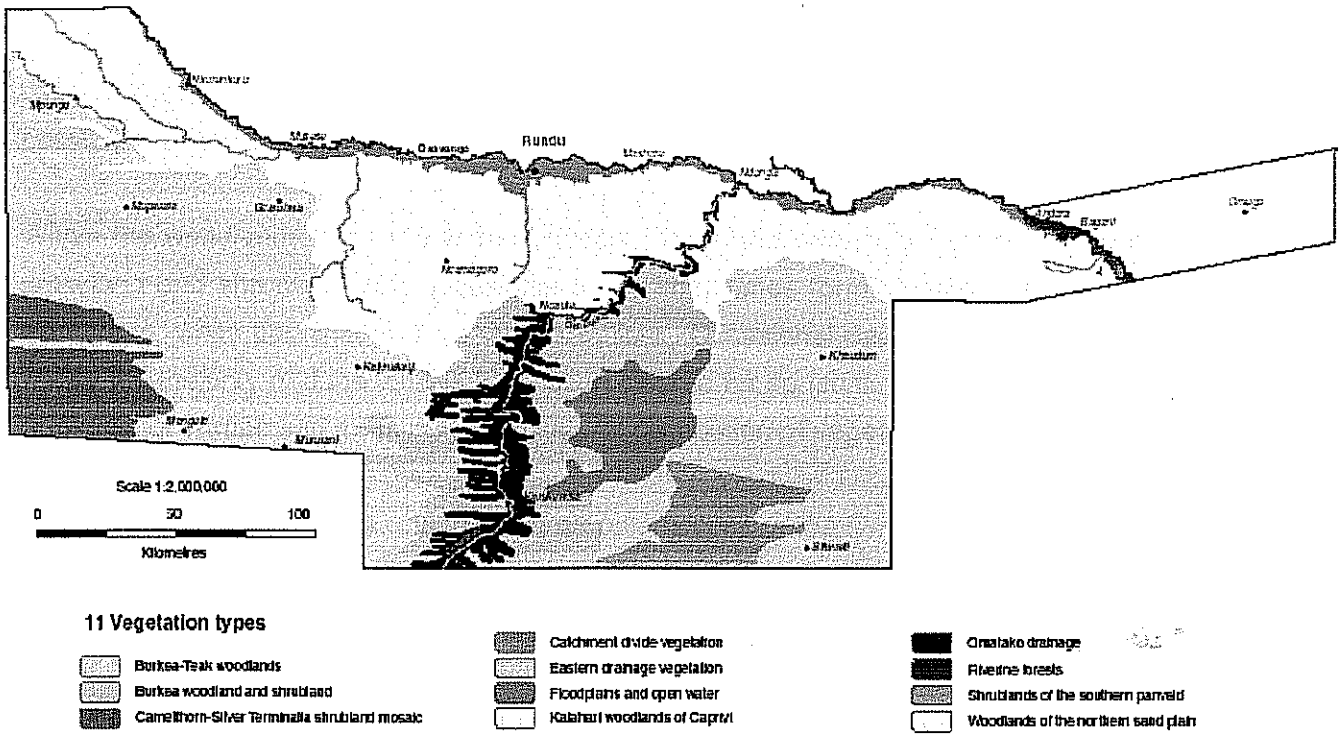


Figure 7 : *Vegetation types in the Kavango Region. (from el Obeid and Mendelsohn 2001)*[22]

1.1.5.1 Woodland Vegetation Types

Much of the region consists of fairly tall woodland growing on deep Kalahari sands. This includes the following vegetation types, all represented by W on the map:

Teak – mangetti woodland on stabilised dunes	*W1*
Burkea woodland and shrubland	*W2*
Kiaat – mangetti woodland of the northern sand plain	*W3*
Burkea woodland on catchment divide	*W4*
Burkea – False Mopane – Baphia woodland and shrubland	*W5*
Kalahari woodlands of Caprivi	*W6*

W1 *Teak-mangetti woodland on stabilised dunes* (labeled as *Burkea-Teak woodland on the map)*

This comprises several woodland and shrubland types which are associated with the east-west running stabilised dunes of western Kavango. The typical sequence of vegetation types is closely associated with landform, and is likely determined by rooting depth. Teak and mangetti, both deep-rooted trees, dominate on dune crests, followed by kiaat on dune slopes, while the

valleys support shrubland and grassland of various species. Shallow soils in the valleys are possibly caused by layers of cemented fine material.

Within the woodlands trees are widely spaced. The dune valleys are covered by a mosaic of grassland and shrubland with occasional trees, sometimes forming single-species thickets of bladethorn, white bauhinia and russet bushwillow. Occasional depressions support grassland. Today the majority of dune valleys have been cleared for agriculture and multiple sequences of re-growth of shrubs and trees mask the natural distribution of vegetation types.

W2 *Burkea woodland and shrubland on outer slopes of the Omuramba Omatako*

The outer slopes of the Omuramba Omatako show a sequence of woodland and shrubland similar to the dune and dune valley pattern. Red seringa woodlands towards the tops of the slopes are replaced by shrubland with silver terminalia and red seringa lower down. The slopes form a transition between the stabilised dunes in the west and the sandplain in the east.

Agricultural activities are evident in the tributaries of the Omatako, and seringa shrubland could be the result of earlier clearing. Their shrubby growth form could also be preventing them from attaining full tree size. Patches of rattle-pod and sicklebush indicate the presence of calcrete or other layers in the soil that prevent root penetration.

W3 *Kiaat - mangetti woodland of the northern sand plain*

The northern sandplain forms a sheet of several meters of sand cover with very few pans. Kiaat and mangetti woodlands are prominent, and there are localised patches of teak and red seringa woodlands.

W4 *Burkea woodland on catchment divide*

The slightly raised relief between catchments provides a mosaic of localised substrate conditions ranging from deep sand to calcrete outcrops and hard layers in the subsoil. The vegetation is dominated by open red seringa woodlands but also comprises other localised types associated with pans and hard substrates underground.

Apart from red seringa, other prominent trees are occasional stands of kiaat and the common bushwillow. The makalani palm is usually associated with pan margins, and is indicative of relatively saline soil. Shrublands are diverse and include almost all shrub types encountered elsewhere in the region. Similarly, the grasses correspond to those found in woodlands and

shrublands elsewhere in the region. The centres of pans support grassland, often comprising a single species, *Eragrostis lehmanniana.*

W5 *Burkea - False Mopane – Baphia woodland and shrubland (labeled as Eastern drainage vegetation on the map)*

Moderate sand cover and numerous pans characterise this habitat. Red seringa and false mopane woodlands are the dominant vegetation, while sand camwood (*Baphia*), leadwood, camelthorn, bladethorn, silver terminalia and bushy red seringas occur in the shrubby layer. Hardpan in the subsoil, creating in effect shallow soil, is reflected in silver terminalia shrubland on the surface.

W6 *Kalahari woodlands of Caprivi*

Teak, red seringa and bushwillow dominate as tall trees in the western end of the Caprivi Strip, with kiaat, false mopane and mangetti occurring less frequently. The shrubby layer is variable in this area.

1.1.5.2 Shrubland Vegetation Types

Tall woodlands grade into and are mixed with shrubby vegetation and shorter trees, and the distinction between woodland and shrubland is often not clear. Shrubland generally occurs where soils are shallow and these areas may coincide with the occurrence of pans. Shrubby vegetation can also reflect the influence of human disturbance such as clearing to create fields and fire.

Vegetation types that are classified as shrubland include:

Camelthorn – silver terminalia shrubland	*S1*
Omatako Omuramba	*S2*
Shrublands of the southern panveld	*S3*

S1 *Camelthorn-silver terminalia shrubland*

Occurring in the south-west corner of the region, this area is characterised by shallow sand cover, numerous pans and exposures of calcrete in many places. Only the remnants of dunes and the fringes of pans support relatively larger trees, namely teak and seringa woodland

patches on dunes and camelthorns near pans. Shrubs dominate the vegetation cover, comprising silver terminalia, camelthorn, white bauhinia, russet bushwillow, bladethorn, sand camwood and common bushwillow. Dense patches of rattle-pod indicate calcrete crusts near the surface. Grasses form locally dense patches in depressions.

S2 *Omatako Omuramba*

The majority of the Omatako, as well as most other omiramba, have been greatly altered by agricultural activities. The valley of the omuramba Omatako itself is covered in a mosaic of recent and old fields, grassland and localised patches of shrubland. Occasional camelthorn trees and shrubby forms of camelthorn and bladethorn are the most prominent woody components of the vegetation.

S3 *Shrublands of the southern panveld*

Remnants of east-west aligned dunes and open valleys support silver terminalia and bladethorn shrublands. Shallow and exposed calcrete occurs locally, with rattle-pod shrubland on the surface. Red seringa shrubland may be the result of fire or it may indicate hardpan layers underground.

1.1.5.3 Riverine Vegetation Types

Vegetation types associated with perennial water of the Okavango River include:

Floodplains and open water	*R1*
Riverine forest	*R2*

R1 *Floodplains and open water*

Floodplain, river bank, terrace and terrace slope form a sequence of landforms on the river's edge. Grasses dominate the floodplain.

R2 *Riverine forest*

The banks of the Okavango River originally supported forests with knobthorn, weeping wattle and jackalberry as dominant trees and a dense shrubby undergrowth. However, riverine forest has now disappeared almost entirely and only a few, localised patches of this vegetation type

remain, mostly within the protected areas of Babwata and Mahango Game Reserves. Today the river banks and terraces are open parkland with few trees, cultivated lands and many villages. The terrace slopes support open stands of mangetti which are still prevalent because they are valued for the fruit they provide.

1.1.5.4 Grasslands

Grasses occur as a component of all the vegetation types described above, and are not described separately. Open grasslands do occur in omiramba, and are conspicuous in the open valleys of the eastward flowing Khaudom and Nhoma River channels. *Cynodon dactylon* is the dominant grass, and *Phragmites* reeds form dense stands where there is standing water.

1.1.5.5 Vegetation Cover

It is useful to classify the vegetation cover of the Region according to density, which avoids the names of different trees and shrubs but still provides a quick overview of the status of the plant cover. This is illustrated in **Figure 8**.

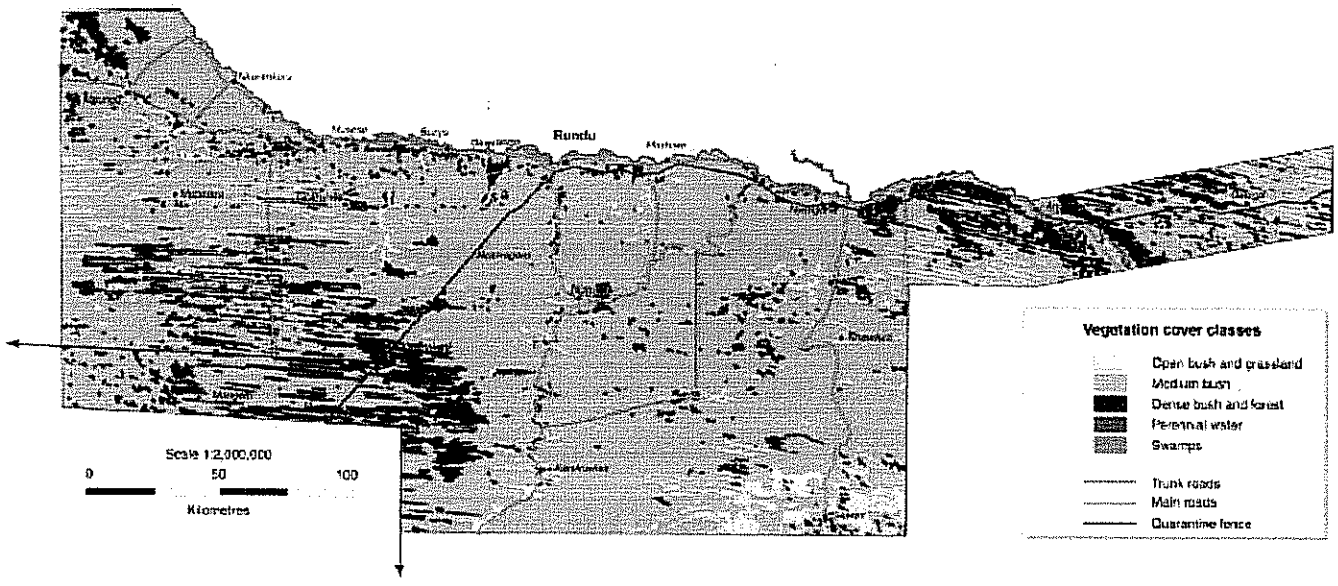


Figure 8 : *Vegetation Cover in the Kavango Region (from el Obeid and Mendelsohn 2001)*[22]

1.2 NATURAL AND AGRICULTURAL RESOURCES

1.2.1 WATER

The source of water used by Kavango people differs from place to place through the region. The Okavango River is obviously the most important and most reliable, and about half of the population get their water from this source (Reuter & van Uytvanck 1995)[23]. Generally, Okavango waters are clear, well mixed and well oxygenated (Bethune 1991)[2], although this status has not been checked or updated. The water quality is likely to decline in future if the new peace in Angola allows people to move back into the headwater areas, as pollution will probably occur.

Away from the river people use boreholes (about 25% of the population), hand-dug wells (12%) and communal taps (less than 10%, most of them in Rundu). Communities along the omiramba rely on hand-dug wells and boreholes for water for livestock, with water tables apparently depending, in part, on runoff into the water course. For communities away from the river there is heavy reliance on boreholes for most of the year (Hennessy 1997)[13]. Prior to the introduction of boreholes, hand-dug wells excavated by farmers opened up inland areas of eastern Oshikoto Region, and permitted immigrants from Oshikoto to use parts of the Kavango interior (Behnke 1998)[1].

Sixteen borehole quality tests carried out by Nolidep showed that all except one produced A-quality water, suitable for stock watering and with mild salinity that was mostly suitable for irrigating plants with moderate salt tolerance (Nolidep 1996)[21].

As water is the primary subject of this Regional Rural Water Supply Development Plan, this patchy information has not been investigated further, and no further detail will be provided here.

1.2.2 FORESTRY PRODUCTS

The term 'forest' may be misleading, as it should more accurately be applied only to the thick stands of tall trees with dense undergrowth that line the Okavango River, which have now largely disappeared. Woodland and shrubland are more appropriate terms for the vegetation of this region, as described in the previous section, but 'forest' and 'forestry' are widely used to describe the trees and their use and management. This usage will be continued here.

About half of the total area of Kavango is forested (Yaron et al 1992[31], Reuter & van Uytvanck 1995)[23]. These forests comprise the woodlands described in the previous section that are

dominated by large trees of the following types: kiaat, teak, mangetti, silver terminalia and red seringa. Other trees, viz camelthorn, buffalo thorn, leadwood and weeping wattle, may also be considered as forestry resources but they are usually less abundant and more confined to specific substrates such as pan margins. Within these woodlands there are many other bushy trees and shrubs, but their value as timber for construction and carving is negligible.

Figure 8, showing vegetation cover in the Region, gives a good indication of where the main forestry resources exist. They are the areas marked as 'dense bush and forest'. Although poor in global terms, Kavango's forests belong to the richest in the country in terms of commercial timber volume.

1.2.2.1 Use of Forestry Resources

Furniture and construction timber

The most valuable species is kiaat, which is used for furniture and woodcarvings. There is a wood carving cooperative at Mbangura that produces household and office furniture and utensils, traditional drums and wood carvings for decoration. Informal cutting of trees for carving and timer purposes is widespread and uncontrolled, even though legal measures to regulate it exist.

Mangetti trees

Mangetti trees (*Schinziophyton rautanenii*, formerly *Ricinodendron rautanenii*) grow naturally over a wide area within the Kavango Region. They occur either as linear groves on well defined, east-west aligned sand dunes, located in the far south and far north of Mpungu District, or as smaller, irregular-shaped groves in central Mpungu District in areas without sand dunes (Figure 9).

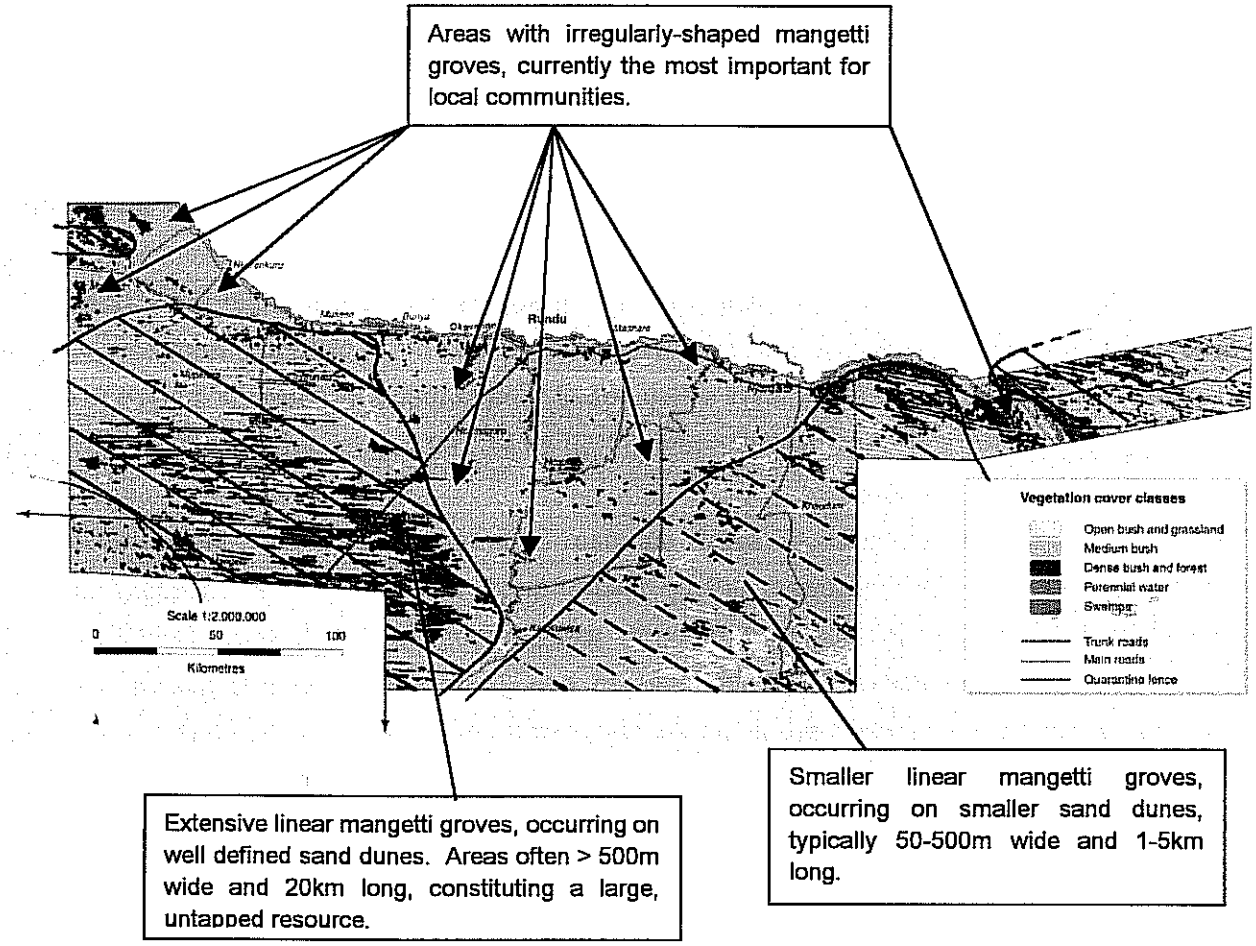


Figure 9: *Approximate distribution and density of mangetti trees in Kavango Region. Information from CRIAA SA-DC 1999[25], overlain on vegetation cover map from Figure 8.*

The fruit of the mangetti, a hard nut with a nutritious kernel, is widely used in the Region. Firstly, it is eaten directly, but only plays a significant direct role in food security during droughts. The nuts are generally used as supplementary or emergency food in the following ways:

- as porridge from the flesh,
- as a snack from the raw or roasted kernels,
- as an oil or relish from the nuts.

For the San people, mangetti is relatively more important as a food source, and it is either eaten directly or exchanged for crops (CRIAA SA-DC 1999)[25].

Secondly, mangetti nuts are used as a source of income through bartering or sale. This is done through the production of a traditional distilled alcoholic drink, kashepembe, that is derived from

the fermented fruit. Many rural households earn much-needed cash from this informal activity, especially in bad agricultural years.

Trials have been conducted to establish the viability of marketing mangetti products on a commercial basis (du Plessis 1999)[8]. Potential products include mangetti nut kernels, mangetti oil, seedcake (a high protein food source in animal feeds) and kashepembe. At present, the main market for mangetti in Rundu is the demand for fruits in the informal kashepembe industry. Some surrounding village dwellers appear to specialise in harvesting and trading the fruits, and can achieve N$5 per bucket of about 14 kg (2000 nuts) (CRIAA SA-DC 1999)[25].

Preliminary work has shown that the resource base is large and that well planned commercialisation would have little direct impact on the resource, while providing a positive impact on the livelihoods of local communities. It could, for instance, improve food security by generating cash income, which could also be used for other needs such as education or medicines. The key determinant of mangetti yield is neither the density of trees nor the number of fruits per tree, but the density of productive trees per hectare. A 'big' mangetti forest comprises a dense grove of female trees (male trees do not produce fruit), which enables quick and easy collection of fruits over a small area.

During harvesting and purchasing trials done in the Region in 1998 and 1999, no problems were encountered with the quality of the fruits. People voluntarily collected and prepared the nuts (by shelling them) and delivered them to a central place that was advertised beforehand. Those community members who were feared might be marginalised by these arrangements - notably San people and women of all races - actually participated the most. Exploiting the resource in this way does not, as far as preliminary results show, exploit the resource at the expense of those who depend on it most for food (CRIAA SA-DC 1999)[25].

Other uses of trees and plant products

Traditionally, homes are built with natural materials such as wood, reed and clay and even stones. Thatching grass is used for the roof, while fences surrounding homesteads and fields consist mainly of branches and sticks. No treatment is given against termites, with the result that woody materials last for only a limited time, and need to be replaced every so often depending on the hardness of the wood. Fences are repaired twice or more frequently a year, and need to be totally renewed every year or second year. There is thus a high demand for wood from the woodlands and forests, but the growth and regeneration rates of the preferred trees are slow and furthermore are jeopardised by the frequent occurrence of fires and heavy grazing of young trees.

Live fences are not very common but are cultivated by some people, particularly in Rundu. They consist mainly of milkbush or a common cactus.

Almost 90% of households use wood for cooking, and outside of Rundu, hardly any households buy firewood. Gas makes up a small proportion, and electricity even smaller. Electricity is available only in parts of Rundu. Cow dung is not mentioned as a fuel source in the survey (Reuter & van Uytvanck 1995)[23]. For lighting the home, wood is also used but candles are used more frequently, and this trend is growing. Trees most frequently used for cooking are silver terminalia, teak, camelthorn and leadwood (Reuter & van Uytvanck 1995)[23], which happen to be some of the most common trees in the region.

A number of trees have medicinal uses and some are planted specifically for this purpose, although tree planting is not a well entrenched habit. Examples of trees that are used in this way are silver terminalia, Eucalyptus, leadwood, false mopane, monkey orange and jackalberry (Reuter & van Uytvanck 1995)[23].

1.2.2.2 Threats to Forestry Resources

Kavango's forests are threatened by deforestation, repeated and uncontrolled fires, overgrazing and soil degradation. Riverine forests lining the Okavango River have all but disappeared. Western Kavango is threatened by commercial forest exploitation by people from other regions (Reuter & van Uytvanck 1995)[23].

Fire

Fires are very common and are usually left to burn uncontrollably. Many fires are started to clear the land of bushes and trees in preparation for growing crops. They also stimulate early sprouting of grasses, and are used to improve grazing in the height of the dry season when there is little grazing available. Lastly, fires are used by illegal hunters to make their prey more easily visible.

These factors make fire an easy and attractive instrument in the livelihood of rural Kavango people. While veld fires are a natural and an important component of savanna ecosystems, they can cause serious damage with long-lasting impacts if they occur frequently, ie for many years in succession, as happens today in large parts of Kavango.

Fires kill young trees, and frequent fires will kill large ones as the damage from each burn accumulates. In this way areas of woodland become encroached with bushy trees and shrubs as the older trees are killed and the younger ones never get the chance to grow to maturity. At the same time, little space is left for grass to grow. Large parts of neighbouring Caprivi have been changed this way, with dense thickets of silver terminalia, bushwillows and sicklebush, and shrublands of species that should grow tall such as seringa and teak (Mendelsohn and Roberts 1997)[32]. The end result is a loss of grazing pastures and, on a global scale, another contribution to the increase of carbon dioxide in the air and to the rate of global warming.

Lack of regeneration

The threat to kiaat and all kinds of trees in northern Namibia generally is that there is very little regeneration. Overgrazing, soil degradation and fires all militate against young saplings ever getting established. So, even if harvesting rates are brought down, the main issue of replacement of trees needs to be urgently addressed.

1.2.2.3 Present and future Management of Forestry Resources

Traditionally the tribal chiefs used to have the authority to distribute land while maintaining control over it. They used to take relatively good care of the environment and severely punished individuals who lit fires by imposing a fine of five head of cattle. In recent years, especially since Independence, the authority of the tribal chiefs has been eroded, and hence regulation of fires has declined (Reuter & van Uytvanck 1995).

The potential for sustainable harvesting of trees needs to be assessed for the region as a whole (Yaron et al 1992)[31]. It is difficult to know what rate of take-off is sustainable, and even more difficult to control. A forest inventory of 10 000 hectares surrounding Mile 30 - an area popular with carvers - estimated that 300 kiaat trees could be harvested each year (Yaron et al 1992)[32]. Kiaat, which is favoured by carvers, takes about 40 years to grow from seedling to harvestable size after germination and establishment.

The issue of conservation of trees is appreciated by some, but not all, wood carvers (Yaron et al 1992)[31]. The activities of Government Forestry officers are clearly inadequate, as Reuter (1995)[23] states that almost 80% of his respondents had never met a forestry officer!

The Forestry Act (201) consolidates the rules and regulations concerning forests and forest products, and introduces measures to protect the environment and manage forest fires. At the

same time, it recognises the need to allow other agricultural activities such as livestock grazing in proclaimed forestry areas. The Act defines four categories of forests:

- State forest reserves, to protect certain forests in the national interest
- Regional forest reserves, to protect regionally important forests
- Community forests, which will be allocated to communities to use and manage
- Forest management areas, where the controlled use of resources will be allowed.

At this stage, a small Forest Reserve is proclaimed immediately west of Hamoye (see **Figure 10**), and two small Community Forest areas are being established:

(i) an area immediately south of Shitemo, close to Ndiyona (approx 18°00'S 20°30'E)
(ii) former experimental plots in the far north-western corner of Kavango Region, west of Nkurenkuru, close to Makambo (approx 17°30'S, 18°25'E).

However, the Areas have not yet been clearly defined for this report by Directorate of Forestry.

1.2.3 CROPS

Kavango soils are generally infertile with low water retention capacity and low nutrient levels. They range from moderately to poorly suited to dryland cropping, and because of their unstructured nature they are susceptible to erosion (Hines 1993)[14]. Without any supplementation of nutrients into the soil, they are productive for only a short time, and fields are abandoned after only a few seasons, sometimes only two (Kirkwood 1994)[16]. In this pattern of shifting cultivation, known as 'slash and burn', fields are not cleared entirely. Most large trees, especially useful ones, are left in place and cultivation takes place around them.

The main crop grown in the region, and the staple diet, is mahangu or pearl millet. It accounts for about 74% of all crop production. The other main crops are maize (13%), sorghum (7%), beans (3%) and other fruits and vegetables (3%) such as water melon, pumpkin, groundnuts and mutete, a local leafy vegetable (Reuter & van Uytvanck 1995[23], Yaron et al 1992)[31].

Much of the soil around villages has been degraded through slash and burn farming. Very few households use manure or any other fertilizer to increase production, and only about a third rotate their crops (Reuter & van Uytvanck 1995)[23]. As a result, crop yields tend to be low (Yaron et al 1992)[31]. Low productivity is also a result of lack of agricultural equipment and draught animals and other factors such as lack of credit for farmers, low expertise, and low

marketability of produce (Yaron et al 1992)[31]. The area that is planted and the traditional methods used to grow crops do not, as a rule, produce enough to last a household for the whole year, and less than 40% of the population grow enough mahangu to last them the whole year (Reuter & van Uytvanck 1995)[23].

Some vegetables, for example beans, pumpkins and groundnuts can be grown without irrigation in Okavango (Yaron et al 1992)[31], and these account for about 5% of total crop production. Beans and pumpkins are traditionally intercropped with mahangu, and they provide variety and nutrition to the diet. Groundnuts are relatively little known amongst households, but National Development Corporation (NDC) farms are substantial producers of groundnuts (Yaron et al 1992)[31].

The region possesses the important asset of the Okavango River which provides the opportunity to grow other crops such as cotton under irrigation. The NDC has developed 10 cotton-growing farms, each of 10 hectares, but there is the potential for expansion provided that the operations are integrated with those in Caprivi, to make them viable (Yaron et al 1992)[31]. Other vegetables such as cabbages, potatoes, onions and tomatoes could also be profitably grown with supplementary irrigation, and they have a large market within the Kavango Region and in the rest of the country.

Irrigated vegetable production is hampered by lack of markets, since there is little money in circulation within the rural communities to pay cash for food, and transport to distant towns adds expense to the total cost of production. Lack of credit to get irrigation systems established has also been identified as a constraint (Yaron et al 1992)[31]. Overhead pivot irrigation and drip-feed systems are very expensive ($15 000/ha in 1992, Yaron et al 1992)[31], and small-scale diesel-operated pumps are also a few thousand dollars. Salem agricultural project at Rundu has had limited success with the latter method, but there were wide variations in production between sub-plots, showing that this method also entails risks, which producers can ill afford. Greater involvement of agricultural extension officers and assistance from cooperatives are obviously required to achieve success in these ventures.

Manual, bucket irrigation might appear to be the obvious solution but vegetable gardens using this method are not widespread in Kavango (Yaron et al 1992)[31].

1.2.4 LIVESTOCK

Livestock rearing has an important role in the Kavango society as well as being a source of agricultural income. Cattle are the main source of wealth and are an indicator of social status. Commercial selling of cattle is very limited and the major source of livestock income for most people are goats and chickens (Yaron et al 1992)[31]. Other animals kept, in roughly decreasing order of abundance, are donkeys, horses, pigs and sheep.

1.2.4.1 Cattle

Cattle are by far the most important livestock species in Kavango. Their value stems not so much from meat products but from the traction power necessary to plough fields and milk from cows, as well as their offspring, while old, sick or dead animals provide meat and hides, or income. Cattle numbers confer status to a household.

More than a third of households reportedly own no cattle at all, but the median number of cattle per household was 13 in 1992 (Yaron et al 1992)[31]. Ownership is skewed by the fact that a small proportion of farmers own very large herds. There is a gradual, yet fluctuating, growth in stock numbers in Kavango (Behnke 1998)[1]. Annual figures fluctuate in response to rainfall and pasture conditions, but there was a rise of about 25% in cattle numbers from 1985 to 1996.

Cattle are herded during the wet season to protect the growing crops. For most of the rest of the year they roam unattended on the Okavango floodplains surrounding homesteads, grazing on the stubble and stalks of mahangu and maize after the harvest. Their owners face the problem that 'where there is grass there is no water, and where there is water there is no grass' (Yaron et al 1992)[31]. In response, the larger herd owners who can afford to do so move their cattle to posts away from the river to the south when grazing becomes limited.

Resettlement to inland areas is led by the owners of large cattle herds. A small nucleus of pioneering households may open up an area without water or with limited water supplies, but the real influx of settlers occurs after a water point has been developed. Thus the siting of cattle posts is determined primarily by functional boreholes. These communities form around water points, reach a maximum size of about 300 people, and then spawn subsidiary satellite communities (Behnke 98)[1]. Yaron (92)[31] states that the grazing potential of this area is "far from realized", The carrying capacity of the woodlands is estimated at one LSU per 30 hectares (Hines 1993)[14].

Managed resettlement has been conducted by allocating farms in the area bordering the Mangetti to families in the Kwangali district, to reduce pressure on the river area (Yaron et al 1992)[31]. However the problem of overgrazing remains for most of the small-scale farmers who keep a few animals such as milk cows or plow oxen, and continue to graze their cattle on communal land. These animals stay permanently in the periphery of villages (Yaron et al 1992[31], Behnke 98)[1]. Not surprisingly, land pressure is most severe along the river, where the fields are exhausted or weed infested and uncultivated grazing land is in short supply. The carrying capacity of the land surrounding riverine communities is estimated at about 15 ha/LSU, but in reality the concentration of cattle is more like three times higher (Yaron et al 1992)[31], and has been for 15 years or more.

Attrition rates from herds are high, between 11 and 33% annually, reflecting relatively poor health of the herds and an inability of owners to treat or prevent diseases by, for instance, supplementary feeding (Behnke 1998)[1]. In 1992 the take-off rate of cattle in Kavango was estimated to be about 3.5%. This is low because cattle owners generally wish to maximise their herd size rather than generate income from it. Other perceived constraints include the "Red Line" or Veterinary Cordon Fence which prevents livestock from being moved south where it can be marketed for South African and overseas consumption. Also, the NDC abattoir in Rundu offers relatively lower prices for carcasses than can be obtained in the informal sector - the so-called 'bush butcheries' - where prices are higher and transport costs low. Most cattle are slaughtered this way, and the bush butcheries fulfil an important economic function.

Kavango residents reap considerable material benefits from cattle wealth. It would therefore benefit the region as well as individuals to expand the cattle industry, **so long as this is done in an ecologically sustainable fashion** (Behnke 98)[1].

Water development in the interior is likely to have great appeal (Behnke 1998)[1] as it will improve herd performance around existing water points, at least in the short term. In the long term it is likely to increase livestock numbers until high stocking rates begin to take their toll. Herd owners will then be forced to intensify and improve their operations through improved range management practices (Behnke 1998)[1]. At present, sustainable cattle farming methods are a vexed issue, as there is little economic incentive to conserve or rehabilitate areas that farmers can afford to abandon (Behnke 1998)[1].

Closer to the river, where poor stock owners cannot relocate their herd, farmers may be receptive to new techniques that can increase their cultivated forage production or conserve natural supplies.

1.2.4.2 Goats

Goats are kept for meat production and sale, but they are less numerous than cattle and make up about one third of total livestock numbers. Goat fertility is high, but so is mortality and the incidence of sickness, especially in years of high rainfall (Behnke 1998)[1].

Contrary to the pattern elsewhere in Africa, poorer households do not commonly accumulate small ruminants and then 'trade up' to cattle.

1.2.5 WILDLIFE

Eastern Kavango represents one of the principal wildlife resources in northern Namibia (Byers 1997)[4]. The Kaudom Game Reserve in the south-eastern corner of the region, Mahango Game Reserve on the western bank of the Okavango River, and Babwata Game Reserve on the eastern side, contain the typical array of large southern African mammals. Also valuable here are the species closely associated with the Okavango River which, due to their reliance on wetland habitat and the human pressures that this habitat experiences, are most vulnerable. This includes wetland-dependant invertebrates, frogs and reptiles as well as the larger and more well-known birds and mammals, such as wattled cranes and otters.

Large herds of elephants frequent the eastern bank of the Okavango River where they are protected within the West Caprivi Game Reserve, and these move into the Mahango area as well (Rodwell et al 1995)[24]. They are part of a population that spans Namibia as well as Botswana and Angola, and their movements through inhabited areas occasionally result in damage to crops and waterpoints (Byers 1997)[4].

In the Kavango Region problems do occur with hunting dogs and jackals killing livestock and monkeys stealing crops (IFAD 1992 in Byers 1997)[4]. Farmers are quite negative towards wildlife and would like to see them limited to fenced game areas. In eastern Kavango, bordering Botswana and Otjozondjupa, the situation is different. The potential for wildlife is much greater, due to the fact that the area is almost unwatered and devoid of domestic stock or crop farming. The region is in a generally rich wildlife habitat and consequently nearby farmers rate damage by wild animals as their greatest crop production problem (Byers 1997)[4].

1.2.6 FISH

The Okavango River supports a rich fish fauna, with 73 species recorded in its waters (Skelton et al 1985)[27]. Species that are valuable for sport and trophy fishing as well as for traditional fisheries are present. Important components of the fish fauna are those, which use the floodplains as a nursery, where shallow waters near riverbanks and quiet backwaters are essential habitat for them.

Traditional fisheries are well developed, and fish constitute the major source of protein in the diet of people living close to the river. Riverine households consume between three and five kilograms of fish per week (Yaron et al 1992)[31]. Fish are caught using a variety of methods, including mesh nets down to the size of mosquito mesh, various locally designed funnels and traps, hook and line and fish spears. A study done in 1990 (van de Waal 1990) did not find evidence that fish stocks were being depleted, although this accusation has been made before and since (e.g. Reuter & van Uytvanck 1995)[23]. According to the latter study, about half the respondents thought that the fish catch had decreased in the last ten years.

Agricultural practices on the riverbanks as well as trampling by livestock and the clearing of riverine vegetation lead to erosion and increased turbidity, which have an adverse effect on breeding success and thus on the populations of certain fish species. High turbidity inhibits the growth of algae which in turn has a negative effect on fish production. Thus conservation of the riverine vegetation is important for sustaining the fisheries resource.

1.3 PRESENT LAND USE AND FUTURE OPPORTUNITIES

1.3.1 PRESENT ACTIVITIES

The map of present (2000-2001) land uses in **Figure 10** shows that about a quarter of the entire area of the Region is taken up activities that do not need to be served by rural water supply.

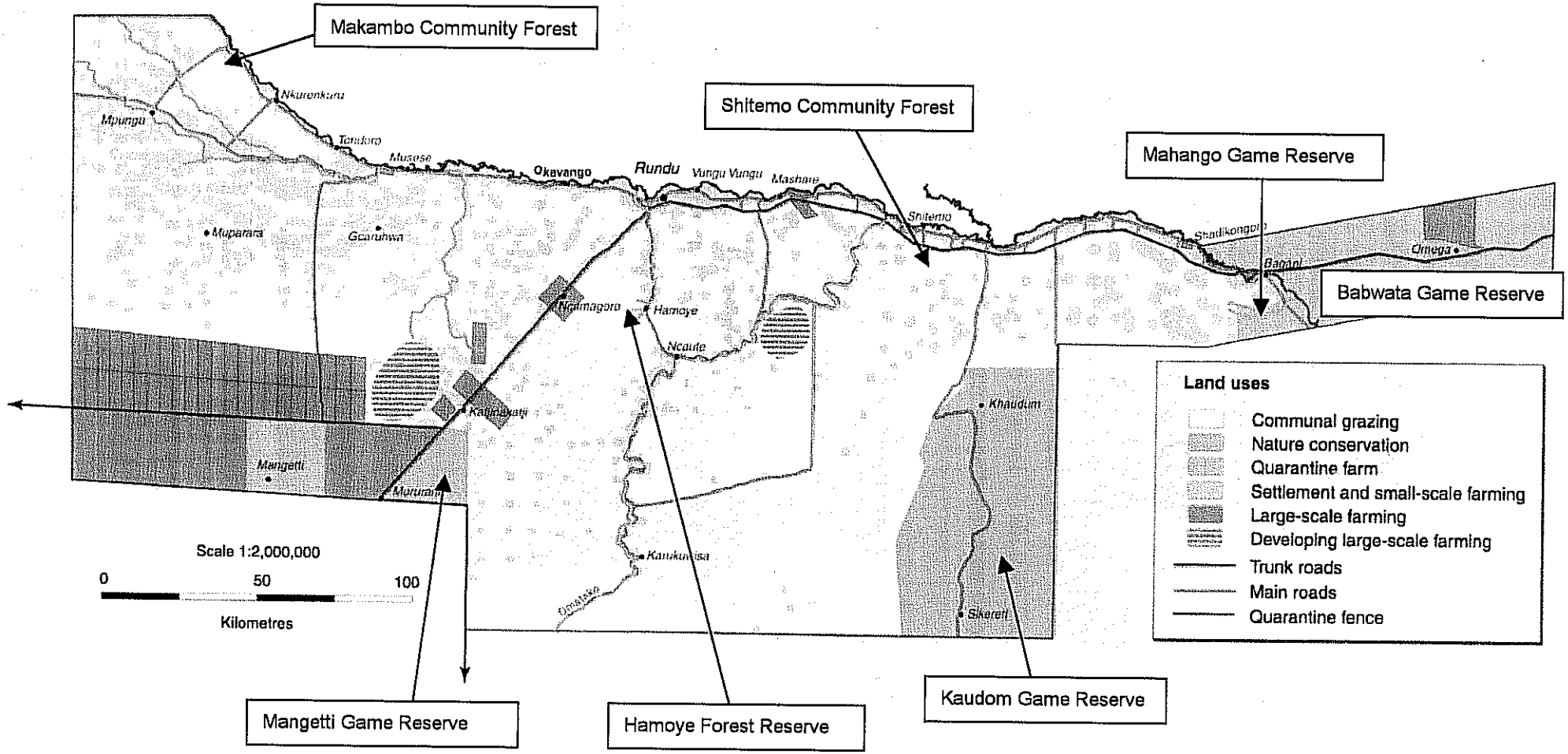


Figure 10 : *Kavango Region showing status of land use in 2000 and indicating areas of conservation activities (from el Obeid and Mendelsohn)*[22]

Dryland farming is the major occupation of Kavango inhabitants, and most people plant all their land. About 75% of people interviewed in the 1995 study of Reuter[23] had to clear their land from trees and bushes in order to establish their plot and homestead. Shifting cultivation is thus widely practiced, but occupies a smaller proportion of the total available space as one moves into the Kavango interior. In addition to land clearing, fires are a frequent occurrence, more so now than in the past. This can largely be attributed to the practice of burning to encourage early growth of green forage for livestock and for traditional hunting.

Ribbon development is conspicuous along the roadway linking Rundu with Grootfontein to the southwest and Katima Mulilo to the east, and along the Omuramba Omatako. This comprises a relatively narrow band of checkerboard settlements with fields and animal enclosures, and little remaining vegetation. Extending outward from the linear focus for 1-2 km are other fields, fewer than near the roadway. Grazing areas extend to about 10 km from the roadway as that is the common maximum distance that livestock tend to range from water daily (Hennessey 1997)[13].

1.3.2 RESERVES, CONSERVANCIES AND RELATED ACTIVITIES

1.3.2.1 State Land for Conservation

The Ministry of Environment and Tourism (MET) has jurisdiction over five areas within the Kavango Region. Four of these are Nature Conservation areas:

- Kaudom Game Reserve, situated in the south-eastern corner of the Region;
- Babwata National Park (West), situated on the eastern bank of the Okavango River and extending for about 30km eastwards (formerly part of West Caprivi Game Reserve);
- Mahango Game Reserve, situated on the western bank of the Okavango River;
- Mangetti Game Reserve, situated east of the main road to Rundu abutting the southern border of Kavango Region. This Reserve is not yet proclaimed but it is managed by MET personnel.

The fifth area falls under the Directorate of Forestry. It is the very small Hamoye Forest Reserve situated directly west of the village of Hamoye south of Rundu.

1.3.2.2 Conservancies and Community Reserves

Unlike the situation to the east, where conservancies are being established and are growing rapidly in Caprivi Region, there are no emerging or proclaimed conservancies in the Kavango

Region. The Integrated Rural Development and Nature Conservation (IRDNC), an NGO, is guiding and promoting the establishment of conservancies in different parts of Namibia, and has an office in Rundu manned by one staff member. Presumably this is to promote conservancies in the Region, but nothing has been established yet.

As mentioned under **Section 1.2.2.3** , Community Forest areas are being established in two other areas of Kavango. They are shown in **Figure 10**, but figures on area and precise locality cannot be provided.

1.3.2.3 Environment-based Initiatives

There are a few projects that are running in the Kavango Region and beyond its boundaries, which may impact on future land uses in the area. They are all concerned with improving sustainable management practices.

Every River has its People

This project is working for the wise and sustainable management and development of the Kavango Region and the entire Okavango River basin. The Namibian component of the project is active in sharing information, consulting with people in the Region (including Regional Councillors, Traditional Leaders, line ministries and resource users), working with the Okavango River Basin Commission (OKACOM), and helping to create development options for the Region. The Namibia Nature Foundation (NNF) is the most active partner in the project, which also involves IRDNC, the Desert Research Foundation of Namibia (DRFN) and the Rossing Foundation as partners.

Development of a strategic management plan and a computer-aided decision support system for endangered and high-value mammal species with shared transboundary populations (DSP).

This project is in the proposal stage, and is being organised by NNF. It covers the area of northern Otjozondjupa, northern and eastern Kavango and Caprivi, together with contiguous areas of Angola, Zambia and Botswana. It aims to develop management strategies that benefit the populations of large mammals (eg elephant, buffalo) that move between the four countries, and that are fully integrated with the management practices of the Game Reserves in which the animals occur. Because the animals are not confined to the game reserves, and occasionally

interact with farmers (eg by damaging water points), this project needs to be integrated with the planning of the rural water supply.

OKACOM

The Okavango River Basin Commission is the body that oversees equitable sharing of the waters of the Okavango River basin. The headquarters of OKACOM are in Luanda.

1.3.3 TOURISM

The Okavango River is a scenic attraction and there are particular sites along the river where there is great potential for tourist developments. Furthermore, there is potential for communities to be involved and for income to be generated by such developments (Bruce 1994)[3].

The recent hostilites and armed conlict in the Region caused a dramatic decline in tourist numbers, but with the return of calm numbers are low but picking up again.
The completion of upgrading of the Trans-Caprivi Highway and upgrading of the road through to Victoria Falls are assisting this trend. There is also an increase in the number of backpackers *en route* to or from Victoria Falls or the Okavango Swamps. The majority of tourists appear to be passing through with only one or two nights stopover, as there is very little to entertain people or to keep them in the area for longer. In addition to accomodation facilities, crafts currently being produced in the region are becoming more popular with both overseas as well as Namibian visitors.

The Kavango Region is therefore well placed to catch the developing tourist market. Probably the greatest asset is the attraction of beautiful sites along the Okavango River. The Namibia Wildlife Resorts-run camp at Popa Falls is one such example - the rapids and riverine forest provide the attraction, and relatively simple accommodation facilities pull people in to stay there.

Some potential sites for tourist development on a community basis have been identified by Oxfam Canada (Bruce 1994)[3], and are listed below:

Gciriku District
Mbukushu District

Kayova Rest Camp
Kangonga Rest Camp
Andara Rest Camp
Kavango Village

The intention of Oxfam Canada is that these camps could be run, at least partially, by community staff, and some of the income derived from the camps be directed back into the communities.

1.4 POTENTIAL IMPACTS

1.4.1 POTENTIAL IMPACTS OF EXTENSION OF WATER SUPPLY TO THE KAVANGO INTERIOR

The experience of opening up relatively unused land for permanent occupation in other areas of Namibia, particularly in the Regions immediately to the west (e.g. the Oshivelo area), shows the following pattern of events:

- Tarred roads become a major focus of settlement due to availability of communications, water, energy, commercial opportunities, social services and economic services, resulting in ribbon development and urban sprawl along the road
- Extensive degradation of grasslands occurs around permanent water points
- Increasing settlement changes woodlands into less useful resources for associated communities
- Availability of permanent water reduces the potential for rotational grazing and limits opportunities for the recovery of the rangelands
- Biodiversity is threatened by the fragmentation of populations and elimination of movement corridors due to dense settlement
- Outsiders may have an incentive to 'privatize' communal lands if permanent water becomes available
- Residents may contribute labour to developing the water infrastructure but in-migrants will bear no cost. The resident community therefore subsidizes the new settlers
- Population growth accelerates rapidly
- New settlers have a short term perspective relative to residents, resulting in a breakdown of resource management strategies
- Limited access to water is the only mechanism which currently limits movement of new settlers into relatively rich resource areas as current legislation gives every Namibian right of access to communal land

The current trend in population movement in north central Namibia is outward from the Oshana –Omusati Regions where resources are generally limited. These resources, including areas for settlement, cultivation, grazing and harvesting of natural products, are not sufficient to meet the needs of the growing population. Consequently, people from the Regions to the west who need

resources or who are no longer satisfied with the quantities of resources currently available, are migrating to locate more resources for supporting a livelihood. The international border to the north, the arid Koakoveld to the west, and the protected area of Etosha to the south, make eastward migration the only feasible option. The north-east has little social and economic infrastructure and few services, which results in population migration in a south-easterly direction, into eastern Oshikoto. This lies contiguous to the south-western border of Kavango, and the eastward trend is likely to continue.

Very positive impacts are expected for the people who might occupy newly opened areas of the Kavango interior, if they are not hindered by lack of water. For instance:

- There would be an increase in available cropping lands and in the potential trade of woodland products
- Schools and clinics would be able to function properly and attract permanent staff
- Water would allow business and business infrastructure to develop – permanent buildings are considered important for business development.
- They would experience improved health from clean and regular supply of water – more frequent washing, less saline water, more productivity with less illness
- There would be an increase in available labour due to a reduction in time wasted collecting water.

On the down side there would be a range of disadvantages that would begin to be felt as the pace of settlement increased. These could include:

- Loss of tourism options if ribbon development and urban sprawl convert a diverse environment into a continuous stretch of urban infrastructure
- Loss of corridors for the movement of animals resulting in a regional biodiversity loss
- Concentrations of people and cattle along the road could create hazardous conditions for both drivers and pedestrians
- Increasing human populations could increase the threat of groundwater pollution by human waste
- Existing communities would have less land resources available as in-migration accelerated
- Stock would have to be moved greater distances to locate adequate forage as more people together with their cattle settled in the area
- Destruction of woodlands would occur, with the consequent decrease in available woodland products and grazing

- Increasing human populations could increase the threat of ground water pollution by human waste as wells would probably continue to be used due to fees being applied to water
- People could be forced to purchase water as water quality declined in wells due to groundwater contamination
- Existing communities would have less land resources available as in-migration accelerated.
- Reduction in opportunities for nature based enterprises such as eco-tourism and game farming
- Greater privatisation of the communal grazing lands may occur with the presence of permanent water
- Conflicts over access rights to resources may occur between current residents, new settlers from other regions, and wealthy outsiders desiring high value grazing lands

1.4.2 Economic Impacts Of Extending The Rural Water Supply Infrastructure

1.4.2.1 Cattle Production

Cattle production is likely to increase in the project area with easier access to water. More water will increase the health of cattle herds, will reduce the distance which animals are currently having to walk to obtain water, and more grazing areas may become available with the provision of permanent water. These three factors will increase cattle herds productivity in the short term [that is, until stock numbers build up to the level where available grazing declines per animal and productivity declines. Should the farmers achieve a 10% increase in production per year due to improved herd fertility, then the average farmer with 20 cattle, could benefit from the sale or use of an additional two head per year. This may have a cash value of between N$2 000 to N$3 000 per year.

However, as water provision would be charged, there would be a cost in increasing cattle production. For example, if water is supplied at N$2 per kilolitre, and each household has on average 20 head of cattle, then it is likely to cost the average household approximately N$2 per day or N$730 per year to water their herd. This cost includes 100 litres used for household consumption. The need for additional cash to pay for water used could lead to greater trade in cattle numbers.

1.4.2.2 Resource Use

With more time available, some households may increase their harvesting of natural resources for either home consumption or for trade, placing greater pressure on the local natural resources. This may lead to unsustainable harvesting intensities, changes to the local ecology and reduce the ability of the environment to meet household needs. For example, some households may trade fuelwood to the urban centres, and reduce the woodlands ability to supply wood to the rural households.

In addition, both the increased cattle production and changes to farming patterns are likely to lead to increases in the intensity of resource use. The increase in cattle numbers that is likely to occur as a result of permanent access to water could lead to situations during dry periods where there is insufficient grazing for the cattle, contributing to population crashes or to the transport of cattle out of the area. For farmers unable to afford transport, they are likely to experience stock losses, while the wealthier farmers who can afford to transport stock will not be seriously affected. It would therefore appear that the least well-off sector of the community will bear the greatest losses in stock should cattle numbers exceed carrying capacity in dry periods. This impact has the most serious implications for small scale cattle owners. A loss of 25% to 50% of their herd [5 to 10 head] could lead to a N$5 000 to N$10 000 loss in stock.

1.5 THE CASE FOR EXTENDING WATER SUPPLIES IN KAVANGO

Kavango Region is an anomaly in that it appears to be well endowed with rain, patches of good soil and the ample water supplies of the Okavango River (Behnke 1998)[1]. People here have the best access to grazing and fishing resources in the country, and groundwater resources are widespread and reasonably strong. Yet there are many poor people in Kavango. The per capita income is low, estimated at less than $2000 per person in 1993/94, and more of this income is spent on food than in any other region in Namibia (Behnke 98)[1].

While all rural communities engage in farming, most households are not primarily supported by farming and carry out other economic activities. People are informally employed in occupations such as the brewing and sale of mahangu beer and of kashipembe, while sale of farm produce, livestock, fish and groceries also occur (Reuter & van Uytvanck 1995)[23]. Households also rely on the income generated by wage earners in towns elsewhere in Namibia, and on retired pensioners (Matanyaire 1997, Behnke 98)[1]. Kavango villages have been described as "not self-sufficient farming communities so much as cash-dependent rural dormitories" (Behnke 98)[1].

One of the hazards of living in Kavango Region is not that it is agriculturally unproductive but that it is erratically productive because of irregular rainfall (Behnke 98)[1]. Because of this variability, small-scale crop farming is a risky undertaking.

Kavango residents have responded to these risks by diversifying. Crop farming is just one component of the livelihood of a typical Kavango resident - there are also cattle farming, fishing where possible, gathering of forestry products, and in the last 60 years, contract labour (Behnke 1998). For the household with average income, employment (either formal, informal or work from home) is by far the most important source of income, constituting more than two-thirds of the total income (Yaron 1992)[31].

Subsistence farming for the Kavango resident does not generate any significant income, but it reduces his/her cash expenditure on food (Behnke 1998). This has reached that point that investing labour in non-formal, non-crop production work yields more income than investing that labour in crop production (Matanyaire 1997). Economic returns to informal sector activities are so high relative to growing mahangu that labour and skills are directed away from producing the subsistence crop (Yaron 1992)[31]. This situation attracts people away from rural life to seek employment elsewhere, but because job opportunities in towns are limited, this creates unemployment in towns combined with a labour shortage in rural districts. This conflict describes the Kavango situation fairly accurately (Behnke 1998)[1].

The situation is a self-sustaining cycle of poverty: a low-input, low-output farming system that is only competitive at a subsistence level of production, and sometimes not even that (Behnke 1998). Cattle help to break this cycle - they are an input into crop farming (in terms of their draught power) and produce other commodities (milk, hides) that increases a household's income from crops and sales.

Thus, farmers accumulate livestock in order to increase their income in absolute terms and to increase the efficiency of their cropping activities. Their cultural inclination to keep cattle pays real dividends, in cash, grain and livestock products (Behnke 1998)[1].

1.6 PRELIMINARY ENVIRONMENTAL GUIDELINES FOR WATER INFRASTRUCTURE DEVELOPMENT IN THE KAVANGO

1.6.1 WATER AS A PLANNING TOOL

It is important to note that water infrastructure development will have a fundamental influence on the land use patterns that will develop as a result of water development in the Kavango region.

Water supply infrastructure is a *de facto* land use planning tool in a locality where regional planning is not determining the location of water supply infrastructure.

Water supply development in a planning vacuum must accept that it will determine land use patterns and must therefore plan for the potential impacts likely to arise in response to new water resources.

1.6.2 ZONATION OF REGION

The past water supply development project in Oshivelo identified the need for zoning the region in terms of the demand and supply of natural resources in Oshivelo. This approach will also be necessary for the Kavango region. The project area should be zoned according to the capability of various areas to provide inputs into household consumption and production, and the demand for these resources or settlement densities. Areas with high potential for natural resource based activities should be maintained as functional natural environments that can continue to supply essential natural resources or services to households in the region.

Importantly, the poorer the region, the greater the reliance on natural resources to meet basic needs such as food and economic opportunities. Zoning is therefore critical for maintaining rural well-being in poor regions.

The project area should be zoned according to the points identified in the discussion below.

1.6.2.1 Maintaining a Diversity of Land Uses

Sustainable economic development requires that a wide range of economic activities be pursued. Single focus economic development is risky and generates systems that are not

sustainable in the long term. This requires maintaining a diversity of land uses that will provide a wide range of opportunities for communities to participate in and to spread their risks.

Water supply infrastructure must therefore promote land use diversity.

1.6.2.2 Establishing Resource Use Areas

As a large number of the community are subsistence farmers, there is likely to be a high demand for ecosystem goods and services such as fuelwood, homestead construction material, medicinal and fibre plants, indigenous foods and fruits, fertile and moist cropping lands, and grazing pastures.

Importantly, these resources are not distributed uniformly though the region. Different habitats have different capacities to supply the above ecosystem services. For example, omurambas have different capabilities when compared to woodlands in supplying croplands. Important resource use areas in different habitats including:

- Okavango river floodplains and wetlands,
- Okavango riverine forests,
- Omuramba wetlands and banks,
- Woodlands, and
- Grasslands.

For each of the above habitats, it will be necessary to identify large areas that can serve as resource harvesting locations for the resident community. The areas need to be relatively large to accommodate the large number of people who are likely to rely on harvesting natural resources.

To establish or maintain harvesting reserves, water supply infrastructure should not be developed in these areas. The lack of permanent water will ensure that permanent settlement remains limited and promotes the maintenance of areas with rich natural resources.

1.6.2.3 Promote Urbanisation as a means to achieve sustainable Land Use

In converse to the above, water supply infrastructure should be used to promote densification of settlement or urbanisation. Densification is important for several reasons, including:-

- Generating enough people in a single locality to encourage the development of retail outlets and services [such as banks, post offices, doctors, etc],
- Generating sufficient people to make the supply of social infrastructure, such as schools and clinics feasible,
- Generating alternative economic opportunities to subsistence farming, which reduces pressure on the land to supply all households in the region with all their basic goods and services, and economic opportunities.

To achieve densification, water supply infrastructure should be made easily accessible and should be relatively cheap. There should also be limited availability of water in the area immediately surrounding the development nodes. Such an approach would prevent urban sprawl into the natural areas surrounding the development nodes.

1.6.2.4 Integration of Land Use

A number of land uses are not complementary and may generate conflict between various people's objectives in the region. For example, cattle farming by rich families may conflict with the game and wild plant production objectives of other poorer families. The design of water supply infrastructure can be used to avoid such conflicts.

Communities have suggested the establishment of several conservancies and natural resources areas in the Kavango region. There may also be opportunities for increased tourism in the future. This implies that the land use planning or in this case - the water supply infrastructure must be designed in a way to accommodate such future economic options.

Water supply infrastructure must therefore promote the integration of land uses by generating:-

- Buffer areas between conservancies and cattle posts,
- Open space for future tourist development options on the Okavango river,
- Buffers between protected areas such as Mahongo and west Caprivi Game reserves and dense settlements,
- Dense settlement next to transport/commercial/industrial nodes,
- Buffers between rivers, active floodplains and dense settlements [to promote improved water quality and reduced threat of flooding].

Buffers and open space can be generated by avoiding the supply of water infrastructure in certain locations.

1.6.3 PLAN FOR COMMUNITY BASED MANAGEMENT

Rural water supply must be ultimately managed by the beneficiary community. The design and location of the infrastructure must therefore accommodate the management limitations [financial and institutional] that may exist within the community.

SECTION 2 : GUIDELINES FOR THE DEVELOPMENT OF RANGELAND

2.1 DEFINITIONS AND BACKGROUND INFORMATION

2.1.1 CARRYING CAPACITY AND GRAZING CAPACITY

Carrying capacity refers to the number of animals an area can sustain from its vegetation. It is an average figure, so its value is restricted in environments such as in Namibia where the great variability in rainfall can cause large variations in the actual capacity of the land from year to year. For this reason, the term grazing capacity is used to refer to the carrying capacity at a particular time. This may be higher or lower than the carrying capacity, depending on the state of the environment and the grazing lands, which in turn is affected by the amount of rainfall of the current or previous season.

Carrying and grazing capacity are measured in hectares per large stock unit (ha/LSU), and one cattle equals one LSU. The conversions for other livestock are as follows:

1 LSU	=	1 cattle
	=	0.5 horse / donkey
	=	6 goats / sheep

The Directorate of Rural Water Supply uses a carrying capacity figure of 10 ha/LSU for the whole Kavango Region. This is too low, a better estimate is 12-15 ha/LSU. Grazing capacity may reach 10 ha/LSU in years of average or above average rainfall, but it must be remembered that rainfall is below average for more than half the time.

2.1.2 WATER DEFICIT AREA AND FODDER DEFICIT AREA

Most of the rangelands of Kavango can be classified as water deficit areas, where fodder availability is not a constraint to livestock production, but there is a lack of permanent water. Areas along the Okavango River, on the other hand, are classified as fodder deficit areas, as they carry high livestock densities due to the proximity of permanent water, and fodder is generally over-utilised.

2.1.3 USE OF RANGELAND IN KAVANGO

Pastoral areas are used communally. There are two main threats to the availability of communal pastoral land. Fencing off of areas for private use by rich and influential people has already reduced the total area of land, so that poor farmers are excluded from these fenced-in areas. Secondly, expansion of crop fields into pastoral areas also reduce the area of land for grazing. Provision of extra permanent water to the inland of Kavango will increase these trends. Increase in the population and the subsequent higher demand for fields and homesteads reduce the available pastoral areas, and could be a major cause for conflict in future.

In line with the Community Based Management (CBM) policy of the Government, water point committees will be formed at all installations installed and maintained by the Directorate of Rural Water Supply. As is well known, water points act as a focus for livestock under traditional pastoral systems, and their installation can have a marked effect on grazing availability and range condition in the vicinity. Experience from other parts of the northern communal areas of Namibia, as well as from Kavango, has shown that sustainable utilisation of rangeland resources in the vicinity of water points is under threat. Even though communities have been consulted and involved in the siting and management of water points, active participation and ownership by the communities has not always been guaranteed.

To exacerbate the situation, the Ministry of Agriculture, Water and Rural Development has a huge shortage of experienced and qualified rangeland and livestock specialists in the northern communal areas. This condition will severely hamper progress in rangeland management in the Kavango Region.

2.2 BENEFITS OF INCREASING THE RURAL WATER SUPPLY NETWORK

A desirable result of increasing the network of water provision in the Kavango Region will be an increase in livestock production through greater productivity and off-take. This is achieved by reducing the distance to water points resulting in more efficient use of energy by livestock, which in turn contributes to better animal condition and increasing survival rates during drought periods.

Potentially, good livestock management can lead to improved rangeland condition in terms of composition of the vegetation community and density of perennial grasses, sustained fodder production and vigour of grasses, and little change in the vulnerability to soil erosion. In semi-

arid environments, seasonal and year-to-year variation in rainfall leads one to expect fluctuations in range productivity and animal performance. Therefore the qualities described above cannot be expected to be maintained continuously, but the overall condition of vegetation and soil, as measured in seasons of average or above-average rainfall, should be maintained.

These benefits can only be achieved if water development goes hand-in hand with development of sustainable range management systems. It must be emphasized that livestock production can be increased only if water provision is accompanied by sustainable management of the associated rangeland resources. Making water available in formerly under-used rangelands, without putting in place strategies and mechanisms to ensure appropriate rangeland management practices, will have a detrimental effect on the rangeland resources.

2.3 GUIDELINES FOR PLANNING FUTURE RURAL WATER SUPPLY IN KAVANGO

2.3.1 USE CARRYING CAPACITY AS A GUIDE FOR PLANNING NUMBER OF LIVESTOCK WATERING POINTS

Livestock watering points should be established in keeping with the carrying capacity of the area, which ranges between 12 and 15 ha/LSU. To plan conservatively, the figure of 15 ha/LSU should be used, as it is well known that livestock numbers will increase beyond the recommended rate.

Communities should be advised that they should adjust stocking rates in line with the annual grazing capacity, with guidance from agricultural extension officers. In this regard, manpower and capacity of the Directorate of Extension and Engineering Services needs to be improved so that the required support can be provided.

2.3.2 BROADEN THE ROLE OF WATER POINT COMMITTEES

The community focus in siting, development and maintenance of new water infrastructure needs to be broadened. Attempts should be made to move beyond community consultation alone and more towards community ownership, and enhancing a greater sense of self-help amongst community structures. Therefore, any planning for the siting of boreholes must be done with the full involvement and collaboration of local communities, local authorities and personnel from the Ministry of Agriculture, Water and Rural Development. Simultaneously, the roles and functions of water point committees should be broadened to include the sustainable management of

natural resources such as rangelands and livestock. The broadened scope of these committees should be reflected in the training and professional backstopping provided to them during the implementation phase. Follow-up training to already trained water point committees should be considered in order to strengthen the capacity to independently maintain and manage water points, and to advise on rangeland and livestock.

Guidelines for sustainable rangeland management should be provided to water point committees and be made easily accessible to technical staff at field level.

2.3.3 PROMOTE AND IMPROVE TRANSHUMANCE PRACTICES

The seasonal movement of livestock between homesteads and croplands, on the one hand, and distant cattle posts, on the other, is a well established practice. This flexibility in movement should be maintained. The establishment of scattered but reasonably large areas where there will be no permanent water provision will facilitate the system of transhumance in the Region.

The key to sustainable rangeland management is to match livestock feed demands (i.e. livestock numbers) with available fodder resources at all times. Facilities that allow farmers to reduce their livestock numbers, either by transhumance or by selling excess animals during times of drought, will reduce vulnerability to droughts and lower the dependence on outside support during disaster droughts. This is in line with stipulations in the National Drought Policy and Strategy, accepted by Government in 1998.

2.3.4 MAINTAIN FLEXIBILITY IN LIVESTOCK NUMBERS

The way to cope during droughts is to timeously adjust animal numbers to the available fodder resources before livestock production has declined significantly. Improved facilities for marketing facilitates this. If animals are marketed early enough, they are still in a good condition and can fetch good prices. The other option, to move animals away to emergency grazing areas, is more difficult to implement because of the restriction of the Veterinary Cordon Fence, and the high cost of transporting animals by truck. However, during disaster droughts, when large numbers of animals need to be transported over long distances, Government could provide support to affected communities by subsidizing transport costs. By testing and adapting these strategies in an interactive and participatory manner with local communities, transhumance practices can be revived and the flexibility that rangelands need can be maintained.

Denuded rangeland resources can only recover if they are given adequate time to recover during subsequent rainy seasons. This means that grazing on denuded rangelands should be limited or prevented during rainy seasons. This is a particularly difficult recommendation to implement because it is the opposite of what normally happens in the northern communal areas. The typical pattern is this: Livestock usually reside around the permanent homesteads (the most heavily utilised areas) at the beginning of the rains, when fields are being prepared. When the dry season comes, crops are usually well established and livestock are moved away to distant cattle posts. After the harvest in the second part of the dry season, livestock gradually move back to the homesteads to feed on crop residues.

To break this pattern, ways should be explored to graze livestock at distant cattle posts during the rainy season, and then to bring them back to the homesteads during the dry season. This will not only provide valuable rest periods to the grazing, but it will also reduce additional stress on livestock in terms of distance they must move between water and fodder during the dry season. A complication will be that livestock will then threaten the crops before harvesting. This could possibly be solved by improving herding by shepherds.

2.3.5 ENCOURAGE KEEPING OF INDIGENOUS BREEDS OF LIVESTOCK

Livestock that are well adapted to fodder and water stress, such as the Sanga breed, should be encouraged, and larger breeds, which have higher nutritional needs, should be reduced. This is also difficult to implement because of the perception that bigger animals are more valuable and receive better prices at the market. However, under sub-optimal rangeland productivity conditions, like in the Kavango Region, the smaller, indigenous Sanga cattle have the physiological ability to reduce fodder and water intake during times of stress, and their production and reproduction characteristics under these circumstances are better than those of larger exotic breeds. A system of selective breeding and upgrading of the existing indigenous livestock breeds should be introduced, instead of bringing in exotic breeds.

2.3.6 IMPROVE THE POLICY FRAMEWORK TO GIVE FARMERS MORE USER RIGHTS

A conducive policy environment is a prerequisite for sustainable natural resource management and poverty reduction in rural communities. Community based natural resource management (CBNRM) requires security of tenure to be successful. This means that pastoralists must have some kind of exclusive rights over the use of their land, so that if they choose to rest an area, it will not be used by someone else. The community based management policy (CBM) of

government where communities are encouraged to take over, control and manage water points, is a step in the right direction towards securing rights over resources. Although the water point is the focus for the surrounding grazing area, security of tenure over the grazing resources is not included. Security over grazing resources should be improved by the recent promulgation of the Communal Land Act and the Conservancy Legislation in the Ministry of Environment and Tourism.

2.3.7 PROMOTE ESTABLISHMENT OF CONSERVANCIES

On the issue of conservancies, wildlife in communal areas can serve as a source of additional or alternative income if it is also managed properly. Conservancies offer communities the opportunity to sustainable manage and utilise their wildlife and tourism resources for their direct benefit, and could benefit communities in the Kavango Region. Although only wildlife and tourism resources are included in the conservancy legislation, the possibilities of broadening the scope to include grazing, water and forestry resources are being explored in the Directorate of Environmental Affairs, Ministry of Environment and Tourism.

SECTION 3 : LEGAL ISSUES

3.1 INTRODUCTION

This report covers the legislative and regulatory issues associated with the Regional Rural Water Supply Development Plan for the Kavango Region. Legislation and policies of relevance to this development plan are considered under the following headings:

- Land Tenure and Ownership of Water Point Facilities
- Fencing of Water Points
- Flora and fauna
- Water
- Soil
- Health and safety
- Environmental Assessments
- International Conventions

At independence in 1990 Namibia adopted a new Constitution and adopted the then applicable South African Roman Dutch common law system including applicable legislation (both domestic and international) which at the time had been applied to the so-called Territory. Since then some of these "old" laws have been repealed and replaced by Namibia's own domestic laws while others are still in place in Namibia.

It should be noted that although Namibia took over South African laws on independence in March 1990, it is not the case that all South African laws applicable at that date were taken over by Namibia. The position is more complex in that only certain laws were extended by South Africa to the Territory. Furthermore, the criteria applied by the South African government during the time it governed the Territory as to which laws were extended to the Territory varied over time. The significance of this is, for example, that the now-repealed South African Water Act, 54 of 1956, dealt with below, is still applicable in Namibia but not all of the sections that were applicable in South Africa at the time of independence were made applicable to Namibia.

Namibia does not currently have a central environmental statute, commonly referred to as a framework environmental act. However a number of sectoral laws as highlighted in this report fall under the general rubric of environmental laws.

3.2 LAND TENURE AND OWNERSHIP OF WATER POINT FACILITIES

The infrastructure to be created will comprise a rural water supply network presently owned by the Directorate of Rural Water Supply and subsequently by the beneficiary communities.

In 1993, Cabinet approved the Water Supply and Sanitation Sector Policy Recommendations ("WASP"). The rural water supply scheme envisaged by the development plan is obviously subject to these recommendations.

WASP formulated a long term policy which has as its basic tenets the fact that the equitable improvement of services should be as a result of the combined efforts of government and the beneficiaries, based on community involvement, participation and responsibility and the fact that communities should have the right to determine which service levels and solutions are acceptable to them.[i]

As full ownership of the rural water supply facilities is considered by the communities in Namibia to be one of the prerequisites for sustainable community-based management, the Department of Water Affairs has embarked on a process of considering methods to ensure that full ownership of water supply facilities is transferred to communities.[ii] To this end a study was undertaken in March 1998, firstly to identify and analyse the legal options available to provide water point associations with formal legal status, and secondly, to identify and analyse the legal options available for the transfer of the ownership of water points from government to rural communities in communal areas.[iii]

The primary concern identified by this study is the pressing need of rural communities for security of tenure over specific areas of communal land. This is particularly important if ownership of water point facilities in communal areas is to be passed to communities as envisaged in WASP, as without this communities' rights to land and to obtain secure tenure on land on which water point facilities are to be located will be wholly dependent on the whim of traditional authorities. This issue is particularly crucial when regard is had to the numerous instances of illegal fencing in communal areas that cut off access to water points and grazing.[iv]

The study recommends that water point associations take the form of voluntary associations and that legislation be drafted to make provision for this. It would appear to be envisaged that water point associations would be constituted in a manner similar to that provided for in the *Nature Conservation Ordinance Amendment Act, 1996* for the establishment and registration of communal conservancies. It is recommended in the study that a specialised Bill be drafted to

provide for community water point management and the establishment of water point associations, local water committees and regional water committees.[v]

Work has commenced on the drafting of a Bill of this nature. In the absence of such enabling legislation, it is however still possible for communities to establish water point committees and to formalise the status of their associations by adopting a constitution affording their association legal personality and the right to act on behalf of its members.[vi]

Once such associations have been formed in the manner referred to above, it would be possible for the government to contract with them for the hand over of water point facilities as has already been done in certain instances.

An important issue to consider then is the transfer of ownership of water point facilities to communities and various options have been identified in the study. These options are however subject to constraints imposed by virtue of the problems of insecurity of tenure on communal land.

The issue of security of tenure is central to the transfer of water point facilities to communities, particularly in view of the fact that it is a principle of common law that any fixed attachments erected on land remain the property of the land owner. In view of the fact that communal land is owned by the State, any water point facilities situated on communal land which are, by their nature, fixed to the land, are also owned by the State.

The Communal Land Reform Act, 2002 does not provide for ownership of communal land by the occupiers thereof and indeed reiterates the position that communal land areas vest in the State in trust for the benefit of the traditional communities residing in those areas (section 17(1)). It is therefore necessary to identify ways of addressing this problem.

In order to afford water point associations, once they are established, greater security of tenure over water point facilities, they should apply to the Communal Land Board established for that area for a right of leasehold over the land on which the water point facility is situated in terms of section 31 of the *Communal Land Reform Act, 2002*. This would entitle such water point associations to exclude users from outside the leasehold area. In terms of section 34(1) of the *Communal Land Reform Act, 2002*, a right of leasehold may be granted for a period of up to 99 years.

Ownership of the rural water supply infrastructure will vest in the Ministry of Agriculture, Water and Rural Development. Ownership of such infrastructure as is fixed to the land will in any event vest in the State by virtue of the common law principle referred to above.

This being so the provisions of the *State Finance Act, 1991* are of importance. In terms of section 18 of this Act, the State may not alienate, let, exchange, donate or otherwise dispose of state property without the approval of Treasury. Thus the Ministry of Agriculture, Water and Rural Development may donate the water point facilities to water point associations but only once Treasury approval is obtained.

The Ministry of Agriculture, Water and Rural Development is obliged to furnish the following information to Treasury when seeking its' approval for donation of water point facilities to water point associations:

(i) the purpose for which the donation is made;
(ii) the value of the donation in cash or kind;
(iii) the conditions, if any, attached to the donation;
(iv) the reason or motivation why the Ministry wants to make the donation;
(v) full particulars of the donation; and
(vi) the financial implications (direct or indirect expenses such as transport costs, personnel expenses, stock, office expenses, tax etc) if any, which have to be incurred on acceptance of the donation.[vii]

In order to give effect to the donation of water point facilities, a handover agreement would need to be concluded between the Ministry of Agriculture, Water and Rural Development and the water point associations concerned, once same are established. Such an agreement would be required to cover issues such as conditions subject to which the donation is made, the responsibilities of each party in respect of the operation and maintenance of the facilities and the responsibilities of the water point association in respect of full cost recovery.[viii]

3.3 FENCING OF WATER POINTS

Illegal fencing of communal land constitutes a problem in the area covered by the rural water supply development plan. Fencing of water points obviously poses a substantial threat to community-based management of water point facilities.

The Communal Land Reform Act, 2002 contains a prohibition on fencing in communal areas (section 18) and provides that:

'Subject to such exemptions as may be prescribed, no fence of any nature -

(a) shall, after the commencement of this Act, be erected or caused to be erected by any person on any land situated within a communal land area; or

(b) which, upon the commencement of this Act, exists on any such land, by whomsoever erected, shall after a date to be notified by the Minister by notice in the Gazette, be retained on such land,

unless authorisation for such erection or retention has been granted in accordance with the provisions of this Act."

As the ***Communal Land Reform Act, 2002*** has only recently been passed into law, the Minister has not yet designated the date referred to in section 18(b). Once the Minister of Lands, Resettlement and Rehabilitation has given notice of the date in terms of this section, it will be possible to require the removal of any existing fences that currently impede community-based management of water points. In terms of section 18, no new fences may be erected on communal land unless authorization for such fences has been obtained in terms of the *Communal Land Reform Act, 2002.*

3.4 FLORA AND FAUNA

The ***Nature Conservation Ordinance 4 of 1975*** protects various categories of protected game and plants.

The ***Forest Act, No 12 of 2001*** also makes provision for the protection of various species of plants. In terms of **section 22(5)** of the ***Forest Act 12 of 2001*** ("the Act"), the Minister of Environment and Tourism may by regulation declare any plant or species of plant to be a protected plant and may impose conditions under which the protected plant shall be conserved, cultivated, used or destroyed by any person. To date however no such regulations have been promulgated under the Act. The Directorate of Rural Water Supply would be well advised to monitor the passing of regulations in terms of this Act in order to ensure that in the course of the development of the rural water supply, no plants which may be declared as protected are destroyed contrary to the provisions of such regulations.

In terms of section 22(1) of the Act it is unlawful for any person to: "*cut, destroy or remove:*

(a) any vegetation which is on a sand dune or drifting sand or on a gully unless the cutting, destruction or removal is done for the purpose of stabilising the sand or gully; or

(b) any living tree, bush or shrub growing within 100 meters of a river, stream or watercourse"

-that is on any land that is not part of a surveyed erven of a local authority area without a licence.

The Directorate of Rural Water Supply must thus ensure that a licence is obtained in terms of this Act, should it be necessary to cut, destroy or remove any vegetation as contemplated in section 22(1) of the Act.

On receipt of the application for such a licence, the licensing officer may only issue such a licence if he or she is reasonably satisfied that the cutting and removal of vegetation will not interfere with the conservation of soil, water or forest resources (section 22(3)).

The Act also provides for the declaration by the Minister of Environment and Tourism of certain areas as different types of classified forests, including state forest reserves (section 13), regional forest reserves (section 14), community forests (section 15) and forest management areas (section 16). Once an area is designated as one of the aforementioned types of classified forests, it will be subject to a management plan. In terms of section 22(3) of the Act, a licensing officer may only grant a license for the cutting or removal of vegetation if such cutting or removal does not fall foul of the provisions of any management plan applicable to that area.

It appears that to date, no classified forests have been designated by the Minister. The Directorate of Rural Water Supply would be well advised to monitor the designation of areas as classified forests in terms of this Act in order to ensure that any cutting or removal of vegetation necessitated by the development of the rural water supply scheme is in line with the management plans adopted for such areas.

Chapter VI of the ***Nature Conservation Ordinance 4 of 1975*** (the "Ordinance") also provides for the designation of indigenous plants as protected species. These are set out in Schedule 9 to the Ordinance as follows:

PROTECTED PLANTS

Common Name	Scientific Name
	AIZOACEAE
Vygies	Aridaria noctiflora
	Astridia all species
	Cephalophyllum all species
	Chasmatophyllum musculinum
	Cheiridopsis all species
	Conophytum all species
	Dinteranthus all species
Mountain Vygie	Ebracteola all species
Window plant, yellow	Fenestraria aurantiaca
Window plant, white	Fenestraria rhopalophylla
Herero Vygie	Hereroa all species
Jensenobotrya	Jensenobotrya lossowiana
Juttadinteria	Juttadinteria all species
Vygie	Lithops all species
Plains Vygie	Nananthus aloides
Vygie	Opthalmophyllum all species
	Psammophora all species
Rusch's Vygies	Ruschia all species
Vygie	Schwatesia all species
	Stoeberia all species
Kalk Vygie	Titanopsis all species
Vygie	Trichodiadema all species
	APOCYNACEAE
Bottel Tree	Pachypodium lealii
Elephant's Trunk	Pachypodium namaquanum
	ASCLEPIADACEAE
Carrion-flower species	Caralluma all species

		Ceropegia all species
		Decabelone barklyi
		Duvalia all species
		Hoodia all species
		Huernia all species
		Huerniopsis all species
		Piaranthus all species
		Stapelia all species
		Tavaresia: see Decabelone species
Ghaap species		*Trichocaulon all species*
	CRASSULACEAE	
		Adromischus all species
		Crassula all species
	LILIACEAE	
		Aloe all species
Small Aloe		*Chortolirion bergerianum*
Variegated Aloe		*Gasteria (ernesti-ruschii) pillansii*
Gloriosa		*Gloriosa virescens*
Small Haworthia		*Haworthia tesselata var. engleri*
	MORINGACEAE	
Moringa		*Moringa ovalifolia*
	ORCHIDACEAE	
Orchids		*Orchidaceae all genera and species*
	PORTULACACEAE	
		Anacampseros all species
Small Elephant's Foot		*Portulacaria pygmaea*

VITACEAE

Butter Tree Species	*Cyphostemma (Cissus)*
Stem Succulent species	

WELWITSCHIACEAE

Welwitschia	*Welwitschia mirabilis*

In terms of section 73 of the Ordinance no person may pick or transport any protected plant without a permit.

Should construction of the pipeline infrastructure and water facilities involve the removal or destruction of any protected species, the Directorate of Rural Water Supply must make application for the necessary permits in terms of section 73 of the Ordinance must accordingly be made by the Directorate of Rural Water Supply.

In terms of section 13 of the Ordinance the provisions relating to protected trees do not apply to the cutting or utilisation of trees or forest produce of a reserved species by an owner or lawful occupier of land owned or occupied by him for his own use.

With the development of the rural water supply infrastructure it may be anticipated that the demand placed on timber reserves for domestic use will increase. If the residents of areas opened up with improved water supply are the lawful occupiers of the land from which such timber will potentially be sourced, reserved species will not be protected in terms of the Ordinance from gathering for domestic use. Use of such species by construction workers engaged to develop the rural water supply infrastructure will however not be permitted under current legislation.

3.5 WATER

The ***Water Act 54 of 1956*** ("the Act") makes provision, *inter alia*, for the control, conservation and use of water for domestic, agricultural, urban and industrial purposes, for the control in certain respects of the use of sea water for certain purposes and for the control of certain activities on or in water in certain areas.

Only certain of the provisions of this Act are however applicable to Namibia.

For the purposes of this study the relevant provisions are section 9B which governs the control and use of private and public water, sections 21 – 23 and 26 which govern the pollution of water, sections 27, 28(1), 30 and 30A which govern the control and use of subterranean water and sections 56 and 57(1) which govern the construction and control of government water works.

Water supplied by the infrastructure to be developed will be derived primarily from underground water. In addition, the option of taking water from the Okavango River via a system of canals and pipelines is being considered.

In terms of section 30A of the Water Act the Minister of Agriculture, Water and Rural Development may convey and supply any subterranean water abstracted or obtained by the state to any person for use on any land for any purpose. Water derived from such a source is considered public water.

Section 9B of the Act limits the quantity of public water that may be impounded or stored in a waterwork to 20 000 cubic meters. A waterwork is defined in the Act as

"*(a) a canal, channel, well, reservoir, protecting wall, embankment, weir, dam, borehole, pumping installation, pipeline, sluice gate, filter, sedimentation tank, road, telephone line or other work constructed, erected or used for or in connection with the impounding, storage, passage, drainage, control or abstraction of water, or the development of water power, including the generation, transmission and supply of electricity, or the filtration or purification of water, sewage, effluent or waste, or the protection of public streams against erosion or siltation, or flood control, or the protection of any water work or irrigated land, other use of water for any purpose, or the conservation of rain water;*

(b) land occupied for or in connection with the impounding, storage, passage, drainage, control, abstraction, filtration, purification, development of power (including generation of electricity), or any other use of water, and includes any area occupied or required or held for the purpose of being irrigated or for flood control purposes;

(c) gauge posts, measuring weirs and any other appliances erected or used by the department or an irrigation board or water board."

The user of water for industrial purposes must furnish the Department of Water Affairs in writing with those particulars regarding the use and disposal of purified or treated water as may be prescribed by regulation (section 21(1)(c)).

The applicable standards for Namibia are those that were promulgated by the Minister by Notice in the Gazette in 1962 (R553 Regional Standards for Industrial Effluent, in Government Gazette No 217 dated 5 April 1962).

The general standards set out in this notice are as follows:

Colour, odour and taste	The effluent shall contain no substance in concentrations capable of producing colour, odour or taste
PH	Between 5.5 and 9.5
Dissolved oxygen	At least 75% saturation
Typical faecal coli	No typical faecal coli per 100ml
Temperature	Not to exceed 35C
Chemical oxygen demand	Not to exceed 75 mg/l after applying a correction for chloride in the method
Oxygen absorbed	Not to exceed 10mg/l
Total dissolved solids	The TDS shall not have been increased by more than 500mg/l above that of the intake water
Suspended solids	Not to exceed 25mg/l
Sodium	The Na level shall not have been increased by more than 50mg/l above that of the intake water
Soap, oil and grease	Not to exceed 2.5mg/l
Other constituents	Residual chlorine 0.1 as Cl2
	Free & saline ammonia 10 as N
	Arsenic 0.5 as As
	Boron 1.0 as B
	Hexavalent Cr 0.05 as Cr
	Total chromium 0.5 as Cr
	Copper 1.0 as Cu
	Phenolic compounds 0.1 as phenol
	Lead 1.0 as Pb
	Cyanide and related compounds 0.5 as CN
	Sulphides 1.0 as S
	Flourine Flounde 1.0 as F
	Zinc 5.0 as Zn

Should any industrial user not be able to comply with these standards, it is required to apply to the Minister of Agriculture, Water and Rural Development for an exemption permit in terms of section 21 (5) of the Act. In terms of such a permit, the user will be exempted from the provisions of section 21(1) and (2) of the Act on condition that all effluents and wastes produced

by, or resulting from its activities are disposed of according to the requirements and conditions set out in the permit.

The Minister of Agriculture, Water and Rural Development may either by notice in writing to a person, or by notice in the Gazette exempt a person or a class of persons on conditions which he or she may specify, from any or all of the aforesaid provisions (section 21(4)(a)). Any person prejudiced by such an exemption may apply to the Minister of Agriculture, Water and Rural Development and the person in whose favour the exemption was granted to object to the continuation of the exemption or any matter in connection with the exemption. The Water Court may confirm or withdraw the exemption or withdraw or amend any condition to which it may be subject (section 21(4)(c)). The Minister of Agriculture, Water and Rural Development may at any time withdraw an exemption or render the continued validity of the exemption subject to such conditions as he or she may determine (section 21(4)(e)).

In terms of section 111 of the ***Public Health Act 36 of 1919*** it is the duty of every local authority to "*take all lawful, necessary and reasonably practical measures:*

(a) for preventing the pollution so as to endanger health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes (whether such supply is derived from within or beyond its district); and

(b) for purifying any such supply which has become so polluted;

and to take measures against any person so polluting any such supply or polluting any stream so as to be a nuisance or danger to health."

To the extent to which the rural water supply scheme concerned will supply water within local authority areas, the aforegoing provisions of the Public Health Act must be considered.

3.6 SOIL

Soil erosion may be a concern in the development of the rural water supply infrastructure. To the extent that this may be a consideration, the ***Soil Conservation Act 76 of 1969*** ("the Act") provides for the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of water sources.

In terms of section 3 of the Act, the Minister of Agriculture, Water and Rural Development ("the Minister") may either by written notice in the Gazette or by written notice to the owner or occupier of land issue directions in respect of, *inter alia*:

(a) *the drainage of vleis, marshes, natural water sponges and water courses;*

(b) *the protection and stabilising of barrier dunes on the coast, of other dunes where drift sand occurs or may occur and of the vegetation occurring thereon;*

(c) *the prevention of erosion, the denudation, disturbance or drainage of land; and*

(d) *any other disturbance of the soil which creates or may create conditions which cause or may cause any form of erosion or pollution of water by silt or drift sand.*

The Minister may, in addition, in terms of section 4 of the Act, order the owner of land to construct soil conservation works, in such manner and within such period as he may determine. Soil conservation works are defined in the act as "*any works constructed on land for the purpose of:*

(a) *the prevention of soil erosion or the stabilising of land subject thereto; or*

(b) *the prevention of drift sand or the stabilising of land subject thereto; or*

(c) *the protection, conservation or improvement of the vegetation and the surface of the soil; or*

(d) *the protection, conservation or stabilising of any natural water source; or*

(e) the prevention of the silting up of dams and the pollution of water by silt." (section 1)

3.7 HEALTH AND SAFETY

Health and safety in the workplace is governed by the regulations relating to the health and safety of employees at work promulgated by the Minister of Labour in terms of section 101 of the ***Labour Act No 6 of 1992***.[ix] These regulations govern the health and safety of workers engaged in the construction of the rural water supply infrastructure.

On a general level an employer has a general duty, in terms of these regulations, to investigate, identify and assess the hazards attached to any work to be performed by his or her employees. The employer has a further general duty to eliminate the said hazards by employing appropriate measures and where it is not reasonably practicable to eliminate the hazards to do all that is reasonably practicable to minimize same.

The employer is obliged to provide training to employees in safety matters relating to the particular work undertaken by that employee and to provide all necessary safety equipment and facilities including personal protective equipment and clothing. An employer may not require or permit an employee to work in a place or in circumstances where the use of safety equipment is required, unless the employee concerned uses the safety equipment so required.

The employer is also under an obligation to ensure that any contractors employed by it also comply with all health and safety regulations.[x]

The Directorate of Rural Water Supply would be well advised to consult the regulations regarding its specific duties pertaining to the various types of work to be engaged in by its employees or its contractor's employees in the construction of the development to ascertain specific health and safety requirements.

3.8 ENVIRONMENTAL ASSESSMENT

In the absence of legislation, environmental impact assessments are currently governed by the ***Environmental Assessment Policy for Sustainable Development and Environmental Conservation, August 1994 (Cabinet Resolution 16.8.94/0021995).***

This policy provides for the promotion of sustainable development and economic growth while protecting the environment in the long term by requiring for environmental impact assessments in respect of certain listed policies, programmes and projects.

Clause 1 provides that all policies, programmes and projects listed in **Appendix B** to the policy, whether initiated by the government or the private sector, should be subjected to the established Environmental Assessment procedure as set out in **Appendix A**.

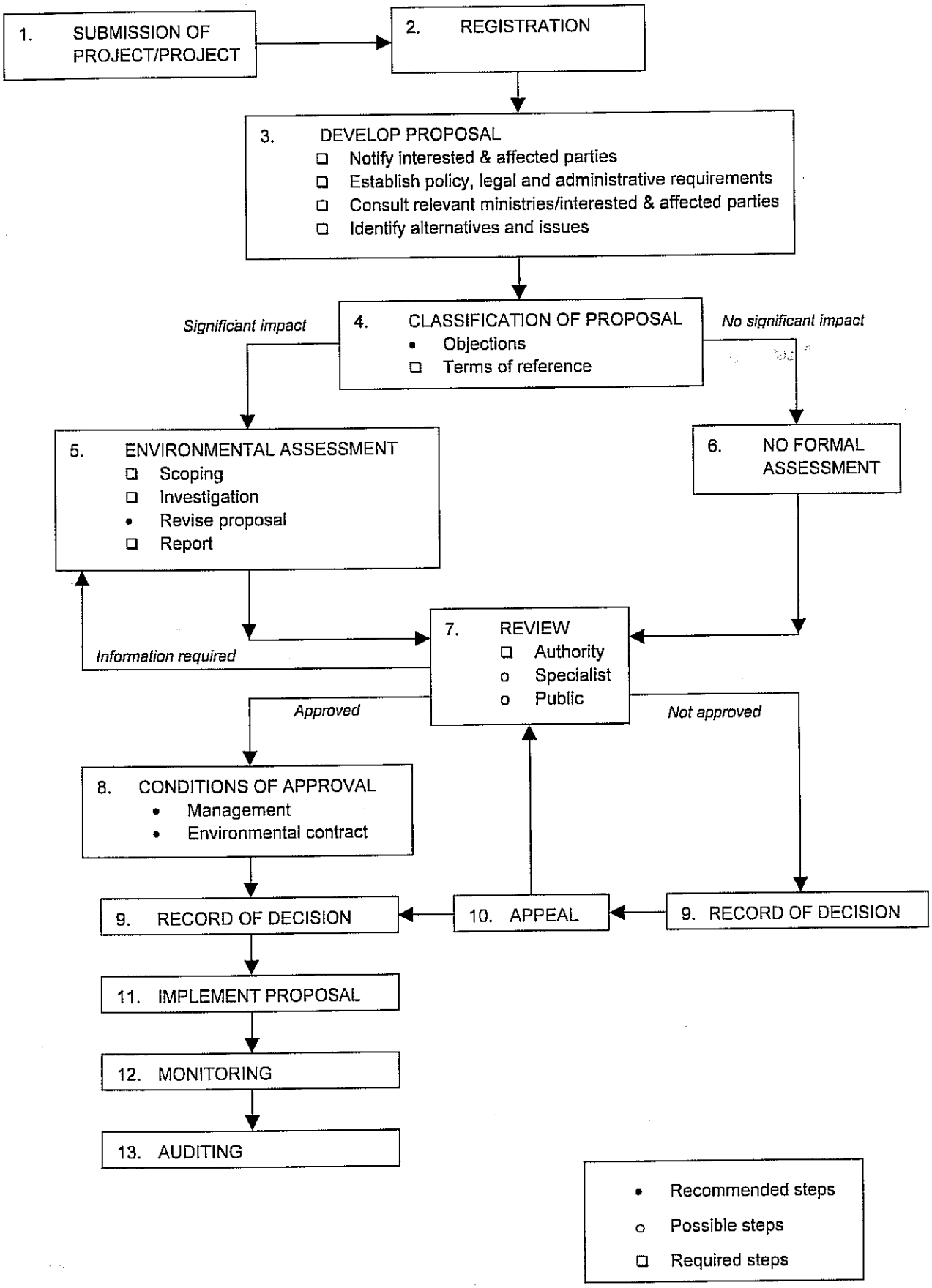
Clause 4 provides that the costs of Environmental Assessments shall be borne by the proponent who is also responsible for ensuring that the quality of the Environmental Assessment and the Environmental Assessment Report are of an acceptable standard.

In terms of **clause 5** the proponent (both Government and Private Enterprise) is required to enter into a binding agreement with the relevant line ministry based on the procedures and recommendations contained in the Environmental Assessment report to ensure that the mitigatory and other measures recommended in the Environmental Assessment, and accepted by all parties, are complied with. This agreement should address the construction, operational and decommissioning phases as applicable, as well as monitoring and auditing.

Clause 9 provides that the Environmental Assessment must, at the cost of the proponent, include the ongoing monitoring of policies, programmes and projects after they have been implemented, to ensure that they conform with the recommendations in the Environmental Assessment report as well as the agreement between the proponent and the relevant line ministry.

The environmental assessment process is set out diagrammatically in Annexure A to the policy as follows:

Diagramm of the Environmental Assessment Process



The Environmental Assessment procedure is described in Annexure A as follows:

"1. SUBMISSION OF POLICY, PROGRAMME OR PROJECT

This is the start of the process, when the proponent (be it government or private enterprise), submits a proposal to the Environmental Commissioner, located in the National Planning Commission.

2. REGISTRATION

The Environmental Commissioner officially registers the policy, programme or project proposal, and ensures that the proponent fully understands the EA procedure that needs to be followed. The Commissioner supplies the proponent with the necessary documentation, general guidance, contacts, and any other support that will facilitate a smooth EA process.

3. DEVELOP PROPOSAL

Because Environmental Assessments are designed to, inter alia, (a) facilitate integrated and improved planning during all stages and (b) ensure that the decision making process is informed and streamlined, the following steps are required at the earliest stage:

- *notify neighbours and other interested and affected parties,*
- *establish policy, legal and administrative requirements and procedural framework,*
- *establish the need for the development, and evaluate this against local, national and international needs on various time scales,*
- *notify and consult with interested and affected ministries,*
- *identify and consider alternatives,*
- *identify and consider issues, opportunities and constraints of alternatives,*
- *consider mitigatory options,*
- *consider management plan options,*
- *consider fatal flaw & risk analyses, and worst-case scenarios, ~ consider secondary and cumulative effects within the region.*

The above activities are the responsibility of the proponent, but are planned jointly by the proponent, the Commissioner and the Board, who engage in a consultative process at this early stage. Through these initial discussions, alternatives, affected parties, potential impacts and benefits, issues, mitigatory and optimisation possibilities, etc., can be identified. Furthermore, a

specific framework, which clearly spells out roles, responsibilities and procedures, should be established.

4. CLASSIFICATION OF PROPOSAL

In consultation with the proponent and his/her consultants, the Board decides on whether this policy; programme or project requires an EA or not. The list of Activities in APPENDIX B should be used to guide this decision. If it is felt that the policy, programme or project is not likely to result in significant impacts and/or that sufficient plans to maximize benefits have already been included, there will be no need for a formal assessment. Alternatively, the Commissioner and/or Board may decide that an EA is required, and they will then discuss the Terms of Reference for the study with the proponent. During this stage, provision is made for individuals and organisations to voice their objections or reservations to the proposal.

For large projects, a pre-feasibility study is usually undertaken. Based on the findings of this, a more detailed feasibility study may be conducted. The Terms of Reference for the detailed feasibility study should be established during the pre-feasibility study.

5. ENVIRONMENTAL ASSESSMENT

It should become clear during the registration or classification of proposal stages whether there will be significant impacts and if an EA is necessary or not. There are three main components to all EA.

(i) Scoping

This determines the extent of and approach to the investigation and should endorse the Terms of Reference established earlier. The proponent (and his/her consultant), in consultation with the Environmental Commissioner. relevant authorities, interested and affected parties, determine which alternatives and issues should be investigated, the procedural framework that should be followed, and report requirements. It is the responsibility of the proponent to ensure that all the above are given adequate opportunity to participate in this process.

The Scoping process should indicate the following:

- *the authorities and public that are likely to be concerned and affected,*
- *methods to be used in informing and involving concerned and affected parties,*
- *opportunities for public input.*

- *specific reference to disadvantaged communities regarding the above.*
- *the use of advisory groups and specialists.*
- *the composition of the EA team and their Terms of Reference,*
- *the degree of confidentiality required.*

If the proposal is likely to affect people, the proponent should consider the following guidelines in Scoping:

- *the location of the development in relation to interested and affected parties, communities or individuals,*
- *the Number of people likely to be involved,*
- *the reliance of such people on the resources likely to be affected, -the resources, time and expertise available for scoping,*
- *the level of education and literacy of parties to be consulted,*
- *the socio-economic status of affected communities,*
- *the level of organisation of affected communities,*
- *the degree of homogeneity of the public involved,*
- *history of any precious conflict or lack of consultation,*
- *social, cultural or traditional norms within the community,*
- *the preferred language used within the community.*

(ii) Investigation

The investigation includes literature research and field work, and is guided by the scoping decisions. It is intended to provide the Board with enough information on the positive and negative aspects of the proposal, and feasible alternatives, with which to make a decision.

(iii) Report

The report should consist of the following:

- *Executive summary*
- *Contents page*
- *Introduction*
- *Terms of Reference*
- *Approach to study*
- *Assumptions and limitations*
- *Administrative, legal and policy requirements*

- *Project proposal*
- *The affected environment*
- *Assessment*
- *Evaluation*
- *Incomplete or unavailable information*
- *Conclusions and recommendations*
- *Definitions of technical terms*
- *List of compilers*
- *Acknowledgements*
- *References*
- *Personal communications*
- *Appendices*

It should also include:

- *Management plan*
- *Monitoring programme*
- *Environmental Agreement*
- *Audit proposal*

6. NO FORMAL ASSESSMENT

If a policy, programme or project is unlikely to result in significant impacts, and plans for maximizing benefits are adequate, then the proposal can proceed without an EA. In the unlikely event of strong opposition to the development at this late stage, the Commissioner could solicit further opinions from specific ministries, specialists, interested and affected parties and the general public. Based on the response, the proposal is either sent back for more information (especially if there is serious uncertainty or significant information gaps), or approval to proceed is confirmed.

7. REVIEW

Once completed, an Environmental Assessment report is submitted to the Environmental Commissioner for review. The Commissioner will review the document with the assistance of local and/or outside experts, sector Ministries, and any other organisations/individuals as considered necessary. The cost of external review shall be borne by the proponent. The recommendations of the Commissioner shall be presented to the Environmental Board, which

will make a decision or recommendation as appropriate. Such decision shall be recorded and made known to the proponent.

8. CONDITIONS OF APPROVAL

Once a policy, programme or project has been approved, the Board, in consultation with the proponent, may set a number of conditions. Such conditions may provide for the establishment of a management plan, which specifies tasks to be undertaken in the construction, operational and decommissioning phases of the development. By mutual agreement, a monitoring strategy and audit procedure will be determined at this early stage so that the proponent can make the necessary budgetary provisions well in advance. Provision is also made for an Environmental Agreement, whereby penalties for not adhering to the Conditions of Approval are agreed upon.

9. RECORD OF DECISION

Whether or not a proposal is approved, there should be a record of decision, which should include reasons for the decision. This Record of Decision should be made available by the Commissioner to any interested party, including the public. Any Conditions of Approval must be reflected in the Record of Decision.

10. APPEAL

The decision making process provides an opportunity for appeal through the Commissioner and/or the Board. Besides appealing to the decision-making authority, appellants should be allowed access to a court of law if malpractice is suspected.

11. IMPLEMENTATION OF PROPOSAL

Once approved, the policy, programme or project may be implemented in accordance with the Environmental Agreement.

12. MONITORING

An appropriate monitoring programme should be required for all approved proposals. Aspects to be covered in Monitoring include verification of impact predictions, evaluation of mitigatory measures, adherence to approved plans, and general compliance with the Environmental Agreement. The responsibility for ensuring that appropriate monitoring takes place lies with the Commissioner, while the proponent shall be responsible for meeting the costs.

13. AUDITS

Periodic assessments of the positive and negative impacts of proposals should be undertaken. These will serve to provide feedback on the adequacy of planning during the ***Develop Proposal*** *stage, the accuracy of investigations in the* ***Environmental Assessment*** *stage, the wisdom of the decisions taken during the* ***Review*** *stage, and the effectiveness of the* ***Conditions of Approval*** *and* ***Monitoring Programme*** *during the* ***Implementation*** *stage. An audit is thus an independent reassessment of the policy, programme or project after a given period of time.*

Annexure B to the policy lists the policies, programmes and projects that must be subjected to the environmental impact assessment process. Those that are relevant to this project are the following:

"6. Any government policy, programme or project on the use of natural resources.
25. Major pipelines.
28. Major canals, aqueducts, river diversions and water transfers.
30. Major dams, reservoirs, levees and weirs.
34. Small scale (formal) water supply schemes.
42. Major groundwater abstraction schemes."

An environmental impact assessment will thus be required in respect of any projects listed in the **Annexure B** to the policy in the manner prescribed. Although this policy does not yet have the force of law, it underpins the new ***draft Environmental Management Act*** that will, in all likelihood be passed in the course of 2002. It would thus be prudent to ensure that the provisions of this policy are complied with. It must be noted however that although the provisions of the policy and the ***draft Environmental Management Act*** are similar, there are some differences. For example, in Annexure A, reference is made in the policy to an Environmental Board. In the ***draft Environmental Management Act***, the body to be established is the Sustainable Development Commission rather than an Environmental Board. There are also some differences between the activities listed in Annexure B to the policy that require an environmental assessment and the list of activities contained in the ***draft Environmental Management Act***. In addition, there are some differences between the policy and the ***draft Environmental Management Act*** with regard to the environmental assessment procedure to be followed. This must be borne in mind once the ***draft Environmental Management Act*** comes into force. For the moment however, the policy provisions should be adhered to.

The ***draft Environmental Management Act***, which is likely to be passed into law in the latter half of 2002, establishes general principles for the management of the environment and natural

resources as well as a comprehensive environmental assessment process. Clause 6 of the draft Act sets out the environmental management principles to be applied in the planning and implementing of acts that are likely to have a significant effect on the environment as follows:

"(1) renewable resources shall be utilised on a sustainable basis for the benefit of current and future generations of Namibians;

(2) community involvement in natural resource management and sharing in the benefits arising therefrom shall be promoted and facilitated;

(3) public participation in decision-making affecting the environment shall be promoted;

(4) fair and equitable access to natural resources shall be promoted;

(5) equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems;

(6) the precautionary principle and the principle of preventive action shall be applied;

(7) there shall be prior environmental assessment of projects and proposals which may significantly affect the environment or the use of natural resources as provided for in Part 4 below and other legislation;

(8) sustainable development shall be promoted in land-use planning;

(9) Namibia's movable and immovable cultural and natural heritage including its biological diversity shall be protected and respected for the benefit of current and future generations;

(10) generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source;

(11) the polluter pays principle shall be applied;

(12) reduction, re-use and recycling shall be promoted."

Part 4 of the draft Act provides for environmental assessments to be carried out in respect of projects that involve activities listed in Schedule 1 to the draft Act. The activities listed in Schedule 1 that are of relevance to this project are the following:

"1. **Construction and related activities**

(m) the construction of canals and channels including the diversion of the normal flow of water in a riverbed and water transfer schemes between water catchments and impoundments;

(n) the drilling of boreholes and the construction of dams, reservoirs, levees and weirs;

(t) the construction of oil, water, gas and petrochemical and other bulk supply pipelines.

3. **Resource extraction, manipulation, conservation and related activities**

(d) the abstraction of ground or surface water".

In terms of clause 18(1) of the draft Act the proponent of the project is responsible for carrying out the environmental assessment and bearing the costs associated therewith.

Clause 18(2) requires that environmental assessment report contain, as a minimum:

"(a) a description of the proposed project and its purpose;

(b) a description of the environment likely to be significantly affected by the proposed project and its alternatives;

(c) a description of the potential environmental impact of the proposed project and its alternatives and an estimation of its significance;

(d) a description of effects on cultural heritage and also of major impacts or socio-economic conditions resulting from alterations to those factors;

(e) a description of mitigation measures to keep adverse environmental impact to a minimum;

(f) an explicit indication of predictive methods and underlying assumptions as well as the relevant environmental data;

(g) an identification of gaps in knowledge and uncertainties encountered in compiling the required information;

(h) a description of the steps taken to consult with and solicit comment from Interested and Affected Parties;

(i) where appropriate, an outline for monitoring and management programmes and any plans for post-project analysis; and

(j) a non-technical summary including a visual presentation as appropriate."

The environmental assessment process provided for in the draft Act is designed in such a way as to make provision for a fast track process in respect of projects that involve activities listed in Schedule 1 but which are not likely to have a significant effect on the environment.

In terms of clause 20, the proponent of a project involving an activity listed in Schedule 1 is required to lodge an application in respect of the proposed project with the relevant competent authority and this application must be accompanied by a form that sets out the potential impacts on the environment and such further information as may be necessary to determine whether or not there is a need for an environmental assessment. Clause 20(2) provides that the competent authority is then obliged to forward such application to the Office of the Environmental Commissioner within 5 days of receipt of the application. The Environmental Commissioner is obliged to invite comment from interested and affected parties.

In terms of Clause 21 the Environmental Commissioner then screens the application and any comments received to determine whether an environmental assessment is required. Where it is determined by the Environmental Commissioner that an environmental assessment is not required, the Environmental Commissioner may issue an environmental clearance in respect of the proposed project in terms of Clause 22.

Where the Environmental Commissioner determines that an environmental assessment should be undertaken, Clause 23 provides that the Environmental Commissioner shall determine the form, scope and content of the assessment.

Once the environmental assessment has been completed the Environmental Commissioner, in consultation with the relevant competent authority, may in terms of Clause 24(1):

"(a) invite such further public comment and input as he or she may determine;

(b) direct that the project to be subject to public hearings;

(c) direct that the Environmental Assessment Report to be subject to independent review at the Proponent's expense;

(d) convene an ad hoc committee of experts to assist with the review of the Environmental Assessment Report;

(e) refer the Environmental Assessment Report back to the Proponent for further elaboration, clarification or information as it may require".

In terms of Clause 24(2), the Environmental Commissioner is then required to review the environmental assessment report and forward it to the Sustainable Development Commission together with his or her recommendations. The Sustainable Development Commission is then required to review the report within a 30-day period and to grant an environmental clearance or refuse to do so.

Part 4 of the draft Act also requires environmental assessments in respect of proposals that may have a "significant effect" on Namibia's environment. Proposals include plans, bills, draft regulations and proposed amendments to existing laws. Inasmuch as the Kavango Rural Water Supply Development Plan constitutes a plan as contemplated in this Part of the draft Act, the Directorate of Rural Water Supply must comply with the provisions of this Part of the draft Act prior to putting the plan into action.

In terms of Clause 19(2), a Proponent may not publish a proposal or put a proposal into action without first getting comments and recommendations from the Environmental Commissioner and the Sustainable Development Commission.

A Proponent must give a copy of any proposal to the Environmental Commissioner as soon as "practicable" after the proposal has been put together. The Proponent must also give the Environmental Commissioner a written summary that says how the proposal takes into account the principles of environmental management.

As soon as "practicable" means as soon as reasonably possible in light of local conditions and circumstances, and keeping in mind the current state of technical and scientific knowledge.

After receiving the proposal, the Environmental Commissioner may impose any of the following additional requirements – acting in consultation with the Competent Authority that is involved:

- Invite further public comment and input.
- Require public hearings on the proposal.

No later than 30 days after the proposal has been received and any further requirements have been completed, the Environmental Commissioner will forward the entire submission on the proposal to the Sustainable Development Commission. The Environmental Commissioner must also give the Sustainable Development Commission his or her comments and recommendations, and written summaries of any public input or comment (Clause 28(2)-(3)).

Within 30 days of receiving the documents on the proposal, the Sustainable Development Commission will make an assessment of the proposal. This time period can be extended if the Proponent agrees.

The assessment of the Sustainable Development Commission must consider the significant effects of the proposal on the environment, the risks and consequences of the proposal, alternatives to the proposal, and steps that could minimise its negative impacts and maximise its positive impacts. It must also look at how best to make the proposal consistent with the principles of environmental management.

After making the assessment, the Sustainable Development Commission will forward its comments and recommendation to the Proponent. They must also be sent to the Competent Authority (if a Competent Authority is involved, and if this Competent Authority is not the Proponent). If the proposal involves a law, then the comments and recommendations must also be sent to Cabinet (Clause 28(4)).

To the extent to which foreign investment may play a role in the development of the rural water supply scheme it is relevant to note the provisions of the Foreign Investment Act 27 of 1990 (as amended by Act 24 of 1993).

This Act provides for the promotion of foreign investments in Namibia but has environmental relevance in the sense that the granting of preferential investment status, which carries with it certain foreign exchange control benefits, is influenced inter alia by the impact which the

activities of the enterprise in which the proposed investment is to be made is likely to have on the environment.

In terms of section 4 of the Act, the Minister of Trade and Industry may issue a Certificate of Status Investment in respect of an investment of foreign assets in Namibia. An enterprise in respect of which such a certificate has been issued is entitled in terms of section 8 to purchase freely convertible foreign currency for use without restriction to, inter alia, repay the principal sum of any loan in foreign currency, the proceeds of which formed part of the foreign assets invested in the enterprise. In addition such enterprise is entitled, in terms of section 9, inter alia to transfer out of Namibia the profits of the investment.

In issuing such a certificate the Minister is obliged, in terms of section 6(3)(e) to have special regard to "the impact which the activities of the enterprise in which the proposed investment is to be made likely to have on the environment and, where necessary, the measures proposed to deal with any adverse environmental consequences."

There is accordingly a clear incentive for any potential foreign investors in the development of the rural water supply infrastructure to ensure that a comprehensive environmental impact assessment is done prior to such investment being made.

3.9 INTERNATIONAL CONVENTIONS

3.9.1 CONVENTION ON BIOLOGICAL DIVERSITY

The Convention's objectives are *'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources"* (Art 1).

It contains a series of far-reaching obligations related to the conservation of biological diversity and the sustainable use of its components, including:

- General measures for conservation and sustainable use (Art 6);
- Identification and monitoring (Art 7);
- In situ conservation (Art8) and ex situ conservation (Art 9);
- Sustainable use of components of biological diversity (Art 10); and
- Specific measures such as impact assessments.

In situ conservation, which is the primary role of the Convention, is the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of specie in their natural surroundings (Art 2). Contracting parties are required to meet, as far as possible and as appropriate, certain goals for in situ conservation including:

- The establishment of a system of protected areas;
- The regulation and management of biological resources;
- *The promotion of the protection of ecosystems, natural habitats and maintenance of viable populations of species in natural surroundings*; (emphasis added)
- *The promotion of environmentally sound and sustainable development in areas adjacent to protected areas* (emphasis added).

The Convention also seeks to ensure sustainable use of components of biological diversity through a number of measures. Provision is made for *integrating the consideration of conservation and sustainable use of biological resources into national decision-making and the adoption of measures that avoid or minimise adverse impacts on biological diversity (Art 10)* (emphasis added).

The sustainable use of natural resources is central to the obligations created under this convention and as a Party thereto, Namibia has an obligation to ensure that the development of the rural water supply infrastructure is not contrary to the principle of sustainable utilisation.

3.9.2 UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION

The primary objective of the Convention is to combat desertification and mitigate the effects of drought through action at all levels, supported by international co-operation and partnership arrangements, *with the aim of achieving sustainable development in affected areas* (emphasis added).

Article 4 lists the general obligations of all Parties under the Convention, emphasising the need to co-ordinate efforts and develop a coherent long-term strategy at all levels. These obligations include, inter alia, the adoption of an integrated approach in addressing desertification and drought.

The obligations of affected Parties, such as Namibia, are set out in article 5 and include giving due priority to combating desertification and mitigating the effects of droughts by allocating adequate resources and establishing strategies, *paying special attention to the socio-economic*

factors when addressing the causes of desertification (emphasis added) and establishing long term policies.

In the context of the pipeline development under consideration Namibia has an obligation under this Convention to consider the secondary effects of the rural water supply development and the possible effects on desertification.

3.9.3 SADC PROTOCOL ON SHARED WATER SYSTEMS

Namibia became a party to this Protocol in August 1995. Two of the major principles set out in this Protocol that are of direct relevance to this development are the following:

- Member states within a shared watercourse system undertake to pursue and establish close co-operation with regard to the study and execution of all projects likely to have an effect on the regime of the watercourse system; and

- Member states shall utilise a shared watercourse system in an equitable manner. In particular, a shared watercourse system shall be used and developed by member states with a view to attaining optimum utilisation thereof and obtaining benefits therefrom consistent with adequate protection of the watercourse system.

As pointed out above, utilisation of water from the Okavango River for the rural population would fall to be negotiated with the other riparian states through the Permanent Joint Technical Commission.

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i A Digest of the Water Supply and Sanitation Sector Policy of the Government of Namibia, MAWRD, November 1993, p. 12

ii Legal Report of the Community Water Supply Management Support Programme; A W Corbett, March 1998, p iii

iii ibid.

iv op cit. 29-30

v op cit. 32

vi op cit. 36

vii op cit. 24-26

viii op cit. 41-42

ix These regulations are contained in Government Notice 156 of 1997 and came into force on 31 July 1997.

x Regulation 2