Appendix A: Lower Orange Water Management Area Strategies

Strategies Table of Contents

Appendix A: INTRODUCTION TO STRATEGY TABLES

The first 2 chapters of the Lower Orange WMA Internal Strategic Perspective (ISP) describe the ISP process, paint a broad perspective of the water situation in the WMA, and describe the key issues that have to be dealt with. The crux of the ISP is located in a series of strategy tables presented in **Appendix A**. The strategy tables for each area present the management objective (what we are trying to achieve); an assessment of the situation along with a motivation as to why the strategy is required; the required actions; responsibilities; priorities; and relevant supporting references. A version control is attached for future versions of this ISP.

Certain issues are clearly applicable to all WMAs in the country and for these a national policy to guide the strategy needs to be developed. These issues and aspects were identified and flagged, during the development of this ISP, for consideration at **National Level**.

The table below provides a brief description of the elements contained in the strategy tables.

Definitions of terminology used in the Strategy Tables

Management Objective	Description of what DWAF is trying to achieve
Situation assessment	Description of the current situation and related issues and motivations to support the management actions.
Management actions (M)	The actions which need to be taken to resolve issues and tasks identified in the situation assessment.

A.1 WATER BALANCE AND WATER RESOURCE RECONCILIATION STRATEGIES

A.1.1 RESOURCE AVAILABILITY

Management objective:

Ensure that reliable estimates of the water resources (surface and groundwater) are available to effectively conduct Integrated Water Resources Management. The factors impacting on the water resources need to be clearly defined and understood.

Situation Assessment:

Surface water resources

The Lower Orange WMA is a component of the extended Vaal and Orange River Systems. Integrated systems models have been compiled to account for the complex interdependencies that exist due to the various inter-basin transfers. The system is currently well modelled using both the WRPM and WRYM models. Model results indicated that there is currently only a small surplus available in the system (See **Strategy A.3.1**). For detail on the overarching water supply system the reader is referred to the Orange River System Overarching ISP (**DWAF, 2004a**)

The surface water resources generated within the Lower Orange alone cannot possibly supply the existing development in the WMA and a release of 2 083 million m³/a at the year 2000 from Gariep and Vanderkloof dams in the Upper Orange WMA is essential to satisfy existing demands and river requirements. The yield from the local sources as summarised in the table below is negative, as the evaporation and evapotranspiration by riparian vegetation along the Orange River, by far exceeds the run-off river yield contribution from local inflows. The water available for users in this WMA therefore amounts to 1 122 million m³/a (2 083 – 961).

Sub-area	Natural Resource		Usable return flow			Total local yield
	Surface water	Ground water	Irrigation	Urban	Mining & bulk	
Orange	(1 092)	9	96	1	0	(986)
Orange Tributaries	9	13	0	0	0	22
Orange Coastal	0	3	0	0	0	3
Total	(1 083)	25	96	1	0	(961)

Note : Values in brackets represent negative values, see description above the Table

Approximately 93% of all the surface water generated in the Orange River catchment (Vaal included) is generated upstream of the Orange/Vaal confluence. The two major storage dams Gariep and Vanderkloof, which are both used to supply all the irrigation, urban, mining and environmental requirements along the Lower Orange River are located in the Upper Orange WMA. Reliable estimates of the surface water resources in the Upper Orange and Vaal River catchment are therefore also of extreme importance for the Lower Orange and are briefly referred to in this situation assessment. For more detail the reader is also referred to the Upper Orange ISP (**DWAF, 2004b**) and Orange River Overarching ISP (**DWAF, 2004a**) documents.

There is a fairly high level of confidence in the yield estimates of the surface water in the main system, although some of the hydrology is relatively old. Hydrological data for the Fish River (Namibia) was updated as part of the LORMS and covers the period

Situation Assessment (Continued):	1920 to 2000. The hydrology for the Fish River (Namibia) represents approximately 60% of the surface runoff generated in the Lower Orange, but this only enters the Orange River ± 100km upstream of the Orange River Mouth. The runoff from the Fish River is therefore not available to most of the users along the Orange and even to users downstream of the confluence due to its sporadic nature. Although the updated hydrology for the Fish River was not done on a very detailed level, it is considered good enough to be used in the existing water resource planning and operating analysis. The remaining hydrology for the Lower Orange downstream of Vanderkloof Dam was obtained from the WR90 (WRC Study). This amounts to 40% of the runoff generated in Lower Orange WMA and represents less than 3% of the total Orange River natural runoff. These records cover the period 1920 to 1989. Although the Lower Orange hydrology was developed at a cursory level, it will not affect the yield determined for Gariep and Vanderkloof dams - the main supply source for users along the main Orange River. The water resource models, as configured for the Orange River System, are not at a high enough resolution to define the availability of local water resources in the tributaries at a sufficient level of confidence. These local resources are used to support water users that are mostly located in tributary catchments that do not have access to the main river reaches. The Ongers River is a typical example. The Lower Orange hydrology is however not at an acceptable level for the planning or operation of local water supply schemes outside the Orange River in any of the main tributaries. The reliability of the Lower Orange Hydrology is becoming more important when storage dams are considered in the Lower Orange, as currently investigated as part of the LORMS. Future studies must consider the updating and extending of the Lower Orange hydrology, or at least carry out sensitivity analyses to determine the effect of inaccuracies with regards to the existing hydrology. Although observed river flow records, rainfall records, and updated demand data are readily available for the Orange River system; it is a costly exercise to include the data into the runoff, yield and planning models. Such an exercise will typically include the following: ▪ Data records need to be verified and patched through various processes before the rainfall runoff models can be calibrated to produce natural runoff records for all the selected sub-catchments. The generated stochastic sequences must be also verified and validated before they can be used in the WRYM and WRPM. Updated environmental requirements might also be required. The WRYM can only then be updated with the new hydrology and water requirement data and used to determine the updated yield characteristics of the system. The updated short-term yield characteristics, hydrology and water requirements and projections are finally used as input to the WRPM for planning and operating purposes. ▪ Any hydrology update must be carefully planned and programmed to co-ordinate the various processes and to ensure that all the components affecting the yield figures are updated. Updates of the Lower Orange hydrology are currently not in progress or planned and an update must be considered as part of future studies. *Factors that could have significant impacts on the available surface water resources, include:* *Mainstream Orange* ▪ Most of these factors are of an overarching nature and the reader is referred to the Orange River Overarching ISP (**DWAF, 2004a**). A few additional factors are however also listed hereafter. ▪ Irrigation Return flows. Very little data is available. WCDM will reduce return flows. Water Quality will be affected. All these effects need to be included in the models.

Situation Assessment (Continued):	Existing models include return flow volumes based on assumptions. ▪ Utilising the inflows from the Vaal River. ▪ Utilising inflows from the Fish River to supply part of the River Mouth environmental requirement. This will in particular be beneficial if a dam is in place in the Lower Orange, as environmental releases from the dam can be decreased or stopped in time to be able to utilise flows from the Fish River for this purpose. (See **Strategies A.1.3** and **A.7.1** for more detail). *Tributaries* ▪ "Saaiwalle" and small dams in some of the tributaries. These are mainly located in the southern Sak-Hartbees sub-catchment. The water is diverted into paddocks. The water use is registered and releases are required for downstream "saaiwal" users. These effects will be of local importance with insignificant impacts on the main Orange River. **Groundwater resources** Information on groundwater can be obtained from the following sources: ▪ NGDB. ▪ WARMS database. ▪ DWAF Geohydrology Northern Cape. ▪ 1:500 000 Geohydrological maps. ▪ Consultants reports and other academic reports. (See groundwater overview report in **Appendix B** for more detail) Groundwater utilisation is of major importance in the Lower Orange WMA and is the only source of water over much of the WMA. It is mainly used for rural, domestic, stock watering and supplies to inland towns. The groundwater resource is of such a nature that it cannot be used for large-scale irrigation anywhere in the WMA. Aquifer characteristics are typically unfavourable due to the hard geological formation underlying most of the WMA. Groundwater availability is site specific. The naturally poor quality and poor yields of most aquifers are a constraining factor of this resource. This is overcome in some areas by good water management practices and treatment of the groundwater. In the Orange River Tributaries sub-area about 60% to 70% of the available water is supplied from groundwater resources. Groundwater availability in the Coastal region is extremely limited as result of lack of rainfall and the risk of seawater intrusion into coastal aquifers. Long term planning for groundwater resources needs to be done through WSDPs. The current utilisation of groundwater close to the towns is approximately in balance with the sustainable yield from the source for most towns. No significant potential for further development therefore exists close to the towns, and some over-exploitation has been experienced in the coastal region. Given that no significant growth in population is expected, perhaps even a decline, this is a situation, which can be managed. Municipalities should also investigate groundwater potential outside town boundaries within a viable economic radius from the town, as a possible source and some towns already practice this. A lack of knowledge and proper understanding of the groundwater resource and resource management exists at local level.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Undertake on a need basis, yield analysis assessments on a cursory level (using verified or improved WR90 data) of the local surface water resources of selected catchments supplied from local resources. This will be the responsibility of the specific Town, Irrigation Board or WUA affected, with support from DWAF from a controlling and advisory perspective. A list of all the towns located in the WMA with indications where a deficit in the water supply exist are provided in **Appendix D.**	Dir: NWRP Region Towns &IB (Priority 4)
	M2. Undertake analysis on a need basis to improve the confidence of the estimates of the unused groundwater resources. The focus should be on the towns where there are currently problems. DWAF will support from a controlling and advisory perspective. Available data should be provided and boreholes drilled in cases where there is a lack of data.	Who ever require the information (Priority 2)
	M3. Municipalities should be required to put a monitoring strategy in place to obtain sufficient data. DWAF can use licensing as a tool to encourage this. DWAF will support from a controlling and advisory perspective.	Region (Priority 1)
	M4. The hydrology update – see Orange River System Overarching ISP (**DWAF, 2004a**)	
References:	a) Orange River System Analysis Phase 1 & 2 (Report no. P D000/00/1092) b) Lower Orange WMA: Overview of Water Resources Availability and Utilisation (Report no. P WMA 14/000/00/0203). c) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697).	

Strategy Version control:	**This version no:**	1
	Date:	July 2004
	Author:	ISP Study

A.1.2 WATER USE REQUIREMENT STRATEGY

Management objective:	Ensure the knowledge base on the water requirement in the WMA is realistic and updated on a regular basis. Maintain and update water requirement projection scenarios for planning and management purposes.
Situation Assessment:	**Water use data** Water requirements within the water management area are dominated by irrigation water use, which represents 95% of the local requirements for water. The main urban/industrial/mining requirements for water are from Upington, De Aar, and other urban/mining abstractions along the main Orange River. Water requirements for rural domestic supplies and for stock watering are relatively small. There are no large industries with their own bulk water supplies in the water management area, while the water requirements for mining (9 million m^3/a) are also relatively small. The 60 million m^3/a transfer shown in **Table 2.2** in **Section 2.4.1** refer to the water used by Namibia along the common border (54 million m^3/a) and 6 million m^3/a transferred to the Coastal sub-area. Although the urban/industrial requirement is small, the water sources are scarce, especially in the tributaries. The irrigation areas and relevant quotas for the Main Orange River System are collated from the different DWAF offices and bulk users on an annual basis, currently captured in a spreadsheet database. This information is compared with the projected water requirements in order to make adjustments (over the short-term) for use in the annual operating analysis. It should be noted that the data on actual water use for irrigation is not available. Indications are that approximately 47% of the irrigation requirement is supplied through canal systems, and the remaining 53% directly from the rivers. The irrigation water use is calculated based on the scheduled area and quota or crop water requirements as determined by means of SAPWAT, mainly for the tributaries. In future all registered lawful irrigation use will be based on SAPWAT. There is however room for improving the available data in this regard. The process of verification of the current registered water use with that from the old permit system has been completed for the Orange River main stream and provided fairly similar results. The main differences were for some towns along the Orange River for which the permit allocations were significantly higher than their current use. The total volume of the over allocations is however very small due to the small total urban use in the system. Verification with the physical development on the ground was only done for the Middle Orange area and needs to be done for the rest of the mainstem. It is expected that the actual water use will be more than the registered water use, as 270 million m^3/a operating losses is currently experienced in the system which is partly due to over or illegal abstractions. Due to the inaccuracy of flow gauging structures in the Orange River for low flows and the fact that irrigation abstractions is not measured, it is difficult to determine what part of the operating losses is as result of over or illegal abstractions. The tributaries are currently being verified on a need basis. Some test cases to curb illegal irrigation water use are underway. Success has been achieved in the Ongers sub-catchment. Once practical experience has been gained further cases will be started with the focus on the larger illegal users. The first development of the 4 000ha earmarked for resource poor farmers is located in the Sandrift-Pella-Blocuso area (approximately 500ha) and the licensing process was started in October 2003. Other developments include 2 000ha for the Northern Cape Province referred to as the Vanderkloof Project. This is physically located in the Upper Orange WMA but within the Northern Cape Province and the allocation is

Situation Assessment (Continued):	taken out of the 4 000 ha for the Lower Orange. Although water use data for the larger demand centres is mostly available, it is necessary to plan for future updates, which will include different demand projection scenarios such as with and without various levels of water demand management and conservation. **Table 2.2** in **Section 2.4.1** gives a breakdown of the water requirements between the indicated sectors and components for the year 2000. The total water use and transfers out for the Lower Orange River System for the year 2000 was estimated at 1 130 million m^3/a and increase to 1 177 when the 4 000ha earmarked for resource poor farmers in the WMA (Or Northern Cape Province) is included. Over and above the requirement of 1 177 million m^3/a**,** 615 million m^3/a is released from Vanderkloof to supply river requirements (mainly evaporation from river of which 559 million m^3/a occur within this WMA) as well as 289 million m^3/a for the river mouth environmental requirements and 270 million m^3/a to cover the operational losses. Between the year 2000 and October 2003, 1 936 ha of water allocations, comprising a total volume of 19.7 million m^3/a, has been transferred, as part of trading agreements between irrigators, from the Eastern Cape (Orange Fish tunnel supply area) back to the main Orange River. The traded volumes are now mainly utilised in the Lower Orange WMA. **Table 2.3** in **Section 2.4.2** gives a breakdown of the water requirements between the indicated sectors and components for the year 2025. The estimated total water use by 2025 for the Lower Orange River System is 1 174 million m^3/a. This includes the effect of the 4 000 ha earmarked for resource poor farmers. This is slightly lower than the year 2000 requirement (plus 4 000 ha requirement) of 1 177 million m^3/a and is as result of the slight reduction in the urban and rural requirement. The 2025 water requirement as given in **Table 2.3** excludes the water allocation of 19.7 million m^3/a that has been transferred from the Eastern Cape back to the main Orange River, as this is information that only recently become available. In the water balance it is currently still included in the transfer volume from the Upper Orange WMA to the Fish to Tsitsikama WMA. **RELEVANT DATA ON A SUB-CATCHMENT BASIS** Details of the water supply to towns and the resources used are summarised in **Appendix D.** **Orange River Sub-area (Includes Boegoeberg, Neusberg, Nossob-Molopo, Vioolsdrift and Alexanderbay sub-catchments)** • The main Orange River System is used to supply almost all the water requirements in these sub-catchments, with the exception of a few small towns and some of the rural, domestic and stock water requirements. • Towns located in these sub-catchments areas include: *Boegoeberg sub-catchment*, Griekwastad, Niekerkshoop, Marydale, Prieska and Westerberg. Prieska and Westerberg are supplied from the Orange River. Groundwater is the main source of water for the remaining towns. *Neusberg sub-catchment,* Groblershoop, Upington, Keimoes and Kakamas. All the towns are supplied from the Orange River. *Vioolsdrift sub-catchment,* Augrabies, Marchand, Pofadder, Aggeneys and Onseepkans. All the towns are supplied from the Main Orange River. *Alexander Bay sub-catchment,* Concordia, Vioolsdrift and Alexander Bay. All the

Situation Assessment (Continued):	towns are supplied from the Orange River. The base scenario shows a small decline in the water requirements from these towns until 2025, and the high growth allows for an increase of approximately 60% of the 2000 demand to the year 2025. The base scenario projection is considered as the most probable projection and is currently used by DWAF for planning purposes. • Irrigation is the main water user in these sub-catchments and includes: (see map in **Appendix C**) *Boegoeberg sub-catchment*, ±24 000ha irrigation (± 240 million m³/a) from the Orange River Main stream and Douglas Weir in the Vaal River. Douglas Weir is however also supported with water from the Orange River through a canal from Marksdrift. This area includes the Lower Vaal and Middle Orange irrigation areas. *Neusberg sub-catchment,* ±25 370ha irrigation (± 380 million m³/a) from the Orange River Main stream. About 80% of the irrigation abstractions in this sub-catchment are through canal systems and diversion weirs in the Orange River. The remaining 20% is abstracted directly from the main river. The Boegoeberg Dam, Upington and Kakamas irrigation areas are located in this sub-catchment. *Vioolsdrift sub-catchment,* ±14 320ha irrigation (± 215 million m³/a) is supplied from the Orange River main stream. About 60 % of the irrigation abstractions in this sub-catchment are through canal systems and diversion weirs in the Orange River. The remaining 40% is abstracted directly from the main river. This irrigation area is referred to as the Namaqualand Irrigation area. The irrigation on the Namibian side of the border is excluded from the irrigation area given for this sub-catchment. *Alexander Bay sub-catchment,* ±1 360ha irrigation (± 20 million m³/a) is supplied from the Orange River main stream. About 50 % of the irrigation abstractions in this sub-catchment are through canal systems and diversion weirs in the Orange River. The remaining 50% is abstracted directly from the main river. The irrigation on the Namibian side of the border is excluded from the irrigation area given for this sub-catchment. *Nossob-Molopo sub-catchment* • Very little development in this area with only two urban centres Mier and Askham, both relying heavily on groundwater. • There is no irrigation in this area. Water resources used for supply to the rural population and for livestock purposes include local groundwater as well as the Kalahari West Rural Water Supply Scheme, which obtains its water from the Orange River. Growth in the irrigation requirement is expected to be limited to the 4 000 ha allocated to resource poor farmers (already included in the water requirement table, **Table 2.2**). **Orange River Tributaries sub-area (Includes Ongers and Sak-Hartbees sub-catchments)** *Ongers Sub-catchment* • Towns located in this sub-catchment include: Strydenburg, Vosburg, Britstown, De Aar, Victoria West, Hutchinson and Richmond. These towns are mainly supplied from groundwater. • Limited irrigation development using water from the Smartt Syndicate Dam (101 million m³ gross storage) is found in this sub-catchment. The total irrigation area listed under this scheme is 1 818 ha, but due to the low assurance of supply only 16% of the total area is irrigated on average. *Sak-Hartbees sub-catchment* • Towns located in this sub-catchment include: Kenhardt, Copperton, Vanwyksvlei, Carnarvon, Loxton, Fraserburg, Sutherland, Williston and Brandvlei. These towns are mainly supplied from groundwater with some support from a few small local dams.

Situation Assessment (Continued):	▪ Limited irrigation development of ± 4 500ha (± 16 million m³/a) is found in this sub-catchment. Van Wyksvlei Dam is located in this area and is used to support 430 ha of irrigation. There is however very seldom sufficient water available (± 1 in 10 years) to irrigate the total area. Opportunistic low assurance irrigation is also commonly found in this area. Very little information is available with regards to this type of irrigation. **Coastal sub-area** ▪ Towns located in this area includes: Port Nolloth, Steinkopf, Nababeep, Okiep, Springbok, Kleinzee, Komaggas, Koiingnaas, Kamieskroon and Garies. Port Nolloth is supplied via the Alexander Bay system, and Steinkopf, Okiep, Springbok and Kleinzee from the Sprinbok system, with Orange River water. The remaining towns rely on groundwater. ▪ There is no irrigation in this area.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. After the completion of the verification of existing lawful use, comparisons should be made between the lawful use and the water use data applied in the water resource system models. The models must then be adjusted accordingly.	Region (Priority 1)
	M2. Initiate studies and/or processes to obtain better information on the actual water use by irrigation. This study should indicate the levels of metering that are required for specific purposes. Information such as the total area/volume supplied from groundwater, canals, major dams, directly from the river, which is measured and which not, should be provided from the study. A strategy to obtain better information on water use must be recommended from the study. The study could also be used as input to the formulation of a national guideline with regards to the measuring requirements for irrigation water use.	Region (Priority 2)
	M3. Update the water requirements and review projections of main users on an annual basis as part of the annual operational analysis.	Region (Priority 1)
	M4. Initiate processes to obtain the water requirements, projections and water resources used by smaller towns, which are not part of the large water supply schemes. The focus should be on areas where a significant increase in water use and/or shortage in supply is evident. This can typically be addressed in the WSDPs. To ensure that meaningful data are obtained, it is very important that DWAF should interact in the process and approval of the data be given by DWAF.	Local Authority/ Region (Priority 2)
	M5. DWAF must request local authorities / municipalities that the water demand projections for towns and cities be checked on an annual basis and that a full update of the projections be made on a 5-year basis, after the completion of a National Census. This information must be included in the WSDPs and should be approved by DWAF. The responsibility of these updates however lies with the municipalities. The DWAF should then check the larger water balance and communicate back to the towns/cities.	Region (Priority 1)

	M6. Further development of resource poor farmers should focus on existing unutilised irrigation areas, as there is no more surplus water available in the system. People should be motivated to initiate further development on a voluntary basis. The current unutilised water from local authorities can also be used for this purpose.	Region (Priority 2)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) c) Lower Orange River Management Study (LORMS) d) Orange River Water Balance – Orange River Continuous Study (Report no. P D000/00/4903)	

Strategy Version control:	**This version no:**	1
	Date:	July 2004
	Author:	ISP Study

A.1.3 WATER BALANCE RECONCILIATION

Management objective:	Manage the water resources to maintain a surplus or balance between the available water resources and the water requirements through progressive implementation of management measures. The aim is to schedule and implement low cost measures first, whereby the most costly measures (usually large capital intensive developments) are postponed.
Situation Assessment:	**Overall water balance situation (Integrated Orange River System)** The Lower Orange WMA is a component of the extended Orange and Vaal River Systems. This larger system has been the subject of various water balance and reconciliation studies in the past, with the purpose of quantifying the water resources availability and/or evaluating measures to transfer water from the Upper Orange to other WMAs. Detail of the overall water balance is given in the Overarching ISP (**DWAF, 2004a**). Results are, for the purpose of this ISP, summarised below. With the full Phase 1 of the LHWP in place and the 12 000ha allocated to resource poor farmers included, the surplus is about 44 million m^3 in year 2000 with an estimated shortage of 47 million m^3 in the year 2025, due to normal urban/industrial growth. It is important to note that the available surplus given is not only for use in the Lower Orange WMA but also in the Upper Orange WMA and the Fish to Tsitsikamma WMA. The growth in demand on the Orange River is relatively low and is driven by two components: ▪ Irrigation – The only planned growth in irrigation is the development of the 12 000 ha earmarked for resource poor farmers. Only limited areas have been taken up so far, and it is not known how long the full phasing of this area will take. ▪ Urban/Industrial/Mining – The growth in this demand is mainly determined by the expected increase in the Bloemwater demand (Bloemfontein, Botshabelo, Thaba 'Nchu) of 60 million m^3 and Eastern Cape (mainly Port Elizabeth) of 27 million m^3 over the projection period. This provides a total increase of 87 million m^3 for the base growth scenario and 145 million m^3 for the high growth scenario. Factors that would impact on the water balance results given above are given in the Orange River Overarching ISP. Due to the relatively small surplus now available in the system, this is reserved for high priority users. (See **Section 2.5** in the Orange River Overarching ISP (**DWAF, 2004a**)) Given that the water resource availability and water requirements for the Integrated Orange River System are effectively in balance, it is required to closely monitor the water balance situation on an ongoing basis. This will ensure that intervention planning can be adjusted to account for any changes that may have an impact on the projected water balance. **Water Balance Perspective and measures to improve water supply in the Lower Orange WMA (Orange River mainstem):** ▪ *Management of medium term surplus* At present (year 2003), limited areas of the 12 000ha earmarked for resource poor farming has been developed, with the result that there is a temporary surplus available in the system. This temporary surplus can be utilised to maximize hydropower generation over the medium term at Gariep and Vanderkloof Dams. The availability of the surplus should be assessed and adjusted on an annual basis as part of the annual operating analysis. It is expected that the surplus will reduce as the

Situation Assessment (Continued):	demands in the system grow and the allocations to resource poor farmers is utilised. It is important to note that the releases by Eskom of this surplus water would mainly be during the winter months when Eskom requires peak power generation. The normal releases for downstream users are also used to generate hydropower throughout the year. The added winter flow would however be in conflict with the ecological requirement at the river mouth that requires low flows during the winter. Arrangements with Eskom are required in this regard. ▪ The most feasible measures to reduce operating losses (primarily caused by the timing of releases over long reaches of river) should be assessed and implemented. This may include improved management and/or construction of re-regulating dams at either the Vioolsdrift or Boegoeberg sites. This aspect is being assessed as part of the LORMS. ▪ Spills from the Vaal could be utilised by means of real time modelling or a storage dam in the Lower Orange, for users in the Lower Orange and thereby reducing the support required from the Upper Orange River System. This will have an effect on the hydropower generation at Gariep and Vanderkloof Dams and therefore need to be clarified in an agreement with Eskom. Spills from the Fish River (Namibia) can be utilised in a similar manner in the future, if a storage dam is in place in the Lower Orange River. ▪ It is perceived that water conservation and demand management measures in the irrigation sector will only improve the efficiency of water use and that any savings will be taken up by the users themselves to expand their irrigated areas. It is therefore anticipated that the overall Orange River System water balance will not be significantly influenced by WCDM in the irrigation sector. Through negotiation, some of this water could perhaps be used to address inequities. ▪ WCDM should remain an important focus activity in all water use sectors as a means to reduce the cost of water supply and improve the efficiency of water use. (Further discussions on WCDM are provided in **Strategy 4**) ▪ DWAF is currently investigating the feasibility of utilising the lower level storage in Vanderkloof Dam for water supply. Previous preliminary assessments indicated that the system yield could be increased by as much as 305 million m^3/a with this option. This would reduce the reliability of the hydro-power generation capability. **RELEVANT INFORMATION ON THE SUB-CATCHMENTS:** **Table 1.1** in **Appendix D** lists all the towns located in the Lower Orange WMA, their sources of water and the current knowledge regarding the water balance. Almost no data with regards to the water supply situation for the towns not supplied from the main Orange River were available from existing reports. Information for these towns was therefore mainly obtained by means of discussions with the regional office. Detailed assessments of the local water balances and reconciliation measures will be the responsibility of the Local Authorities, supported (on request) by DWAF. **Water Balance Perspective and measures to improve water supply in the tributary catchments:** The measures of reconciling the water balance in areas removed from the main Orange River should include the following: ▪ Implement water conservation and demand management measures as a first option to extend the supply capability of the existing water resources. Any new development should also implement sound water conservation and demand management practices. ▪ Investigate the utilisation of local water resources, and particularly groundwater. Exploration investigations for groundwater and surface water resources should cover areas beyond town boundaries but within practical reach.

Situation Assessment (Continued):	▪ Undertake feasibility studies to compare all alternative options of supply on the grounds of economic, social and environmental acceptability. ▪ Working for Water should focus on areas where invasive alien plants are affecting the supply. ▪ The need has been expressed in the NWRS to develop and implement appropriate measures to manage the practice of constructing "soomwalle" and "saaidamme" for irrigation, in particular with respect to the impact it has on downstream water users.

MANAGEMENT ACTIONS			
Required actions, responsibilities and priorities:	**M1.**	Management actions to address possible measures and development options to alleviate the shortfall in 2025, the timing of intervention measures, as well as to determine the ecological requirements are included in the Orange River Overarching ISP document.	
	M2.	Different options can be followed to prevent that irrigation is using resources that might be required by towns. Towns can trade the water from irrigation users when required in future. If the town are certain that they will need the resource they should apply for a license.	Region (Priority 5)
	M3.	Develop and implement procedures for the management of "saaidamme" and "soomwalle". Particular attention should be given to the impact of this practice on downstream users. Investigations should start on a cursory level, which can be improved on over time. Any new "saaidamme" and "soomwalle" will have to go through the normal licensing procedure.	Region (Priority 2)
	M4	Water Conservation Demand Management should be promoted in all the areas supplied from the Lower Orange WMA and implemented as one of the first options to extend the supply capability of existing water resources. Indications of possible savings will be given for some of the areas in the LORMS. (Details are provided in **Strategy 4)**	Region (Priority 1)
	M5.	Implement measures to improve the water supply in the tributary catchments as required. This could include WCDM, the exploration of groundwater resources beyond the town boundaries and the removal of invasive alien plants	Local Authority/ Region (Priority 2)
	M6.	Assess the possibility of utilising the spills from the Vaal to support users in the Lower Orange. Results from the LORMS will provide more information and recommendations in this regard, which should be evaluated and implemented depending on the findings.	DIR OA (Priority 1)

References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) c) Lower Orange River Management Study (LORMS) d) Orange River Water Balance – Orange River Continuous Study (Report no. P D000/00/4903) e) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06)

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A.1.4 TRANSFER AND RESERVATION OF WATER

Management objective:	Reserve adequate water resources to support the transfers out of the WMA and secure internal transfers as well as the water supply to existing users within the borders of the WMA.
Situation Assessment:	**General** There are mainly three types of water transfer in this WMA. The first and most important are the major transfers into the WMA from the Upper Orange WMA. These are referred to as *transfers* in the NWRS documents as water from one WMA needs to be transferred to the other WMA to support its water users. This is not a transfer in the true meaning of the word and could be referred to as a *release obligation*. There are also transfers within the WMA to other sub-catchments, and transfers out of the WMA (See **Figure C-1** in **Appendix C**). **Existing release obligations (transfers) between the WMAs:** The release obligation is discussed in detail in the Orange River System Overarching ISP (**DWAF, 2004a**) and refers to the releases from Vanderkloof Dam to support the Lower Orange WMA. **Existing transfers within the Lower Orange WMA.** There are four transfers within the WMA as listed below: 1. Water is abstracted at Henkriesmond in the Orange River for the Springbok Regional water supply scheme. Water is transferred from there to the towns of Springbok, Steinkopf, Nababeep, Okiep and Kleinzee located in the Coastal Sub-catchment. The total volume transferred in 2000 was 4.2 million m³/a. 2. Part of the water abstracted close to the Orange River mouth for the Alexander Bay water supply system, is transferred to the Coastal Sub-catchment to support Port Nolloth. This is a relative small transfer of 0.44 million m³/a at 2000 development level. 3. Water is transferred from the Upington municipal reservoir to the area north of Upington located mainly in the Nossop-Molopo Sub-catchment. This scheme is referred to as the Kalahari West rural water supply scheme. A relative small volume of approximately 0.5 million m³/a is transferred. 4. Pelladrift scheme takes water from the Orange River to Pofadder, Aggeneys Pella, Black Mountain Mine and some farmers. The volume transferred at 2000 development level was 4.7 million m³/a. **Existing transfers out of the Lower Orange WMA.** 1. Water is abstracted along the common border area by Namibia for irrigation purposes. The total abstraction at 2000 development level was estimated at 40 million m³/a and is expected to increase to 58 million m³/a in 2005. Future growth in irrigation on the Namibian side is difficult to estimate at this stage. As part of the LORMS, Namibia indicated substantial developments in irrigation of up to 200 million m³/a in 2025. The development of these possible irrigation areas will depend on the results from the LORMS and further negotiations between Namibia and the RSA.

Situation Assessment (Continued):	2. Water is also abstracted by Namibia for urban and mining purposes. The total abstraction at 2000 development level was 12 million m³/a and is expected to increase to 16 million m³/a in 2005. Indications from the LORMS study are that these requirementswill increase to 47 million m³/a in 2025. There are uncertainties with regards to the growth in water use by Namibia. The maximum volume Namibia is allowed to abstract from the Orange River still needs to be formalised in an agreement. (See **Strategy A.1.5**)

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Include recommendations of the LORMS with regards to the transfer/support from the Upper Orange WMA to the Lower Orange WMA and from the Lower Orange to Namibia.	IWRP (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) c) Orange River Water Balance – Orange River Continuous Study (Report no. P D000/00/4903)	

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A.1.5 INTERNATIONAL OBLIGATIONS

Management objective:	Comply with all International Obligations assigned to the Lower Orange WMA.
Situation Assessment:	This strategy is fully described in the Orange River Overarching ISP document (**DWAF, 2004a**). Although the agreements will take place on national level, practical issues need to be addressed on locally. As part of the national level agreements, bodies will be created to decide on cross border issues. The WMA should have representation to be able to address practical issues. Interaction between Namibia and the RSA is currently deals with several common interests including: ▪ PWC (Permanent Water Commission); with representatives from Namibia and the RSA at a national level. ▪ Orange River Mouth Interim Management Committee, including the Provincial Department of Agriculture (RSA) as well as Ministry of Environment and Tourism (Namibia). ▪ Ai-Ais / Richtersveld Trans Frontier Conservation Park (TFCP). The first draft of guidelines for the joint management of the TFCP was made available in June 2002. ▪ Lower Orange River Remediation Forum (LORRF) mainly addressing the problem of toxic algae. As part of the national level agreements, bodies will be created to decide on cross border issues. At local level it is important that the WMA should have representation on the body to be able to address practical issues.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Ensure that the WMA has representation on communication and operational bodies or committees dealing with cross border issues.	Region (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.1.6 COMPULSORY LICENSING

Management objective:	Ensure the sharing of the available water resources for both Equity and the Reserve (as priority users) and for activities to maintain the economic and social structures that rely on the water resources of the Lower Orange WMA.
Situation Assessment:	Considering the three variables (Reserve, water for equity, and a negative water balance resulting from over allocation) that could drive the need for Compulsory Licensing, the status is as follows: ▪ Currently the Reserve has not been determined for the WMA. No urgent Reserve issues were identified during the Overarching Workshops that pointed to the need for Compulsory Licensing on the basis of pressures brought upon by the Reserve. Releases are however currently made to supply the environmental requirements at the estuary based on the work done in the ORRS (See also **Strategy A.2.1**). ▪ Due to the current excess supply situation as indicated in the Reconciliation Strategy, there is no need to implement compulsory licensing on the grounds of water supply constraints. ▪ Allocations to address inequities in water allocation have already been made by means of the 4 000ha of irrigation land earmarked for emerging and resource poor farmers. These allocations must first be taken up before more will be considered. Only at that stage will compulsory licensing be considered as a possible option for re-allocation if water cannot be made available otherwise. ▪ Other measures such as WCDM, saving in operational losses etc. will be used first to deal with water supply issues in the Lower Orange WMA.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Use other measures first to deal with water supply issues in the Lower Orange WMA, before using compulsory licensing. This should typically include the verification of lawfull use, eliminating of illegal users, imposing of curtailments, educating people and make them aware of the problem, improve the management of the groundwater system, etc.	Region (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.1.7 SUPPLY TO DISTRICT AND LOCAL MUNICIPALITIES

Management objective:	Ensure that local and other authorities implement measures for efficient utilisation of the available resources and have sufficient water resources to supply their requirements. The objective with water supply to local authorities should be to implement economical feasible supply options with acceptable environmental impacts.
Situation Assessment:	A significant number of towns in the WMA are supplied directly from the Orange River. A number of supply schemes have been implemented to transfer water from the Orange River some distance into the arid areas to support the water requirements of urban developments that are mostly associated with mining activities in the WMA (see **Strategy A.1.5**). The water requirements in the above-described situations are considered as part of the water balance of the Integrated Orange River System. However, a third supply situation exists where towns rely partially or fully on local water resources. In order to obtain an indication of the supply situation in these cases, information was obtained from the Regional Office. The results of the balance calculations are presented in **Appendix D.** There is a fair amount of groundwater resources in the WMA, with some already utilised, and in some cases even over-utilised. DWAF estimated the total abstraction from groundwater at 10 million m³/a for domestic supply to approximately 100 000 people. Groundwater is an extremely valuable source of supply and is in many cases the only option available to towns. Most of the problems with groundwater are due to the fact that it is not managed correctly and it is therefore critical that this be well managed within the limits of the resource. This places strong limits on the demand and requires careful monitoring, scientific operation and strict operating rules. In areas distant from the Orange River, groundwater should be assessed as one of the first options when considering further development of the water supply to Local Authorities and will in many cases be the most economic option. The NWA now allows a town to search for groundwater outside its boundaries. In a number of places boreholes were drilled, but no funds were available to equip the boreholes. Some of the desalination plants in the coastal areas need replacing. These and other related problems should be routed through the WSDPs. It is DWAFs role to assist people to route the problems through the correct channels. The following towns were indicated to experience a shortage in water supply, Strydenburg, Vanwyksvlei, Carnarvon, and Garies. Carnarvon and Vanwyksvlei have problems with invasive alien plants within their supply catchments. Clearing these would improve the groundwater supply in the area. The impact of sanitation on water resources does not seem to be a major problem in this WMA. A large number of people has opted the route of dry sanitation, mainly for the reasons of affordability and availability of sufficient water. Water Conservation and Demand Management should be regarded as the first possible measure to be utilized before the development of any future resource is considered. New users will also have to develop and implement plans to ensure efficient use of water.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. Promote the implementation of WCDM measures as first priority before developing alternative water resources.	Region (Priority 1)
	M2. Promote and encourage the utilisation of groundwater resources for local water resource development and in particular for Vanwyksvlei, Strydenburg, Carnarvon & Garies. Clear invasive alien plants in areas where they significantly affect the water supply. Water Service Development Plans and feasibility studies (business plans) should indicate what groundwater supply options were considered for development.	Region (Priority 1)
	M3. Pro-actively assess local groundwater yield and quality capabilities as a support function to local authorities that require additional water resources.	Region (Priority 1)
	M4. Provide support to local authorities in the assessment of water resource availability and water quality for areas where extensions to the water resources are required. The need for this information should be identified in the WSDP development process and the results should be included in the WSDP reports.	Region (Priority 1)
	M5. Provide and support groundwater utilization and management protocols for all the required groundwater actions..	Region (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) c) Lower Orange River Management Study (LORMS) d) Orange River Water Balance – Orange River Continuous Study (Report no. P D000/00/4903)	

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A.2 WATER RESOURCES PROTECTION STRATEGY

A.2.1 RESERVE AND RESOURCE QUALITY OBJECTIVES

Management objective:	The main stem of the Orange River and all major tributaries needs to be classified in terms of the new classification system to ensure a balance between environmental health and the optimal use of the resource. Ultimately a Comprehensive Reserve determination needs to be undertaken for the Orange River catchment, with the Reserve being implemented and enforced. The Reserve determination for the Lower Orange WMA will be co-ordinated with the Reserve determination for the Upper Orange WMA and the Vaal River System.
Situation Assessment:	Ecological water requirements have been determined in the ORRS and in the more recent LORMS. As part of the ORRS, the river and river mouth environmental requirements were determined. From the ORRS it was estimated that the river mouth requires approximately 290 million m^3/a and the instream flow requirement for the river was estimated to be 270 million m^3/a. At the same time a separate study by the WRC, determined river requirements downstream of Vanderkloof Dam as result of evaporation from the surface of the river, evapo-transpiration from riparian vegetation and seepage. These river requirements were estimated at 615 million m^3/a for the river at normal operating conditions. The river requirement is a natural phenomenon and is regarded as part of the environmental requirement. All these requirements are currently released from Vanderkloof Dam. The Orange River estuary has been declared a transborder Ramsar wetland and there are plans to expand the boundaries of the site. A draft management plan for the Orange River mouth has been produced. Recommendations in the plan include monitoring at the mouth to determine the flows entering the estuary by establishing a gauging station. This flow gauging station will also assist with the estimation of operational losses. A gauging station at Sendelingsdrift is currently in the planning phase and will be ideal for the monitoring of flows entering the estuary. One of the main problems with the flow currently reaching the Orange River mouth is the high flow in the winter months, which prevents mouth closure. This is mainly as a result of surplus releases to generate additional hydropower. Eskom is only allowed to generate the additional hydropower when there is a surplus available in the system. With the expected increase in demands this surplus will disappear in the next 3 to 5 years and the additional winter releases are likely to cease. This problem should however be discussed with Eskom, as it might be possible for Eskom to have no winter releases for at least one of the winter months, allowing the river mouth to close. Although the current methodology used to determine the ecological requirements has significantly improved since the ORRS (1996) a fair amount of effort and time was spent during the ORRS to determine the environmental requirements for the Orange River main stem. As part of the LORMS study, an adjusted desktop estimate of the ecological Reserve has been undertaken. When the effect of this Reserve on the system yield was determined, a reduction in the system yield of approximately 100 million m^3/a was evident compared to the scenario where the ORRS ecological requirements were used in the model. This implies that a comprehensive Reserve determination will have to be done in future to obtain a more reliable estimation of the environmental

Situation Assessment (Continued):	requirement. There is no need to immediately revise the ecological water requirements. However the ecological Reserve will have to be determined. The methodology to be used to set the Reserve and the timing of the determination must be decided. In the mean time, the approach to be adopted will be to continue operating the system using the ORRS ecological water requirements but institute an ecological monitoring programme to collect data to understand the behaviour of the system. Consideration will also be given to adjusting the releases to improve the flow patterns.

MANAGEMENT ACTIONS			
Required actions, responsibilities and priorities:	**M1**	Provide the required infrastructure to obtain accurate flow measurement upstream of the river mouth.	Regional Office (Priority 1)
	M2	A proper ecological monitoring system for the Orange River will be designed and implemented to obtain the required ecological data needed to understand the system behaviour as soon as possible.	Regional Office (Priority 1)
	M3	The possibility of adjusting the releases from Vanderkloof Dam to improve the flow patterns must be investigated. The changes to the flow patterns must take into account, mouth closure requirements, water quality and the algal problem experienced in the lower reaches of the Orange River (see **Strategy 2.2**).	Dir NWRP (Priority 1)
	M4	Based on the data obtained from **M2,** determine the appropriate confidence level and timing for the determination of the ecological Reserve. A flow management plan should also be considered.	RDM (Priority 1)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) b) Lower Orange River Management Study (LORMS)		

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A.2.2 WATER QUALITY MANAGEMENT STRATEGY

Management objective:	The Department has a mandate to manage water resources in a sustainable manner. It is recognised that, in the pursuit to stimulate development and socio-economic growth, there will be a negative water quality impact on our environment. The main objective is therefore to ensure a sound and reasonable balance between development impacts and the protection of the resource. Fitness for use by all users (especially downstream users), and protection of the natural ecosystems, must be used as the basis for strategy development.
Situation Assessment:	**Surface Water** The water quality of the Orange River main stem is affected by the contributions from upstream viz the Vaal River, Modder Riet and the Orange River in the Upper Orange WMA. as well as by the irrigation activities along the Orange River within the Lower Orange WMA. The water quality issues are salinity, microbiological pollution and eutrophication due to elevated nutrients. Outbreaks of algal blooms occur along the lower reaches of the Orange River. These algal blooms have been identified as potentially toxic and are of serious concern. The approach to the management of water quality in other WMAs, is by developing water quality management plans, which specify Water Quality Objectives (WQO) as the mechanism to protect the water quality of the resource. In the Orange and Vaal River Systems, the WQO will have to be developed with full cognisance of downstream impacts to cater for the interdependence of the WMAs. A fully integrated water quality management plan would therefore be the only way to derive appropriate WQO in each WMA . Water quality monitoring stations are located on the main stem of the Orange river with very few located on the tributaries. The difficulty in collecting samples on the tributaries in this WMA is that the rivers are ephemeral and sampling can only be done if the personnel are in place at the time that the flows take place. The runoff water quality is likely to be similar to natural conditions as the land use has not changed substantially from natural conditions. Runoff also occurs infrequently in the area and therefore does not contribute significantly to the system. The toxic algal blooms that occur in the Orange River main stem are a public health risk. To address the problem, the Department has set up a monitoring program and a communication system through the Lower Orange River Remediation Forum (LORRF). The purpose of the monitoring program is both to identify the toxic algal blooms and to provide information to develop an understanding of the sources and behaviour of the algae. The current monitoring indicates that the likely source is from the Vaal River, possibly the Spitskop Dam on the Harts River. If the monitoring program identifies the presence of toxic algae, the LORRF is used to communicate and control management protocols and actions. The long-term management of the algae problem will be dealt with in the Integrated Water Quality Management Studies of the Vaal and Orange Rivers. In these studies the sources and sinks of nutrients will be identified and management actions formulated. The water quality data collected at the Douglas weir shows that the water quality is poor and concerns have been raised about the current management strategy at the weir. The poor quality emanates from the Harts River due to the return flows from the Vaal-Harts irrigation scheme and the irrigation downstream of the Spitskop Dam. There are further contributions from the irrigation areas downstream of the confluence of the Harts and Vaal Rivers. The Orange-Vaal WUA is responsible for the day to day management of the weir and a pilot project has been initiated to investigate pollution sources and pathways from agriculture and the water quality management strategy at

Situation Assessment (Continued):	the weir. The Institute of Groundwater Studies of the University of the Free State is also busy with studies in the area. The increasing salinity in the lower reaches of the Orange River is also of concern. The algae monitoring program has shown that there is an interaction between the types of algae, in particular the toxic algae, and the salinity. The elevated salinity provides an environment in which the toxic algae dominate. The elevated salinity is also an issue as sensitive crop types are grown in the area. The sources of the salinity are both local from irrigation return flows and poor water quality passed down from upstream. There is extensive irrigation practised along the banks of the Orange River. The extent of the return flows to the river and canal systems is not known, nor is the recharge of the groundwater from the irrigation areas and the transport of salt from the irrigation areas to the groundwater. The extent of the interaction between groundwater and surface water along the banks of the Orange River main stem, is also not well understood. Microbiological water quality problems are also associated with the return flows into the irrigation canals and main stem. A monitoring program has been established and the communication of public health risk is undertaken through the LORRF. The sanitation systems of the smaller towns in the WMA are inadequate or poorly managed. These systems need to be improved as they are threatening both the surface and groundwater quality. The WSDP and licensing process should be used to address these issues. There are mining activities taking place in the WMA such as the diamond mining along the coast. These activities do not currently present a problem to water quality and are managed through the EMPR and water use licencing processes. Large blue asbestos dumps are found in the Westernberg area. These mine dumps have been fully rehabilitated but might have health implications when inundated by a possible large dam at Boegoeberg. Indications from the LORMS study however is, that a large dam at Vioolsdrift will be more beneficial. **Groundwater** Groundwater is an important resource in the Lower Orange WMA. The groundwater quality varies from good to unacceptable in terms of potable standards. The majority of the WMA is categorised as class 3 to 4. There are also radioactivity, fluoride and nitrate water quality issues related to the groundwater in the WMA. The Water Research Commission has funded studies to investigate the radioactivity and nitrate issues. The results of these studies need to be passed on to the water users in the WMA. The zoning of groundwater quality in the WMA needs to be undertaken. The zones will provide the spatial extent of the water quality issues related to the groundwater. The zones will be the basis of the communication with the local authorities concerning groundwater quality issues as well as treatment options and groundwater management. Groundwater in the WMA should be protected and correctly managed. This is both from the quantity and quality point of view. Groundwater management plans should be developed by the local authorities. These plans should include the collection of monitoring information as input to the management of the groundwater system.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1** A management plan needs to be developed to address the issues related to the irrigation along the main stem of the Orange River. The issues that need to be addressed are the quantification of the return flow volumes and qualities, recharge of salt to the groundwater, interaction with surface water and the diffuse washoff loads.	Regional Office (Priority 1)
	M2 The existing algae study results need to be assessed and further studies planned to better understand the behaviour of the algae and sources so that management options can be developed and implemented.	Regional Office (Priority 1)
	M3 The sanitation system issues should be addressed through the WSDP and licencing processes as well as the communication network set up for the WMA.	Regional Office (Priority 1)
	M4 A map showing the groundwater zones in terms of radioactivity, fluoride and nitrates should be produced using the available data from the WRC studies when completed as well as from other data bases.	Regional Office (Priority 1)
	M5 The Department must promote sustainable water management at local authority level. The guidelines and protocols developed by the Department must be communicated to the local authorities.	Regional Office (Priority 1)
	M6 The use of the EMPR and water use licensing processes should be continued to manage the mining activities in the WMA. The diamond mining activities along the coast were mentioned as activities that needed particular attention.	Regional Office (Priority 1)
	M7 A literature review of water quality related studies that have been carried out in the Lower Orange WMA needs to be compiled.	Regional Office (Priority 2)
References:	a) Vaal River System Analysis Update-Summary Report (Report no. P C000/00/19496) b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697)	

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A.3 WATER USE MANAGEMENT STRATEGY

A.3.1 INTERNATIONAL USE

Management objective:	Ensure that international water use is based on sound agreements among shared basin states and that current and future water use data are exchanged to facilitate efficient planning and management.
Situation Assessment:	This strategy is described in the Orange River Overarching ISP document (**DWAF, 2004a**). The Lower Orange CMA will only be responsible for operational arrangements with Namibia if delegated to them from the Overarching ISP. (Also see **Strategy A.1.5**)

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:		
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.3.2 GENERAL AUTHORISATIONS STRATEGY

Management objective:	To ensure that General Authorisations are used sensibly and effectively, reducing the administrative load but without detriment to the resource.
Situation Assessment:	**GENERAL** The Orange River main stem is part of a Government Water Control Area since 1977 and General Authorisations were therefore not required for the main stem Orange. Currently the General Authorisations applicable to the Lower Orange WMA is according to National General Authorisation publication No 398 dated 26 March 2004. No amendments to this publication were made for the Lower Orange WMA. Small diamond diggers are commonly found in the area and guidance is required with regards to the authorisation for water use to these diggers to ease the current licensing process. The extent and effects of small mining operations are not known. General Authorisation should be amended to include: ▪ Small mines (delwers). ▪ Recreational use such as rafters, jetty construction and canoeing. ▪ Groundwater abstractions for local supply, which could be agriculture or municipal. ▪ Sanitation discharge authorisations.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1**. The Regional Office needs to determine the general authorisations needed for the WMA and ensuring that they are developed and published.	Regional Office (Priority 1)
	M2. Revisit water uses (defined in Section 21 of the NWA) in the catchment and determine which can be generally authorised.	Regional Office (Priority 1)
	M3. Carry out a survey to determine the extent of small mining operations and their cumulative impact on water use, water quality and the river banks and bed. Design general authorisations to deal with this.	Regional Office (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Notice number 1911 promulgated in Government Gazette No. 20526 dated 8 October 1999, providing the current General Authorisation Schedule.	

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A.3.3 LICENSING AND COMPLIANCE STRATEGY

Management objective:	Licensing of water use (as defined in the National Water Act) should be considered on a continuous basis when applications are received. The licences should be considered in accordance with the framework as presented below:
Situation Assessment:	One of the most important water resource issues facing the WMA is the licensing of current and new water users and the licensing of water discharges (e.g. urban effluent returns, mines decanting groundwater, etc). The issuing of licences for water abstraction should be considered within the following framework: ▪ Apply the allocation priorities as defined in the Water Act. ▪ New abstraction licences supplied from the Orange River will have to be supported from additional intervention measures (See Orange and Vaal Overarching ISPs for a description of measures) and therefore have to bear the full cost of water supply from the Orange River System. This however excludes the 4 000ha already allocated to resource poor farmers and new licences as result of trading. ▪ In the tributaries, new abstraction licenses that do not have direct access to the main Orange River System will be assessed with respect to their impacts on local water resources and other uses. If the impacts are acceptable, a licence could be issued. ▪ All new license applicants will have to prepare plans of how water will be used effectively. ▪ Water quality impacts of any new licence must be assessed. ▪ When the trading of water allocations is considered, the existing trading policies should be applied. ▪ Allowing new abstraction licences may cause the date that intervention measures is required to be brought earlier. The impact thereof on the recommendation from the LORMS will have to be assessed on a continuous basis. The process of verification of the current registered irrigation water use has started but is not yet completed. Satellite imagery is used for verification purposes and the required tools for this process are already in place. The verification process was started in the areas where the most problems were being experienced. Non-compliance will be dealt with through prosecutions if necessary (see also **Strategy 1.2**)**.** The existing WARMS information management system will be used to manage water use licences data and capture data of the actual use / discharges of users.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** When individual applications are received, process according to the given framework. **M2.** Look continuously at ways to improve or streamline the licensing process. **M3.** The process of verification of registered use and seeking unlawful should be continued. **M4.** Monitor if the conditions (compliance monitoring) of the licences are in place. When the licence is reviewed in 5 years time and it does not comply with the conditions set, the licence might not be renewed.	Regional Office (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.3.4 PRICING STRATEGY

Management objective:	Implementation of the water resource use charge as well as other types of charges (e.g. polluter pays charges) as a means of funding the management of water resources and future development.
Situation Assessment:	There is a National Pricing policy in place and the pricing of water use should be determined accordingly. A national policy for waste discharge charges is currently in the process of being developed. The principle is that polluters must pay for their impacts with the charges being used to manage the water quality in the WMA. In the case of the Lower Orange WMA, the water quality is also impacted on by upstream WMAs and upstream polluters should contribute to the water quality management in the Lower Orange WMA. There is a requirement for an organisational structure to support and manage these payments. (See overarching ISP document for more detail)

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:		

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A.4 WATER CONSERVATION & WATER DEMAND MANAGEMENT

A.4.1 WATER CONSERVATION & WATER DEMAND STRATEGY

Management objective:	To improve efficiency of water use by developing and implementing targeted measures to monitor and control demand. To make more effective and efficient use of the existing available water resources in all water user sectors. This will enable both DWAF and the future Catchment Management Agency to conserve this scarce resource and avoid expensive schemes for transfers and storage when these may not be necessary if demand is properly managed.
Situation Assessment:	Evidence of inefficient water usage can be found in all water use sectors throughout the country and the value of water still seems largely unrecognised by many water users. South Africa is a developing country that is water stressed and requires improved management of its limited water resources. The implementation of water conservation and water demand management practices is essential in meeting the national goals of basic water supply for all South Africans and the sustainable use of water resources. Comprehensive irrigation water demand management, or water conservation strategies and actions, were prepared for the Orange River Replanning Study (ORRS) in 1998. Irrigation is the main water user in this WMA and water conservation and demand management should be focussed on this user group to obtain maximum savings. Significant savings can be obtained by reducing conveyance losses in canals, proper irrigation scheduling, metering and pricing of irrigation water, as well as the improvement of irrigation systems. Although urban/industrial use is a relative small component in this WMA, Water Conservation and Demand Management Programmes or strategies for urban centres need to be reviewed or if necessary designed and implemented as these can have significant impact in some of the sub-catchments. This is specifically important for the larger mining towns where water to individual homes is not metered and people do not pay for their own water use. Groundwater is the only source of water for a large number of towns in the Orange Tributaries and Coastal sub-areas and Water Conservation and Demand Management Programmes is extremely important in these areas to protect the resource. There is a need to make small towns aware of WCDM as a source and not to first develop other new sources. WCDM also has a direct benefit to municipalities due to savings on source development costs and sewage treatment costs. There are currently several initiatives by Local Authorities and Service Providers, industries and mines to implement Water Conservation and Demand Management (WCDM) measures and it is perceived that significant savings could be achieved in the gross demand of the urban sector. The operational losses of 270 million m³/a with regards to releases from Vanderkloof Dam, can be regarded as an conveyance loss and reduction in these losses can result in significant savings. Measures as identified in the LORMS to reduce the 270 million m³/a operational losses, as well as other recommendations with regards to WCDM, should be evaluated and implemented The 4 000ha allocated to resource poor farmers in the Lower Orange represents only approximately 6% of the current area under irrigation. Further equity actions over and

Situation Assessment (Continued):	above the 4 000 ha will possibly be required in future. By saving 10% of the current irrigation demand through WCDM, 90 million m³/a can be made available for the irrigation of an additional approximately 6 000ha. There is currently only a small surplus available in the Orange River System after the water allocated to resource poor farmers is utilised and releases for the ecological requirements have been made. It can therefore be promoted that improved water use efficiency by irrigators be used to their own benefit. This includes the possibility of irrigation water savings being traded with other sectors. Only after the 4 000 ha has been fully utilised, will additional measures be used i.e. compulsory licensing to obtain more water for resource poor farmers. As part of this process inefficient users will be targeted rather than the efficient users. **Scope for savings:** Substantial scope exists for saving water through the implementation of strategies to improve efficiency of water use. E.g. - Water use especially in mining towns are in the order of 350l/c/d and can be reduced significantly. - Irrigation scheduling and farming practices10% savings. - Metering and pricing of irrigation water 10% savings. - Improvement of irrigation systems up to 27% This potential savings will be utilized by the irrigators to extend their area currently under irrigation. There are currently various WCDM initiatives undertaken in the areas supplied from the water resources in the WMA, however, what is lacking is a clear picture of what the impact will be on the water requirements in future. This information is essential to ensure intervention and operations planning are based on realistic water requirement projections. In the Overarching ISP for the Orange River Catchment the need was identified for a study to determine how the projected water requirements and return flows would be affected by WCDM measures. Work done in this regard and the relevant results from the LORMS should be incorporated in the proposed study.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Irrigators can utilise savings as result of improved water use efficiency to their own benefit, on the condition that they can prove they comply with the licence conditions.	Regional Office (Priority 1)
	M2. Encourage small towns to consider WCDM as a first action before the development of new sources.	Dir NWRP (Priority 1)
	M3. Evaluate results and recommendations from the LORMS with regards to WCDM and take action as needed.	Regional Office (Priority 1)
	M4. Implement recommendations from the LORMS to reduce operational losses.	Regional Office (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06) c) DWAF & Eskom operational contract.	

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A.5 INSTITUTIONAL DEVELOPMENT & SUPPORT MAIN STRATEGY

A.5.1 CO-OPERATIVE GOVERNANCE STRATEGY

Management objective:	Co-operative governance (i.e. liaison and integration of planning between government departments, district and local authorities) needs to be factored into the overall integrated water resources management arena to ensure a compounded benefit to all users in the catchment.
Situation Assessment:	Efforts are made to have a networking system in place for communication with the District Municipalities, Provincial Government as well as the Department of Agriculture and Land Affairs. The District Municipalities discuss their projects with DWAF to obtain DWAFs input on priorities and content. The WSDPs are also discussed with DWAF at these Forums. Existing Forums include Namakwa, Karoo and Siyanda. Pertinent issues that have to be communicated to the District Municipalities relate to sanitation, water supply and water management. The Lower Orange River Remediation Forum (LORRF) has been set up to facilitate communication between the local municipalities and DWAF. The establishment of this forum has largely been driven by public health issues relating to the monitoring and management of potentially toxic algal blooms as well as microbiological pollution. Agriculture is widely practised in the WMA and is impacting on groundwater and surface water quality. The final allocation of irrigation areas to establish the 4000 ha for resource poor farmers should take place through the Co-ordinating Committee for Agriculture and Water (CCAW). The licencing and WC&DM issues relating to irrigators, also need to be communicated through the CCAW. There is mining taking place in the WMA. The environmental impacts of the mining are dealt with in the EMPR process of the Department of Minerals and Energy. The inputs from DWAF into this process is essential as far as management of water pollution impacts, water use licencing and water supply is concerned. DWAF needs to know the extent of future mining so that it can be incorporated into water resource planning.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.**The existing practise should be continued.	Regional Office (ongoing)
References:	a) National Water Resource Strategy DWAF RSA, First Edition	

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A.5.2 LOCAL AND CATCHMENT LEVEL STRATEGY

Management objective:	The Regional Office (as the interim CMA) needs to take institutional control of all Water Resource Management functions and will be supported by DWAF Head Office Directorates. The main objective is to responsibly manage the water resources of the Lower Orange WMA until such time as the Catchment Management Agency can take over some of the functions.
Situation Assessment:	Irrigation Boards are currently being transformed to Water User Associations. This process will continue and these institutions will fulfil their roles in line with the NWA, WSA and the NWRS. There are seven WUAs currently transforming from Irrigation Boards. The constitutions for these WUAs are being drafted. The viability of some of the existing Irrigation Boards is also being investigated and new WUAs are to be established particularly for Resource Poor Farmers. There is a public participation process underway informing stakeholders about the CMA. The process will allow stakeholders to make informed decisions when the CMA establishment process is started. The process of setting up Forums or structures, which will form the basis of the CMA, is starting. The Lower Orange River Remediation Forum (LORRF) has been established to assist with managing the algal and microbiological problems associated with the Orange River main stem.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** The process of setting up WUA and the process currently started to establish the CMA should be continued. This includes the establishment of new Forums and the optimum use of the existing Forums as a means of communicating with the public, District Municipalities and Water Sector Forums.	Regional Office (Priority 1)

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A.5.3 POVERTY ERADICATION

Management objective:	The main objective is to contribute to the eradication of poverty through the provision of basic Community Water Supply, to supply to viable Industrial/urban growth as well as to offer agricultural production, food and household security through water. Due to a significant rural composition of the population and dependence on agriculture, make specific allowances for irrigation water to resource poor farmers.
Situation Assessment:	The economy of the Lower Orange WMA is driven by agriculture and mining with these sectors employing the majority of the people in the WMA. A large proportion, 32% of the workforce, is unemployed. The mining sector will be relatively stable in the medium term but in the long term mines will start closing down. Water could play a role under these circumstances in providing economic opportunities. Small diamond digging operations also provide opportunities for employment. Expansion in the agricultural sector is limited by the availability of water and arable land. However water has been earmarked for the establishment of 4000 ha of irrigation for resource poor farmers. There are a number of initiatives, which address poverty and the well being of people in the WMA, in which the Department participates. These include: ▪ The poverty eradication budget of Working for Water. Partnerships have been formed with mines and Correctional Services to eradicate invasive alien plants. ▪ The spending of funds from the Premier's Office to eradicate the bucket system of sanitation and implement the National Sanitation Policy. ▪ The health and hygiene awareness campaigns. The Department is also involved with the Department of Agriculture with projects for Resource Poor Farmers (RPF). The Department will be giving input to the establishment of the 4000 ha allocated to the Lower Orange WMA for the development of RPF. Constructive, well-structured and viable development plans are required for the 4 000 ha allocation to RPF. Other initiatives that can be utilised by the DWAF to address poverty includes: ▪ Obtaining more water through the implementation of WC&DM to be used by RPF. ▪ Be aware of land restitution and make water available where possible to make these initiatives viable. ▪ Making water available for tourism and eco-tourism will also contribute to poverty eradication. The Department must work closely with other government Departments at the national and provincial level to identify poverty eradication initiatives. The Department will also support investigations into water i.e. sources, costs, etc.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Continue to be involved in poverty eradication initiatives and continue to look for poverty eradication opportunities.	Regional Office (Priority 1)
	M2. Support the Department of Agriculture through the CCAWs and existing forums to undertake judicious planning of irrigation developments of the 4 000ha allocated to resource poor farmers in the Lower Orange WMA.	Regional Office (Priority 1)
	M3. Small diamond diggers should be assisted by using general authorisations to facilitate access to water. The smaller diggers are generally poor and cannot afford to wait long periods for licences.	Regional Office (Priority 1)
	M4. Support other initiatives with information on water availability.	Regional Office (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition b) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697)	

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A.6 ENVIRONMENTAL STRATEGY

A.6.1 ENVIRONMENTAL MANAGEMENT STRATEGY

Management objective:	Ensuring that there is a balance between the need for development (i.e. including all activities undertaken by DWAF) and the need to protect the natural and social environment for the benefit of all.
Situation Assessment:	Although a nationally applicable environmental strategy will be prepared for all the WMAs, a number of environmentally related issues and facts that are of importance to this WMA need to be mentioned. ▪ The Orange River estuary has been declared a transborder Ramsar wetland and there are plans to expand the boundaries of the site. As result of hydropower generation with surplus water during winter months, too much water is entering the estuary in these months. This problem will however disappear over time as the available surplus has almost reduced to zero. (Also see **Strategy Table 2.1**). ▪ Actions from mining development and more specifically the small diggers might be in conflict with the environmental management strategy. This also applies to the possibility of small hydropower developments along the Orange River. ▪ An Arid Zone Ecological Forum has been established to address the large pan areas. ▪ It is important that the Ai-Ais / Richtersveld Trans Frontier Conservation Park (TFCP) should be aware of development along the Orange River which might result in potential conflict. The real need for development in this area is also high and should be taken into account. ▪ Possible future large infrastructure development along the Lower Orange might be a re-regulation and/or a large storage dam near Vioolsdrift or at Boegoeberg. Results and recommendations from the LORMS will provide more detail in this regard.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	The reader is referred to **Chapter 1 Paragraph 1.5** of this report with regards to DWAF's responsibility.	

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A.7 INFRASTRUCTURE DEVELOPMENT & MANAGEMENT MAIN STRATEGY

A.7.1 INFRASTRUCTURE DEVELOPMENT & SUPPORT STRATEGY

Management objective:	Provision of adequate water resource development infrastructure (storage) and bulk water supply infrastructure to sustain and encourage social and economic growth.
Situation Assessment:	**General** With the introduction of the Municipal Systems Act and the emphasis on sustainable development in the municipal IDP planning process, there may be some development in the towns. Although there are a high number of small towns in the WMA, it is expected that the impact of these developments on the water resources will be relatively small, as the total urban/industrial requirement in the WMA is low and most of the people has opted the route of dry sanitation due to affordability and the availability of water. **Planning approach** A holistic planning effort is also required to identify the optimum bulk water storage and supply infrastructure layout that will make optimal use of the local water resources in the Lower Orange River WMA. Development options to supply in the possible future water requirements from the Orange River main stem are discussed in detail in the Orange River Overarching ISP (**DWAF, 2004a**) The possible developments in Namibia along the common border can have significant impacts on the water availability. The impacts of these developments on the water resources of the Orange River need to be assessed and should be illustrated clearly in results from the LORMS study. The existing Permanent Water Commission should be used to communicate RSA's and Namibia's requirements in terms of the developments. **Situation Assessment** There are currently no major dams on the main stem of the Orange River within the Lower Orange WMA, only several diversion weirs of which Boegoeberg is the largest. Two larger dams are located on the main tributaries and includes: ▪ Smartt Syndicate Dam (101 million m³ storage) on the Ongers River. ▪ Van Wyksvlei Dam (143 million m³ storage) on the Carnarvonleegte. No future dams are currently considered or planned in any of the tributary catchments. Vanderkloof and Gariep dams are located in the Upper Orange WMA but are used as the main source of water supply to the Lower Orange WMA. The utilisation of the lower level storage in Vanderkloof Dam is expected to be the first development option to be utilised when shortages start to occur in the Orange River System. This is expected to occur not to far in the future and depends on the rate of developments for resource poor farmers, irrigation in Namibia and the implementation of an updated EFR.

Situation Assessment (Continued):	Development in the Lower Orange WMA such as a re-regulating or storage dam at Vioolsdrift or Boegoeberg will have a direct positive effect on the availability of water in the Lower Orange WMA due to significant reduction in operating losses. These possibilities have been investigated as part of the LORMS. Clarity on which of the proposed LORMS developments will be taken further will be given at National level according to National Planning. Possible options (See Orange River Overarching ISP (**DWAF, 2004a**)) that are considered in the LORMS include: ▪ Utilising the Lower Level storage in Vanderkloof. (A separate and more detailed study with the emphasis on the effect on hydropower generation is also currently in process). ▪ Utilising spills from the Vaal River by means of real time modelling and simultaneously increasing the efficiency of the system operation. ▪ Decrease operational losses by means of re-regulation dams at Boegoeberg or Vioolsdrift. ▪ Large Storage Dam at Boegoeberg or Vioolsdrift to capture local runoff and Vaal spills. ▪ Making more water available through WCDM. Other possible future developments at WMA level include: ▪ Small hydropower plants along the Lower Orange River. This development option will not impact on the water availability in the system. ▪ Infrastructure to recharge groundwater and typically includes small dams and pipelines transferring water from the dam to boreholes located in the area of recharge for the main production boreholes. This will be the responsibility of the Local Authority and DWAF will only ensure that it complies with the NWA. ▪ Water supply to Mier in the Kalahari from the Lower Vaal (Mainly a social political decision). All boreholes currently under government control are to be transferred to local authorities, and this process is expected to be completed within the next two years.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Evaluate results from the LORMS and take the required actions to follow up.	NWRP (Priority 1)
	M2. Support water resource developments at WMA level with information on water availability.	Region (Priority 2)
	M3. Complete the transfer process of government controlled boreholes to local authorities.	Region (Priority 1)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) b) Lower Orange River Management Study (LORMS)	

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A.7.2 SYSTEM MANAGEMENT STRATEGY

Management objective:	Implement system management measures to optimally utilise the available water resources, in terms of short-term benefits and to maintain the reliability of supply over the long-term. The aim is to postpone the need for the development of new costly infrastructure through increased efficiency while also saving operating costs over the short-term. Optimise the utilisation of the water resource by allowing maximum hydropower generation without adversely impacting on either the ecology or the reliability of supply to the users in the system.
Situation Assessment:	The management of the Main Orange River System is done on an overarching level with a detail description given in the Orange River System Overarching ISP (**DWAF, 2004a**). Operating analyses for the Orange River System are undertaken on an annual basis to determine the surplus available in the Orange River System, which can be used for the generation of hydro-power over and above that released for normal downstream requirements. The operating analyses are also used to indicate the extent of curtailments that need to be imposed on the system during drought conditions. One of the most important measures to improve the system management is to reduce the operating losses by means of real time modelling and/or the use of a re-regulating structure in the Lower Orange. Estimations are that the current operating losses can be reduced from the current 270 million m³/a to 100 million m³/a (See Orange River System Overarching ISP (**DWAF, 2004a**). Other aspects of the current operating rule for the main system that directly impacts on the Lower Orange WMA is the release pattern from Vanderkloof Dam. Eskom currently releases surplus water mainly in the winter months for hydro-power generation, which is in conflict with the river mouth requirements as closure of the river mouth is required from time to time. Although this problem will disappear over time as the surplus decreases, discussions with Eskom in this regard can contribute to improve the current situation. There are algal blooms experienced in the main stem due largely to irrigation return flows, diffuse sources and poor quality water from the upstream Vaal WMAs. The management of the patterns of the ecological flows should also be considered to improve the management of the algae. The Smartt Syndicate and Van Wyksvlei dams are currently managed and maintained by the Irrigation Boards (IB). Spesific operating rules are used by the IBs to manage these dams.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** If a change in the ecological flow pattern is found to be a viable algal management tool, develop a suitable strategy and determine the feasibility of achieving the required pattern from a reconciliation point of view and implemented if feasible.	Region & WRPs (Priority 1)
	M2. Discuss the impact of the surplus releases for hydro-power generation during the winter months on the environmental requirement of the estuary with Eskom, to obtain an acceptable solution for both needs.	WRPs (Priority 1)
	M3. Evaluate results from the LORMS and implement as required.	WRPs (Priority 1)
	M4. Record existing rules and monitor if these rules are implemented. These rules as well as possible new rules must be verified by means of a system analysis.	WRPs (Priority 1)
	See ISP Orange River Overarching document (**DWAF, 2004a**) for management actions relating to the main system.	
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) b) Lower Orange River Management Study (LORMS) c) Orange River System: 2002 Hydropower Operating Analysis (Report no. 8350/06) d) DWAF & Eskom operating contract	

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A.7.3 PUBLIC HEALTH & SAFETY STRATEGY

Management objective:	The water resource needs to be protected. Users must be safe from the effects of poor water quality that can create health problems (e.g. toxic algea). Strategies must be in place to deal with floods and droughts, as these impacts on the socio-economic environment.
Situation Assessment:	The Department's current commitments are associated with: Managing floods and drought disasters by direct intervention on the ground. ▪ Reducing pollution and preventing serious or hazardous pollution events ▪ Promoting dam safety. DWAF's (and the CMAs) future commitments under the National Disaster Management Act, which was promulgated in 2003, will be: - DWAF/CMA are required to become involved in supporting disaster management planning by all relevant authorities. - Drafting a National Flood Management Policy (DWAF). - Dam safety policy (Currently DWAF but responsibility will be transferred to WUA). - Co-operating with the Department of Agriculture on drought relief strategies and policy formulation. - Pollution control of water resources (i.e. limiting health hazards such as cholera, fluoride/chloride heath problems and algae blooms). The toxic algal blooms that occur in the Orange River main stem are a public health risk. To address the problem, the Department has set up a monitoring program and a communication system through the Lower Orange River Remediation Forum (LORRF). The actions of the LORRF must be continued in monitoring, communicating and managing public health risk arising from toxic algal blooms and microbiological health (See **Strategy A.2.2**). Blackflies is still a problem along the Orange River but is currently under control. No additional releases from Gariep and Vanderkloof dams are required for this purpose. The only requirement is that a constant flow rate is required in the river over a period of ± 14 days during the application of larvicides. These actions are currently controlled by means of a Task team appointed for this purpose, with involvement of DWAF and the Department of Agriculture. Flood and drought management at Gariep and Vanderkloof Dams is discussed in the Orange River System Overarching ISP (**DWAF, 2004a**).

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Compliance with the above-mentioned requirements.	Region (Priority 1)
References:	a) National Water Resource Strategy DWAF RSA, First Edition NWRS	

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A.8 MONITORING AND INFORMATION MANAGEMENT STRATEGY

Management objective:	The design and implementation of effective monitoring networks and repository databases to ensure adequate quantification of the balance between sustainable water use and protection for surface freshwater bodies and groundwater.
Situation Assessment:	**Water use control** Irrigation is by far the main water user in this WMA and very little data is available on the actual water use by and return flow from irrigation, as irrigation abstractions are not gauged. On the larger irrigation schemes the releases into the main canals is often available but no measurements of the outflow at the canal end is available. **Monitoring networks and data capturing** Monitoring is required for all aspects of water resource management from local, to catchment, to WMA to National level. Other institutions than DWAF such as Local Authorities, Industries, Universities etc. also do monitoring work. The data collection is therefore largely uncoordinated and results in unnecessary duplication and gaps in data. It is important that proper coordination should take place. **Resources** currently available for monitoring are generally inadequate throughout all existing systems. Some notable issues in the ISP-area are briefly discussed below: Groundwater monitoring includes water levels and ambient water quality. There are automatic data loggers at some stations but the time dimension is not included in some of the available data. Monitoring needs to be extended together with the proper management of the groundwater resources. Over utilisation of boreholes is a problem and a definite need for proper water use control exists. Groundwater monitoring is also inadequate although the groundwater potential is very important in this WMA. Monitoring is required to enable improved management. The calibration of the salinity model for the Orange River proved very difficult due to problems with the available water quality data and specific recommendations were given in the relevant report to DWAF with regards to a water quality monitoring programme in the WQ reports. Most of the stream flow gauges (± 10 gauging weirs in total) in the Orange River downstream of Vanderkloof Dam are inaccurate at low flows. Low flow conditions occur most of the time under normal operating conditions where the river flow is mainly dependent on releases from Vanderkloof Dam. This makes it extremely difficult to operate the system and to release the correct volume from Vanderkloof without resulting in excessive losses or some times in shortages. Operating losses of 270 million m^3/a currently experienced in the system is partly due to the inaccuracy of flow gauges at low flows. Obtaining the required flow to meet the river mouth environmental requirement, particularly at low flows is hardly possible. Details of the various data related problems and shortcomings is given the recommendations of the relevant study reports and should be consulted to evaluate and prioritise the monitoring needs. The most prominent problem areas relevant to this WMA have been mentioned above.

Situation Assessment (Continued):	**Information Management** To be considered at National Level. At local level the Regional office / CMA should co-ordinate all the monitoring needs in the WMA. Some of these needs will be required at a National level while others will be related to requirements at local level.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** As part of the Overarching ISPs a need was identified to undertake an assessment of all the monitoring needs to support Integrated Water Resource Management in the Vaal and Orange river catchments. The most important needs are given in the situation assessment of this strategy. Details of the monitoring needs must be obtained from the recommendations given in the relevant study reports as well as inputs from the Regional Office and CMAs. As part of the audit function of the WMA it is also required to know how much water is flowing into and out of the WMA. Co-ordination should be done at WMA level. (See Orange River Overarching ISP (**DWAF, 2004a**))	Region (Priority 1)
	M2. Develop a strategy and action plan to monitor and control irrigation water use. This can typically include the use of aerial photography and satellite images initially, which can be followed by actual metering at a later stage.	Region (Priority 1)
	M3. Develop a co-ordinating system for integrated management of monitoring requirements. (The CMA or Region is the best suited to specify the requirements and to co-ordinate the needs).	Region (Priority 1)
	M4. Develop a Lower Orange Information Office.	Region (Priority 1)
References:	a) Orange River Development Project Replanning Study Main Report. (Report no. P D000/00/6697) b) Orange River System Analysis Phase 1 & 2 (Report no. P D000/00/1092) c) Vaal Augmentation Planning Study: Calibration of Water Quality Model for Orange River Catchment (Report no. P C000/00/15896)	

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A.9 IMPLEMENTATION MAIN STRATEGY

Management objective:	To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Lower Orange River WMA. This will require willpower, funding and capacity.
Situation Assessment:	The ISP is an internal document, developed by the Department of Water Affairs and Forestry. The ISP sets out the approaches, which the Department is taking towards water management in the Lower Orange River WMA and list, suggested actions towards achieving good management of the water resource. The wider public has had no direct input into this ISP – yet it is recognised that the approaches adopted have a significant impact on the populace of the Lower Orange River WMA. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy – but **DWAF** setting out how it sees the situation, and the steps which it views as most appropriate in dealing with the situation. The ISP is not a closed document but is to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document – exposing the thinking and planning of the Department in a way that has never been done before. Although DWAF makes no commitment to adopt every comment made, these will be taken seriously and the ISP will be updated and improved as newer and better perspectives are formed. Once the CMA has been established it will be required to develop a CMS, and this will require full public participation. It is to be hoped that the ISP will be taken as useful baseline information and, indeed, that the approaches adopted here are found to be acceptable to, and adaptable by, the new dispensation. The ISP is guided by the approach set out in the NWRS – and details this approach for the Lower Orange River WMA along with improvements in information. The ISP carries significant weight in expressing how water resource planning and management will be carried out in the WMA. It is not, however, an inflexible document. As such the ISP may be adjusted and adapted when new and better ideas are presented. Despite this the approaches and requirements of this ISP may not be ignored. The Implementation of the ISP is an enormous task and will have to be tackled in a stepwise fashion. Much of what is in this document describes the day-to-day functions of the Department – but there are many new tasks, functions, and actions set out in response to DWAF's visions for the future. It is recognised that it is quite impossible to immediately launch into, and achieve, all that is required by this ISP. Funding and capacity are both real hurdles. The approach is to take the ISP and to use it as instruction, guidance, and motivation in the development of yet clearer management and action plans. These must be built into Departmental Business Plans, and budgeted for as part of Departmental operating costs. This will necessarily be in a phased manner as dictated by available resources, but it is important that the ISP be used to leverage maximum funds, maximum capacity, and to bring optimum management to the WMA. The position with regard to the Authority of Information contained in the ISP is set out in **Paragraph 1.3.4** of **Chapter 1** of this ISP document.

MANAGEMENT ACTIONS		
Required actions, responsibilities and priorities:	**M1.** Publish the ISP to be accessible for public input and comment with both hardcopy and web-based options. Copies will be presented to key stakeholders on request. It is not the intention to have a major drive for public input, but merely to create accessibility for input.	Regional Offices (Priority 1)
	M2. All Regional staff, District Authorities, Working for Water, Eskom, and other major stakeholders should have access to, or copies of, the ISP.	Regional Offices (Priority 1)
	M3 There are many actions in the ISP, which do require public involvement – and it is important that the thinking with regard to, for example, the use of groundwater, and the importance of WCDM, is taken out forcefully both to local authorities, other direct water users such as agriculture, and the wider public.	Regional Offices (Priority 1)
	M4. Collate comment and consider this in revising and improving the ISP.	Regional Offices (Priority 1)
	M5. There is a need to develop materials suited for the preparation of the Provincial Growth and Development Strategy, and other regional, provincial and local planning activities. Materials should support the preparation of WSDPs, land use and agricultural planning, and land reform initiatives etc.	Regional Offices (Priority 1)
	M6. The ISP should be open to continuous improvement and updated regularly.	Regional Offices (Priority 1)
	M7. Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP will be done as required.	Regional Offices (Priority 1)
	M8. The practicalities of implementation demands must always be considered.	Regional Offices (Priority 1)
	M9. Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets	Regional Offices (Priority 1)
Implementation	The implementation is to be ongoing until the Upper and Lower Orange River WMAs is established and the ISP is superseded by a CMS	

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