8. COMPARISON OF WATER AVAILABILITY AND USE BETWEEN THE NWRS AND THE ISP

8.1 Methodology Used

An exercise has been undertaken to compare the NWRS yield balance figures with revised figures based on the latest available information used in this ISP study. However, the five sub-areas identified in this ISP are smaller than the two primary catchments in the NWRS and therefore more detailed information was required. The following points are important when analysing the water resources of each of the five sub-areas to ensure consistent use of the same figures or to justify changes to the figures provided in the NWRS. This was done in the ISP with respect to comparing water resource availability and water requirements for each sub-area. The following approach was used in the ISP.

- The water availability and impact on the available water resource was determined based on the latest available information. This applies mainly to where the ecological Reserve requirements were determined at a higher level of confidence than for the NWRS.

- The water requirements for the Year 2000 development were updated based on the latest available information from various sources. The sources of water supply for the various water user sectors in the various catchments were identified. These sources were grouped together in five main categories, namely groundwater resources, surface water resources that are only available at a local (quaternary) level (for example farm dams), surface water resources that are available in other catchments (usually downstream and defined as “incremental”), inter-basin transfers and return flows.

- The water requirements and the sources of supply of these requirements at quaternary catchment level were determined. This was done in order to analyse where local deficits and local surpluses occur in each of the sub-areas. The purpose of providing water balance figures at quaternary catchment level is to provide the DWAF Regional Office with the first level assessment against which water resource allocations (licences) can be considered. This information will be provided to the Regional Office in a separate document.

The yield and requirement figures for the five ISP sub-areas were aggregated to reflect the two primary catchment areas given in the NWRS. A comparison was then made between the NWRS and the ISP water balance reconciliation figures and the results presented in the following tables in this chapter. The basis for determining the water balance figures as part of the ISP study was the same as for the NWRS. Where inconsistencies between the two studies were identified and a change to the NWRS figures is recommended, motivations are given for using the ISP figures.

8.2 Comparison of Available Yield

Tables 8.1 and 8.2 present a comparison of the NWRS and the ISP water availability figures for the Amatole and Great Kei primary catchments respectively.

Table 8.1 Amatole Primary Catchment
Comparison of Water Availability between the ISP and NWRS (Year 2000)

Type of Water Resource	Amount (million m^3/a)			
	Amatole sub-area*	Keiskamma sub-area	Total ISP	Total NWRS
Total surface water resource yield	82	53	135	135
Subtract:				
- Ecological Reserve	17	4	21	7
- Invasive alien plants	4	2	6	6
Net surface water yield available for use	61	47	108	122
Available groundwater resource	1	0	1	1
Usable return flows	18	1	19	26
Total Local Yield	**80**	**48**	**128**	**149**

* The inter-basin transfer from the Lower Kei sub-area (Kubusi catchment) to the Amatole sub-area is not included in the above comparative figures.

As can be seen from the above table, the estimate of the total local yield of the Amatole primary catchment determined for the ISP is lower than that determined for the NWRS. This is due to a higher ecological Reserve and lower usable return flows that were more accurately determined as part of an ecological Reserve study undertaken for the Amatole System (**Ref. 26**) after the NWRS estimates were done. It is recommended that the latest study estimate of 21 million m^3/a for the ecological Reserve and 19 million m^3/a for the return flows be used.

It should be noted that the return flows determined in the ISP are usable quantities returned to rivers and do not take into account flows being discharged into the Indian Ocean. For example, the treated effluent water from the East London West Bank Water Reclamation Works is presently discharged into the sea at Bats Cave and has not been included in the above figures. However, this water is available for re-use should a suitable customer be found. Only those return flows to rivers that are usable are considered in order to avoid the perception that there is more water available than is actually the case.

Table 8.2 Kei Primary Catchment
Comparison of Water Availability between the ISP and NWRS (Year 2000)

Type of Water Resource	Available/impact (million m^3/a)				
	Upper Kei sub-area	Middle Kei sub-area	Lower Kei sub-area	Total ISP	Total NWRS
Total surface water resource yield	151	134	87	372	372
Subtract:					
- Ecological Reserve	10	10	15	35	35
- Invasive alien plants	4	2	6	12	12
Net surface water yield available for use	137	122	66	325	325
Available groundwater resource	12	2	0	14	14
Usable return flows	10	0	10	20	20
Total Local Yield	**159**	**124**	**76**	**359**	**359**

As can be seen from the above table the ISP and NWRS figures for the Kei primary catchment are the same.

8.3 Comparison of Water Requirements

Tables 8.3 and 8.4 compare the water requirement figures between the ISP and the NWRS for the Amatole and Kei primary catchments respectively.

Table 8.3 Amatole Primary Catchment
Comparison of Water Requirements between the ISP and NWRS (Year 2000)

Sector	Amount (million m^3/a)			
	Amatole sub-area	Keiskamma sub-area	Total ISP	Total NWRS
Irrigation	19	10	29	33
Urban	59	11	70	57
Rural	3	3	6	5
Afforestation	1	1	2	4
Total Local Requirements	**82**	**25**	**107**	**99**

The significant difference between the NWRS and ISP water requirements is for the urban water use sector within the Amatole sub-area ie. Buffalo City. The ISP uses the latest water requirement figures for the Year 2000 for the Buffalo City Municipality based on the actual requirements as given in the WSDP (**Ref. 5**), which indicates a higher requirement than that used in the NWRS.

Table 8.4 Kei Primary Catchment
Comparison of Water Requirements between the ISP and NWRS (Year 2000)

Sector	Amount (million m^3/a)				
	Upper Kei sub-area	Middle Kei sub-area	Lower Kei sub-area	Total ISP	Total NWRS
Irrigation	69	15	14	98	135
Urban	10	1	10	21	18
Rural	5	3	3	11	10
Afforestation	0	2	11	13	11
Total Local Requirement	**84**	**21**	**38**	**143**	**174**

The difference between the ISP and NWRS figures is largely due to the irrigation requirements. The irrigation requirements for this ISP were based on data obtained from the Water Resources Situation Assessment Report (**Ref. 24).** The NWRS used the WSAM database which in turn also quotes the same source. There is clearly a difference in interpretation of the source information given in the WRSA. Appendix F4 of the WRSA report gives an irrigation requirement of 106 million m^3/a for the Great Kei catchment which is close to the figure used in this ISP report.

Further investigation and comparison of various sources indicates that the main difference lies in the Black Kei sub-catchment (S31/32). This ISP study based its irrigation requirement on the two established irrigation schemes in the area, namely the Klipplaat and Nthabethemba schemes, which have a 1:50 year assurance requirement of 26,1 million m^3/a. The WSAM database gives a total irrigation requirement of 68,2 million m^3/a. This large discrepancy was discussed at the two ISP workshops and there was consensus that the NWRS (WSAM data) had overestimated the irrigation requirements in the area.

A further independent comparison has been carried out which shows that the registered average irrigation water use in the WARMS database totals 19,9 million m^3/a compared to the WSAM data figure of 68,2 million m^3/a.

Based on the above it is recommended that the irrigation figures in the NWRS be change to those given in this ISP until such time as a more accurate figure for the scheduled areas is determined.

8.4 Comparison of Water Balances

Based on **Sections 8.2 and 8.3** above, the comparative water balances for the ISP and NWRS are presented in **Table 8.5** without inter-basin transfer of water from Wriggleswade Dam on the Kubusi River to the Amatole Sub-area.

Table 8.5 Comparison of Water Balance between the ISP and NWRS (Year 2000) without transfer from Wrigglewade Dam (million m^3/a)

Description	Amatole Primary Catchment			Kei Primary Catchment			
	Amatole Sub-area	Keiskamma Sub-area	Total	Upper Kei Sub-area	Middle Kei Sub-area	Lower Kei Sub-area	Total
Total local yield	80	48	128	159	124	76	359
Transfer in	0	0	0	0	0	0	0
Total yield	80	48	128	159	124	76	359
Local requirement	82	25	107	84	21	38	143
Transfer out	0	0	0	0	105	0	105
Total requirement	82	25	107	84	126	38	248
ISP Water Balance per Sub-area	**- 2**	**23**	**21**	**75**	**- 2**	**38**	**111**
ISP Water Balance	**21**			**111**			
NWRS Water Balance	**50**			**100**			

The inter-basin transfer of 18 million m^3/a of water from the Kubusi catchment in the Lower Kei sub-area to the Amatole sub-area is not reflected in the NWRS. Transfers are only made during serious droughts, but the quantity is reserved for future urban use in the Amatole Water Supply System serving Buffalo City. **Table 8.6** shows the comparative water balance figures allowing for this transfer of 18 million m^3/a.

Table 8.6 Comparison of Water Balance between the ISP and NWRS (Year 2000) with inter-basin transfer from Wrigglewade Dam (million m^3/a)

Description	Amatole Primary Catchment			Kei Primary Catchment			
	Amatole Sub-area	Keiskamma Sub-area	Total	Upper Kei Sub-area	Middle Kei Sub-area	Lower Kei Sub-area	Total
Total local yield	80	48	128	159	124	76	359
Transfer in	18	0	18	0	0	0	0
Total yield	98	48	146	159	124	76	359
Local requirement	82	25	107	84	21	38	143
Transfer out	0	0	0	0	105	18	123
Total requirement	82	25	107	84	126	56	266
ISP Water Balance per Sub-area	**16**	**23**	**39**	**75**	**- 2**	**20**	**93**
ISP Water Balance	**39**			**93**			
NWRS Water Balance	**50**			**100**			

The reasons for the discrepancies in the comparative figures between the ISP and the NWRS have been explained in the previous sections together with motivations for using the above ISP figures in the future.

The ISP study area is one of the few in the country that has surplus water resources available. However, it must be emphasised that the catchment wide figures of the Amatole - Kei area can be misleading as local deficits are experienced in some quaternary catchments, such as in the Upper Buffalo River in the Amatole sub-area and in the Upper Kei sub-area.

The Amatole sub-area is highly regulated and developed and is presently in balance with respect to existing water use and existing supplies sourced from within the sub-area. As growth in demand is experienced in the sub-area mainly from Buffalo City, it will be necessary to implement the inter-basin transfer of water from Wriggleswade Dam on the Kubusi River to the Amatole sub-area catchments. It is estimated that even with this transfer and demand side management and water re-use, the Amatole sub-area which includes Buffalo City is likely to experience a water deficit by the year 2012.

In the Upper Kei sub-area an overall surplus balance is shown. However, the Klipplaat River, a tributary of the Black Kei River, has relatively large areas allocated

for irrigation. This, together with the urban requirements of Queenstown and Sada/Whittlesea and the domestic requirements of the large rural population, has resulted in an over-allocation of the water resources from Waterdown Dam compared to the available yield. As a result there is a local deficit in the Klipplaat catchment resulting in irrigators receiving water at a relatively low level of assurance.

The Middle Kei sub-area is presently showing a slight water deficit due to the transfer of water from the Tsomo River to the Mbashe catchment for irrigation requirements at Ncora and hydropower generation by Eskom at Ncora Dam and at Collywobbles.

NOTE: As part of the ISP study, water requirements and the sources of supply of these requirements were determined at quaternary catchment level. This was done in order to analyse where local deficits and local surpluses occur in each of the sub-areas. Water balance figures at quaternary catchment level have been provided in a separate document to the Regional Office as a first level assessment on which the water resource allocation (or licences) can be considered. It must be emphasised that there is a degree of uncertainty (risk) in the level of confidence of some figures used in the ISP reconciliation. Where the difference between available water resources and water requirements is small, then a detailed system analysis is recommended. Only then should a decision be made for water use allocation and licensing of the water resources. Where the differences are significantly positive (surplus water), then water use allocation can be considered and implemented with little or no risk of failure in the system.