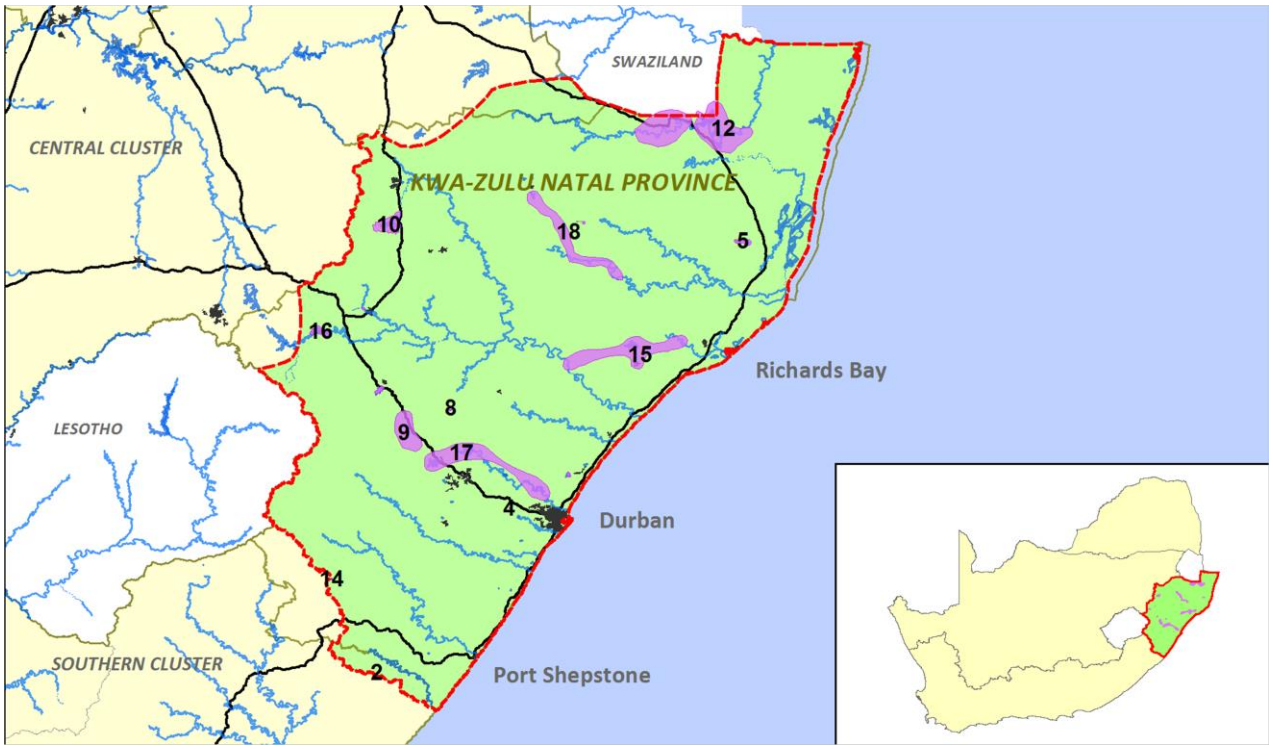
National Water Resources Infrastructure (NWRI)

Immovable Asset Management Plan

Eastern Operations Cluster

March 2017



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EXECUTIVE SUMMARY

1. Introduction and Service Description

This document is an infrastructure Asset Management Plan (AMP) for the Eastern Operations Cluster, hereinafter referred to as the Cluster, of the National Water Resources Infrastructure (NWRI) branch of the Department of Water and Sanitation (DWS). It outlines a ten-year plan for the acquisition, operation and maintenance (O&M), renewal, upgrading, new capital investments, and disposal of the Cluster's immovable assets, aiming at maximising the assets' service delivery potential and benefits, and minimising their related risks and costs over the assets' life cycle.

This AMP was produced in accordance and compliance with the provisions of the Government Immovable Asset Management Act (GIAMA), Act No. 19 of 2007. In addition, the DWS is required to annually update this AMP, as contemplated in Section 12 of the GIAMA. This AMP is also aligned to other relevant South African legislation, DWS's strategic plan, and international standards such as ISO 55000.

1.1 Key Data Sources Used to Develop this AMP

The key sources of data used to develop this AMP are: NWRI Immovable Asset Register for the financial year 2015/16; NWRI Infrastructure Asset Hierarchy (latest version updated in the financial year 2013/14); Condition Assessment Audit of Irrigation Scheme Infrastructure – Scheme Report for Pongola River GWS for 2016; financial information (obtained mainly from DWS Head Office and the Cluster Office); and face-to-face scheme visit interviews conducted with the relevant DWS personnel at cluster and national level. The overall confidence rating for the data used in the development of this AMP is four (4) on a rating scale of 1 to 5, which means some of the data used was derived.

1.2 Cluster Description and Location

The Cluster is part of NWRI and is located in the KwaZulu Natal Province. It constitutes one area office (Midmar) and has 18 government water schemes, of which 17 are active and one (Hammersdale Dam) is inactive.

1.3 Service Description

The primary service offered by the Cluster is the delivery of bulk raw water to its domestic and industrial (D&I), and irrigation water users (customers). Total raw water registered volume for the Cluster is about 1 114.622 Mm^3 per annum, of which 65.87% is for domestic and industrial, and 34.13% is for irrigation use.

2. Levels of Service

There are three key desired levels of service applicable to the Cluster's raw water supply service, namely: volume of raw water supplied; assurance level of raw water supply; and quality of raw water supplied. The first two fall under the direct responsibility of the Cluster's Operations unit; whilst 'quality of raw water supplied' falls under the responsibility of the Catchment Management Agency (CMA). The Cluster is expected to supply a total of: 734.235 Mm^3 per annum of raw water to D&I water users for which it assures 97% non-interruption; and 380.387 Mm^3 per annum to irrigation water users for which it assures 91%.

3. Future Raw Water Demand

Insight of the Cluster's future raw water demand helps in optimised planning for future upgrade and new capital needs (capital acquisitions), as contemplated in Sections 5 and 6 of the GIAMA. Figure 0.1 shows projected raw water demand for the Cluster, based on the Cluster's registered volumes for both domestic and industrial (D&I), and irrigation (IRR) water use. Ideally, the Cluster's future raw water demand determined by the DWS's Planning Office needs to take precedence; this will be addressed in the next update of this AMP.

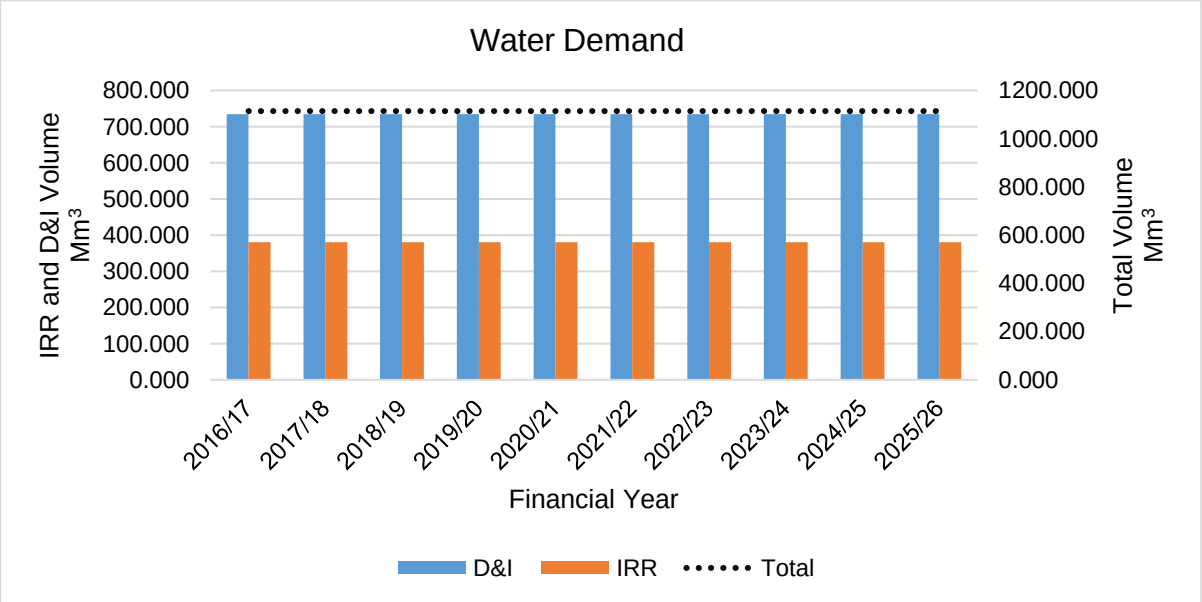

Figure 0.1: Projected raw water demand

4. Asset Details, Risk and Life Cycle Works

4.1 Asset Information

Table 0.1 shows the extent (number of asset components), acquisition cost, CRC, DRC and asset carrying values for the Cluster's assets per asset facility category. The Cluster's immovable asset components have a total DRC and CRC of about R17.186 billion and about R18.165 billion, respectively. They can be grouped into two: infrastructure asset components with a total DRC and CRC of about R15.240 billion and about R16.219 billion, respectively;

and land with a total of about R1.946 billion for both DRC and CRC. The DRC/CRC ratio for infrastructure asset components is about 94%, indicating that about 6% of the infrastructure asset base has been consumed so far.

For infrastructure assets, dams-related asset components have the highest CRC of about R13.115 billion, followed by canals-related asset components with R852.20 million, and pipelines-related asset components with R761.20 million. A similar pattern is evident for DRC.

Table 0.1: Asset extent, acquisition costs, CRC and values

Asset Facility Category	No. of Asset Components	Acquisition Cost (R Million)	Asset Carrying Value (R Million)	CRC (R Million)	DRC (R Million)	DRC / CRC (%)
Buildings	370	117.60	62.53	324.14	269.08	83.01
Canals	572	308.11	194.92	852.20	739.02	86.72
Dams	878	5 426.18	4 832.40	13 115.10	12 521.33	95.47
Measuring facilities	216	280.39	197.64	726.05	643.53	88.63
Pipelines	60	308.76	230.08	761.20	682.52	89.66
Power supply	2	0.16	0.05	0.46	0.34	75.42
Pump stations	311	113.24	63.02	302.28	252.06	83.39
Reservoirs	7	2.78	2.33	4.6	4.1	90.04
Roads	9	85.83	81.65	122.10	117.92	96.58
Telemetry	5	6.99	6.21	9.28	8.50	91.67
Water Treatment	3	0.58	0.30	1.60	1.32	82.50
Sub-total Infrastructure	**2 433**	**6 650.61**	**5 671.14**	**16 218.99**	**15 239.74**	**93.96**
Land - owned land	20	646.96	645.27	1 789.44	1 789.44	100.00
Land - servitudes	315	56.72	56.72	156.86	156.86	100.00
Sub-total Land	**335**	**703.68**	**701.99**	**1 946.30**	**1 946.30**	**100.00**
Total	**2 768**	**7 354.29**	**6 373.13**	**18 165.29**	**17 186.04**	**94.61**

4.2 Risk Management and Asset Life Cycle Works

Key asset-related risks for the Cluster include: *condition risk* (failure by the asset to deliver the required service due to deteriorated physical condition); *capacity risk* (failure by the asset to deliver the required service as a result of it exceeding its design capacity/stressed); and *not in use / under-utilisation risk* (resulting in misallocation of resources, e.g. financial, human resources, material, etc.).

To minimise the abovementioned risks, and in order for the Cluster to meet its set levels of service and the projected future raw water demand, the following asset life cycle management activities and works are recommended for the Cluster in this AMP: appropriate and adequate operation, maintenance and renewals (condition risk); upgrades and new capital investments (capacity risk); and disposals (not in use / under-utilisation risk).

- *Maintenance and Renewal Works:*

  The Cluster has about 88% of its infrastructure asset components (with a total CRC of

about R15.997 billion) in fair, good and very good conditions. Appropriate maintenance strategies, recommended and prioritised based on criticality and condition for each of these asset components in the individual scheme AMPs, have been summarised per asset facility category in this AMP.

The Cluster also has about 12% (with a total CRC of about R222.29 million) in poor and very poor conditions. Appropriate renewal strategies, recommended and prioritised based on criticality and condition for each of these asset components in the individual scheme AMPs, have been summarised per asset facility category in this AMP. In addition, a prioritised list of the asset components, per scheme and per facility category, has been included in this AMP.

For those schemes that are not being operated and maintained by the DWS, it is crucial that the DWS makes regular inspections to be sure that the Cluster's assets are adequately maintained and renewed.

- *Upgrades and New Capital Works:*
  Upgrade works are recommended for the Cluster's infrastructure asset components, about 3.7% and with a total CRC of about R362.76 million, which are stressed (exceeding design capacity on utilisation). These are mainly: dams; pipelines; and pump stations related asset components. Such upgrade works are aimed at avoiding stress related failures, and to ensure the Cluster meets the required level of service. Such upgrade works are aimed at avoiding stress related failures, and to ensure the Cluster meets the required level of service. However, before such upgrade works are executed, it is imperative that the utilisation gradings (captured in the Asset Register) of the affected asset components are first verified to confirm the necessity of the upgrades.

  Furthermore, a 2016 report on the Condition Assessment Audit for the Pongola River GWS's irrigation infrastructure identified some canal-related upgrade works with a total acquisition cost of about R170 million; these have been considered in this AMP.

- *Impairments and Disposals:*
  The Cluster has some asset components, mainly dams and measuring facilities-related, being considered as impairments (due to zero asset carrying values) with a total CRC of about R37.31 million. The DWS needs to take further steps on these asset components to determine appropriate disposal plans for them.

  Furthermore, about 2.3% of the Cluster's infrastructure asset components (with a total CRC of about R30.65 million) are under-utilised. These asset components, which are

mainly buildings and measuring facilities related, could be candidates for disposal. The reasons for the under-utilisation need to be assessed and consideration made for decommissioning and disposal, where necessary.

No asset components for the Cluster were identified for disposal (from the Asset Register) in the foreseeable future. However, Hammersdale Dam is in the process of being decommissioned, making it a candidate for disposal.

Noteworthy is that the quality and usefulness of an AMP is highly dependent on the completeness and accuracy of the asset register used in the development of the AMP. Accordingly, the abovementioned asset life cycle management activities and works recommended for the Cluster in this AMP are highly dependent on the asset component condition, criticality and utilisation gradings captured in the asset register used in the development of this AMP. As such, execution of the asset life cycle management activities and works need to be adapted in line with the prevailing situation on the ground. Refer to Section 6 of this Executive Summary regarding some recommendations on how to improve on the current NWRI immovable asset register.

5. Asset Life Cycle Financial Plan

Figure 0.2 present the Cluster's modelled identified optimal total cost requirement over the next 10 years.

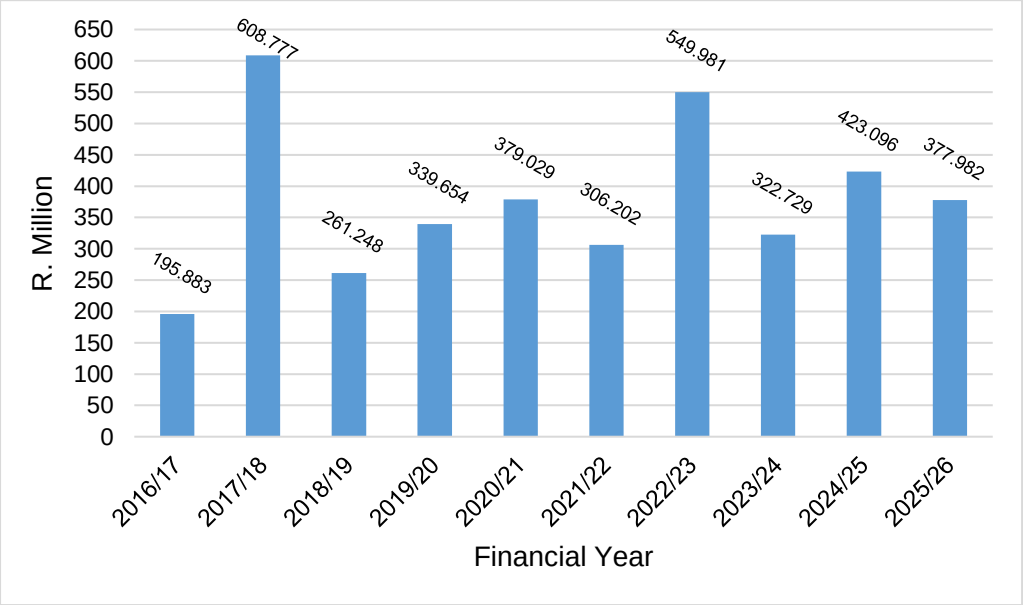

Figure 0.2: Modelled identified optimal total cost requirement per asset facility category

The Cluster's projected modelled identified optimal total cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R608.777 million; and R261.248 million, respectively, as shown in Figure 0.2. The projected sharp increases in total optimal cost in the financial years 2017/18 and 2022/23 are attributed to significant renewal,

and upgrade and new capital cost requirements. Such significant increases, compounded by the current economic and financial constraints facing the country, present some implementation challenges for the Cluster's modelled identified optimal total cost requirement. As such, for practical implementation purposes, the identified optimal cost requirements for the Cluster are adjusted as presented in Tables 0.2 and 0.3, and Figure 0.3.

Table 0.2: Modelled adjusted optimal total cost requirement per cost component

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
O&M	195.883	207.780	220.450	233.139	247.819	262.827	278.732	295.567	313.629	332.650
Renewal	-	12.319	14.537	21.132	41.009	54.002	104.700	114.492	140.992	157.992
Upgrade & New	-	47.831	60.754	67.116	62.631	61.340	51.687	37.930	48.940	49.754
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**195.883**	**267.930**	**295.742**	**321.387**	**351.459**	**378.169**	**435.118**	**447.989**	**503.560**	**540.397**

Table 0.3: Modelled adjusted optimal total cost requirement per asset facility category

Asset Facility Category	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	21.874	23.441	24.434	34.933	40.598	44.101	43.021	44.369	43.875
WR: Canals	19.149	20.659	27.699	30.219	37.147	45.130	53.519	54.735	73.016	88.237
WR: Dams	114.862	130.711	139.472	157.965	172.230	182.898	201.871	208.880	220.226	231.760
WR: Power Supply	0.031	0.032	0.034	0.036	0.039	0.041	0.043	0.046	0.049	0.052
WR: Pump stations	9.435	12.850	13.886	17.379	18.695	23.063	26.167	25.674	30.362	35.555
WR: Reservoirs	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.315	0.454
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.202	5.522	5.860	6.212
WR: Steel Pipelines	8.373	53.519	60.756	58.230	52.957	48.333	41.606	32.829	40.795	42.752
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.762	0.817	0.870	0.916
WR: Water Treatment	0.055	0.058	0.062	0.065	0.069	0.073	0.180	0.216	0.238	0.233
WS: Measuring facility	21.642	23.788	25.682	28.077	30.096	32.416	61.616	76.194	87.461	90.349
Total	**195.883**	**267.930**	**295.741**	**321.386**	**351.458**	**378.167**	**435.117**	**447.989**	**503.561**	**540.397**

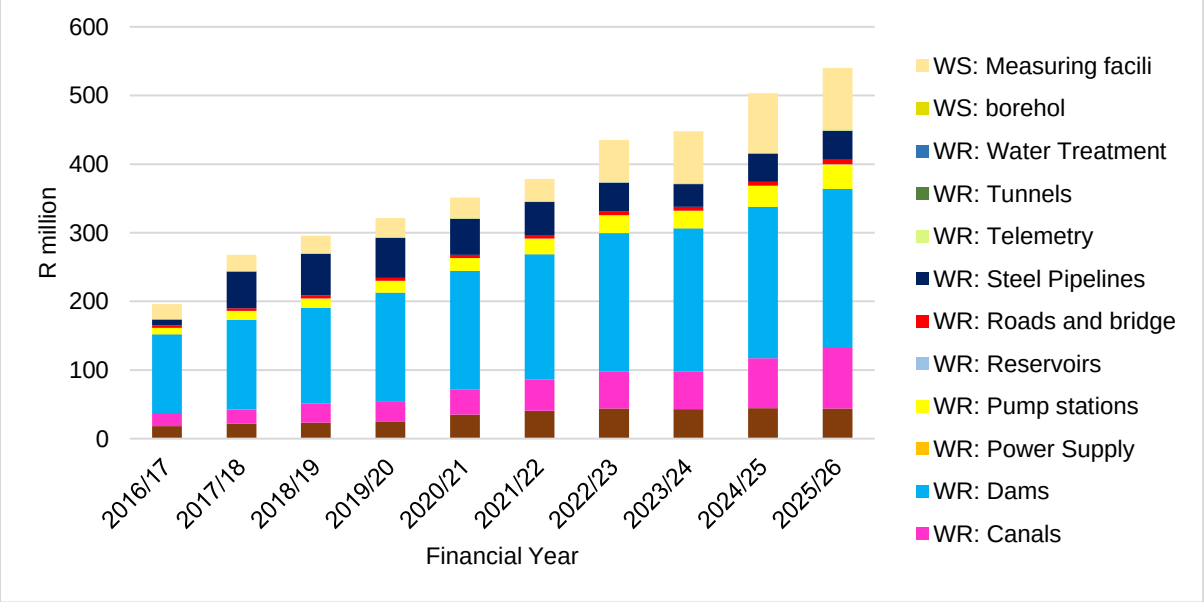

Figure 0.3: Modelled adjusted optimal total cost requirement per asset facility category

The Cluster's projected adjusted modelled optimal total cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R267.099 million; and R294.416 million, respectively. Dams, canals, buildings and pipelines related asset components are the main cost drivers. The projected total cost breakdown for the Cluster is as follows:

- The Cluster's projected optimal annual O&M cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R207.780 million; and R220.450 million, respectively. Dams related asset components are the main cost drivers.
- Optimal annual renewal cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R12.319 million and R14.537 million, to be incurred only in 2017/18 and 2018/19, respectively. Dams, buildings and pump stations related asset components are the main cost drivers.

  The projected renewals cost for 2017/18 is attributed to condition backlog from the past years. It is crucial that these renewals be given high priority in the year indicated to minimise asset component condition risk and, consequently, deteriorating service delivery.
- Optimal annual upgrades and new capital cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R47.831 million and R60.754 million to be incurred only in 2017/18 and 2018/19, respectively. Pipelines and dams related asset components are the main cost drivers.

The Cluster's projected optimal annual revenue requirements for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R196 million, R268 million and R296 million, respectively. Over the projected 10-year period, the revenue which needs to be generated by the Cluster to fund the required immovable asset life cycle works varies between about R196 million and about R540 million. In the event that such revenue cannot be generated through user charges (an indication that the Cluster is not financially self-sustainable), external funding would need to be considered. Such funding can be in the form of fiscal support, cross subsidisation or debt raised through such institutions as TCTA.

6. Recommendations

Some of the key areas of concern, identified for this Cluster, and recommended improvement actions thereof are presented in Table 0.4.

Table 0.4: Recommended areas for improvement

No.	Area for Improvement	Issue Description	Recommended Action
1	**Asset Information Management**		
1.1	Asset Register as the indispensable key data source for AMP development	The quality and usefulness of an AMP is highly dependent on the completeness and accuracy of the asset register used in the development of the AMP. Accordingly, the asset life cycle management activities and works (such as maintenance, renewals, upgrades and new capital, and disposals) recommended for the Cluster in this AMP are highly dependent on the asset component condition, criticality and utilisation gradings captured in the asset register used in the development of this AMP. However, during the AMPs review workshops conducted during the development of this AMP, the Cluster and scheme personnel did not fully concur with some of the asset component counts, condition as well as utilisation gradings; indicating the possibility of misalignment between the asset register and the prevailing situation on the ground.	The NWRI needs to urgently conduct physical asset verification and assessments (extent, condition, criticality, utilisation, etc.) for all its immovable assets and develop a comprehensive asset register, inclusive of all crucial asset component details, such as asset component sizes, material of construction, condition, criticality, utilisation, etc. Thereafter, the NWRI needs to conduct similar assessments at least every five years as contemplated in Section 13 of the GIAMA. The abovementioned asset assessments need to be conducted by adequately experienced professionals.
1.2	Current Replacement Cost (CRC)	Each and every asset component in the asset register needs to have a corresponding CRC. The CRCs are useful in the determination and projection of optimal asset life cycle management works, such as O&M, renewals, upgrades and new capital, etc., in line with international best practices. Ideally, the CRC of an asset component needs to be determined by multiplying the unit cost rate (cost per unit size, ideally obtained from suppliers) by the size of the asset component. Thus, the asset register needs to adequately capture such details as asset component sizes, material of construction, etc. However, such asset component details are not fully captured in the asset register used in the development of this AMP. As a result, the CRCs presented in this AMP were determined by adjusting the provided acquisition costs with PPI and an uncertainty factor; hence the projected optimal asset life cycle management costs may be on the conservative side.	The above-recommended assessments for the NWRI immovable assets need to adequately capture such asset component details as sizes and material of construction. This will enable the determination of more accurate CRCs, and consequently projection of more accurate optimal asset life cycle management costs.
2	**Financial Management**		

No.	Area for Improvement	Issue Description	Recommended Action
2.1	O&M Costs reporting	The DWS is not fully aware of O&M costs currently being incurred by some of the schemes being operated and maintained by other institutions, such as irrigation boards, water boards and water user associations, and no financial reports are being sent to DWS.	The DWS needs to liaise with the respective institutions and agree on frequent O&M reports, preferably on a quarterly basis.
2.2	O&M Costs splitting	O&M costs in the individual schemes are currently not being budgeted and recorded separately per asset facility category.	Budget for and record O&M costs: separately (separate operations from maintenance). Budget for and record O&M costs per asset facility category.
3	**Risk Management**		
3.1	Risk Management	Risk (expected loss) is calculated by determining the product of the likelihood of the risk and the total amount of loss (impact) when the risk occurs: *Expected Loss (Risk) = Risk Likelihood x Total Loss (Impact)* For this Scheme, however, risk likelihood per asset component was not captured in the Asset Register used in the development of this AMP. Hence, an in-depth risk analysis could not be conducted.	Capture risk likelihood per asset component in the infrastructure asset register, so that the next update of this AMP can incorporate an in-depth risk analysis.

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GLOSSARY

Activity	An activity is the work undertaken on an asset or group of assets to achieve a desired outcome.
Asset	A resource controlled by the DWS as a result of past events and from which future economic benefits are expected to flow to DWS.
Asset Hierarchy	A framework for segmenting an asset base into appropriate classifications.
Asset Management	A process of decision making, planning and control over acquisition, use, safeguarding and disposal of assets to maximise their service delivery potential and benefits, and to minimize their related risks and costs over their entire life.
Asset Management System	A system (usually computerised) for collecting, analysing and reporting data on the utilisation, performance, lifecycle management and funding of existing assets.
Asset Management Plan	Documented information that specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organization's asset management objectives.
Asset Management Policy	The overall intentions and direction of an organisation related to the assets and the framework for the control of asset related processes and activities.
Asset Management Strategy	A strategy for asset management covering, the development and implementation of plans and programmes for asset creation, operation, maintenance, renewal, disposal and performance monitoring to ensure that the desired levels of service and other operational objectives are achieved at optimum cost.
Asset Management Team	The team appointed by an organisation to review and monitor the corporate asset management improvement programme and ensure the development of integrated asset management systems and plans consistent with organisational goals and objectives.
An active market	a market in which all of the following conditions exist: • The items traded in the market are homogeneous • Willing buyers and sellers can normally be found at any time • Prices ae available to the public
Asset carrying amount/value	The amount at which an asset is included in the statement of financial position after deducting any accumulated depreciation and any impairment losses thereon.
Asset Register	A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, and construction, technical and financial information about each.
Condition Monitoring	Continuous or periodic inspection, assessment, measurement and interpretation of resulting data, to indicate the condition of a specific component so as to determine the need for some preventive or remedial action
Critical Assets	Assets or assets components, that are identified as being critical in achieving the organisation's strategic objectives (note that assets can be safety critical, environmental critical or performance critical).
Current Replacement Cost	A measure of replacement value – the cost of replacing an existing asset with a modern asset of equivalent capacity.
Deferred Maintenance	Planned maintenance that has been deferred (backlog in maintenance).
Demand Management	The active intervention in the market to influence demand for services and assets with forecast consequences, usually to avoid or defer CAPEX expenditure. Demand management is based on the notion that as needs are satisfied expectations rise automatically and almost every action taken to satisfy demand will stimulate further demand.
Depreciated Replacement Cost	A measure of current value of an asset, based on its current replacement cost less an allowance for deterioration of condition to date (based on the fraction of remaining useful life/expected useful life).
Depreciation	The systematic allocation of the depreciable amount of a physical asset over its useful life.
Disposal	Activities necessary to dispose of decommissioned assets.

Economic life	The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life however obsolescence will often ensure that the economic life is less than the physical life.
Expenditure-based cost	Projected cost based on historical actual expenditures.
EUL	Expected Useful Life of an asset
Facility	A complex asset comprising many assets (e.g. a hospital, water treatment plant, recreation complex, etc.) which represents a single management unit for financial, operational, maintenance or other purposes.
Geographic Information System	Software which provides a means of spatially viewing, searching, manipulating, and analysing an electronic database.
Impairment	The loss of future economic benefits or service potential of an asset over and above the systematic recognition of the loss of the asset's future economic benefits or service potential through depreciation.
Infrastructure Assets	Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components. The network may include normally recognized 'ordinary' assets as components.
Key Performance Indicator	A qualitative or quantitative measure of a service or activity used to compare actual performance against a standard or other target. Key performance indicators commonly relate to statutory limits, safety, responsiveness, cost, comfort, asset performance, reliability, efficiency, environmental protection and customer satisfaction.
Level of service	The defined service quality for a particular activity or service area against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental acceptability and cost.
Life	A measure of the anticipated life of an asset or component; such as time, number of cycles, distance intervals etc.
Life cycle	The cycle of activities that an asset (or facility) goes through while it retains an identity as a particular asset i.e. from planning and design to decommissioning or disposal.
Lifecycle Cost	The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, and rehabilitation and disposal costs.
Maintenance	All actions necessary for an asset to achieve its expected useful life as near as practicable to its original condition, but excluding rehabilitation or renewal.
Maintenance Plan	Collated information, policies and procedures for the optimum maintenance of an asset, or group of assets.
Maintenance Standards	The standards set for the maintenance service, usually contained in preventive maintenance schedules, operation and maintenance manuals, codes of practice, estimating criteria, statutory regulations and mandatory requirements, in accordance with maintenance quality objectives.
Objective	An objective is a general statement of intention relating to a specific output or activity. They are generally longer term aims and are not necessarily outcomes that managers can control.
Operating Expenditure	Expenditure necessary to provide services such as water catchment or water distribution. Examples of OPEX include staff costs, administration costs, consumables, maintenance and repairs and feasibility studies.
Operation	The active process of utilising an asset which will consume resources such as manpower, energy, chemicals and materials. Operation costs are part of the lifecycle costs of an asset.
Optimal cost	Cost determined based on established ratios of CRCs, and is deemed sufficient to cover all the expenditure requirements of an entity.
Performance Monitoring	Continuous or periodic quantitative and qualitative assessments of the actual performance compared with specific objectives, targets or standards.
Planned Maintenance	Planned maintenance activities fall into 3 categories:

	▪ Periodic – necessary to ensure the reliability or sustain the design life of an asset. ▪ Predictive – condition monitoring activities used to predict failure. ▪ Preventive – maintenance that can be initiated without routine or continuous checking (e.g. using information contained in maintenance manuals or manufacturers' recommendations) and is not condition-based.
Rehabilitation	Works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification. Generally, involves repairing the asset using available techniques and standards to deliver its original level of service (e.g. relining bulk raw water pipelines) without resorting to significant upgrading or replacement.
Renewal	Works to refurbish, rehabilitate or replace existing facilities with facilities of equivalent capacity or performance capability.
Repair	Action to restore an item to its previous condition after failure or damage.
Replacement	The complete replacement of an asset that has reached the end of its life, so as to provide a similar, or agreed alternative, level of service.
Remaining Useful Life	The time remaining over which an asset is expected to be used.
Residual Value	The net amount which the entity expects to obtain for an asset at the end of its useful life after deducting the expected costs of disposal.
Risk Management	The application of a formal process to the range of possible values relating to key factors associated with a risk in order to determine the resultant ranges of outcomes and their probability of occurrence.
Routine Maintenance	Day to day operational activities to keep the asset operating (e.g. repairing leaks) and which form part of the annual operating budget, including preventative maintenance.
Strategic Plan	Strategic planning involves making decisions about the long-term goals and strategies of an organisation. Strategic plans have a strong external focus, cover major portions of the organisation and identify major targets, actions and resource allocations relating to the long-term survival, value and growth of the organisation.
Unplanned Maintenance	Corrective work required in the short term to restore an asset to working condition so it can continue to deliver the required service or to maintain its level of security and integrity.
Upgrading	The replacement of an asset or addition/ replacement of an asset component which materially improves the original service potential of the asset.
Useful life	The period over which a depreciable asset is expected to be used. (GAMAP: Either (i) the period of time over which an asset is expected to be used by the entity, or (ii) the number of production or similar units expected to be detained from the asset by the entity).
Valuation	Estimated asset value, which may depend on the purpose for which the valuation is required, i.e. replacement value for determining maintenance levels or market value for lifecycle costing.
Yield	Water which can reliably be withdrawn from a water source at a relatively constant rate.

ABBREVIATIONS

AM	Asset Management
AMP	Asset Management Plan
AMIP	Asset Management Improvement Plan
AMS	Asset Management System
CAPEX	Capital Expenditure
CBM	Condition Based Maintenance
CPI	Consumer Price Index
CRC	Current Replacement Cost
DRC	Depreciated Replacement Cost
D&I	Domestic and Industrial
DWS	Department of Water and Sanitation
EUL	Expected Useful Life
GIAMA	Government Immovable Asset Management Act
GIS	Geographic Information System
GFMAM	Global Framework for Maintenance and Asset Management
GPS	Global Positioning System
GRAP	Generally Recognized Accounting Practices
GWS	Government Water Scheme
ISO	International Standards Organization
IAS	International Accounting Standards
IFMS	Integrated Financial Management System
IRR	Irrigation
KPI	Key Performance Indicator
LCC	Life Cycle Costing/Cost
MTEF	Medium Term Expenditure Framework
NWRI	National Water Resources Infrastructure
NWRIB	National Water Resources Infrastructure Branch
NWA	National Water Act
OPEX	Operating Expenditure
O&M	Operation and Maintenance
OSH	Occupational Health and Safety
PFMA	Public Finance Management Act
PPE	Property, Plant and Equipment
PPI	Producer Price Index
PM	Preventive Maintenance
PdM	Predictive Maintenance
RAMS	Reliability, Availability, Maintainability and Safety
RUL	Remaining Useful Life
RTF	Run to Failure
RCM	Reliability Centred Maintenance
WARMS	Water-Use Authorization and Registration Management System
WDCS	Waste Discharge Charging System
WMA	Water Management Area
WTE	Water Trading Entity

1. INTRODUCTION AND SERVICE DESCRIPTION

1.1 Overview

This document is a 10-year infrastructure Asset Management Plan (AMP) for the Eastern Operations Cluster, hereinafter referred to as the Cluster, of the National Water Resources Infrastructure (NWRI) branch of the Department of Water and Sanitation (DWS). This section begins with a brief background as well as the key sources of data used in the development of this AMP. It proceeds with outlining: the purpose of this AMP; and alignment of this AMP with the South African legislative framework, international standards, and the DWS's strategic plan. Finally, it: indicates the physical location of the Cluster; highlights the service provided by the Cluster; and also, provides an overview of the Cluster's immovable assets.

1.2 Background

The NWRI is responsible for operating, maintaining and managing a number of raw water schemes spread throughout South Africa. The NWRI divided the country into four operational clusters: Northern; Eastern; Southern; and Central. Each cluster is responsible for a number of raw water schemes.

In 2010, the NWRI prepared the second set of infrastructure AMPs: one AMP for each of its four operational clusters, and one National AMP; hereinafter all referred to as the 2010 AMPs. However, the 2010 AMPs needed some updating and improvements, in view of the following:

- the 2010 AMPs were produced at a relatively high level of detail and ultimately needed to be improved in accordance and compliance with the provisions of the Government Immovable Asset Management Act (GIAMA), Act No. 19 of 2007.
- no AMP was prepared at the GWS level (the 2010 AMPs were only prepared at the Cluster and National levels).
- no analysis was done, and no life cycle works and strategies were prescribed at asset component level; and hence
- the 2010 AMPs only partially complied with the provisions of the GIAMA.

In addition, the DWS is required to annually update its AMPs, as contemplated in Section 12 of the GIAMA. It is against this background that this AMP has been prepared for NWRI's Eastern Operations Cluster as an update and improvement to the 2010 AMP.

1.3 Data Sources and Overall Data Confidence

1.3.1 Key Data Sources Used to Develop this AMP

The key sources of data used to develop this AMP are:

- *NWRIB Immovable Asset Register* for the financial year 2015/16 (refer to Appendix A).
- *NWRIB Infrastructure Asset Hierarchy* (latest version updated in the financial year 2013/14).
- *Condition Assessment Audit of Irrigation Scheme Infrastructure – Scheme Report for Pongola River GWS for 2016,* dated the 30th of September 2016.
- *financial (revenue and expenditure) information* (obtained from: the DWS Head Office; and the Eastern Cluster Office).
- *face-to-face scheme visit interviews* conducted with the relevant DWS Eastern Cluster operations personnel.
- *Other relevant NWRIB documentation*, such as water use registrations records.

1.3.2 Data Confidence Rating

Table 1.1 shows the confidence grading criteria used for rating the data used in this AMP.

Table 1.1: Data confidence grading scale

Data Confidence Grade	Description	Margin of Error
5	**Highly accurate** Data based on sound records, procedure, investigations and analysis which is properly documented and recognised as the best method of assessment.	1 – 20 %
4	**Minor inaccuracies** Data based on sound records, procedures, investigations and analysis which is properly documented but has minor shortcomings; for example, the data is old, some documentation is missing and reliance is placed on unconfirmed reports or some extrapolation.	21 – 30%
3	**50% estimated** Data based on sound records, procedures, investigations, and analysis which is incomplete or unsupported, or extrapolation from a limited sample for which grade 1 or 2 data is available.	31 – 40%
2	**Significant data estimated** Data based on incomplete or outdated data, or conflicting data sets exists requiring the assessor to apply judgement as to which portions of data would be most appropriate.	41- 50%
1	**All data estimated** No written records, procedures or other supporting documentation available. Data based on unconfirmed verbal reports and/or cursory inspection and analysis	> 51%

Source: Adapted from DWS Valuation Guide (2008)

Table 1.2 summarizes the confidence rating for the data used to develop this AMP.

Table 1.2: Overall data confidence rating

Section of this AMP	Data Description	Data Confidence Rating	Reason for rating
1	Cluster location and service description	5	Data gathered during interviews and also obtained from other relevant NWRIB documentation, such as the WARMS registrations (DW760).
2	Levels of service, performance measures, targets	4	Data obtained from DWS Raw Water Pricing Strategy; raw water supply agreements; and some data verified/provided by the DWS Eastern Cluster Team.
3	Future raw water demand	3	Future raw water demand based on registered volumes for irrigation and domestic and industrial water users. Actual raw water volumes could not be obtained.
4	Asset details	4	Required asset information that was not in the Asset Register was derived (see Section 4.2).
5	Financial information	4	Required financial information that could not be found was derived (refer to Sections 5 and 6).
Average Data Confidence		**4**	**Minor inaccuracies, with 21 – 30% margin of error.**

1.4 Purpose of this Asset Management Plan

The main purpose of this 10-year AMP is to enable the Cluster to effectively and efficiently manage its infrastructure assets, thereby enabling it to maximise its service delivery potential and benefits (delivering the desired level of service to its clients), and to minimise related risks and costs over its infrastructure assets' entire life cycle. To this end, this AMP aims at achieving the following:

- Describing the service offered by the Cluster.
- Articulating the intended 'levels of service' relevant to this Cluster, and the performance measures and targets against which actual performance needs to be assessed.
- Analysing the Cluster's assets and proposing appropriate asset life cycle activities/works aimed at making sure the Cluster's assets meet: the levels of service (for supply of raw water) agreed with its clients; as well as the projected future raw water demand for the Cluster.
- Proposing a financial plan for the Cluster for the next 10 years.
- Identifying areas of improvement with regards to the DWS Asset Management practices, and providing appropriate recommendations thereof.
- Enabling the Cluster to make optimized asset creation, operation, maintenance, renewal, upgrade and disposal decisions; and
- Complying with the provisions of the GIAMA.

1.5 Legislative Framework, Policies, Strategies and Standards

This AMP has been developed in line with the laws of the Republic of South Africa, relevant DWS policies, strategies and guides, as well as relevant international standards. The legislative framework includes, but is not limited to:

- Constitution of the Republic of South Africa (Act No. 108 of 1997).
- National Water Act (No. 36 of 1998).
- Government Immovable Asset Management Act (GIAMA) No. 19 of 2007.
- Public Finance Management Act (PFMA) No. 1 of 1999.

The relevant DWS policies and strategies include:

- Immovable Asset Management Policy (2015).
- Disposal Policy for Immovable Assets (2015).
- Valuation Guide (2008).

The relevant international standards include:

- Generally Recognized Accounting Practice for Property, Plant and Equipment (GRAP 17).
- International Standard for Asset Management Systems (ISO 55000).
- International Infrastructure Management Manual.

1.6 Strategic Context

This AMP is aligned with the DWS's Strategic Plan, ensuring that the NWRI's immovable assets are managed in a manner that fully supports the DWS's vision of delivering "equitable and sustainable water and sanitation that support socio-economic growth and development of the well-being of current and future generations". This AMP flows from and supports the DWS's Asset Management Policy, High-level Strategic Goals, Mission and Vision (refer to Appendix B).

1.7 Cluster Description and Location

The Eastern Cluster is part of NWRI and is located in the KwaZulu Natal Province, as shown in Figure 1.1. It constitutes one area office (Midmar) and has 18 government water schemes, of which 17 are active and one (Hammersdale Dam) is inactive, as shown in Table 1.3.

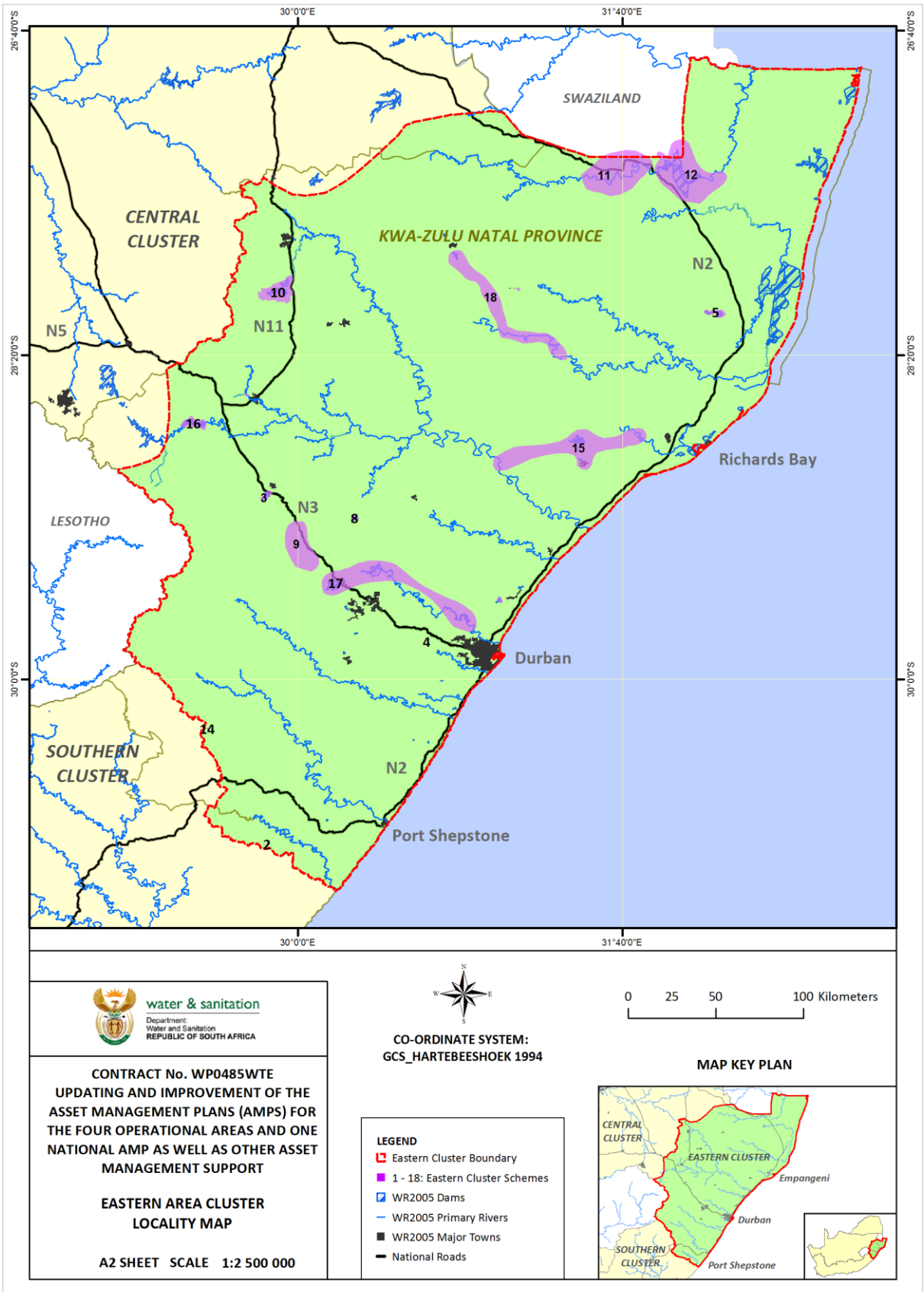


Figure 1.1: Locality map for the Eastern Operations Cluster

Table 1.3: Eastern Operations Schemes List

No.	Scheme Name	Operational Status
1	Bevenson Dam GWS	Active
2	Bizana Dam	Active
3	Bushmans River GWS	Active
4	Hammersdale Dam	Inactive
5	Hluhluwe River GWS	Active
6	Lavumisa GWS	Active
7	Mdloti River GWS	Active
8	Mnyamvubu River GWS	Active
9	Mooi Mgeni Rivers GWS	Active
10	Ngagane River GWS	Active
11	Pongola River GWS	Active
12	Pongolapoort GWS	Active
13	Qedusizi GWS	Active
14	Singisi GWS	Active
15	Tugela Mhlatuze Rivers GWS	Active
16	Tugela River GWS	Active
17	Umgeni River GWS	Active
18	White Mfolozi River GWS	Active

1.8 Service Description and Assets Summary

The primary service offered by the Cluster is the delivery of bulk raw water to its domestic and industrial (D&I), and irrigation (IRR) water users/customers. Total raw water registered volume for the Cluster is about 1 114.622 Mm^3 per annum, of which 65.87% is for domestic and industrial, and 34.13% is for irrigation use as shown in Table 1.4.

Table 1.4: Raw water allocations per water user category

Water User Category	Total Registered Volume (Mm^3 pa)	% of Total Registered Volume
Domestic & Industrial	734.235	65.87%
Irrigation	380.387	34.13%
Total	**1 114.622**	**100.00%**

The key stakeholders for the Cluster are shown in Appendix C. Table 1.5 shows the principal customers (in terms of registered raw water volumes) for the Cluster. Appendix D, Table D.1 shows registered raw water volumes per water use category.

Table 1.5: Principal water users for the Cluster

Principal Customer Name	Water User Category	Registered Water Volume (Mm^3 pa)
Umgeni Water	Domestic & Industrial	452.000
Mhlathuze Water	Domestic & Industrial	104.974
Uthukela Water	Domestic & Industrial	65.378
KZ282 - Umhlathuze Local Municipality	Domestic & Industrial	33.796
Mjindi Farming	Irrigation	33.000
Total		**689.148**
% of Total Cluster Registered Volume		*61.83%*

Table 1.6 summarizes the immovable assets for Cluster as they appear in the Asset Register (refer to Appendix A) used in the development of this AMP. The Cluster's immovable asset components have a total DRC and CRC of about R17.186 billion and about R18.165 billion, respectively. They can be grouped into two:

- infrastructure asset components (with total DRC and CRC of about R15.240 billion and about R16.219 billion, respectively), and
- land (with a total of R1.946 billion for both DRC and CRC).

For infrastructure assets, dams-related asset components have the highest CRC of about R13.115 billion, followed by canals-related asset components with R852.20 million, and pipelines-related asset components with R761.20 million. A similar pattern is evident for DRC.

Table 1.6: Summary of the Cluster's immovable assets

Asset Facility Category	No. of Asset Components	CRC (R Million)	DRC (R Million)
Buildings	370	324.14	269.08
Canals	572	852.20	739.02
Dams	878	13 115.10	12 521.33
Measuring facilities	216	726.05	643.53
Pipelines	60	761.20	682.52
Power supply	2	0.46	0.34
Pump stations	311	302.28	252.06
Reservoirs	7	4.6	4.1
Roads	9	122.10	117.92
Telemetry	5	9.28	8.50
Water treatment	3	1.60	1.32
Sub-total Infrastructure	**2 433**	**16 218.99**	**15 239.74**
Land - owned land	20	1 789.44	1 789.44
Land - servitudes	315	156.86	156.86
Sub-total Land	**335**	**1 946.30**	**1 946.30**
Total	**2 768**	**18 165.29**	**17 186.04**

To be noted is that the Asset Register (see Appendix A) used in the development of this AMP did not have sizes (e.g. lengths of canals, roads, etc.) on most of the asset components. Hence, asset sizes are not shown in Table 1.6.

1.9 Summary

This AMP is for the Eastern Operations Cluster which is part of the DWS's NWRI operations. Key data sources used in the development of this AMP include: the NWRI's immovable asset register; asset hierarchy; the 2016 Condition Assessment Audit of Irrigation Scheme Infrastructure - Scheme Reports for Eastern Cluster operations; the Cluster's financial information (costs and revenue); face-to-face interviews conducted with the relevant Cluster personnel; as well as other relevant NWRI documentation.

The main purpose of this AMP is to enable the Cluster to effectively and efficiently manage its infrastructure assets, thereby enabling it to maximise its service delivery potential and benefits (delivering the desired level of service to its clients), and to minimise related risks and costs over its infrastructure assets' entire life cycle. This AMP is prepared in accordance with the provisions of the GIAMA, and is also aligned to: other relevant South African legislation; international standards; as well as the DWS's strategic plan.

The primary service offered by the Cluster is the delivery of bulk raw water to its domestic and industrial (D&I), and irrigation water users (customers). Total raw water registered volume for the Cluster is about 1 114.622 Mm^3 per annum, of which 65.87% is for domestic and industrial, and 34.13% is for irrigation use.

The Cluster's immovable assets can be grouped into two: infrastructure assets (with total DRC and CRC of about R17.186 billion and about R18.165 billion, respectively), and land (with a total of about R1.946 billion for both DRC and CRC).

The next section highlights the levels of service expected from the Cluster, as well as the associated performance measures and targets for the Scheme.

2. LEVELS OF SERVICE, PERFORMANCE MEASURES & TARGETS

2.1 Overview

This section presents the levels of service, as well as the associated performance measures and targets, for the Eastern Operations Cluster. Understanding the levels of service for the Cluster assists in monitoring and managing the Cluster's infrastructure assets so as to ensure effective service delivery to its water users and, thus, leading to customer satisfaction.

2.2 Levels of Service, and Associated Performance Measures and Targets

In this AMP, 'levels of service' refers to the quality and quantity of the Cluster's service delivery, against which the Cluster's performance may be measured. As indicated in the preceding section, the key service delivered by the Cluster is the supply of raw water to its customers (irrigation, and domestic and industrial water users). The total raw water registered volume for this Cluster is 1 114.622 Mm^3. Appendix D, Table D.1, shows the registered raw water volumes per water use category.

There are three key levels of service applicable to the Cluster's raw water supply service, namely:

- Volume of raw water supplied;
- Quality of raw water supplied; and
- Assurance level of raw water supply.

The above-listed levels of service are evident in the: raw water supply agreements with water users; and the DWS's Raw Water Pricing Strategy. The DWS's Catchment Management Area (CMA) is responsible for raw water registration/licensing. Two of the levels of service (volume of raw water supplied; and assurance level of raw water supply) fall under the direct responsibility of the Cluster (which is part of NWRI Operations); whilst the 'quality of raw water supplied' level of service falls under the direct responsibility of the CMA. As this AMP focuses on NWRI, the 'quality of raw water supplied' level of service is not covered in subsequent text.

Table 2.1 presents the performance measures and targets (associated with each of the two levels of service for which the Cluster, as part of NWRI, is responsible), current performance, as well as the desired future performance targets.

Table 2.1: Levels of service, and associated performance measures and targets

Level of Service	Performance Measure	Performance Target (2015/16)	Current Performance (2015/16)	Desired Performance Targets (2016/17 – 2025/26)
Volume of raw water supplied	Number of agreements with water users in place	All water users have valid agreements in place (100%).	Could not be ascertained for some of the schemes.	All water users have valid agreements in place (100%).
	Volume of raw water supplied	Registered raw water volumes per annum: ▪ 734.235 Mm^3 for domestic and industrial water users; ▪ 380.387 Mm^3 for irrigation water users; ▪ 1 114.622 Mm^3 Total.	Actual raw water volumes supplied to D&I and irrigation water users could not be obtained.	Be able to meet the growth in demand (refer to Section 3),
	Asset Maintenance	No deferred maintenance.	There is some deferred maintenance (refer to Section 5.5).	No deferred maintenance.
	Water conveyance efficiency	Percentage of unaccounted for raw water during delivery: < 3% for pipes; <20% for canals.	Could not be ascertained for some of the schemes.	Percentage of unaccounted for raw water during delivery: < 3% for pipes; <20% for canals.
Assurance level of raw water supply	Water supply assurance	▪ 97% for domestic and industrial water users; ▪ 91% for irrigation water users.	Could not be ascertained for some of the schemes.	▪ 97% for domestic and industrial water users; ▪ 91% for irrigation water users.

2.3 Summary

There are three key desired levels of service applicable to the Eastern Operations Cluster's raw water supply service: volume of raw water supplied; quality of raw water supplied; and assurance level of raw water supply. Volume of raw water supplied and assurance level of raw water supply fall under the direct responsibility of the Cluster operations; whilst quality of raw water supplied falls under the direct responsibility of the CMA. The Cluster is expected to supply a total of: 734.235 Mm^3 per annum of raw water to D&I water users for which it assures 97% non-interruption; and 380.387 Mm^3 per annum to irrigation water users for which it assures 91%.

In order to ensure that the Cluster provides the levels of service agreed with the water users, a number of asset life cycle management activities need to be executed, as outlined in Sections 4 and 5 of this AMP. The following section indicates the future raw water demand projections for this Cluster.

3. FUTURE RAW WATER DEMAND

3.1 Overview

This section highlights the Eastern Operations Cluster's projected raw water demand levels based on the past trend.

3.2 Raw Water Demand Projection

Insight of the Cluster's future raw water demand helps in optimised planning for future new and upgrade capital needs (capital acquisitions), as contemplated in Sections 5 and 6 of the GIAMA. Figure 3.1 shows projected raw water demand for the Cluster, based on the registered volumes for both domestic and industrial (D&I) and irrigation (IRR). Refer to Appendix D, Table D.2, for the data used to generate the graph in Figure 3.1. Ideally, the Cluster's future raw water demand determined by the DWS's Planning Office needs to take precedence; this will be addressed in the next update of this AMP.

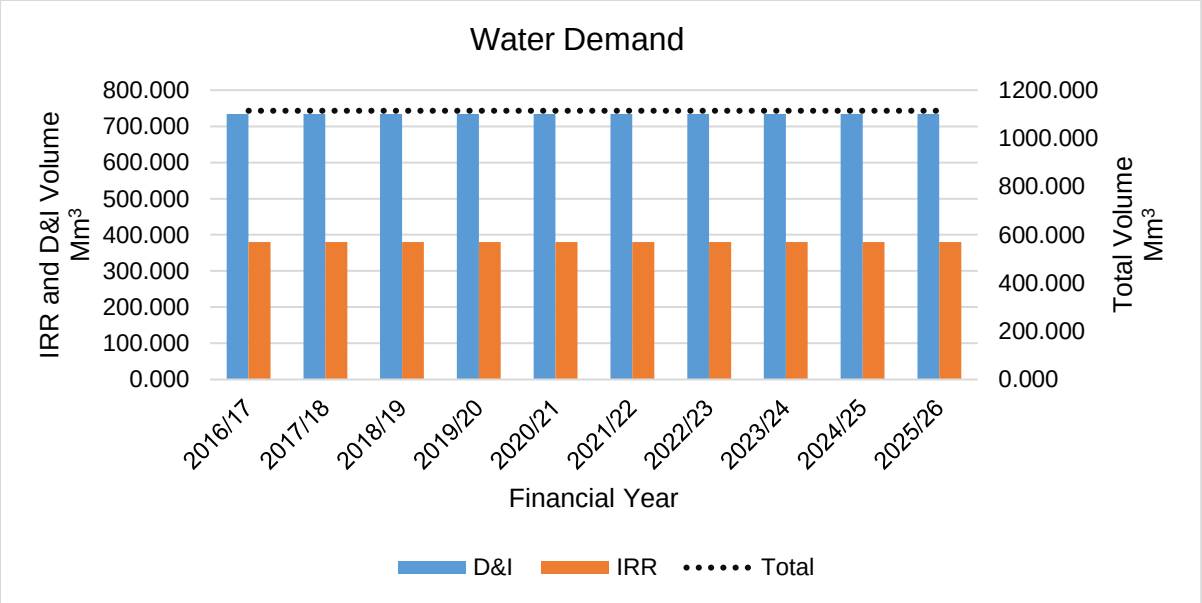


Figure 3.1: Projected raw water demand

3.3 Assumptions Made in Projecting Water Demand.

The main assumption made here is that there will be no major changes on the economic, political, demographic, settlement, irrigation, and domestic and industrial fronts affecting the Cluster. It is however important to note that in the event that there is a significant unforeseen change in any of these fronts, the projected raw water demand is bound to change. This calls for forward-looking planning where the Cluster needs to always keep track of changes

unfolding in these fronts, watching for changes that could significantly shift the current raw water demand, and consequently requiring upgrades or new capital or disposals of the Cluster's assets.

3.4 Sensitivity Analysis

Figure 3.2 shows possible scenarios from a sensitivity analysis; refer to Appendix D, Table D.3, for the data used to generate the graph.

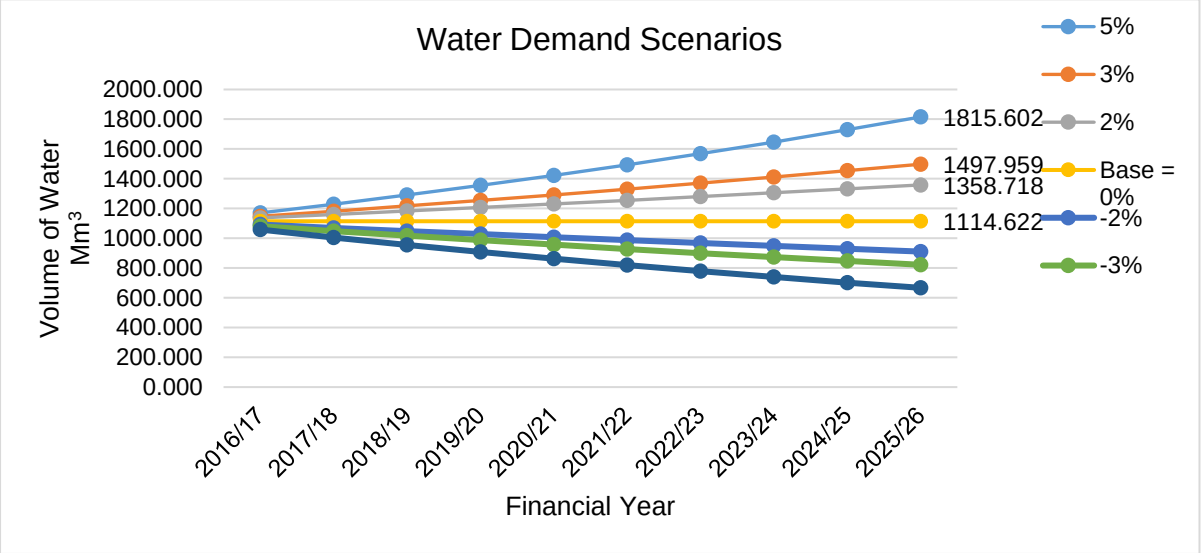


Figure 3.2: Future raw water demand sensitivity analysis

Ideally, the sensitivity graph in Figure 3.2 needs to be compared to the yields of the dams in the Cluster to ascertain whether or not the Cluster will be able to meet its projected raw water demand without the need for additional assets (new and/or upgrades). The next update of this AMP is expected to incorporate the dam yields.

3.5 Summary

The Eastern Operations Cluster's future raw water demand for the next 10 years is projected to be around 1 114.622 Mm^3 per annum. The main assumption made here is that there will be no major changes on the economic, political, demographic, settlement, irrigation, and domestic and industrial fronts affecting the Cluster. Ideally, the Cluster's future raw water demand determined by the DWS's Planning Office takes precedence. The next update of this AMP is expected to make use of such data.

In order for the Cluster to meet the future raw water demand projected in this section, the following Sections 4 and 5 highlight the accordingly required asset life cycle works and associated financial plan, respectively.

4. ASSET DETAILS, RISK AND LIFE CYCLE WORKS

4.1 Overview

This section begins with an analysis of the immovable asset details (e.g. extent, value, condition, criticality, utilisation, etc.) for the Eastern Operations Cluster. It then proceeds to discuss the associated risks, the works and strategies recommended for the Cluster to effectively and efficiently manage its assets throughout their life cycles in order to meet the levels of service agreed with its water users (see Section 2) and the projected future raw water demand (see Section 3).

4.2 Asset Information

The following subsections highlight the details (extent, value, condition, criticality and utilization) of the Cluster's immovable assets, based on the NWRI's Immovable Asset Register for the 2015/16 financial year (refer to Appendix A).

The DWS Immovable Asset Management Policy (Section 6) and GRAP 17 (Section 11) prescribe the minimum asset register information, including: detail asset description (e.g. sizes, material of construction, etc.), EUL, RUL, impairments, and disposal (date, proceeds, and depreciation up to date of disposal). Where such information was incomplete in the asset register used in this AMP, the DWS Infrastructure Asset Hierarchy (latest version updated in 2013/14), the DWS's Immovable Asset Management Policy, Valuation Guide and the 2010 AMPs formed the basis for addressing the shortcoming. For instance:

- EULs were assigned based on the DWS Infrastructure Asset Hierarchy.
- RULs were determined using the age-based approach (and moderated by the condition-based approach).
- CRCs were determined by adjusting the provided acquisition costs with PPI and an uncertainty factor, and moderated using the CRCs reported in the 2010 AMPs, owing to the insufficient data on asset component sizes and material of construction.

4.2.1 Asset Extent and Values

Table 4.1 shows the extent (number of asset components), acquisition cost, CRC, DRC and asset carrying values for the Cluster's assets, split between scheme-specific and non-scheme specific.

Table 4.1: Asset extent, acquisition costs, CRC and values (scheme- and non-scheme-specific)

Description	No. of Asset Components	Acquisition Cost (R Million)	Asset Carrying Value (R Million)	CRC (R Million)	DRC (R Million)	DRC / CRC (%)
Scheme-Specific Infrastructure	2 283	6 472.23	5 553.68	15 727.78	14 809.24	94.16
Scheme-Specific Land	266	703.39	701.70	1 945.51	1 945.51	100.00
Sub-Total Scheme-Specific	**2 549**	**7 175.62**	**6 255.38**	**17 673.29**	**16 754.75**	**94.80**
Non-Scheme-Specific Infrastructure	150	178.39	117.46	491.21	430.50	87.64
Non-Scheme-Specific Land	69	0.29	0.29	0.79	0.79	100.00
Sub-Total Non-Scheme-Specific	**219**	**178.68**	**117.75**	**492.00**	**431.29**	**87.66**
Total	**2 768**	**7 354.30**	**6 373.13**	**18 165.29**	**17 186.04**	**94.61**

Table 4.2 shows the extent (number of asset components), acquisition cost, CRC, DRC and asset carrying values for the Cluster's assets per asset facility category.

Table 4.2: Asset extent, acquisition costs, CRC and values (per facility category)

Asset Facility Category	No. of Asset Components	Acquisition Cost (R Million)	Asset Carrying Value (R Million)	CRC (R Million)	DRC (R Million)	DRC / CRC (%)
Buildings	370	117.60	62.53	324.14	269.08	83.01
Canals	572	308.11	194.92	852.20	739.02	86.72
Dams	878	5 426.18	4 832.40	13 115.10	12 521.33	95.47
Measuring facilities	216	280.39	197.64	726.05	643.53	88.63
Pipelines	60	308.76	230.08	761.20	682.52	89.66
Power supply	2	0.16	0.05	0.46	0.34	75.42
Pump stations	311	113.24	63.02	302.28	252.06	83.39
Reservoirs	7	2.78	2.33	4.6	4.1	90.04
Roads	9	85.83	81.65	122.10	117.92	96.58
Telemetry	5	6.99	6.21	9.28	8.50	91.67
Water Treatment	3	0.58	0.30	1.60	1.32	82.50
Sub-total Infrastructure	**2 433**	**6 650.61**	**5 671.14**	**16 218.99**	**15 239.74**	**93.96**
Land - owned land	20	646.96	645.27	1 789.44	1 789.44	100.00
Land - servitudes	315	56.72	56.72	156.86	156.86	100.00
Sub-total Land	**335**	**703.68**	**701.99**	**1 946.30**	**1 946.30**	**100.00**
Total	**2 768**	**7 354.29**	**6 373.13**	**18 165.29**	**17 186.04**	**94.61**

As shown in Table 4.1, the Cluster has an immovable asset base consisting of: *infrastructure assets* (with a total of 2 433 asset components) and *land* (with a total of 335 asset components). The Cluster's infrastructure asset components have a total DRC and CRC of about R17.186 billion and about R18.165 billion, respectively; whilst land has a total of about

R1.946 billion for both DRC and CRC. The DRC/CRC ratio for infrastructure asset components is about 94%, indicating that about 6% of the infrastructure asset base has been consumed so far.

For infrastructure assets, dams-related asset components have the highest CRC of about R13.115 billion, followed by canals-related asset components with R852.20 million, and pipelines-related asset components with R761.20 million. A similar pattern is evident for DRC.

Figure 4.1 shows the proportional distribution of the Cluster's asset components per asset facility category. The majority of the Cluster's asset components are dams, canals, buildings, land and pump stations related asset components (about 32%, 21%, 14%, 12% and 11%, respectively).

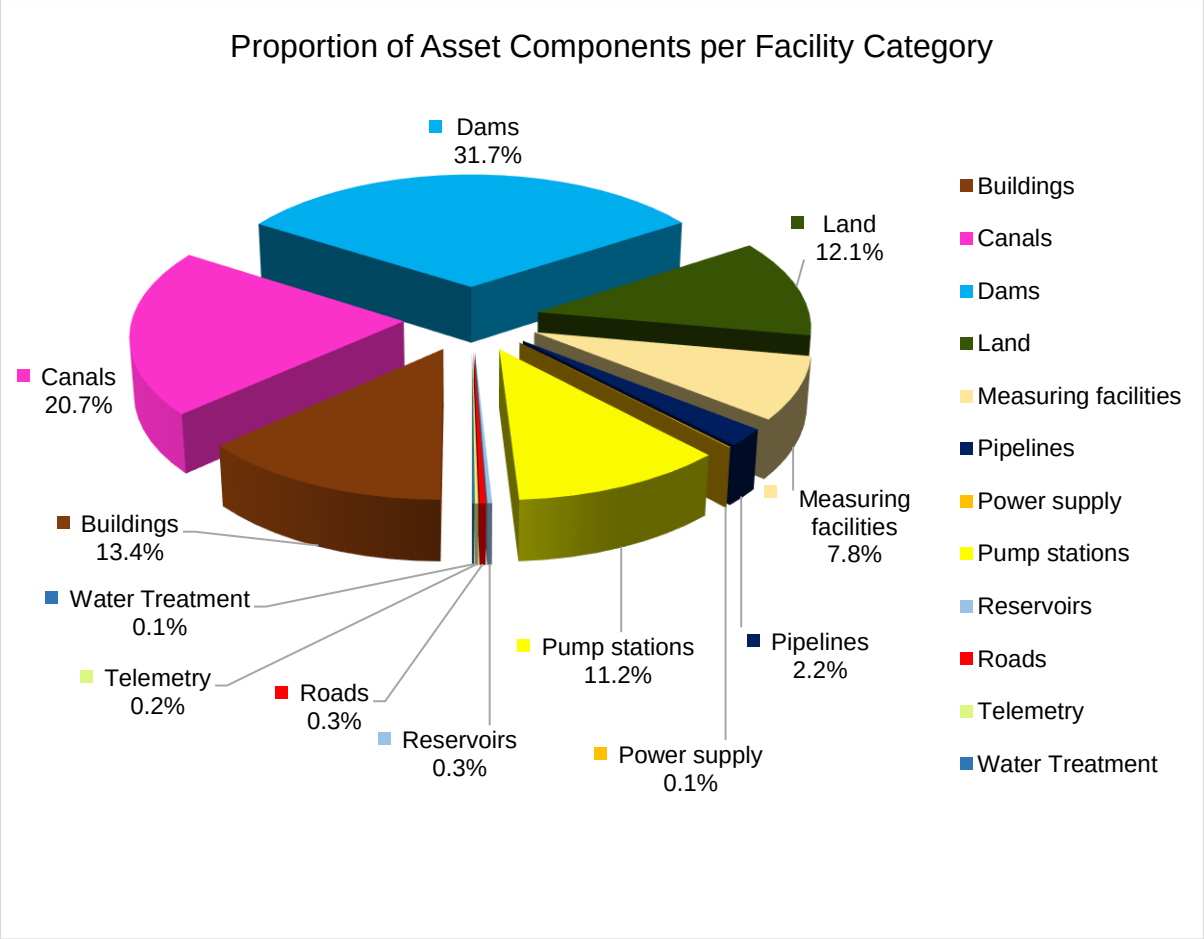


Figure 4.1: Proportion of asset components per asset facility category

Figures 4.2 and 4.3 show the associated proportions of the DRC and CRC per asset facility category, respectively.

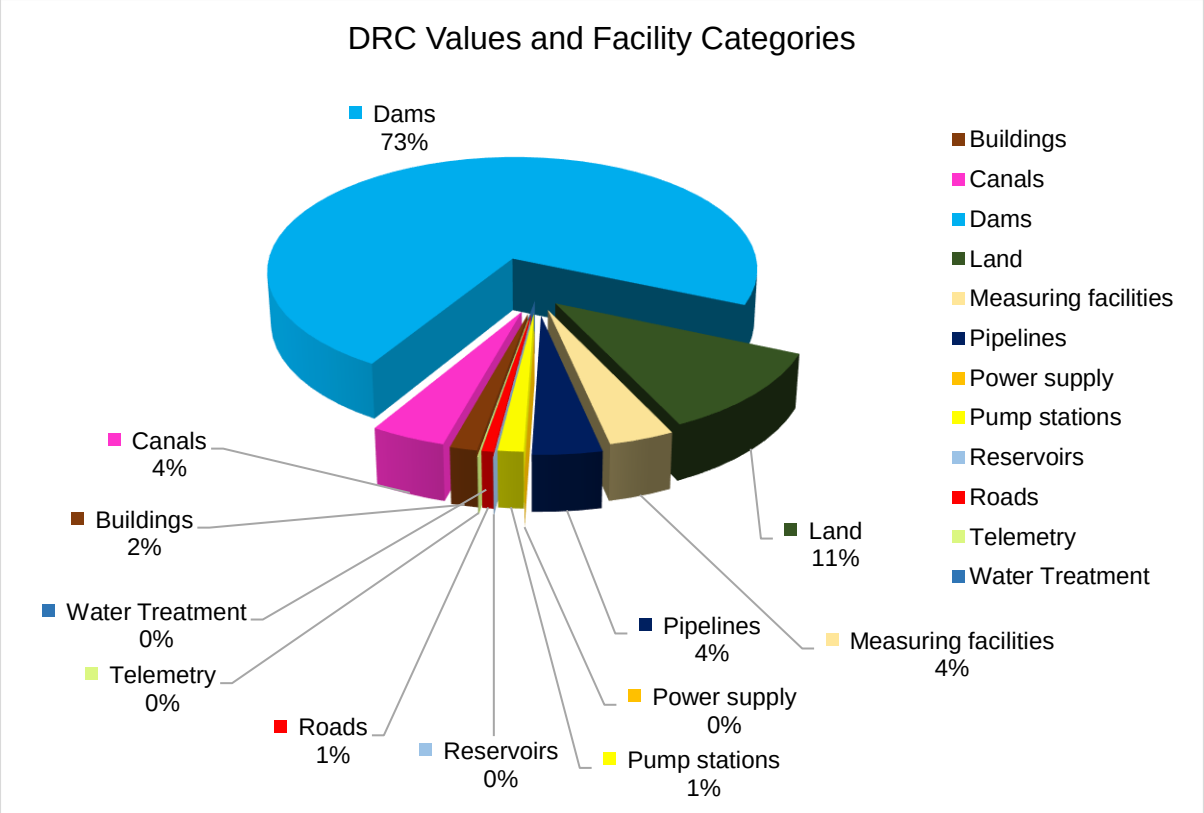


Figure 4.2: DRC per asset facility category

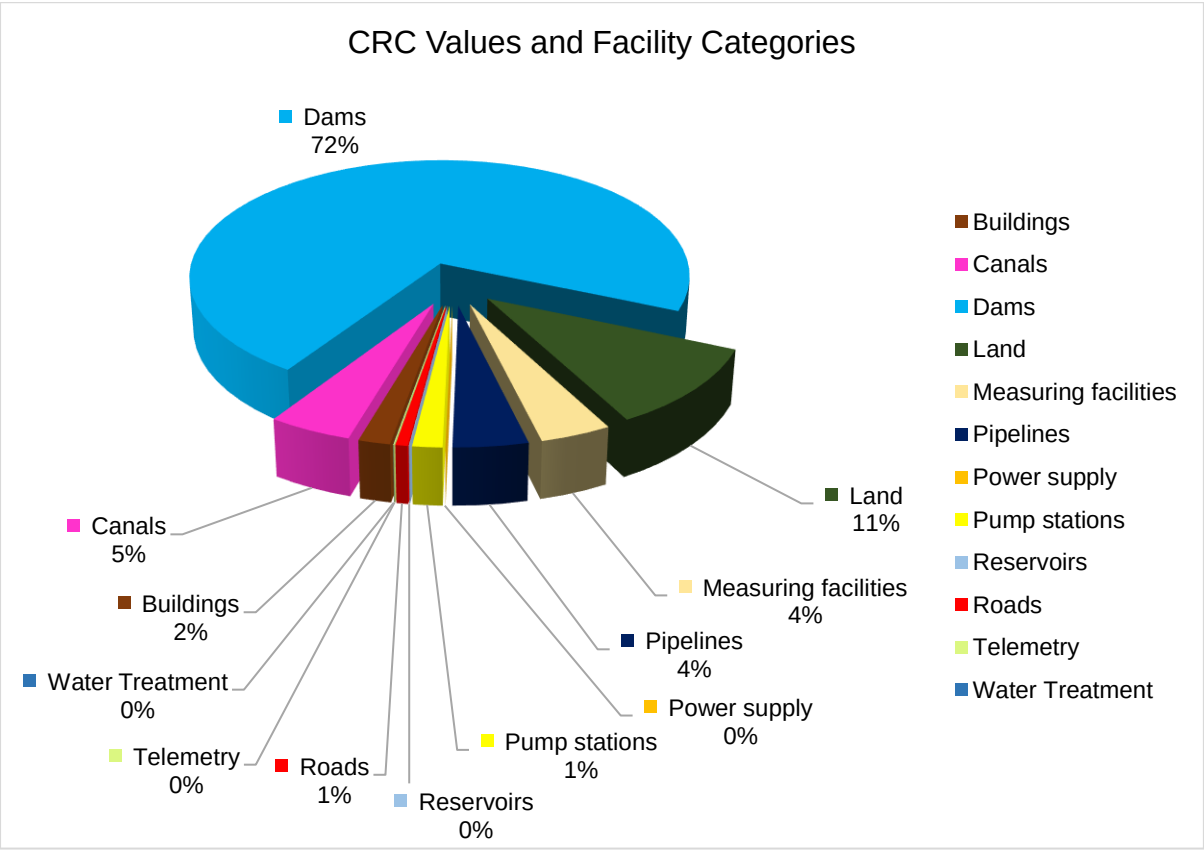


Figure 4.3: CRC per asset facility category

4.2.2 Asset Condition and RUL/EUL Ratio

Table 4.2 shows the asset condition grading criteria as well as the link between the condition grading and the RUL/EUL ratio range.

Table 4.3: Linking asset condition grades to RUL/EUL ratio range

Condition Grade	Description	Detailed Description	Indicative RUL/EUL
5	Very good	Sound structure, well maintained. Only normal maintenance required.	71 - 100%
4	Good	Serves needs but minor deterioration (< 5%). Minor maintenance required.	46 - 70%
3	Fair	Marginal, clearly evident deterioration (10-20%). Significant maintenance required.	26 - 45%
2	Poor	Significant deterioration of structure and/or appearance. Significant impairment of functionality (20-40%). Significant renewal/upgrade required.	11 - 25%
1	Very poor	Unsound, failed, needs reconstruction/ replacement (> 50% needs replacement).	0 - 10%
0	Not Working	Unsound, failed, needs reconstruction/ replacement (100% needs replacement).	0%

Source: Adapted from DWS Immovable Asset Management Policy (2015)

Asset Condition

Table 4.4 and Figure 4.4 show the proportion of asset components per condition grading and per asset facility category. Appendix E, Table E.1, an expanded version of Table 4.4, shows the number of asset components in each condition grading.

- About 88% of the Cluster's infrastructure asset components are in fair, good and good conditions. These include all: pipelines, power supply, reservoirs, roads, telemetry, and water treatment related asset components. Also, the majority of buildings (about 85%), canals (about 96%), dams (about 88%), measuring facilities (about 90%) and pump stations (about 74%) related asset components fall under the same condition gradings. All these asset components require appropriate maintenance to prevent them from deteriorating to poor and very poor condition.
- On the other hand, about 12% of the Cluster's infrastructure asset components have deteriorated to poor and very poor conditions. These are the minority of buildings (about 15%), canals (about 4%), dams (about 12%), measuring facilities (about 10%) and pump stations (about 26%) related asset components. These assets require immediate renewal to ensure they continue delivering the required service.

Table 4.4: Asset component proportions per condition grading and per asset facility category

Asset Facility Category	Condition Grading					Total
	1-Very Poor	2-Poor	3-Fair	4-Good	5-Very Good	
Buildings	7.57%	6.76%	62.97%	21.89%	0.81%	**100.00%**
Canals	0.70%	2.97%	32.34%	63.99%	-	**100.00%**
Dams	1.14%	10.93%	33.49%	37.24%	17.20%	**100.00%**
Measuring facilities	1.40%	8.37%	50.23%	31.63%	8.37%	**100.00%**
Pipelines	-	-	25.00%	36.67%	38.33%	**100.00%**
Power supply	-	-	100.00%	-	-	**100.00%**
Pump stations	12.54%	13.18%	31.19%	19.61%	23.47%	**100.00%**
Reservoirs	-	-	85.71%	-	14.29%	**100.00%**
Roads	-	-	44.44%	11.11%	44.44%	**100.00%**
Telemetry	-	-	40.00%	-	60.00%	**100.00%**
Water Treatment	-	-	66.67%	-	33.33%	**100.00%**
All Cluster asset components	*3.45%*	*8.10%*	*38.98%*	*38.08%*	*11.39%*	***100.00%***

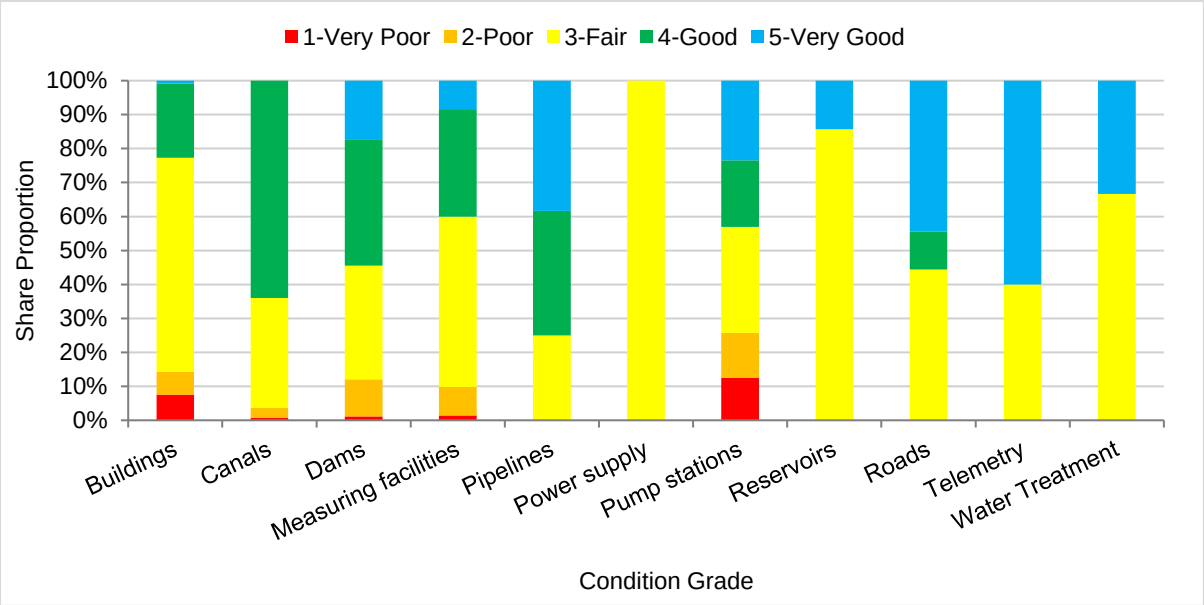
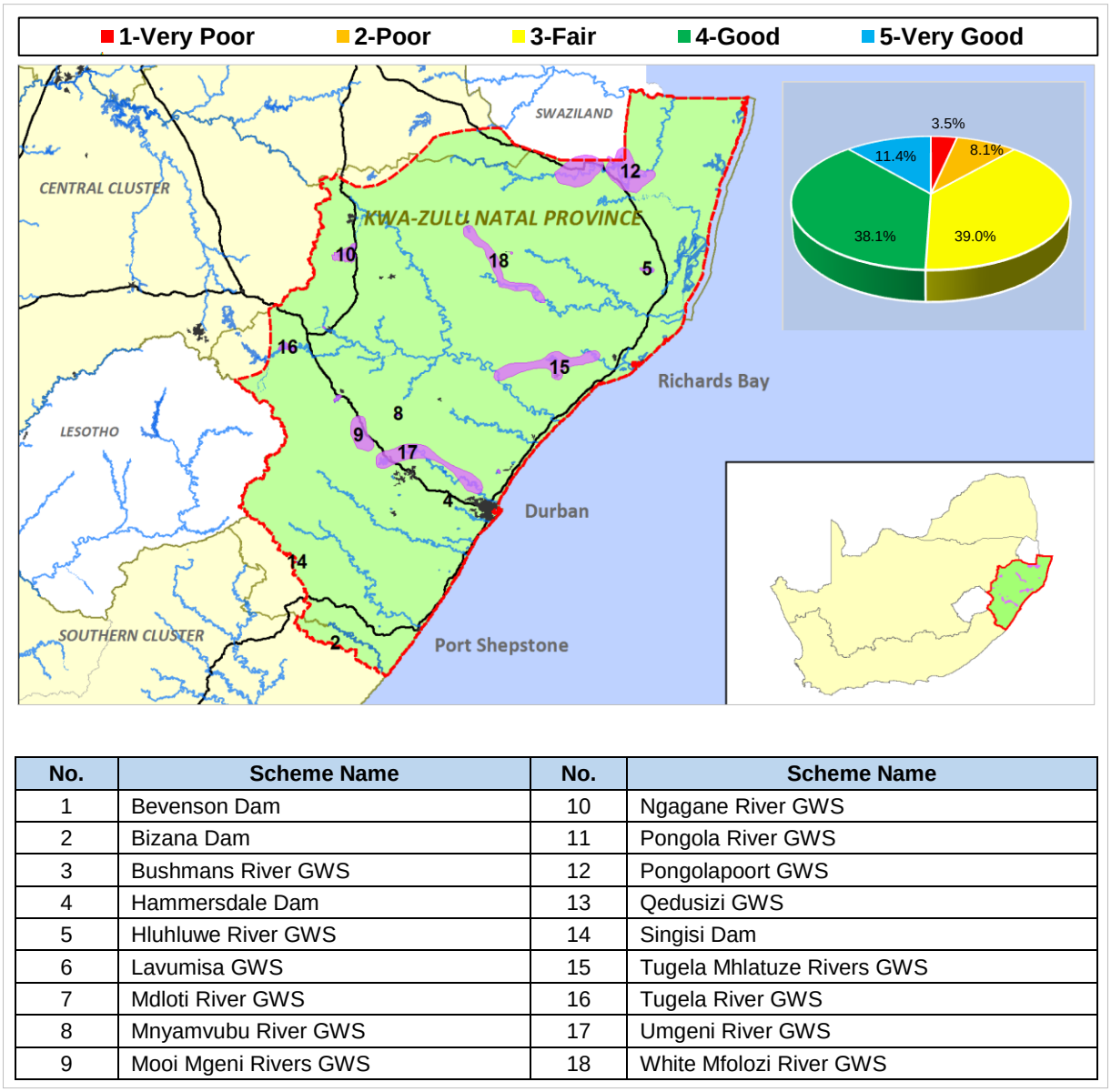


Figure 4.4: Asset component condition grading proportions per asset facility category

Figure 4.5 presents the overall condition gradings of the Cluster's asset components indicating that, as also shown in Table 4.4: about 88% of the Cluster's infrastructure asset components are in fair, good and good conditions; while about 12% are in poor and very poor conditions.



No.	Scheme Name	No.	Scheme Name
1	Bevenson Dam	10	Ngagane River GWS
2	Bizana Dam	11	Pongola River GWS
3	Bushmans River GWS	12	Pongolapoort GWS
4	Hammersdale Dam	13	Qedusizi GWS
5	Hluhluwe River GWS	14	Singisi Dam
6	Lavumisa GWS	15	Tugela Mhlatuze Rivers GWS
7	Mdloti River GWS	16	Tugela River GWS
8	Mnyamvubu River GWS	17	Umgeni River GWS
9	Mooi Mgeni Rivers GWS	18	White Mfolozi River GWS

Figure 4.5: Asset component condition grading proportions for the Cluster

Table 4.5 and Figure 4.6 present the CRCs of the Cluster's infrastructure asset components per condition grading and per asset facility category. Asset components that are in fair, good and very good conditions (representing about 88% of all the Cluster's infrastructure asset components, as shown in Table 4.4 and Figures 4.4 and 4.5) have a total CRC of about R15.997 billion; the main contributions coming from:

- dams-related asset components (representing about 88% of all dams-related asset components, as shown in Table 4.4 and Figure 4.4) with a total CRC of about R12.994 billion;
- canals-related asset components (representing about 96% of all canals-related asset components, as shown in Table 4.4 and Figure 4.4) with a total CRC of about R843.48 million; and

- all pipelines-related asset components (as shown in Table 4.4 and Figure 4.4) with a total CRC of about R761.20 million.

On the other hand, asset components that are in poor and very poor condition (representing about 12% of all the Cluster's infrastructure asset components, as shown in Table 4.3 and Figure 4.4) have a total CRC of about R222.29 million; the main contribution coming from:

- dams-related asset components (representing about 12% of all dams-related asset components, as shown in Table 4.4 and Figure 4.4) with a total CRC of about R120.89 million;
- pump stations-related asset components (representing about 26% of all pump stations-related asset components, as shown in Table 4.4 and Figure 4.4) with a total CRC of about R36.61 million; and
- buildings-related asset components (representing about 15% of all buildings -related asset components, as shown in Table 4.4 and Figure 4.4) with a total CRC of about R33.92 million.

Table 4.5: CRC per condition grading and per asset facility category

Asset Facility Category	**CRC (R Million) per Condition Grading**					**Total**	*% of Total CRC*
	1-Very Poor	**2-Poor**	**3-Fair**	**4-Good**	**5-Very Good**		
Buildings	21.50	12.42	207.36	78.23	4.63	**324.14**	*2.00%*
Canals	0.40	8.33	312.95	530.53		**852.20**	*5.25%*
Dams	27.28	93.61	1 247.17	7 875.26	3 871.78	**13 115.10**	*80.86%*
Measuring facilities	6.47	15.67	464.11	168.83	70.96	**726.05**	*4.48%*
Pipelines			69.64	616.55	75.00	**761.20**	*4.69%*
Power supply			0.46			**0.46**	*0.00%*
Pump stations	8.90	27.71	116.15	105.41	44.10	**302.28**	*1.86%*
Reservoirs			2.20		2.39	**4.59**	*0.03%*
Roads			0.28	1.97	119.85	**122.10**	*0.75%*
Telemetry			1.66		7.61	**9.28**	*0.06%*
Water Treatment			1.16		0.44	**1.60**	*0.01%*
Total	**64.55**	**157.75**	**2 423.15**	**9 376.78**	**4 196.77**	**16 218.99**	***100.00%***
% of Total CRC	*0.40%*	*0.97%*	*14.94%*	*57.81%*	*25.88%*	***100.00%***	

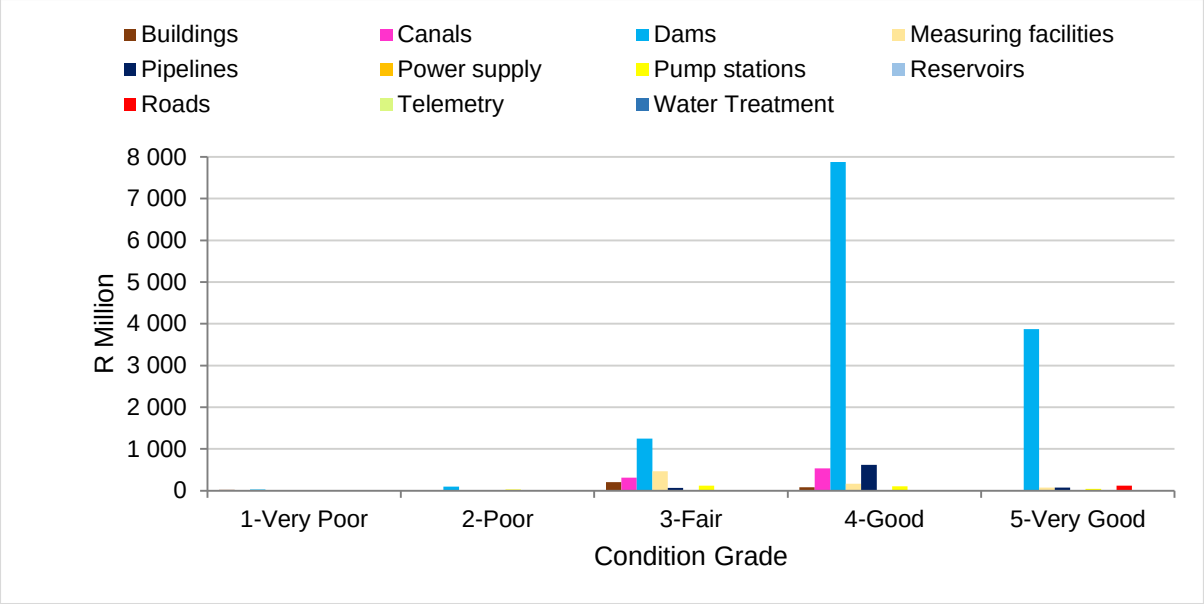


Figure 4.6: CRC per condition grading and per asset facility category

Asset RUL/EUL ratio

Table 4.6 and Figure 4.7 show the proportions of RUL/EUL ratio per asset facility category components. Appendix E, Table E.2, an expanded version of Table 4.6, shows the number of asset components in each RUL/EUL ratio range.

- About 88% of the Cluster's infrastructure asset components have RUL/EUL ratios in the 26% to 100% range. These include all: pipelines, power supply, reservoirs, roads, telemetry, and water treatment related asset components. Also, the majority of buildings (about 85%), canals (about 96%), dams (about 88%), measuring facilities (about 90%) and pump stations (about 74%) related asset components fall under the same RUL/EUL ratio ranges. These asset components require appropriate maintenance to ensure they continue to meet the required service.
- On the other hand, about 12% of the Cluster's infrastructure asset components have RUL/EUL ratios of 25% and below. These are the minority of buildings (about 15%), canals (about 4%), dams (about 12%), measuring facilities (about 10%) and pump stations (about 26%) related asset components. The RUL/EUL ratios of 25% and below mean that these asset components are nearing the end of their EULs; calling for immediate asset renewal to extend their useful lives.

Table 4.6: Asset component proportions per RUL/EUL ratio and per asset facility category

Asset Facility Category	RUL/EUL Ratio					Total
	0-10%	11-25%	26-45%	46-70%	71-100%	
Buildings	7.57%	6.76%	62.97%	21.89%	0.81%	**100.00%**
Canals	0.70%	2.97%	32.34%	63.99%	-	**100.00%**
Dams	1.14%	10.93%	33.49%	37.24%	17.20%	**100.00%**
Measuring facilities	1.39%	8.33%	50.00%	31.94%	8.33%	**100.00%**
Pipelines	-	-	25.00%	36.67%	38.33%	**100.00%**
Power supply	-	-	100.00%	-	-	**100.00%**
Pump stations	12.54%	13.18%	31.19%	19.61%	23.47%	**100.00%**
Reservoirs	-	-	85.71%	-	14.29%	**100.00%**
Roads	-	-	44.44%	11.11%	44.44%	**100.00%**
Telemetry	-	-	40.00%	-	60.00%	**100.00%**
Water Treatment	-	-	66.67%	-	33.33%	**100.00%**
All Cluster asset components	*3.45%*	*8.10%*	*38.96%*	*38.10%*	*11.39%*	***100.00%***

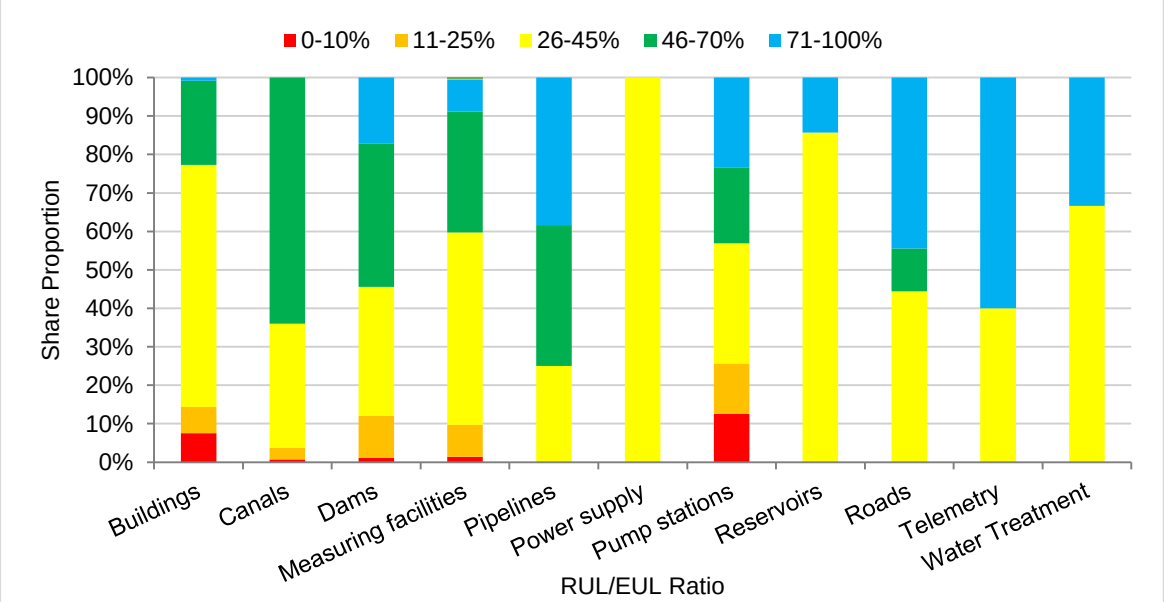


Figure 4.7: Asset component proportions per RUL/EUL ratio and per asset facility category

Table 4.7 and Figure 4.8 present the CRCs of the Cluster's asset components per RUL/EUL ratio range and per asset facility category. Asset components with RUL/EUL ratios in the ranges 26% to 100% (representing about 88% of all the Cluster's asset components, as shown in Table 4.6 and Figure 4.7) have a total CRC of about R15.997 billion; the main contributions coming from:

- dams-related asset components (representing about 88% of all dams-related asset components, as shown in Table 4.6 and Figure 4.7) with a total CRC of about R12.994 billion;
- canals-related asset components (representing about 96% of all canals-related asset components, as shown in Table 4.6 and Figure 4.7) with a total CRC of about R843.48

million; and

- all pipelines-related asset components (as shown in Table 4.6 and Figure 4.7) with a total CRC of about R761.20 million.

On the other hand, asset components with RUL/EUL ratios of 25% and below (representing about 12% of all the Cluster's asset components, as shown in Table 4.6 and Figure 4.7) have a total CRC of about R222.29 million; the main contribution coming from:

- dams-related asset components (representing about 12% of all dams-related asset components, as shown in Table 4.6 and Figure 4.7) with a total CRC of about R120.89 million;
- pump stations-related asset components (representing about 26% of all pump stations-related asset components, as shown in Table 4.6 and Figure 4.7) with a total CRC of about R36.61 million; and
- buildings-related asset components (representing about 15% of all buildings -related asset components, as shown in Table 4.6 and Figure 4.7) with a total CRC of about R33.92 million.

Table 4.7: CRC per RUL/EUL ratio and per asset facility category

Asset Facility Category	**CRC (R Million) per RUL/EUL ratio**					**Total**	*% of Total CRC*
	0-10%	**11-25%**	**26-45%**	**46-70%**	**71-100%**		
Buildings	21.50	12.42	207.36	78.23	4.63	**324.14**	*2.00%*
Canals	0.40	8.33	312.95	530.53		**852.20**	*5.25%*
Dams	27.28	93.61	1 247.17	7 875.26	3 871.78	**13 115.10**	*80.86%*
Measuring facilities	6.47	15.67	464.11	168.83	70.96	**726.05**	*4.48%*
Pipelines			69.64	616.55	75.00	**761.20**	*4.69%*
Power supply			0.46			**0.46**	*0.00%*
Pump stations	8.90	27.71	116.15	105.41	44.10	**302.28**	*1.86%*
Reservoirs			2.20		2.39	**4.59**	*0.03%*
Roads			0.28	1.97	119.85	**122.10**	*0.75%*
Telemetry			1.66		7.61	**9.28**	*0.06%*
Water Treatment			1.16		0.44	**1.60**	*0.01%*
Total	**64.55**	**157.75**	**2 423.15**	**9 376.78**	**4 196.77**	**16 218.99**	***100.00%***
% of Total CRC	*0.40%*	*0.97%*	*14.94%*	*57.81%*	*25.88%*	***100.00%***	

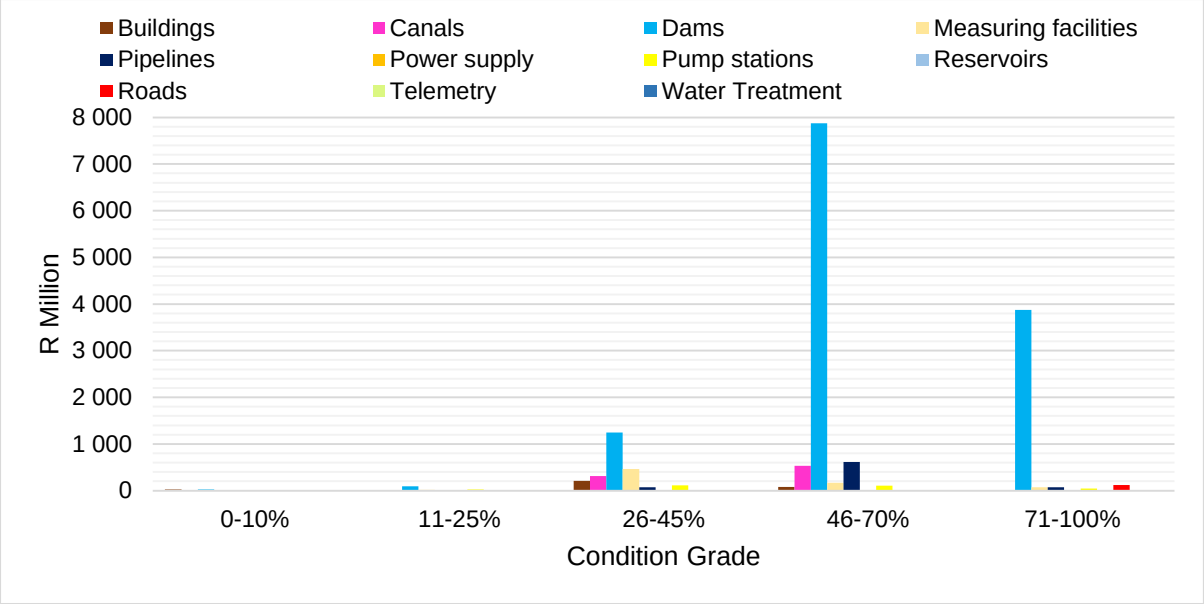


Figure 4.8: CRC per RUL/EUL ratio and per asset facility category

4.2.3 Asset Criticality

In this AMP, asset components are graded in terms of criticality according to the criteria listed in Table 4.8.

Table 4.8: Asset criticality grading criteria

Grade	Criticality Description	Consequence of Failure (Impact)	Qualitative Description
1	Very Low	Insignificant	Is readily absorbed under normal operating conditions.
2	Low	Minor	Can be managed under normal operating conditions.
3	Moderate	Moderate	Can be managed but requires additional resources and management effort.
4	High	Major	Will have a prolonged impact and extensive consequences.
5	Very High	Catastrophic	Irreversible and extensive impacts, or will significantly undermine business objectives.

Table 4.9 and Figure 4.9 show the proportions of the criticality grade per asset facility category. Appendix E, Table E.3, an expanded version of Table 4.9, shows the number of asset components in each criticality grade. For this Cluster:

- About 65% of the Cluster's asset components are in the moderate, high and very high criticality grades. These include the majority of: buildings (about 78%); dams (about 81%); pipelines (about 78%); and pump stations (about 92%) related asset components. In the event of failure, these asset components will cause a moderate to catastrophic impact on the Cluster's ability to meet the required levels of service. Thus, these assets require appropriate maintenance and renewal to ensure they continue

delivering the required service.

- On the other hand, about 35% of the Cluster's asset components are in the low and very low criticality grades. These include all: power supply; reservoirs; roads; telemetry; and water treatment related asset components. Also, the majority of canals and measuring facilities related asset components are in the same criticality gradings. In the event of failure, these asset components will cause a minor to insignificant impact on the Cluster's ability to meet the required levels of service.

Table 4.9: Asset component proportions per Criticality grading and per asset facility category

Asset Facility Category	Criticality Grading					Total
	1-Very Low	2-Low	3-Moderate	4-High	5-Very High	
Buildings	10.00%	11.89%	77.57%	0.54%	-	**100.00%**
Canals	3.67%	58.74%	36.71%	0.87%	-	**100.00%**
Dams	2.39%	16.17%	26.31%	50.46%	4.67%	**100.00%**
Measuring facilities	35.19%	50.00%	14.35%	0.46%	-	**100.00%**
Pipelines	1.67%	20.00%	45.00%	33.33%	-	**100.00%**
Power supply	-	100.00%	-	-	-	**100.00%**
Pump stations	-	8.36%	33.44%	34.41%	23.79%	**100.00%**
Reservoirs	-	100.00%	-	-	-	**100.00%**
Roads	88.89%	11.11%	-	-	-	**100.00%**
Telemetry	-	60.00%	40.00%	-	-	**100.00%**
Water Treatment	-	100.00%	-	-	-	**100.00%**
All Cluster asset components	*6.74%*	*28.11%*	*36.66%*	*23.76%*	*4.73%*	***100.00%***

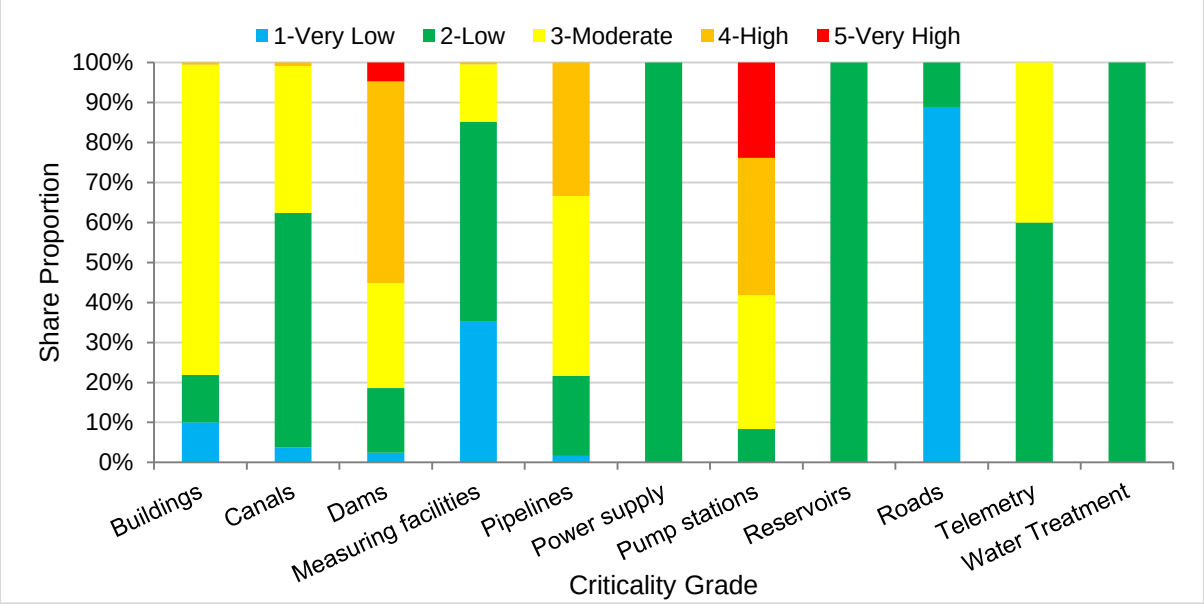
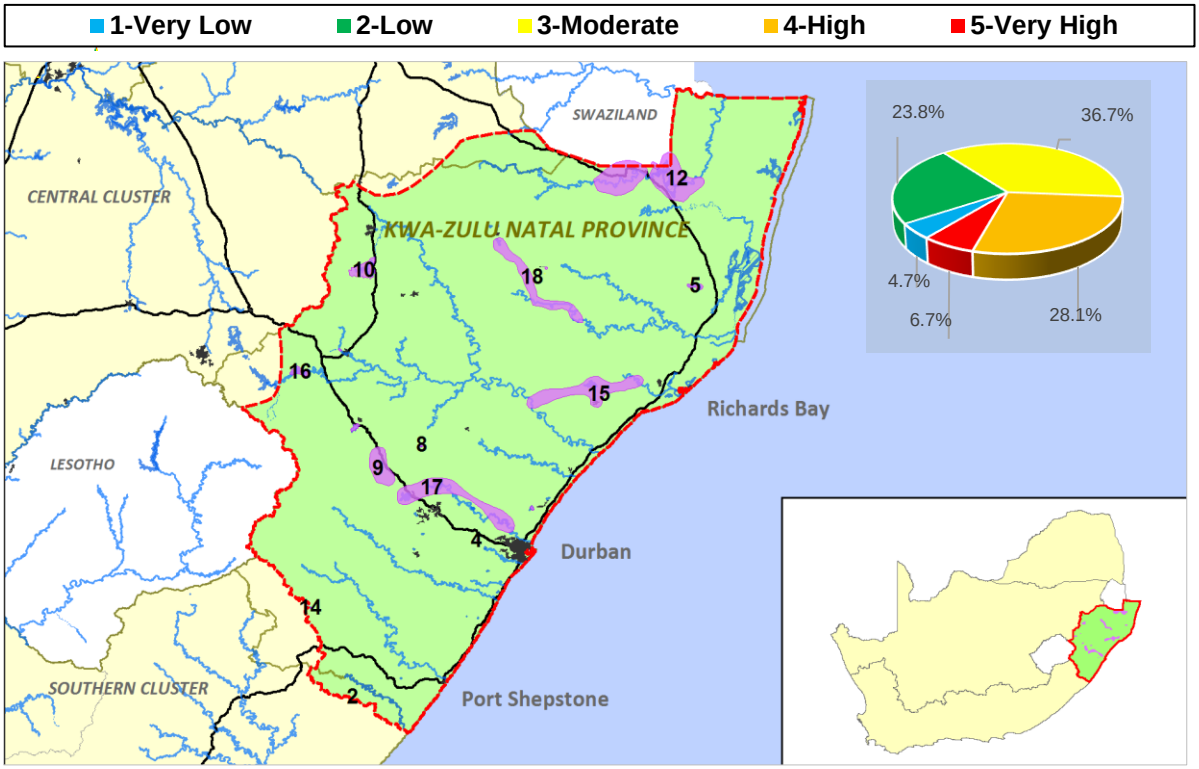


Figure 4.9: Asset component proportions per Criticality grading and per asset facility category

Figure 4.10 presents the overall criticality gradings of the Cluster's asset components

indicating that, as also shown in Table 4.9: about 65% of the Cluster's infrastructure asset components are in moderate, high and very high criticality gradings; while about 35% are in the low and very low criticality gradings.



No.	Scheme Name	No.	Scheme Name
1	Bevenson Dam	10	Ngagane River GWS
2	Bizana Dam	11	Pongola River GWS
3	Bushmans River GWS	12	Pongolapoort GWS
4	Hammersdale Dam	13	Qedusizi GWS
5	Hluhluwe River GWS	14	Singisi Dam
6	Lavumisa GWS	15	Tugela Mhlatuze Rivers GWS
7	Mdloti River GWS	16	Tugela River GWS
8	Mnyamvubu River GWS	17	Umgeni River GWS
9	Mooi Mgeni Rivers GWS	18	White Mfolozi River GWS

Figure 4.10: Asset criticality grading proportions for the Cluster

Table 4.10 and Figure 4.11 show the CRCs of the Cluster's asset components per criticality grading and per asset facility category. Asset components that are of moderate, high and very high criticality (representing about 65% of all the Cluster's asset components, as shown in Table 4.9 and Figures 4.9 and 4.10) have a total CRC of about R14.726 billion, with main contributions coming from:

- dams related assets (representing about 81% of all dams related asset components, as shown in Table 4.9 and Figure 4.9) with a total CRC of R12.761 billion;

- pipelines related assets (representing about 78% of all pipelines related asset components, as shown in Table 4.9 and Figure 4.9) with a total CRC of R710.66 million; and
- canals related assets (representing about 37% of all canals related asset components, as shown in Table 4.9 and Figure 4.9), with a total CRC of R599.26 million.

On the other hand, asset components that are of low and very low criticality (representing about 35% of all the Cluster's asset components, as shown in Table 4.9 and Figure 4.9) have a total CRC of about R1.493 billion, with the main contributions coming from:

- measuring facilities assets (representing about 37% of all canals related asset components, as shown in Table 4.9 and Figure 4.9) with a total CRC of R550.20 million;
- dams related assets (representing about 19% of all dams related asset components, as shown in Table 4.9 and Figure 4.9) with a total CRC of R353.67 million; and
- canals related assets (representing about 63% of all canals related asset components, as shown in Table 4.9 and Figure 4.9) with a total CRC of R252.95 million.

Table 4.10: CRC per Criticality grading and per asset facility category

Asset Facility Category	**Criticality Grading vs CRC (R Million)**					**Total**	*% of Total CRC*
	1-Very Low	**2-Low**	**3-Moderate**	**4-High**	**5-Very High**		
Buildings	76.20	25.92	221.44	0.58		**324.14**	*2.00%*
Canals	15.90	237.05	545.76	53.50		**852.20**	*5.25%*
Dams	33.20	320.47	1 270.52	2 304.43	9 186.49	**13 115.10**	*80.86%*
Measuring facilities	28.50	521.70	166.91	8.93		**726.05**	*4.48%*
Pipelines	0.37	50.17	667.00	43.66		**761.20**	*4.69%*
Power supply		0.46				**0.46**	*0.00%*
Pump stations		46.90	65.91	65.10	124.37	**302.28**	*1.86%*
Reservoirs		4.59				**4.59**	*0.03%*
Roads	116.90	5.20				**122.10**	*0.75%*
Telemetry		7.61	1.66			**9.28**	*0.06%*
Water Treatment		1.60				**1.60**	*0.01%*
Total	**271.07**	**1 221.66**	**2 939.20**	**2 476.19**	**9 310.86**	**16 218.99**	***100.00%***
% of Total CRC	*1.67%*	*7.53%*	*18.12%*	*15.27%*	*57.41%*	***100.00%***	

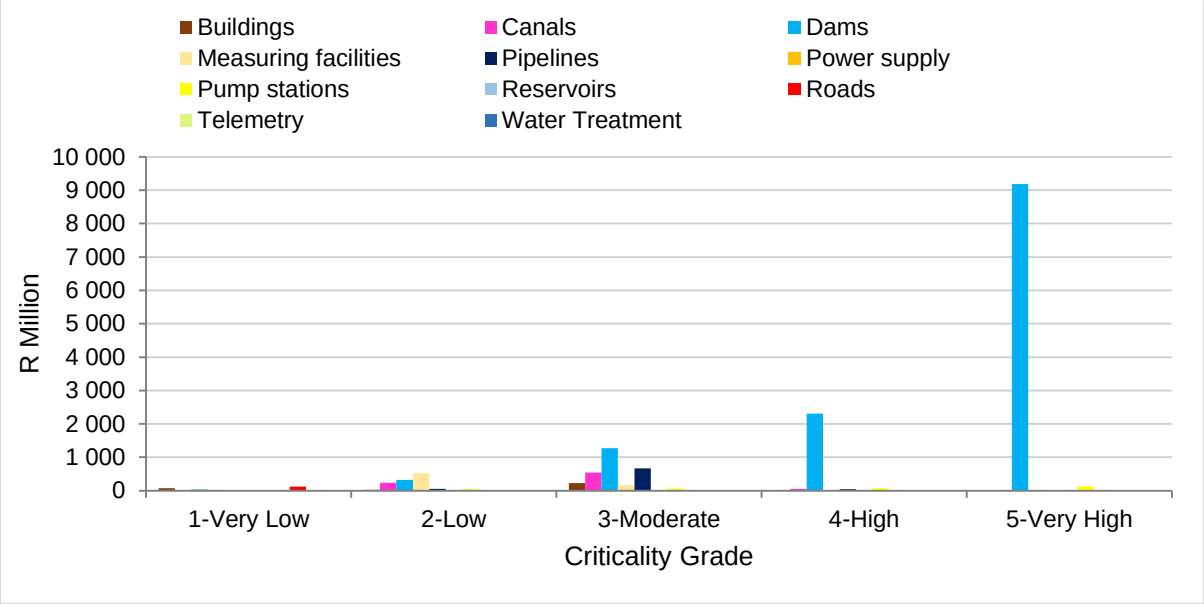


Figure 4.11: CRC per Criticality grading and per asset facility category

4.2.4 Asset Utilization

Assets are graded in terms of utilisation according to the criteria listed in Table 4.11.

Table 4.11: Asset utilisation grading criteria

Grade	Utilisation Description
0	Not in use
1	Strategic redundancy
2	Under-utilised
3	Moderate use
4	Approaching design capacity
5	Exceeding capacity/stressed

Table 4.12 and Figure 4.12 show the proportion of asset utilisation grading per asset facility category. Appendix E, Table E.4, an expanded version of Table 4.12, shows the number of asset components in each utilisation grade. For this Cluster:

- About 2.3% of the Cluster's asset components are under-utilised. These include: buildings (about 7%); measuring facilities (about 8%); the two power supply; roads (about 44%); reservoirs (about 40%) and telemetry (about 40%) related asset components. The reasons for the under-utilisation need to be assessed and consideration made for decommissioning and disposal, where necessary.
- About 57% of the Cluster's asset components are 'approaching design capacity' in utilisation; which means that these asset components require continual monitoring and planning to avoid exceeding design capacity.

- About 3.7% of the Cluster's asset components are exceeding design capacity. These include: 35% of pipelines; and about 11% of pump stations related asset components. These asset components need to be upgraded immediately to avoid stress related failures, and to ensure the Cluster meets the required level of service.

Table 4.12: Asset component Utilisation grading proportions per asset facility category

Asset Facility Category	Utilization Grading					Total
	1-Strategic redundancy	2-Under-utilised	3-Moderate use	4-Approaching design capacity	5-Exceeding capacity / stressed	
Buildings	1.62%	6.76%	5.95%	85.41%	0.27%	**100.00%**
Canals	-	-	81.47%	18.53%	-	**100.00%**
Dams	-	0.57%	24.49%	71.07%	3.87%	**100.00%**
Measuring facilities	-	7.91%	19.07%	73.02%	-	**100.00%**
Pipelines	-	-	21.67%	43.33%	35.00%	**100.00%**
Power supply	-	100.00%	-	-	-	**100.00%**
Pump stations	-	-	38.26%	50.80%	10.93%	**100.00%**
Reservoirs	-	14.29%	-	85.71%	-	**100.00%**
Roads	-	44.44%	44.44%	11.11%	-	**100.00%**
Telemetry	-	40.00%	60.00%	-	-	**100.00%**
Water Treatment	-	-	-	100.00%	-	**100.00%**
All Cluster asset components	*0.25%*	*2.30%*	*36.31%*	*57.44%*	*3.70%*	***100.00%***

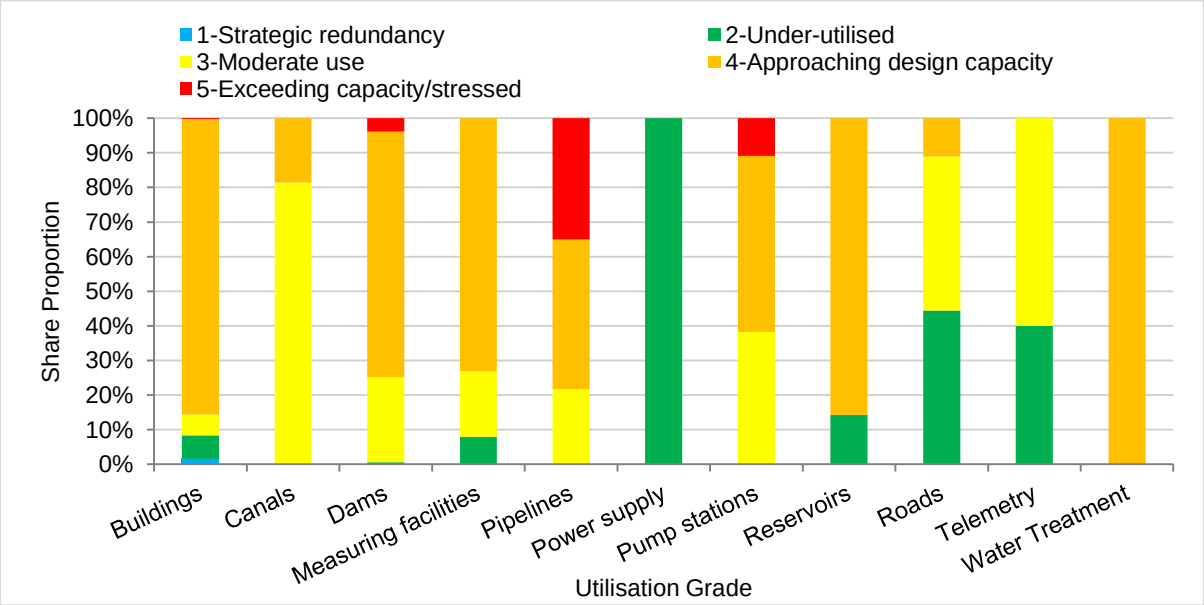
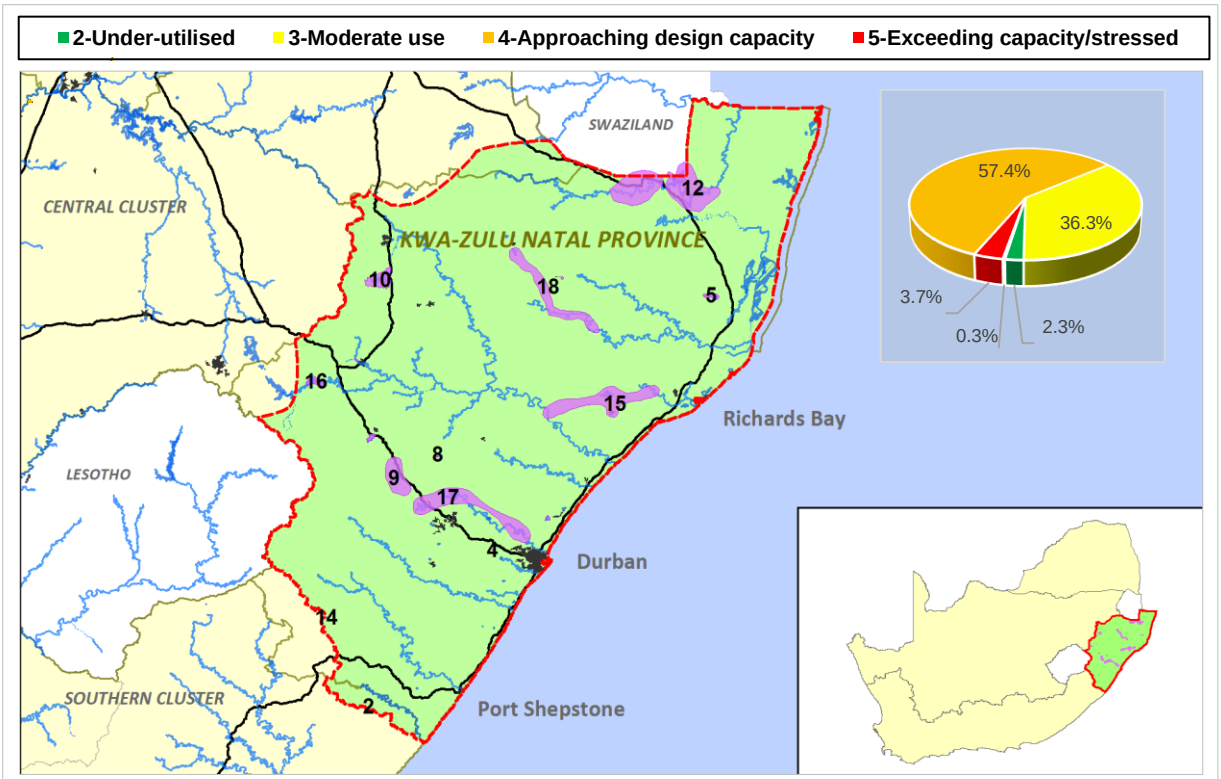


Figure 4.12: Asset component Utilisation grading proportions per asset facility category

Figure 4.10 presents the overall utilisation gradings of the Cluster's asset components, in line with Table 4.9.



No.	Scheme Name	No.	Scheme Name
1	Bevenson Dam	10	Ngagane River GWS
2	Bizana Dam	11	Pongola River GWS
3	Bushmans River GWS	12	Pongolapoort GWS
4	Hammersdale Dam	13	Qedusizi GWS
5	Hluhluwe River GWS	14	Singisi Dam
6	Lavumisa GWS	15	Tugela Mhlatuze Rivers GWS
7	Mdloti River GWS	16	Tugela River GWS
8	Mnyamvubu River GWS	17	Umgeni River GWS
9	Mooi Mgeni Rivers GWS	18	White Mfolozi River GWS

Figure 4.13: Asset component utilisation grading proportions for the Cluster

Table 4.13 and Figure 4.14 show the CRCs of the Cluster's infrastructure asset components per utilisation grading and per asset facility category.

Under-utilised asset components (representing about 2.3% of all the Cluster's infrastructure asset components, as shown in Table 4.12 and Figure 4.12) have a total CRC of R30.65 million, with the main contributions coming from:

- measuring facilities related assets (representing 7.91% of all measuring facilities-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R13.56 million; and
- buildings related assets (representing 6.76% of all buildings-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R10.72 million.

Asset components that are approaching design capacity (representing 57.44% of all the Cluster's asset components) have a total CRC of about R3.197 billion, with the main contributions coming from:

- dams related assets (representing about 71% of all dams-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R1.421 billion;
- measuring facilities related assets (representing about 73% of all measuring facilities-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R649.93 million; and
- pipelines related assets (representing about 43% of all pipelines-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R395.63 million.

Asset components that are stressed (exceeding design capacity on utilisation) (representing 3.70% of all the Cluster's infrastructure asset components, as shown in Table 4.12 and Figure 4.12) have a total CRC of about R362.76 million, with the main contributions coming from:

- pipelines related assets (representing 35% of all pipelines-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R297.58 million; and
- dams related assets (representing about 4% of all dams-related asset components, as shown in Table 4.12 and Figure 4.12), with a total CRC of R56.51 million.

Table 4.13: CRC per Utilization grading and per asset facility category

Asset Facility Category	**Utilisation Grading vs CRC (R Million)**					**Total**	*% of Total CRC*
	1-Strategic redundancy	**2-Under-utilised**	**3-Moderate use**	**4-Approaching design capacity**	**5-Exceeding capacity / stressed**		
Buildings	2.61	10.72	19.87	288.54	2.40	**324.14**	*2.00%*
Canals			565.70	286.50		**852.20**	*5.25%*
Dams		1.57	11 635.39	1 421.63	56.51	**13 115.10**	*80.86%*
Measuring facilities		13.56	62.56	649.93		**726.05**	*4.48%*
Pipelines			67.98	395.63	297.58	**761.20**	*4.69%*
Power supply		0.46				**0.46**	*0.00%*
Pump stations			146.13	149.87	6.27	**302.28**	*1.86%*
Reservoirs		2.39		2.20		**4.59**	*0.03%*
Roads		0.28	119.85	1.97		**122.10**	*0.75%*
Telemetry		1.66	7.61			**9.28**	*0.06%*
Water Treatment				1.60		**1.60**	*0.01%*
Total	**2.61**	**30.65**	**12 625.10**	**3 197.87**	**362.76**	**16 218.99**	***100.00%***
% of Total CRC	*0.02%*	*0.19%*	*77.84%*	*19.72%*	*2.24%*	***100.00%***	

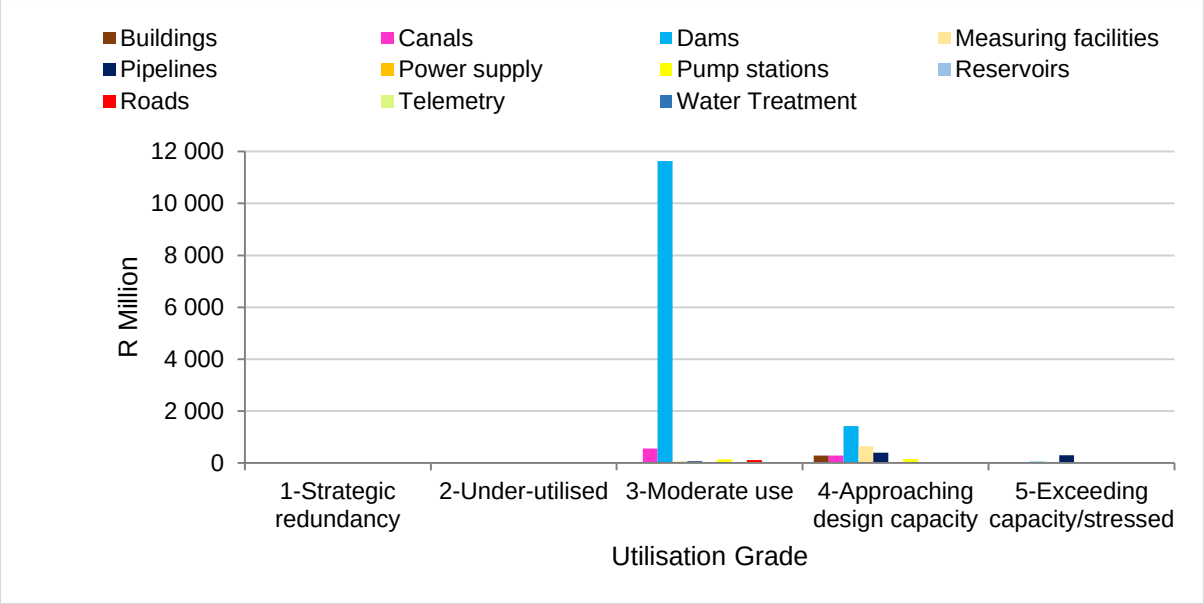


Figure 4.14: CRC per Utilization grading and per asset facility category

4.3 Risk Management

4.3.1 Risk Management Process

In this AMP, 'risk' refers to the possibility that an undesired outcome disrupts the service offered by the Cluster, resulting in the Cluster failing to meet its set levels of service. Risk management is, thus, an indispensable part of infrastructure Asset Management Planning and Implementation. Typically, the risk management process includes the following key steps:

- Identification of risk events and their impacts;
- Analysing the risks (identification of the risk drivers; determining their likelihoods; and calculating their expected losses);
- Prioritizing the risks, so that one can take appropriate action starting with the most devastating risks;
- Resolving the risks through taking some actions, e.g. avoiding, transferring or mitigating the risk; or redundancy measures; and
- Continual monitoring of risk resolution action plans, termination of successful action plans, identification of new risks that, and initiation of new risk resolution action plans.

Risk (expected loss) is calculated by determining the product of the likelihood of the risk and the total amount of loss (impact) when the risk occurs:

Expected Loss (Risk) = Risk Likelihood x Total Loss (Impact)

As indicated in Section 4.2.3 of this AMP, impact is related to criticality. For this Cluster, however, risk likelihood was not captured in the Asset Register (see Appendix A) used in the

development of this AMP. Hence, an in-depth risk analysis could not be conducted. It is, thus, recommended that the DWS captures risk likelihood in its infrastructure asset register so that the next update of this AMP can address this short-coming.

4.3.2 The Cluster's Risks and Resolution Actions

Whilst cognisant of the presence of non-asset related risks (such as understaffing, vandalism, theft, etc.), this Cluster AMP focuses mainly on infrastructure asset-related risks. Table 4.13 shows some of the Cluster's key asset-related risks and associated risk resolution actions (aimed at reducing the risk likelihood) recommended in this AMP:

Table 4.14: The Cluster's asset risks and recommended resolution actions

No.	Asset Risk	Status for the Cluster	Recommended Risk Resolution Action
1	*Condition risk:* Failure by the asset to deliver the required service due to deteriorated physical condition.	About 12% of the Cluster's infrastructure asset components (with a total CRC of about R222.29 million) have deteriorated to poor and very poor conditions. Refer to Section 4.2.2.	Implement immediate renewal of the asset components to ensure they continue delivering the required service. Refer to Section 4.4.2 for the recommended renewal strategies per asset component.
		About 88% of the Cluster's infrastructure asset components (with a total CRC of about R15.997 billion) are in fair to very good conditions. Refer to Section 4.2.2.	Conduct appropriate maintenance to prevent the asset components from deteriorating to poor and very poor condition. Refer to Section 4.4.1 for the recommended maintenance strategies per asset component.
2	*Capacity risk:* Failure by the asset to deliver the required service as a result of it exceeding its design capacity/stressed.	About 3.7% of the Cluster's infrastructure asset components (with a total CRC of about R362.76 million) are stressed (exceeding design capacity on utilisation). About 57% of the Cluster's infrastructure asset components (with a total CRC of about R3.197 billion) are approaching design capacity in utilisation. Refer to Section 4.2.4.	Consider and implement appropriate upgrades and/or new capital investments, immediately, to avoid stress related failures, and to ensure the Cluster meets the required levels of service. Refer to Section 4.4.3.
3	*Not in use / under-utilisation risk:* Misallocation of resources (e.g. financial, human resources, material, etc.).	About 2.3% of the Cluster's infrastructure asset components (with a total CRC of R30.65 million) are under-utilised. Refer to Section 4.2.4.	Assess the reasons for non/under-utilisation and consider asset decommissioning and disposal of.

For generic risks typically associated with the different asset facility categories, refer to Appendix F.

4.4 Asset Life Cycle Works and Strategies

The key stages of an asset life cycle include: planning, design, procurement, construction, commissioning, operation, maintenance, renewal, upgrading and disposal. Thus, asset life cycle management involves decision making, planning and control over acquisition, operation, maintenance, renewal, upgrading, safeguarding and disposal of an asset to maximise its service delivery potential and benefits, and to minimise its related risks and costs over its entire life cycle (i.e. “cradle to the grave”).

In order for the Cluster to meet the levels of service agreed with its water users (see Section 2) and the projected future raw water demand (see Sections 3), the Cluster needs to accordingly carry out the following asset life cycle management activities and works:

- Operations and Maintenance;
- Renewals;
- Upgrades and new capital investments; and
- Disposals.

The associated expenditure requirements for each of the abovementioned activities are outlined in the Section 5 of this AMP.

Noteworthy is that the quality and usefulness of an AMP is highly dependent on the completeness and accuracy of the asset register used in the development of the AMP. Accordingly, the abovementioned asset life cycle management activities and works recommended for the Cluster in this AMP are highly dependent on the asset component condition, criticality and utilisation gradings captured in the asset register used in the development of this AMP. As such, execution of the abovementioned asset life cycle management activities and works recommended for the Cluster (as detailed in the following subsections) need to be adapted in line with the realities on the ground. Refer to Section 6 regarding some recommendations on how to improve on the current NWRI immovable asset register.

Asset component maintenance and renewals works in this AMP have been prioritised using the criteria shown in Table 4.15. For example, renewal works priorities were set as follows: VH-NW (top priority); VH-VP; VH-P; H-NW; H-VP; H-P; M-NW; M-VP; and M-P, making sure that the asset components have not been marked for disposal.

Table 4.15: Asset criticality versus condition grading

Criticality Grade	Condition Grade					
	For Maintenance			For Renewals		
	5 Very Good (VG)	4 Good (G)	3 Fair (F)	2 Poor (P)	1 Very Poor (VP)	0 Not Working (NW)
1 Very Low (VL)	VL-VG	VL-G	VL-F	VL-P	VL-VP	VL-NW
2 Low (L)	L-VG	L-G	L-F	L-P	L-VP	L-NW
3 Moderate (M)	M-VG	M-G	M-F	M-P	M-VP	M-NW
4 High (H)	H-VG	H-G	H-F	H-P	H-VP	H-NW
5 Very High (VH)	VH-VG	VH-G	VH-F	VH-P	VH-VP	VH-NW

4.4.1 Operations and Maintenance (O&M)

Operations

Operations includes activities associated with the delivery of service (raw water supply) to the customers (water users) through the utilisation of the Cluster's immovable assets, which consume resources such as manpower, energy, chemicals and materials. Operations require two key resources: direct and indirect manpower and utilities (e.g. electricity, fuel and chemicals).

Operation of the Cluster's immovable assets needs to be done in line with the relevant O&M Manuals and Operating Rules.

Maintenance

Maintenance entails all actions necessary for retaining an asset as near as possible to its desired functional condition with normal wear and tear (achieving its expected useful life), but excluding renewal. Maintenance requires three key resources: direct and indirect labour/manpower; plant (movable assets, such as vehicles) and materials.

For those schemes that are not being operated and maintained by the DWS, it is crucial that the DWS makes regular inspections to be sure that the Scheme's assets are adequately maintained and renewed.

Asset maintenance works for Cluster's infrastructure assets are prioritized in the scheme AMPs according to asset component criticality and condition grading, as indicated in Table

4.15. The Cluster has about 88% of its infrastructure asset components in fair, good and very good conditions, as shown in Table 4.4 and Figures 4.5. These asset components require appropriate significant/improved maintenance to preventative and normal maintenance to prevent them from deteriorating to poor and very poor condition.

Figure 4.15 shows the proportions of these infrastructure asset components (in fair, good and very good conditions) per criticality-condition grading for the Cluster. Appendix E, Table E.5A shows the data table used to generate Figure 4.15.

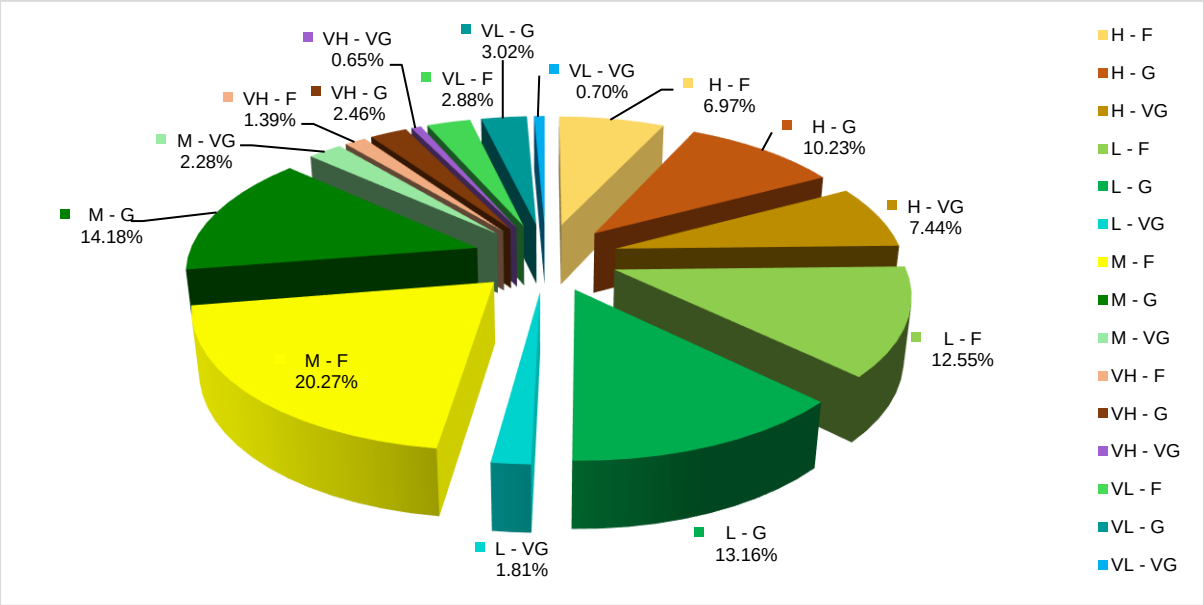


Figure 4.15: Asset component proportions per Criticality-Condition grading (maintenance)

The approximately 88% of the Cluster's infrastructure asset components (see Table 4.4 and Figures 4.5 and 4.15) that are in fair, good and very good conditions have a total CRC of about R15.997 billion, as shown in Table 4.5 and Figure 4.16 (which shows the split of the total CRC per criticality-condition grading). Appendix E, Table E.5B shows the data table used to generate Figure 4.16.

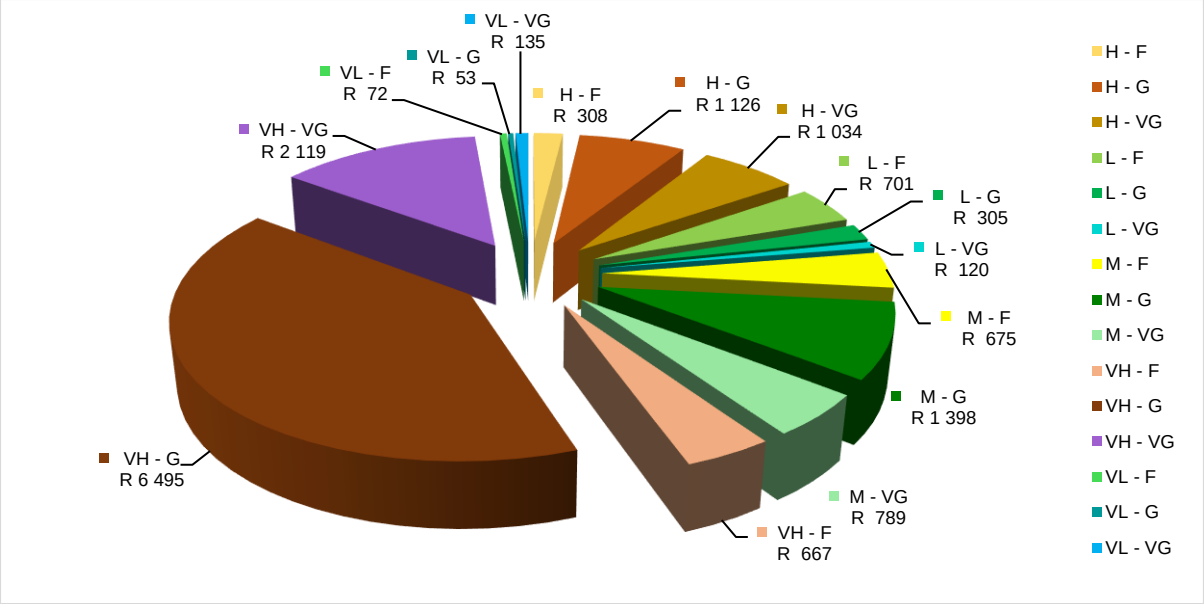


Figure 4.16: CRC (R million) per asset component criticality-condition grading (maintenance)

Appendix I, Table I.1 shows the maintenance strategies per asset component condition grading used in this AMP as well as in the individual scheme AMPs. For instance, asset components that are in very good condition require preventative and normal maintenance, whilst those that are in fair condition require significant/improved maintenance.

Table 4.16 summarises the Cluster's required maintenance works (number of infrastructure asset components per maintenance strategy and per asset facility category) for the first projected financial year.

Table 4.16: Maintenance works (asset components per maintenance strategy per asset facility category)

Asset Facility Category	Maintenance Strategy (No. of Asset Components)			Total
	Significant / improved	Target condition	Preventative and Normal	
Buildings	233	81	3	317
Canals	185	366	-	551
Dams	294	327	151	772
Measuring facilities	108	68	18	194
Pipelines	15	22	23	60
Power Supply	2	-	-	2
Pump stations	97	61	73	231
Reservoirs	6	-	1	7
Roads	4	1	4	9
Telemetry	2	-	3	5
Water Treatment	2	-	1	3
Total	**948**	**926**	**277**	**2 151**

Appendix I, Tables I.2 and I.3 show a split of the required maintenance works for the Cluster (shown in Table 4.16) between scheme specific and non-scheme specific asset components, respectively.

Appendix I, Table I.2 of the individual scheme AMPs present a prioritised list of all the infrastructure asset components requiring maintenance (the order of which would need to be followed when executing the works) and maintenance strategies assigned to them. The identified maintenance strategies for the Cluster's infrastructure asset components need to be implemented in line with the DWS Maintenance Policy, the DWS Maintenance Strategy, as well as the Operating and Maintenance Manual for the individual schemes.

Section 5.4.1 of this AMP shows the associated projected O&M costs for this Cluster.

4.4.2 Renewals

Asset renewals entails works to refurbish (electrical or mechanical), rehabilitate (civil) or replace an existing asset with another asset of equivalent capacity or performance capability.

The Cluster has about 12% of its infrastructure asset components in poor and very poor conditions, as shown in Table 4.4 and Figures 4.5. These asset components need to be renewed, failure of which poses a high risk to the delivery of services to its customers as well as its environment.

Figure 4.17 shows the proportions of these infrastructure asset components (in poor and very poor conditions) per criticality-condition grading for the Cluster. Appendix E, Table E.6A shows the data table used to generate Figure 4.17.

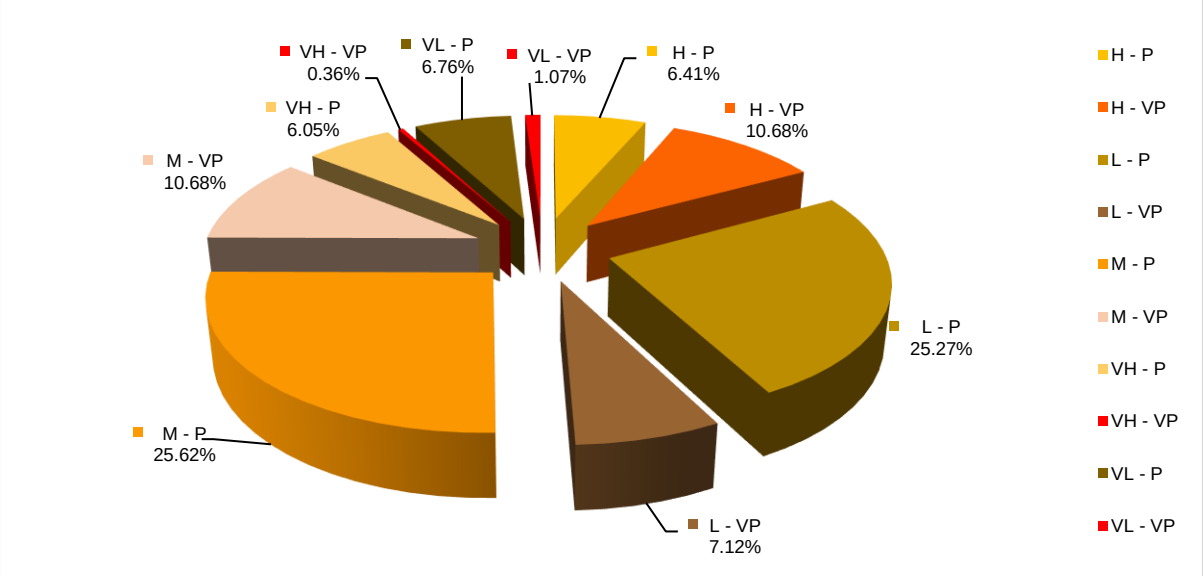


Figure 4.17: Asset component proportions per Criticality-Condition grading (renewals)

The about 12% of the Cluster's infrastructure asset components (see Table 4.4 and Figures 4.5 and 4.17) that are in poor and very poor conditions have a total CRC of about R222.29 million, as shown in Table 4.5 and Figure 4.18 (which shows the split of the total CRC per criticality-condition grading). Appendix E, Table E.6B shows the data table used to generate Figure 4.18.

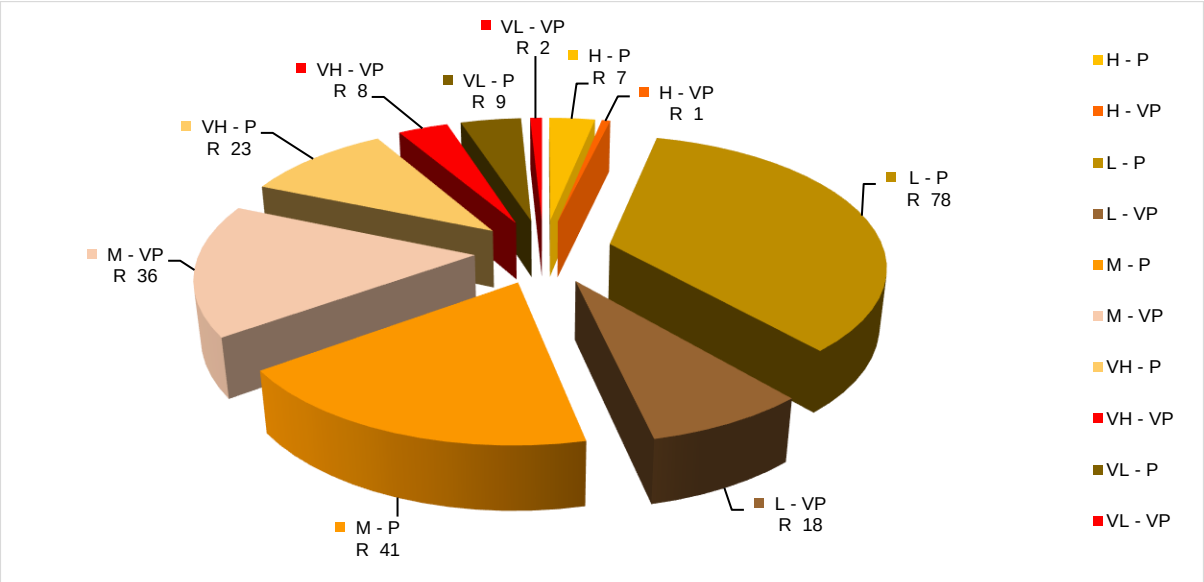


Figure 4.18: CRC (R million) per asset component criticality-condition grading (renewals)

Appendix J, Table J.1 summarises the renewal strategies per asset condition grading used in this AMP as well as in the individual scheme AMPs. Table 4.17 summarises the Cluster's required asset renewals works for the first projected financial year; it shows the number of asset components per renewals strategy per asset facility category.

Table 4.17: Renewals works (asset components per renewals strategy and per facility category)

Asset Facility Category	Renewal Strategy (No. of Asset Components)		Total
	Stop operating immediately and renew the asset component	Significantly renew	
Buildings	28	25	53
Canals	4	17	21
Dams	7	96	103
Measuring facilities	3	18	21
Pipelines	-	-	-
Power supply	-	-	-
Pump stations	39	41	80
Reservoirs	-	-	-
Roads	-	-	-
Telemetry	-	-	-
Water Treatment	-	-	-
Total	**81**	**197**	**278**

Appendix J, Tables J.2 and J.3 show the required renewals works for the Cluster for the first projected year (shown in Table 4.17) split between scheme-specific and non-scheme-specific asset components, respectively.

Appendix J, Table J.4 present a prioritised list (the order of which would need to be followed when executing the works) of all the Cluster's asset components that are in poor and very poor conditions, per scheme and per asset facility category, and the associated renewal strategies assigned to them. To be noted is that such renewal works priorities are based solely on criticality and condition grading (as indicated in the Asset Register – see Appendix A) of the asset components. Before any renewal work can commence, it is imperative that a further analysis is conducted to ascertain the feasibility of the renewal work and any impact the renewal work might have on other asset components. For example, renewal work on canal excavation is likely to affect the associated canal lining.

Table 4.18 summarises the Cluster's required asset renewals works (total number of asset components requiring renewal per asset facility category) for each of the projected ten years.

Table 4.18: Renewals works (asset components per asset facility category)

Asset Facility Category	Renewals (No. of Asset Components) per Projected Financial Year									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	53	-	-	211	-	20	-	-	-	-
Canals	21	-	4	108	-	42	-	20	127	3
Dams	103	-	38	83	10	134	-	5	92	18
Measuring facilities	21	16	9	3	9	90	9	18	2	9
Pipelines	-	-	2	-	-	-	2	3	-	10
Power supply	-	-	2	-	-	-	-	-	-	-
Pump stations	80	-	41	8	31	17	-	16	17	24
Reservoirs	-	-	-	-	-	-	-	6	-	-
Roads	-	-	-	-	-	4	-	-	-	-
Telemetry	-	-	-	-	-	1	-	-	-	-
Water Treatment	-	-	-	-	-	2	-	-	-	-
Total	**278**	**16**	**96**	**413**	**50**	**310**	**11**	**68**	**238**	**64**

Section 5.4.2 of this AMP shows the associated projected asset renewal costs for this Cluster.

4.4.3 Upgrades and New Capital

The Cluster's future raw water demand projection as well as asset utilisation grading determine the need for either increasing or decreasing the Cluster's asset extent, functional performance or capacity (done through asset upgrades or new capital developments).

An analysis of the asset utilisation grading (obtained from the Asset Register – see Appendix A and Section 4.2.4) per asset component revealed that about 3.7% of the Cluster's infrastructure asset components (with a total CRC of about R362.76 million) are stressed (exceeding design capacity on utilisation). These are mainly: dams; pipelines; and pump stations related asset components, as shown in Table 4.19. These asset components need to be upgraded to avoid stress related failures, and to ensure the Cluster meets the required level of service. However, before such upgrade works are executed, it is imperative that the utilisation gradings (captured in the Asset Register) of the affected asset components are first verified to confirm the necessity of the upgrades.

Table 4.19: Utilisation-based upgrade works (asset components exceeding capacity in utilisation)

Asset Facility Category	No of Asset Components Exceeding Capacity / Stressed (Upgrades)	CRC (R million)
Buildings	1	2.40
Canals	-	-
Dams	34	56.51
Measuring facilities	-	-
Pipelines	21	297.58
Power supply	-	-
Pump stations	34	6.27
Reservoirs	-	-
Roads	-	-
Telemetry	-	-
Water Treatment	-	-
Total	**90**	**362.76**

Appendix K, Table K.2 shows a split of the required utilisation-based upgrade works for the Cluster (shown in Table 4.19) between scheme-specific and non-scheme-specific infrastructure asset components.

Appendix K, Table K.3 shows a list of all the Cluster's infrastructure asset components per scheme and per asset facility category that are exceeding their design capacities (stressed), and, thus, require upgrading.

A 2016 report on the Condition Assessment Audit for the Pongola River GWS's irrigation infrastructure identified some canal-related upgrade works with a total acquisition cost of about R170 million; these have been considered in this AMP. For a summary of the required upgrades and new capitals works for the Cluster, refer to Appendix K, Table K.4.
Section 5.4.3 of this AMP shows the associated upgrades and new capital costs for the Cluster.

4.4.4 Impairments and Disposals

Impairments

Asset impairment is the loss of future economic benefits or service potential of an asset over and above the systematic recognition of the loss of the asset's future economic benefits or service potential through depreciation. As a result, the carrying value of assets needs to be reduced where there is evidence that the value has become over-stated due to unexpected events or circumstances (depreciation caters for normal consumption of the assets, through normal wear and tear).

Impairment causes an acceleration of one or more of the following failure modes: condition, functional performance, utilisation, or obsolescence. As such, an asset may be impaired based on: condition (e.g. vandalism, theft, poor maintenance, etc.), functional performance (e.g. siltation of dams), utilisation (under-utilisation), or obsolescence (e.g. spare parts no longer available).

For the Cluster, no asset components were impaired as per the DWS Annual Review of Impairment and Useful Life - NWRIB Immoveable Assets 31 March 2016 report. However, the Cluster has some infrastructure asset components with zero asset carrying values (according to the Asset Register), which implies that they are either fully depreciated or fully impaired. In this AMP, these infrastructure asset components with zero asset carrying values are being treated as impairments. They have a total CRC of about R37.31 million, and are summarised per asset facility category in Table 4.20. The DWS needs to take further steps on these asset components to determine appropriate disposal plans for them.

Table 4.20: Impaired asset components per asset facility category

Asset Facility Category	No. of impaired asset components	CRC (R million)
Buildings	1	0.89
Canals	2	1.40
Dams	6	22.68
Power Supply	-	-
Pump stations	-	-
Reservoirs	-	-
Roads and bridge	-	-
Steel Pipelines	-	-
Telemetry	-	-
Water Treatment	-	-
Measuring facilities	5	12.34
Total	**14**	**37.31**

Appendix L, Table L.2 shows a split of the impaired asset infrastructure components for the

Cluster (shown in Table 4.20) between scheme-specific and non-scheme-specific asset components.

Appendix L, Table L.3 presents a list of all the Cluster's infrastructure asset components, per scheme and per asset facility category, that have zero asset carrying values, and are here considered to be impaired.

Disposals

Asset disposal entails termination of the DWS's control over the asset; and needs to be done in line with the DWS Disposal Strategy for Immovable Assets.

An analysis of the asset utilisation grading (obtained from the Asset Register – see Appendix A and Section 4.2.4) per asset component revealed that about 2.3% of the Cluster's infrastructure asset components (with a total CRC of about R30.65 million) are under-utilised. These are mainly buildings and measuring facilities related asset components, as shown in Table 4.21. These asset components could be candidates for disposal. The reasons for the under-utilisation need to be assessed and consideration made for decommissioning and disposal, where necessary.

Table 4.21: Asset components that are under-utilised

Asset Facility Category	No. of Asset Components Under-Utilised	CRC (R million)
Buildings	25	10.72
WR: Canals	-	-
WR: Dams	5	1.57
WR: Power Supply	2	0.46
WR: Pump stations	-	-
WR: Reservoirs	1	2.39
WR: Roads and bridge	4	0.28
WR: Steel Pipelines	-	-
WR: Telemetry	2	1.66
WR: Water Treatment	-	-
WS: Measuring facilities	17	13.56
Total	**56**	**30.65**

Appendix L, Table L.4 shows a split of the under-utilised asset components for the Cluster (shown in Table 4.21) between scheme-specific and non-scheme-specific asset components.

Appendix L, Table L.5 presents a list of all the Cluster's asset components, per scheme and per asset facility category, that are under-utilised.

Based on previous assessments and the Asset Register (refer to Appendix A) used in the development of this AMP, the Cluster does not have any assets that are not in use and/or identified for disposal in the foreseeable future. However, from the scheme visit interviews conducted during data gathering for this AMP it was indicated that Hammersdale Dam is in the process of being decommissioned, making it a candidate for disposal.

4.5 Summary

The Eastern Cluster has an immovable asset base consisting of: infrastructure assets (with a total of 2 433 asset components) and land (with a total of 335 asset components). The majority of the Cluster's asset components are dams, canals, buildings, land and pump stations related asset components (about 32%, 21%, 14%, 12% and 11%, respectively).

The Cluster's infrastructure assets have a total DRC and CRC about R17.186 billion and about R18.165 billion, respectively; whilst land has a total of about R1.946 billion for both DRC and CRC. The DRC/CRC ratio for infrastructure assets is about 94%, indicating that about 6% of the infrastructure asset base has been consumed so far.

For infrastructure assets, dams-related asset components have the highest CRC of about R13.115 billion, followed by canals-related asset components with R852.20 million, and pipelines-related asset components with R761.20 million. A similar pattern is evident for DRC.

Key asset-related risks for the Cluster include: condition risk (failure by the asset to deliver the required service due to deteriorated physical condition); capacity risk (failure by the asset to deliver the required service as a result of it exceeding its design capacity/stressed); and not in use / under-utilisation risk (resulting in misallocation of resources, e.g. financial, human resources, material, etc.). To minimise these risks, and in order for the Cluster to meet its set levels of service and the projected future raw water demand, the following asset life cycle management activities are recommended for the Cluster in this AMP: appropriate and adequate maintenance and renewals (condition risk); upgrades and new capital investments (capacity risk); and disposals (not in use / under-utilisation risk).

The Cluster has about 88% of its infrastructure asset components (with a total CRC of about R15.997 billion) in fair, good and very good conditions; and about 12% (with a total CRC of about R222.29 million) in poor and very poor conditions. Appropriate maintenance and renewal strategies, respectively, recommended and prioritised based on criticality and condition for these asset components in the individual scheme AMPs, have been summarised

per asset facility category in this AMP.

Upgrade works are recommended for the Cluster's infrastructure asset components, about 3.7% and with a total CRC of about R362.76 million, which are stressed (exceeding design capacity on utilisation). These are mainly: dams; pipelines; and pump stations related asset components. Such upgrade works are aimed at avoiding stress related failures, and to ensure the Cluster meets the required level of service. However, before such upgrade works are executed, it is imperative that the utilisation gradings (captured in the Asset Register) of the affected asset components are first verified to confirm the necessity of the upgrades.

Furthermore, a 2016 report on the Condition Assessment Audit for the Pongola River GWS's irrigation infrastructure identified some canal-related upgrade works with a total acquisition cost of about R170 million; these have been considered in this AMP.

The Cluster has some impaired asset components (mainly dams and measuring facilities-related) with a total CRC of about R37.31 million. The DWS needs to take further steps on these asset components to determine appropriate disposal plans for them.

Furthermore, about 2.3% of the Cluster's infrastructure asset components (with a total CRC of about R30.65 million), mainly buildings and measuring facilities related are under-utilised. These asset components could be candidates for disposal. The reasons for the under-utilisation need to be assessed and consideration made for decommissioning and disposal, where necessary.

Based on previous assessments and the Asset Register (refer to Appendix A) used in the development of this AMP, the Cluster does not have any asset components that are not in use and/or identified for disposal in the foreseeable future. However, from the scheme visit interviews conducted during data gathering for this AMP it was indicated that Hammersdale Dam is in the process of being decommissioned, making it a candidate for disposal.

The next section presents a ten-year financial plan associated with the asset life cycle management activities discussed above.

5. ASSET LIFE CYCLE FINANCIAL PLAN

5.1 Overview

This section presents the Eastern Cluster's ten-year projected optimal financial requirements that are necessary to fund the asset life cycle works identified in Section 4, and it answers the questions of 'when' and 'for how much' of those works. Asset life cycle works costs are discussed per asset facility category; a further zoom in is made on optimum revenue requirement, past and future potential renewal backlog, as well as infrastructure asset movement over the ten-year period, all in alignment to Section 4.4.

5.2 Financial Projection Assumptions

Key assumptions underpinning financial projections in this AMP are:

- Growth Factors: Expenditure and/or Revenue were grown by:
  - *Inflation rate* of 6.8% in 2016/17, 6.2% in 2017/18, 5.9% in 2018/19, and 5.6% in 2019/20 as provided for in the South African National Treasury 2016/17 MTEF Technical Guidelines on budgeting. Thereafter, a four-year moving average rate was used; and
  - A *progressive factor* averaging 0.9% in 2016/17, 1.7% in 2017/18 and 2.4% in 2018/19 as projected in the 2016/17 South African National Treasury Budget Review. Thereafter, a three-year moving average rate was used.
- Growth Factor for PPE related values.
  - Average PPI of about 7.1% was used to adjust for PPE related monetary values.
- New capital costs are a function of growth in water demand beyond the existing raw water yield of the Cluster.
- Upgrade costs are a function of either growth in water demand beyond the existing raw water yield of the Cluster or of asset utilisation, or both.
- Renewal Capital Expenditure are a function of accumulated depreciation from the last date of renewal and a price adjustment equivalent to: the engineering professional fees; construction preliminary and generals (P&Gs); construction contingency reserves as well as the projected PPI in the particular year renewal work will be carried out.
- Once renewal work is determined, there will be at least one-year provision for planning and resource mobilization.
- Straight line depreciation method was used for the projections.
- The modelled optimal O&M costs per asset facility category, in this AMP, are proportions of the CRCs derived for the year 2015/16; where the following sources formed the basis for the splitting ratios:
  - Guidelines for Infrastructure Asset Management in Local Government 2006– 2009

(Department of Provincial and Local Government, 2006).

- Maintenance Accounting Framework for immovable assets under the custodianship of National and Provincial Department of Works (Department of Public Works, 2015).
- Monitoring and Evaluation Protocol for immovable assets under the custodianship of National and Provincial Department of Works (Department of Public Works, 2015).
- Operations and maintenance costs of rural water supply schemes in South Africa (Gibson, 2010).

5.3 Optimal Total Cost Requirement

5.3.1 Identified Optimal Total Cost Requirement

Table 5.1 presents the Cluster's modelled identified optimal total cost requirement, in light of asset life cycle works discussed in Section 4.4, per cost component (i.e., O&M (inclusive of direct and indirect labour costs); renewal works; upgrades and new capital; as well as asset disposal) for the 10-year period, where incurred. These costs are made up from scheme and non-scheme specific asset components. These costs are made up from scheme and non-scheme specific asset components. Non-scheme specific asset components are found under these categories: Area Manager Office Midmar, Man: Hydro Eastern, and Hydrometry KwaZulu Natal.

- The Cluster's projected modelled identified optimal annual total cost requirements for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R608.777 million; and R261.248 million, respectively.
- The projected spike in 2017/18 is attributed to significant renewal, and upgrade and new capital cost requirements (R82.126 million and R318.871 million, respectively).
- Table 5.2 and Figure 5.1 show the optimal annual total cost requirement per asset facility category; where dams, measuring facilities and buildings related asset components are the main cost drivers.
- The cost requirement, per cost component, and per facility category (shown in Tables 5.1 and 5.2) are separated between Scheme and Non-Scheme specific, and are also given per Scheme, refer to Appendix H, Tables H.1A to H.5.

Table 5.1: Optimal total cost requirement per cost component

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
O&M	195.883	207.780	220.450	233.139	247.819	262.827	278.732	295.567	313.629	332.650
Renewal	-	82.126	2.471	49.447	131.211	22.216	271.249	21.534	61.317	45.332
Upgrade & New	-	318.871	38.327	57.068	-	21.160	-	5.628	48.150	-

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**195.883**	**608.777**	**261.248**	**339.654**	**379.029**	**306.202**	**549.981**	**322.729**	**423.096**	**377.982**

Table 5.2: Optimal total cost requirement per asset facility category

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	36.723	20.428	21.604	86.199	24.355	40.672	27.389	29.063	30.826
WR: Canals	19.149	22.622	59.878	23.824	62.811	46.853	64.594	34.522	82.782	52.517
WR: Dams	114.862	180.992	129.268	214.537	171.403	155.104	229.992	173.315	185.111	206.863
WR: Power Supply	0.031	0.032	0.034	0.263	0.039	0.041	0.043	0.046	0.049	0.052
WR: Pump stations	9.435	28.952	10.618	31.772	13.366	30.954	26.535	14.541	27.872	25.437
WR: Reservoirs	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.911	0.062
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.292	5.492	5.827	6.181
WR: Steel Pipelines	8.373	306.464	9.423	10.337	10.593	11.235	11.915	13.218	46.090	14.219
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.917	0.767	0.814	0.863
WR: Water Treatment	0.055	0.058	0.062	0.065	0.069	0.073	0.590	0.083	0.088	0.093
WS: Measuring facility	21.642	28.495	26.827	32.270	29.255	31.972	169.379	53.300	44.490	40.870
Total	**195.883**	**608.777**	**261.248**	**339.654**	**379.029**	**306.202**	**549.981**	**322.729**	**423.096**	**377.982**

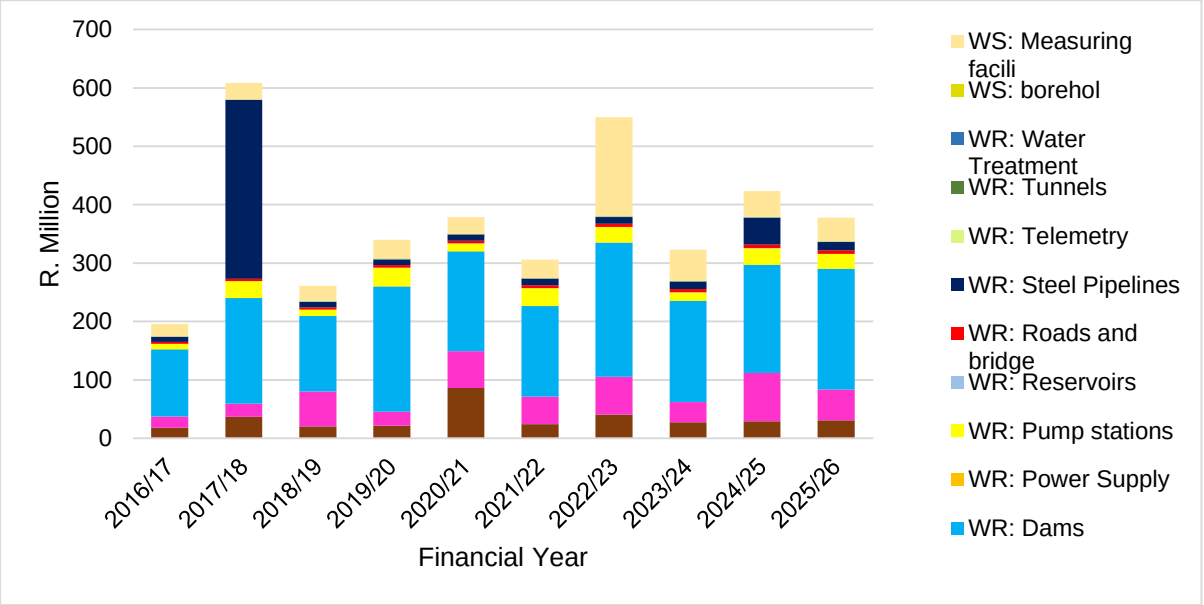


Figure 5.1: Optimal total cost requirement per asset facility category

The projected spikes in the modelled identified optimal total cost requirement for the financial years 2017/18 and 2022/23, evident in Figure 5.1, (emanating mainly from the modelled identified optimal renewal and upgrades and new capital cost requirements), compounded by the current economic and financial constraints facing the country, present some implementation challenges for the Cluster's modelled identified optimal total cost requirement. As such, for practical implementation purposes, the modelled identified optimal cost requirements for the Cluster are adjusted as indicated in the following subsection.

5.3.2 Implementation Plan for Identified Optimal Cost requirements

Table 5.3 presents the Cluster's adjusted modelled optimal total cost requirements per cost component (i.e. O&M (inclusive of direct and indirect labour costs); renewal works; upgrades and new capital; as well as asset disposal) for the projected 10-year period, where incurred.

- The Cluster's projected adjusted modelled optimal total cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R267.099 million; and R294.416 million, respectively, as presented in Table 5.3.
- Table 5.4 and Figure 5.2 show the projected modelled adjusted optimal total cost requirement per asset facility category; where dams, canals, buildings and pipelines related asset components are the main cost drivers.
- The cost requirement, per cost component, and per facility category (shown in Tables 5.3 and 5.4) are separated between scheme and non-scheme specific, and are also given per scheme, as shown in Appendix H, Tables H.1B to H.5.

Table 5.3: Adjusted modelled optimal total cost requirement per cost component

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
O&M	195.883	207.780	220.450	233.139	247.819	262.827	278.732	295.567	313.629	332.650
Renewal	-	12.319	14.537	21.132	41.009	54.002	104.700	114.492	140.992	157.992
Upgrade & New	-	47.831	60.754	67.116	62.631	61.340	51.687	37.930	48.940	49.754
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**195.883**	**267.930**	**295.742**	**321.387**	**351.459**	**378.169**	**435.118**	**447.989**	**503.560**	**540.397**

Table 5.4: Adjusted modelled optimal total cost requirement per asset facility category

Asset Facility Category	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	21.874	23.441	24.434	34.933	40.598	44.101	43.021	44.369	43.875
WR: Canals	19.149	20.659	27.699	30.219	37.147	45.130	53.519	54.735	73.016	88.237
WR: Dams	114.862	130.711	139.472	157.965	172.230	182.898	201.871	208.880	220.226	231.760
WR: Power Supply	0.031	0.032	0.034	0.036	0.039	0.041	0.043	0.046	0.049	0.052
WR: Pump stations	9.435	12.850	13.886	17.379	18.695	23.063	26.167	25.674	30.362	35.555
WR: Reservoirs	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.315	0.454
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.202	5.522	5.860	6.212
WR: Steel Pipelines	8.373	53.519	60.756	58.230	52.957	48.333	41.606	32.829	40.795	42.752
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.762	0.817	0.870	0.916
WR: Tunnels	-	-	-	-	-	-	-	-	-	-
WR: Water Treatment	0.055	0.058	0.062	0.065	0.069	0.073	0.180	0.216	0.238	0.233
WS: borehole	-	-	-	-	-	-	-	-	-	-
WS: Measuring facility	21.642	23.788	25.682	28.077	30.096	32.416	61.616	76.194	87.461	90.349
Total	**195.883**	**267.930**	**295.741**	**321.386**	**351.458**	**378.167**	**435.117**	**447.989**	**503.561**	**540.397**

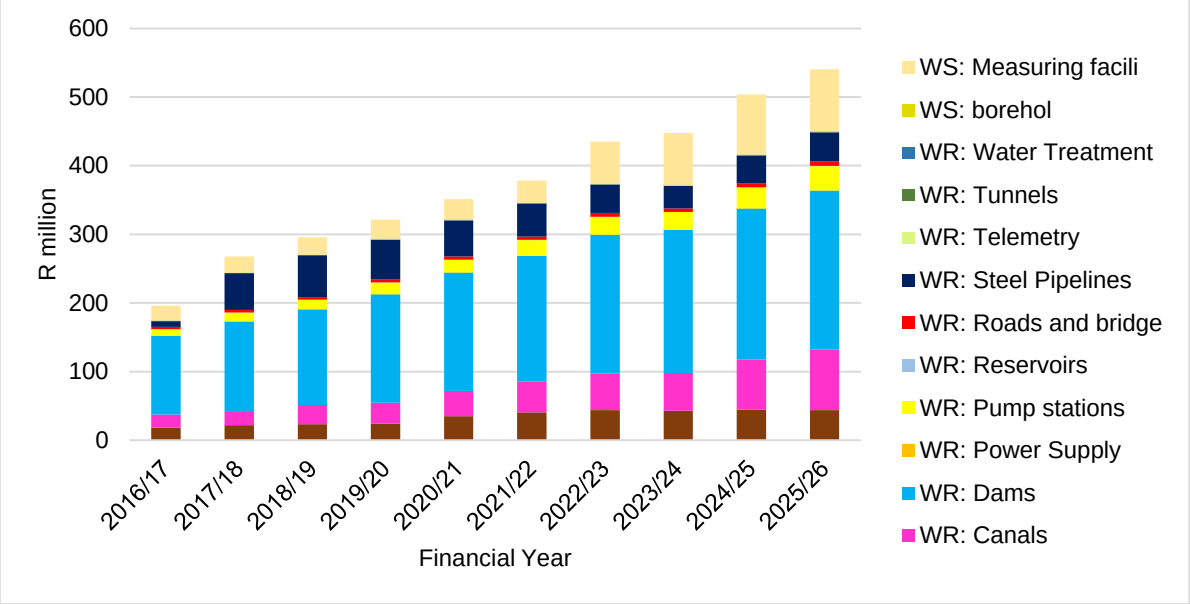


Figure 5.2: Adjusted modelled optimal total cost requirement per asset facility category

5.4 Costs Breakdown

5.4.1 Operations and Maintenance (O&M)

Optimally funding asset maintenance ensures that an asset will retain, or be restored, to a state in which it can perform its function. Table 5.5 and Figure 5.3 show the Cluster's optimal O&M cost requirements, in light of works discussed in Section 4.4.1, per asset facility category:

- The Cluster's projected optimal annual O&M cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are: R195.883 million; R207.780 million; and R220.450 million, respectively. Dams related asset components are the major cost drivers in this Cluster.
- O&M costs were further modelled to stand separately between operations (O) and maintenance (M) costs (per asset facility category), and were further separated between scheme and non-scheme specific, and are also given per scheme, refer to Appendix I, Table I.4 to I.6.

Table 5.5: Modelled optimal O&M cost per asset facility category

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	19.254	20.428	21.604	22.965	24.355	25.829	27.389	29.063	30.826
WR: Canals	19.149	20.312	21.551	22.791	24.226	25.693	27.248	28.894	30.660	32.519
WR: Dams	114.862	121.838	129.268	136.708	145.317	154.117	163.443	173.315	183.907	195.060
WR: Power Supply	0.031	0.032	0.034	0.036	0.039	0.041	0.043	0.046	0.049	0.052
WR: Pump stations	9.435	10.008	10.618	11.229	11.936	12.659	13.425	14.236	15.106	16.022
WR: Reservoirs	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.059	0.062

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.179	5.492	5.827	6.181
WR: Steel Pipelines	8.373	8.882	9.423	9.966	10.593	11.235	11.915	12.634	13.406	14.219
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.723	0.767	0.814	0.863
WR: Water Treatment	0.055	0.058	0.062	0.065	0.069	0.073	0.078	0.083	0.088	0.093
WS: Measuring facility	21.642	22.957	24.356	25.758	27.380	29.038	30.796	32.656	34.651	36.753
Total	**195.883**	**207.780**	**220.450**	**233.139**	**247.819**	**262.827**	**278.732**	**295.567**	**313.629**	**332.650**

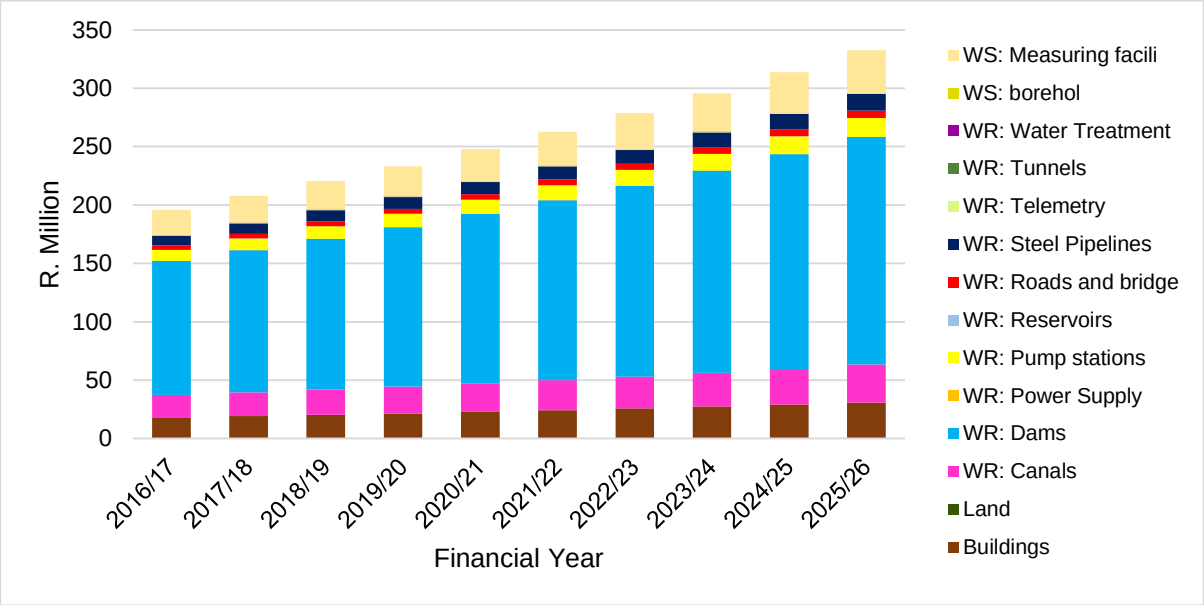


Figure 5.3: Modelled optimal O&M cost per asset facility category

5.4.2 Renewals

Renewal works on existing assets are meant to enable the Cluster to retain the service potential or the life of the asset to that which it had originally. Hence, the necessity of optimally funding such renewals, where identified.

Table 5.6 and Figure 5.4 show the Cluster's modelled optimal annual renewal cost requirements, in light of the works discussed in Section 4.4.2:

- Optimal annual renewal cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R12.319 million and R14.537 million, to be incurred only in 2017/18 and 2018/19, respectively. Dams, buildings and pump stations related asset components are the main cost drivers.
- The projected renewals cost for 2017/18 is attributed to condition backlog from the past years. It is crucial that these renewals be given high priority in the year indicated to minimise asset component condition risk and, consequently, deteriorating service delivery.

A provision of at least one year for planning and resources mobilization is made from the time renewal work is identified and associated cost budgets determined to the time the renewals are done (as shown in Table 5.6 and Figure 5.4). For example, renewals for 2017/18 were actually identified in 2016/17. For the list of asset component identified for renewal and associated component renewal budgets, refer to relevant Scheme AMPs.

The cost requirement per facility category (shown in Table 5.6) are separated between scheme and non-scheme specific, and are also given per scheme, refer to Appendix J, Tables J.5 to J.7.

Table 5.6: Optimal renewal cost per asset facility category

Asset Facility Category	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	-	2.441	2.807	2.636	11.798	16.094	18.152	15.551	15.237	12.995
WR: Canals	-	0.347	0.398	0.529	6.310	9.077	16.153	16.461	18.421	25.272
WR: Dams	-	6.330	7.280	9.950	13.803	15.365	26.917	27.309	28.904	30.835
WR: Pump stations	-	2.371	2.727	5.642	6.313	10.014	12.429	11.227	15.073	19.394
WR: Reservoirs	-	-	-	-	-	-	-	-	0.256	0.392
WR: Roads and bridge	-	-	-	-	-	-	0.023	0.030	0.033	0.031
WR: Steel Pipelines	-	-	-	0.056	0.070	0.074	0.064	0.192	10.051	15.284
WR: Telemetry	-	-	-	-	-	-	0.039	0.050	0.056	0.053
WR: Water Treatment	-	-	-	-	-	-	0.102	0.133	0.150	0.140
WS: Measuring facility	-	0.831	1.326	2.319	2.716	3.378	30.820	43.538	52.810	53.596
Total	**-**	**12.319**	**14.537**	**21.132**	**41.009**	**54.002**	**104.700**	**114.492**	**140.992**	**157.992**

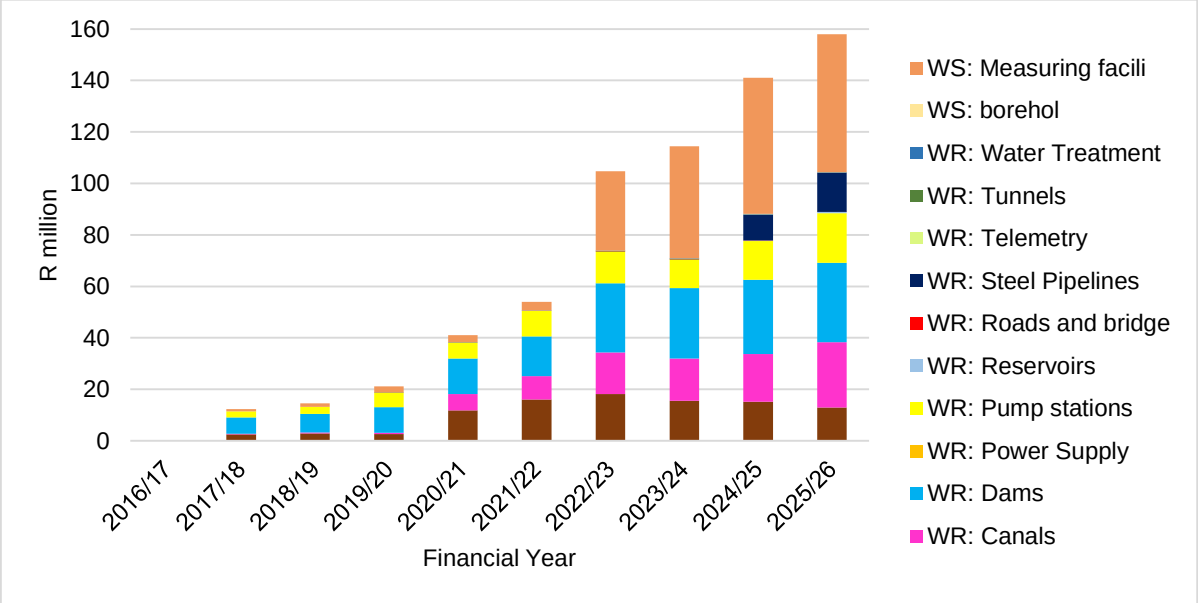


Figure 5.4: Optimal renewal cost per asset facility category

5.4.3 Upgrades and New Capital

As indicated in section 4.4.3 Table 5.7 and Figure 5.5 show the upgrades and new capital costs requirements for the Cluster.

- Optimal annual upgrades and new capital cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R47.831 million and R60.754 million to be incurred only in 2017/18 and 2018/19, respectively. Pipelines and dams related asset components are the main cost drivers.

The cost requirement per facility category (shown in Table 5.7) are separated between scheme and non-scheme specific, and are also given per scheme, refer to Appendix K, Tables K.4 to K.5.

Table 5.7: Modelled optimal upgrades and new capital cost per asset facility category

Asset Facility Category	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	-	0.180	0.207	0.194	0.170	0.149	0.119	0.081	0.070	0.053
WR: Canals	-	-	5.749	6.899	6.611	10.360	10.117	9.380	23.935	30.446
WR: Dams	-	2.543	2.925	11.307	13.110	13.416	11.511	8.256	7.414	5.865
WR: Pump stations	-	0.471	0.541	0.508	0.446	0.390	0.312	0.211	0.183	0.140
WR: Steel Pipelines	-	44.637	51.333	48.208	42.294	37.025	29.627	20.003	17.338	13.250
Total	**-**	**47.831**	**60.754**	**67.116**	**62.631**	**61.340**	**51.687**	**37.930**	**48.940**	**49.754**

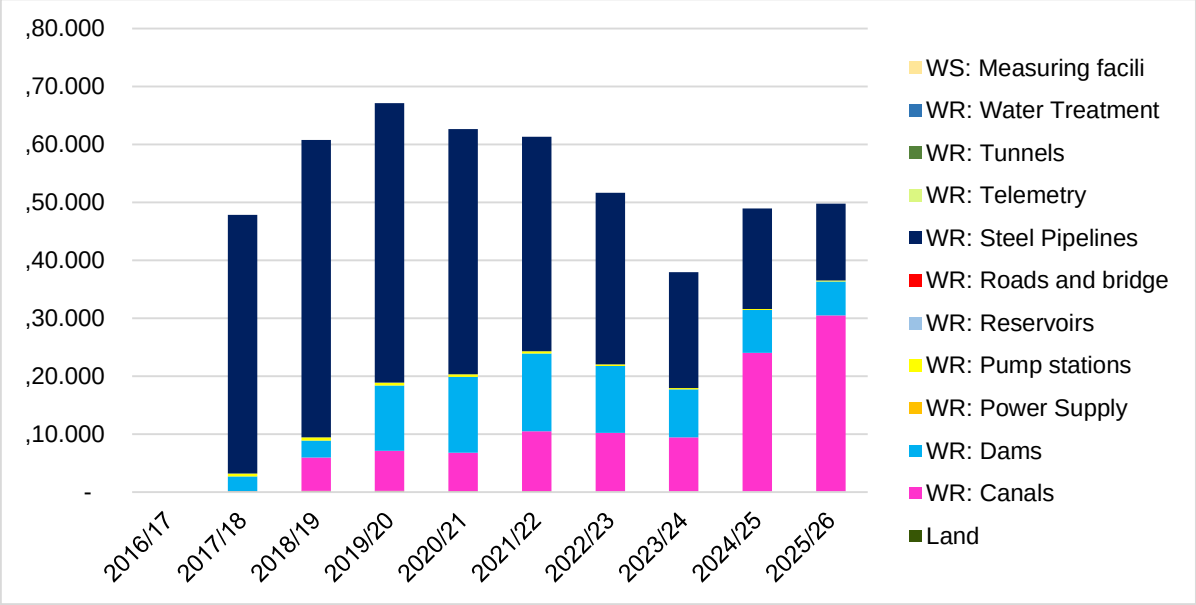


Figure 5.5: Modelled optimal upgrades and new capital cost per asset facility category

5.4.4 Impairments and Disposals

As indicated in Section 4.4.4, the Cluster has some asset components classified as:

- impaired (those with zero asset carrying values), with a total CRC of about R37.31

million, which could be candidates for disposal. For a summary of these asset components, per facility category and the respective CRCs, and also a list of them, refer to Appendix L, Tables L.1 and L.2, respectively.

- under-utilised', with a total CRC of about R30.65 million, which could also be candidates for disposal. For a summary of these asset components, per facility category and the respective CRCs, and also a list of them, refer to Appendix L, Tables L.3 and L.4, respectively.

5.5 Backlog (Deferred Maintenance and Deferred Renewals)

'Backlog' (or Deferred Maintenance and Deferred Renewals) is "The value of maintenance and renewal work that has not been done when it should have been – in order to meet the prescribed levels of service". If maintenance and renewal work is not carried out at the optimum time in the asset lifecycle:

- the assets will deteriorate further;
- the maintenance or renewal work that will have to be done later may be more extensive and expensive (in real terms) than it would have been if it had been carried out at the optimum time;
- the asset may not be able to continue to perform to its original design capacity or performance standard, or to deliver the specified levels of service, and, if the work continues not being done, may ultimately be unable to provide the required service altogether.

Figure 5.6 depicts the projected potential renewal backlog for the Cluster. This backlog is a direct mirror image of the projected renewals because a delay or part spending of the renewal budget would lead to renewal backlog on those particular assets.

- The amount (about R82 million) recorded for 2016/17 in Figure 5.6 is backlog on maintenance and/or renewals that were supposed to have been done in the previous year(s), because if maintenance and renewals were optimally done, no asset component in the current year could be in poor or very poor condition.
- It is imperative that this backlog be cleared in the year indicated, otherwise the works may be spread over a maximum of three years.

The backlog per facility category (shown in Figure 5.6) are separated between scheme and non-scheme specific, and are also given per scheme, refer to Appendix J, Tables J.4 and J.6.

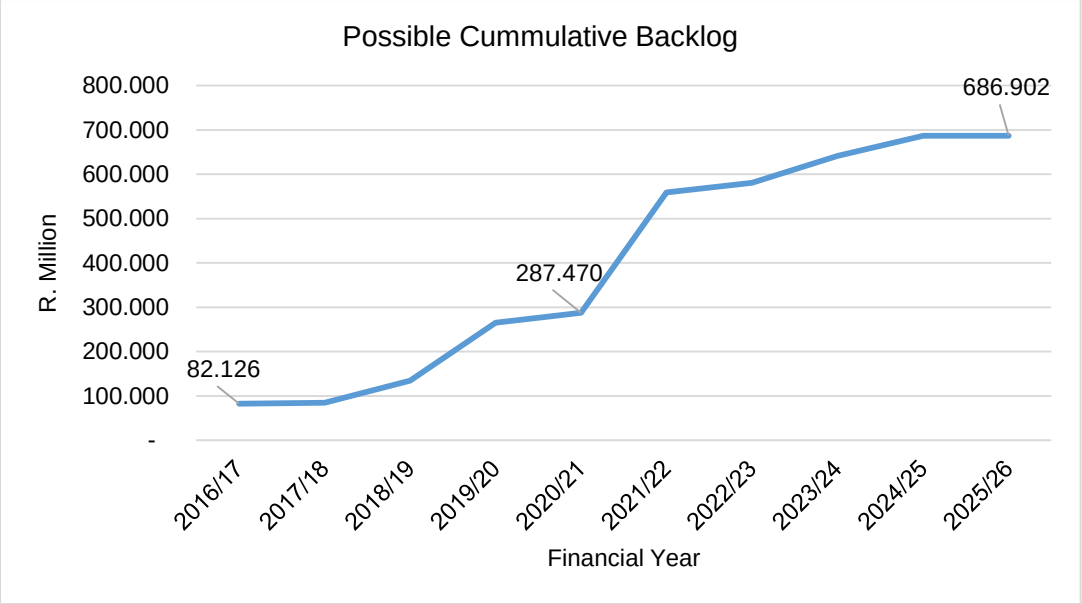


Figure 5.6: Possible cumulative backlog

5.6 Funding Requirements

Table 5.8 and Figure 5.7 present the adjusted modelled optimal revenue requirements necessary to sustain the Cluster. For the Cluster to be able to cover all its cost requirements, its revenue needs to be at least equivalent to the modelled revenue.

The Cluster's projected optimal annual revenue requirements for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R196 million, R268 million and R296 million, respectively. Over the projected 10-year period, the revenue which needs to be generated by the Cluster to fund the required immovable asset life cycle works varies between about R196 million and about R540 million. In the event that such revenue cannot be generated through user charges (an indication that the Cluster is not financially self-sustainable), external funding would need to be considered. Such funding can be in the form of fiscal support, cross subsidisation or debt raised through such institutions as TCTA.

Table 5.8: Adjusted modelled optimal revenue requirement

	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Adjusted modelled optimal revenue requirement	195.883	267.930	295.742	321.387	351.459	378.169	435.118	447.989	503.560	540.397

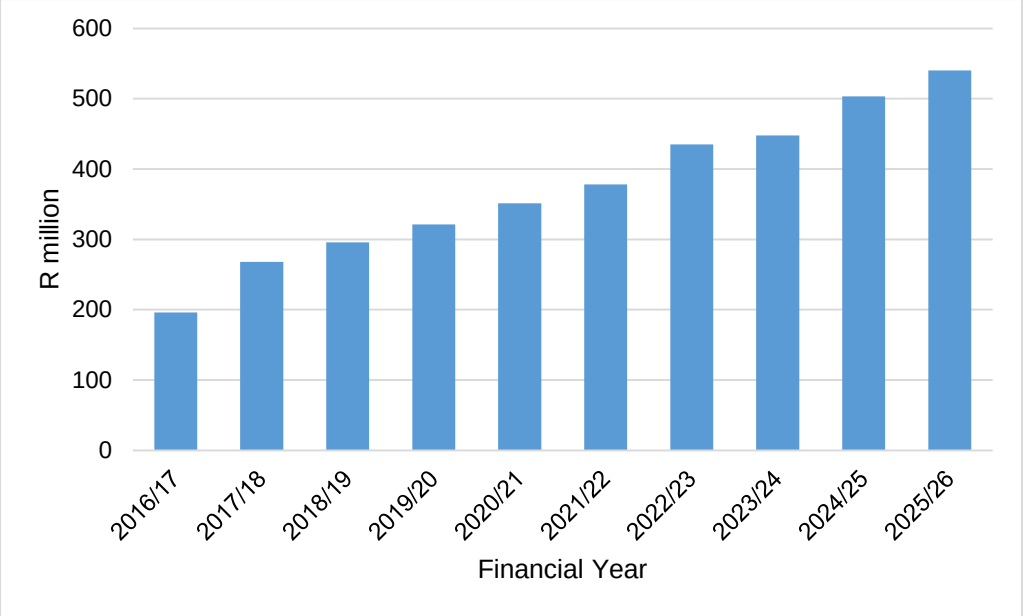


Figure 5.7: Adjusted modelled optimal revenue requirement

5.7 Infrastructure Assets Movement

Tables 5.9 to 5.11 and Figures 5.8 to 5.10 present the Cluster's projected annual infrastructure asset movement, but excluding land. The asset carrying value for land at this Cluster is about R1.946 billion. The asset movement position per facility category (shown in Tables 5.9 to 5.11) are separated between scheme and non-scheme specific, and are also given per scheme, refer to Appendix M, Tables M.1 to M.3.

Table 5.9: Accumulated acquisition cost per asset facility category

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	117.597	135.066	135.066	135.066	198.300	198.300	213.143	213.143	213.143	213.143
WR: Canals	308.109	310.420	348.747	349.779	388.364	409.524	446.870	452.498	504.620	524.618
WR: Dams	5 426.177	5 485.330	5 485.330	5 563.159	5 589.245	5 590.232	5 656.781	5 656.781	5 657.985	5 669.787
WR: Power Supply	0.165	0.165	0.165	0.392	0.392	0.392	0.392	0.392	0.392	0.392
WR: Pump stations	113.240	132.184	132.184	152.727	154.157	172.453	185.563	185.868	198.634	208.049
WR: Reservoirs	2.784	2.784	2.784	2.784	2.784	2.784	2.784	2.784	3.636	3.636
WR: Roads and bridge	85.829	85.829	85.829	85.829	85.829	85.829	85.942	85.942	85.942	85.942
WR: Steel Pipelines	308.758	606.341	606.341	606.712	606.712	606.712	606.712	607.296	639.979	639.979
WR: Telemetry	6.987	6.987	6.987	6.987	6.987	6.987	7.180	7.180	7.180	7.180
WR: Water Treatment	0.577	0.577	0.577	0.577	0.577	0.577	1.089	1.089	1.089	1.089
WS: Measuring facility	279.596	285.134	287.605	294.117	295.992	298.925	437.508	458.153	467.992	472.109
Total	**6 649.819**	**7 050.816**	**7 091.614**	**7 198.129**	**7 329.339**	**7 372.715**	**7 643.964**	**7 671.126**	**7 780.593**	**7 825.925**

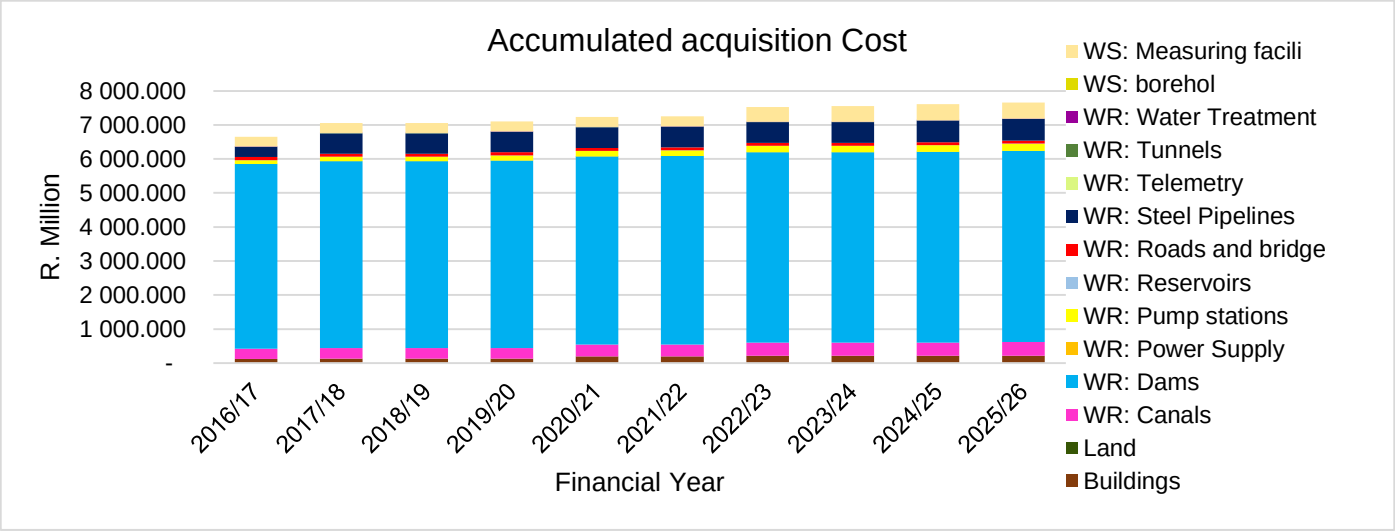


Figure 5.8: Accumulated acquisition cost per asset facility category

Table 5.10: Accumulated depreciation cost per asset facility category

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	62.128	67.625	71.869	76.113	82.441	88.723	95.098	101.473	107.848	114.223
WR: Canals	122.162	131.030	137.974	145.753	154.740	164.822	175.897	186.972	198.128	210.924
WR: Dams	664.928	733.405	784.823	837.372	891.399	962.723	1 033.921	1 105.120	1 176.322	1 247.912
WR: Power Supply	0.119	0.127	0.135	0.155	0.174	0.191	0.207	0.224	0.241	0.257
WR: Pump stations	55.417	59.883	64.246	69.313	74.934	80.877	87.500	94.134	100.919	108.227
WR: Reservoirs	0.500	0.542	0.576	0.611	0.646	0.689	0.731	0.774	0.821	0.868
WR: Roads and bridge	6.140	8.099	9.857	11.614	13.371	15.348	17.325	19.302	21.279	23.256
WR: Steel Pipelines	86.473	98.320	110.484	122.661	134.800	146.617	158.434	170.251	183.622	196.993
WR: Telemetry	0.875	0.977	1.080	1.168	1.256	1.357	1.460	1.562	1.665	1.768
WR: Water Treatment	0.292	0.304	0.316	0.327	0.339	0.352	0.371	0.391	0.410	0.430
WS: Measuring facility	92.771	102.402	108.699	114.800	122.886	137.002	150.281	160.392	180.076	201.670
Total	**1 091.806**	**1 202.716**	**1 290.058**	**1 379.888**	**1 476.986**	**1 598.699**	**1 721.226**	**1 840.595**	**1 971.331**	**2 106.527**

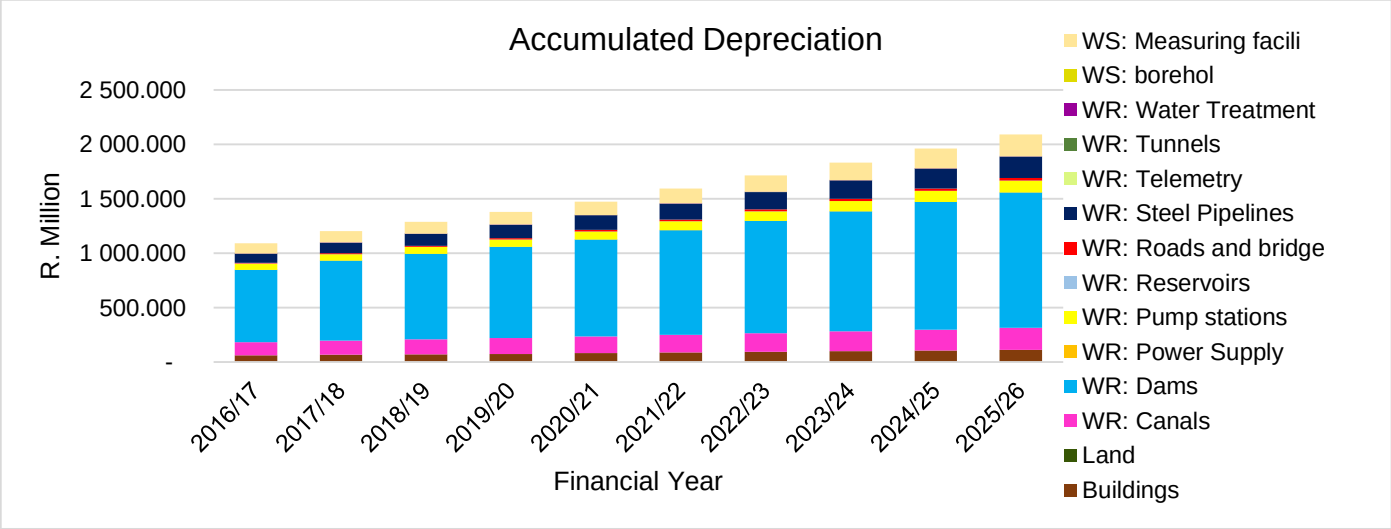


Figure 5.9: Accumulated depreciation cost per asset facility category

Table 5.11: Asset carrying value per asset facility category

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	55.469	67.441	63.197	58.953	115.860	109.577	118.045	111.670	105.295	98.921
WR: Canals	185.947	179.388	210.772	204.026	233.623	244.702	270.972	265.525	306.492	313.694
WR: Dams	4 761.248	4 751.925	4 700.508	4 725.787	4 697.846	4 627.509	4 622.860	4 551.661	4 481.663	4 421.876
WR: Power Supply	0.045	0.038	0.030	0.237	0.217	0.201	0.184	0.168	0.151	0.134
WR: Pump stations	57.831	72.301	67.938	83.414	79.224	91.576	98.062	91.734	97.715	99.822
WR: Reservoirs	2.284	2.242	2.208	2.173	2.138	2.095	2.053	2.010	2.815	2.768
WR: Roads and bridge	79.689	77.729	75.972	74.215	72.457	70.481	68.618	66.641	64.663	62.686
WR: Steel Pipelines	222.285	508.020	495.857	484.051	471.912	460.095	448.278	437.045	456.358	442.986
WR: Telemetry	6.112	6.010	5.907	5.819	5.731	5.630	5.721	5.618	5.515	5.413
WR: Water Treatment	0.285	0.273	0.261	0.250	0.238	0.225	0.718	0.698	0.678	0.659
WS: Measuring facility	186.850	182.762	178.906	179.317	173.106	161.924	289.128	297.913	287.997	271.426
Total	**5 558.045**	**5 848.130**	**5 801.556**	**5 818.240**	**5 852.353**	**5 774.016**	**5 924.639**	**5 830.683**	**5 809.344**	**5 720.385**

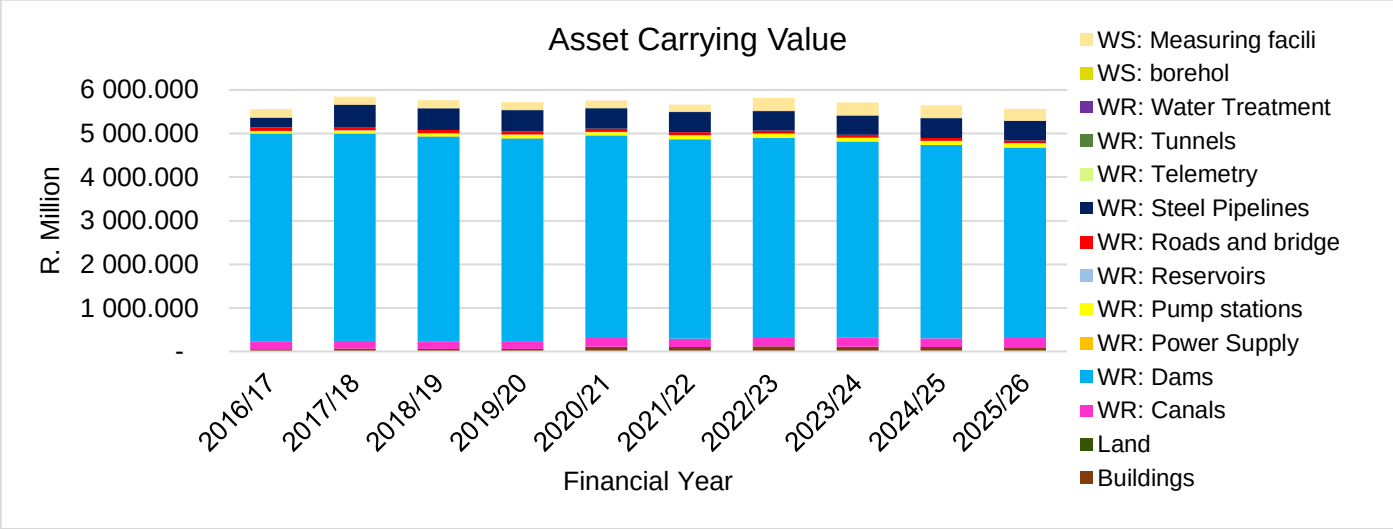


Figure 5.10: Asset carrying value per asset facility category

5.8 Summary

Modelled ten-year optimal cost requirements, per cost component (i.e. O&M (inclusive of direct and indirect labour costs); renewal works; upgrades and new capital; and asset disposal) and per asset facility category, necessary to fund the asset life cycle works identified in Section 4 were presented in this section for the Cluster.

The Cluster's projected modelled identified optimal annual total cost requirements for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R608.777 million; and R261.248 million, respectively. The projected spike in 2017/18 is attributed to significant renewal, and upgrade and new capital cost requirements (about R82.126 million and R318.871 million, respectively). Such significant increase, compounded by the current economic and financial constraints facing the country, present some implementation challenges for the Cluster's modelled identified optimal total cost requirement. As such, for practical implementation purposes, the identified optimal cost requirements for the Cluster are adjusted as indicated below.

The Cluster's projected adjusted modelled optimal total cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R267.099 million; and R294.416 million, respectively. Dams, canals, buildings and pipelines related asset components are the main cost drivers. The projected total cost breakdown for the Cluster is as follows:

- The Cluster's projected optimal annual O&M cost requirement for the first three years (2016/17, 2017/18 and 2018/19) are about: R195.883 million; R207.780 million; and R220.450 million, respectively. Dams related asset components are the main cost drivers.
- Optimal annual renewal cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R12.319 million and R14.537 million, to be incurred only in 2017/18 and 2018/19, respectively. Dams, buildings and pump stations related asset components are the main cost drivers.

  The projected renewals cost for 2017/18 is attributed to condition backlog from the past years. It is crucial that these renewals be given high priority in the year indicated to minimise asset component condition risk and, consequently, deteriorating service delivery.
- Optimal annual upgrades and new capital cost requirements for the Cluster for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R47.831 million and R60.754 million to be incurred only in 2017/18 and 2018/19, respectively. Pipelines and dams related asset components are the main cost drivers.

The Cluster's projected optimal annual revenue requirements for the first three years (2016/17, 2017/18 and 2018/19) amount to about: R196 million, R268 million and R296 million, respectively. Over the projected 10-year period, the revenue which needs to be generated by the Cluster to fund the required immovable asset life cycle works varies between about R196 million and about R540 million. In the event that such revenue cannot be generated through user charges (an indication that the Cluster is not financially self-sustainable), external funding would need to be considered. Such funding can be in the form of fiscal support, cross subsidisation or debt raised through such institutions as TCTA.

6. RECOMMENDATIONS

6.1 Overview

This section provides recommendations for improvement on challenges identified throughout the preceding sections of this AMP, with a particular focus on best practices and AMP monitoring and control.

6.2 Practices Improvement

Key areas of concern, and recommended improvement actions thereof, identified in the preceding sections of this AMP are summarized in Table 6.1.

Table 6.1: Recommended areas for improvement

No.	Area for Improvement	Issue Description	Recommended Action
1	**Asset Information Management**		
1.1	Asset Register as the indispensable key data source for AMP development	The quality and usefulness of an AMP is highly dependent on the completeness and accuracy of the asset register used in the development of the AMP. Accordingly, the asset life cycle management activities and works (such as maintenance, renewals, upgrades and new capital, and disposals) recommended for the Cluster in this AMP are highly dependent on the asset component condition, criticality and utilisation gradings captured in the asset register used in the development of this AMP. However, during the AMPs review workshops conducted during the development of this AMP, the Cluster and scheme personnel did not fully concur with some of the asset component counts, condition as well as utilisation gradings; indicating the possibility of misalignment between the asset register and the prevailing situation on the ground.	The NWRI needs to urgently conduct physical asset verification and assessments (extent, condition, criticality, utilisation, etc.) for all its immovable assets and develop a comprehensive asset register, inclusive of all crucial asset component details, such as asset component sizes, material of construction, condition, criticality, utilisation, etc. Thereafter, the NWRI needs to conduct similar assessments at least every five years as contemplated in Section 13 of the GIAMA. The abovementioned asset assessments need to be conducted by adequately experienced professionals.

No.	Area for Improvement	Issue Description	Recommended Action
1.2	Current Replacement Cost (CRC)	Each and every asset component in the asset register needs to have a corresponding CRC. The CRCs are useful in the determination and projection of optimal asset life cycle management works, such as O&M, renewals, upgrades and new capital, etc., in line with international best practices. Ideally, the CRC of an asset component needs to be determined by multiplying the unit cost rate (cost per unit size, ideally obtained from suppliers) by the size of the asset component. Thus, the asset register needs to adequately capture such details as asset component sizes, material of construction, etc. However, such asset component details are not fully captured in the asset register used in the development of this AMP. As a result, the CRCs presented in this AMP were determined by adjusting the provided acquisition costs with PPI and an uncertainty factor; hence the projected optimal asset life cycle management costs may be on the conservative side.	The above-recommended assessments for the NWRI immovable assets need to adequately capture such asset component details as sizes and material of construction. This will enable the determination of more accurate CRCs, and consequently projection of more accurate optimal asset life cycle management costs.
2	**Financial Management**		
2.1	O&M Costs reporting	The DWS is unaware of O&M costs currently being incurred by some of the schemes being operated and maintained by other institutions, such as irrigation boards, water boards and water user associations, and no financial reports are being sent to DWS.	The DWS needs to liaise with the respective institutions and agree on frequent O&M reports, preferably on a quarterly basis.
2.2	O&M Costs splitting	O&M costs in the individual schemes are currently not being budgeted for and recorded separately per asset facility category.	Budget for and record O&M costs: separately (separate operations from maintenance). Budget for and record O&M costs per asset facility category.
3	**Human Resources**		
3.1	O&M Human Resources Requirements	The DWS is unaware of the optimum number of personnel required for effective operation and maintenance of some of the schemes being operated and maintained by other institutions, such as irrigation boards, water boards and water user associations, and no related reports are being sent to DWS.	The DWS needs to liaise with the respective institutions and agree on frequent O&M reports (including human resources), preferably on a quarterly basis.

No.	Area for Improvement	Issue Description	Recommended Action
4	**Risk Management**		
4.1	Risk Management	Risk (expected loss) is calculated by determining the product of the likelihood of the risk and the total amount of loss (impact) when the risk occurs: *Expected Loss (Risk) = Risk Likelihood x Total Loss (Impact)* For this Scheme, however, risk likelihood per asset component was not captured in the Asset Register used in the development of this AMP. Hence, an in-depth risk analysis could not be conducted.	Capture risk likelihood per asset component in the infrastructure asset register, so that the next update of this AMP can incorporate an in-depth risk analysis.
5	**Contracts Management**		
5.1	Immovable Asset Maintenance Contract	The Cluster does not have an immovable asset maintenance contract in place. The one that was there was terminated in October 2016. This poses a high risk of service delivery failure as a result of deteriorating asset condition.	Appoint an immovable asset maintenance contractor, and work towards clearing the maintenance backlog.

6.3 Asset Management Planning, Monitoring and Evaluation

The AMP development, monitoring and evaluation recommendations are consistent with the GIAMA and DWS Asset Management Policy:

- The Director for the Cluster is the *controller* for the Cluster's infrastructure assets and is required to: "safeguard and maintain" the assets; "maintain a system of internal control" over the assets; "maintain an asset register" for the assets; and appoint an Asset Manager at the Cluster level, as contemplated in Section 5 of the DWS Asset Management Policy. It is recommended that:
  - The Asset Manager (instead of working alone) sets up a dedicated Asset Management team (Asset Management Specialists) at the Cluster level to effectively plan, and effectively monitor the implementation of the AMPs for all the schemes in the cluster.
  - The NWRIB appoints a dedicated in charge AMPs planning, monitoring and evaluation team (at Head Office).
- The AMPs need to be updated annually to inform the budget and after budget allocations have been finalised by the National Treasury, and incorporated into the DWS Strategic Plan, as contemplated in Section 12 of the GIAMA.

6.4 Summary

In order to effectively and efficiently deliver its service (supply of raw water) to its irrigation,

and domestic and industrial water users (Section 1), meeting the required levels of service (Section 2), and meeting the projected future raw water demand (Section 3), the Cluster needs to execute the recommended asset life cycle management activities (Section 4) in line with the planned budgets and timeframes (Section 5). Furthermore, a number of recommendations made for process improvement, particularly with regards to the DWS immovable asset register, Asset Management Information System, financial management (in particular the recording of O&M costs), human resources, contract management, as well as risk management, need to be implemented. Pro-activeness and forward-looking, taking care of any changes in the assumptions made in this AMP are also of vital importance.

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APPENDICES

APPENDIX A – Asset Register for Eastern Operations Cluster

<Refer to soft-copy file>

APPENDIX B – Strategic Context

1. DWS's Vision, Mission, and Organisational Goals & Objectives

Figure B.1 shows the link between this AMP and the DWS's Vision.

Figure B.1: AMP Alignment with DWS's Vision, Mission, and Organisational Goals & Objectives

Vision

Equitable and sustainable water and sanitation that support socio-economic growth and development of the well-being of current and future generations.

Mission

To ensure the universal access of all South Africans to equitable water resources and sustainable water and sanitation services, by:

- Protecting, developing, conserving, managing and regulating water resources;
- Managing, regulating and providing efficient and effective water and sanitation

services;

- Providing strategic leadership and evidence based policy direction to a coordinated water and sanitation sector for improved sector performance and service delivery;
- Building the skills and capabilities of the sector and enhancing information management to inform decision making; and
- Enhancing communication and stakeholder partnerships with communities and sector constituencies to advance the national development agenda.

Values

- Promoting and maintaining high standards of professional ethics.
- Utilising resources efficiently and effectively.
- Providing services impartially, fairly, equitably and without bias.
- Responding to people's needs; citizens are encouraged to participate in policy-making.
- Rendering an accountable, transparent, and development-oriented public administration.

Organisational Goals and Objectives

- Enhanced and protected water as a resource across the value chain.
- Equitable access to reliable, sustainable and acceptable water resources and water and sanitation services.
- An enhanced contribution to socio-economic development and transformation by the sector.
- An efficient, effective and development oriented water and sanitation sector.
- Sound cooperative governance and an active and engaged citizenry.

APPENDIX C – Stakeholders

1. Key Stakeholders

The key stakeholders are listed in Table C.1.

Table C.1: Key Stakeholders

Stakeholder
Catchment Management Agency (CMA)
Water Service Authorities (WSAs)
Water Service Providers (WSPs)
The customers served by assets in the Cluster: ▪ 468 water users (401 for irrigation, and 67 for D&I).
Internal Stakeholders ▪ DWS Head Office; ▪ The Eastern Operations Cluster Office.

APPENDIX D – Raw Water Volumes and Future Demand

Table D.1: Registered Raw Water Volumes Specific to Each Customer

No.	Question	Answer			
1	Why does this Cluster exist?	To supply domestic and industrial water and water for irrigation.			
2	How much water was registered to the customers for the past 3 financial years?	***Water User Category***	**Cubic Metres (Million)**		
			2013/14	**2014/15**	**2015/16**
		Domestic & Industrial			734.235
		Irrigation			380.387
		Total			**1 114.622**

Table D.2 – The Likely Future Demand for Raw Water

Water Use Category	10 year Projections (Mm^3)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
D&I	734.235	734.235	734.235	734.235	734.235	734.235	734.235	734.235	734.235	734.235
IRR	380.387	380.387	380.387	380.387	380.387	380.387	380.387	380.387	380.387	380.387
Total	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**

Table. D.3: Sensitivity Analysis

What if Scenario demand changes by		10 year Projections (Mm3)									
		2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
	5%	1170.353	1228.871	1290.314	1354.830	1422.572	1493.700	1568.385	1646.804	1729.145	1815.602
	3%	1148.061	1182.502	1217.978	1254.517	1292.152	1330.917	1370.844	1411.970	1454.329	1497.959
	2%	1136.914	1159.653	1182.846	1206.503	1230.633	1255.245	1280.350	1305.957	1332.076	1358.718
	Base = 0%	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**	**1114.622**
	-2%	1092.330	1070.483	1049.073	1028.092	1007.530	987.379	967.632	948.279	929.314	910.727
	-3%	1081.183	1048.748	1017.285	986.767	957.164	928.449	900.595	873.578	847.370	821.949
	-5%	1058.891	1005.946	955.649	907.867	862.473	819.350	778.382	739.463	702.490	667.365

APPENDIX E – Asset Details

Table E.1: Asset Condition - Asset component condition grading proportions per asset facility category

Asset Facility Category	Condition Grading										Totals	
	1-Very Poor		2-Poor		3-Fair		4-Good		5-Very Good		Total No. of Assets	Total Row N %
	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %		
Buildings	28	7.57%	25	6.76%	233	62.97%	81	21.89%	3	0.81%	**370**	**100.00%**
Canals	4	0.70%	17	2.97%	185	32.34%	366	63.99%		-	**572**	**100.00%**
Dams	10	1.14%	96	10.93%	294	33.49%	327	37.24%	151	17.20%	**878**	**100.00%**
Measuring facilities	3	1.40%	18	8.37%	108	50.23%	68	31.63%	18	8.37%	**215**	**100.00%**
Pipelines		-		-	15	25.00%	22	36.67%	23	38.33%	**60**	**100.00%**
Power supply		-		-	2	100.00%		-		-	**2**	**100.00%**
Pump stations	39	12.54%	41	13.18%	97	31.19%	61	19.61%	73	23.47%	**311**	**100.00%**
Reservoirs		-		-	6	85.71%		-	1	14.29%	**7**	**100.00%**
Roads		-		-	4	44.44%	1	11.11%	4	44.44%	**9**	**100.00%**
Telemetry		-		-	2	40.00%		-	3	60.00%	**5**	**100.00%**
Water Treatment		-		-	2	66.67%		-	1	33.33%	**3**	**100.00%**
All Cluster asset components	*84*	*3.45%*	*197*	*8.10%*	*948*	*38.98%*	*926*	*38.08%*	*277*	*11.39%*	***2 433***	***100.00%***

Table E.2: Asset RUL/EUL Ratio - Proportion of RUL/EUL Ratio grading for assets per facility category

Asset Facility Category	RUL/EUL Ratio										Totals	
	0-10%		11-25%		26-45%		46-70%		71-100%		Total No. of Assets	Total Row N %
	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %		
Buildings	28	7.57%	25	6.76%	233	62.97%	81	21.89%	3	0.81%	**370**	**100.00%**
Canals	4	0.70%	17	2.97%	185	32.34%	366	63.99%		-	**572**	**100.00%**
Dams	10	1.14%	96	10.93%	294	33.49%	327	37.24%	151	17.20%	**878**	**100.00%**
Measuring facilities	3	1.39%	18	8.33%	108	50.00%	69	31.94%	18	8.33%	**216**	**100.00%**
Pipelines		-		-	15	25.00%	22	36.67%	23	38.33%	**60**	**100.00%**
Power supply		-		-	2	100.00%		-		-	**2**	**100.00%**
Pump stations	39	12.54%	41	13.18%	97	31.19%	61	19.61%	73	23.47%	**311**	**100.00%**
Reservoirs		-		-	6	85.71%		-	1	14.29%	**7**	**100.00%**
Roads		-		-	4	44.44%	1	11.11%	4	44.44%	**9**	**100.00%**
Telemetry		-		-	2	40.00%		-	3	60.00%	**5**	**100.00%**
Water Treatment		-		-	2	66.67%		-	1	33.33%	**3**	**100.00%**
All Cluster asset components	*84*	*3.45%*	*197*	*8.10%*	*948*	*38.96%*	*926*	*38.10%*	*277*	*11.39%*	***2433***	***100.00%***

Table E.3: Asset Criticality - Proportion of Asset Criticality grading for assets per facility category

Asset Facility Category	Criticality Grading										Totals	
	1-Very Low		2-Low		3-Moderate		4-High		5-Very High		Total No. of Assets	Total Row N %
	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %		
Buildings	37	10.00%	44	11.89%	287	77.57%	2	0.54%		-	**370**	**100.00%**
Canals	21	3.67%	336	58.74%	210	36.71%	5	0.87%		-	**572**	**100.00%**
Dams	21	2.39%	142	16.17%	231	26.31%	443	50.46%	41	4.67%	**878**	**100.00%**
Measuring facilities	76	35.19%	108	50.00%	31	14.35%	1	0.46%		-	**216**	**100.00%**
Pipelines	1	1.67%	12	20.00%	27	45.00%	20	33.33%		-	**60**	**100.00%**
Power supply		-	2	100.00%		-		-		-	**2**	**100.00%**
Pump stations		-	26	8.36%	104	33.44%	107	34.41%	74	23.79%	**311**	**100.00%**
Reservoirs		-	7	100.00%		-		-		-	**7**	**100.00%**
Roads	8	88.89%	1	11.11%		-		-		-	**9**	**100.00%**
Telemetry		-	3	60.00%	2	40.00%		-		-	**5**	**100.00%**
Water Treatment		-	3	100.00%		-		-		-	**3**	**100.00%**
All Cluster asset components	*164*	*6.74%*	*684*	*28.11%*	*892*	*36.66%*	*578*	*23.76%*	*115*	*4.73%*	***2 433***	***100.00%***

Table E.4: Asset Utilisation - Proportion of Asset Utilisation grading for assets per asset facility category

Asset Facility Category	Utilisation Grading										Totals	
	1-Strategic redundancy		2-Under-utilised		3-Moderate use		4-Approaching design capacity		5-Exceeding capacity / stressed		Total No. of Assets	Total Row N %
	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %	No. of Assets	Row N %		
Buildings	6	1.62%	25	6.76%	22	5.95%	316	85.41%	1	0.27%	**370**	**100.00**
Canals		-		-	466	81.47%	106	18.53%		-	**572**	**100.00**
Dams		-	5	0.57%	215	24.49%	624	71.07%	34	3.87%	**878**	**100.00**
Measuring facilities		-	17	7.91%	41	19.07%	157	73.02%		-	**215**	**100.00**
Pipelines		-		-	13	21.67%	26	43.33%	21	35.00%	**60**	**100.00**
Power supply		-	2	100.00%		-		-		-	**2**	**100.00**
Pump stations		-		-	119	38.26%	158	50.80%	34	10.93%	**311**	**100.00**
Reservoirs		-	1	14.29%		-	6	85.71%		-	**7**	**100.00**
Roads		-	4	44.44%	4	44.44%	1	11.11%		-	**9**	**100.00**
Telemetry		-	2	40.00%	3	60.00%		-		-	**5**	**100.00**
Water Treatment		-		-		-	3	100.00%		-	**3**	**100.00**
All Cluster asset components	*6*	*0.25%*	*56*	*2.30%*	*883*	*36.31%*	*1397*	*57.44%*	*90*	*3.70%*	***2433***	***100.00***

Table E.5A: Asset component proportions per Criticality - Condition grading and per asset facility category (Maintenance)

Asset Facility Category	Criticality-Condition Grading (Proportion, %)															
	H - F	H - G	H - VG	L - F	L - G	L - VG	M - F	M - G	M - VG	VH - F	VH - G	VH - VG	VL - F	VL - G	VL - VG	Total
Buildings	-	0.63%	-	6.94%	1.58%	-	57.10%	21.77%	0.63%	-	-	-	9.46%	1.58%	0.32%	**100.00%**
Canals	0.91%	-	-	17.06%	41.38%	-	14.88%	21.96%	-	-	-	-	0.73%	3.09%	-	**100.00%**
Dams	16.19%	25.65%	13.21%	8.03%	2.07%	2.20%	12.95%	9.33%	2.98%	0.65%	3.76%	0.65%	0.26%	1.55%	0.52%	**100.00%**
Measuring facilities	-	-	0.52%	37.11%	13.92%	2.58%	7.73%	5.67%	2.58%	-	-	-	10.82%	15.46%	3.61%	**100.00%**
Pipelines	1.67%	8.33%	23.33%	5.00%	3.33%	11.67%	16.67%	25.00%	3.33%	-	-	-	1.67%	-	-	**100.00%**
Power supply	-	-	-	100.00%	-	-	-	-	-	-	-	-	-	-	-	**100.00%**
Pump stations	8.23%	6.49%	18.61%	3.03%	2.16%	1.73%	19.91%	7.36%	7.36%	10.82%	10.39%	3.90%	-	-	-	**100.00%**
Reservoirs	-	-	-	85.71%	-	14.29%	-	-	-	-	-	-	-	-	-	**100.00%**
Roads	-	-	-	-	-	11.11%	-	-	-	-	-	-	44.44%	11.11%	33.33%	**100.00%**
Telemetry	-	-	-	-	-	60.00%	40.00%	-	-	-	-	-	-	-	-	**100.00%**

Asset Facility Category	Criticality-Condition Grading (Proportion, %)															
	H - F	H - G	H - VG	L - F	L - G	L - VG	M - F	M - G	M - VG	VH - F	VH - G	VH - VG	VL - F	VL - G	VL - VG	Total
Water Treatment	-	-	-	66.67%	-	33.33%	-	-	-	-	-	-	-	-	-	**100.00%**
All Cluster asset components	*6.97%*	*10.23%*	*7.44%*	*12.55%*	*13.16%*	*1.81%*	*20.27%*	*14.18%*	*2.28%*	*1.39%*	*2.46%*	*0.65%*	*2.88%*	*3.02%*	*0.70%*	***100.00%***

Table E.5B: CRC per asset Criticality - Condition grading and per asset facility category (Maintenance)

Asset Facility Category	Criticality-Condition Grading (CRC, R Million)															Total	*% of Total CRC*
	H - F	H - G	H - VG	L - F	L - G	L - VG	M - F	M - G	M - VG	VH - F	VH - G	VH - VG	VL - F	VL - G	VL - VG		
Buildings		0.58		15.01	3.98		130.41	62.31	2.91				61.95	11.36	1.72	**290.22**	*1.81*
Canals	53.50			59.09	174.41		198.19	342.38					2.17	13.73		**843.47**	*5.27*
Dams	224.24	1,094.88	979.04	188.92	25.32	44.88	202.94	313.57	714.03	629.97	6,427.84	2,117.84	1.10	13.65	15.99	**12,994.22**	*81.23*
Measuring facilities			8.93	405.86	90.35	10.89	52.41	66.37	48.12				5.83	12.11	3.02	**703.91**	*4.40*
Pipelines	1.22	16.01	26.43	2.17	2.89	45.11	65.88	597.65	3.47				0.37			**761.20**	*4.76*
Power supply				0.46												**0.46**	*0.00*
Pump stations	28.91	14.92	19.17	26.62	8.04	3.58	23.66	15.78	20.10	36.97	66.67	1.24				**265.66**	*1.66*
Reservoirs				2.20		2.39										**4.59**	*0.03*
Roads						5.20							0.28	1.97	114.65	**122.10**	*0.76*
Telemetry						7.61	1.66									**9.28**	*0.06*
Water Treatment				1.16		0.44										**1.60**	*0.01*
Total	**307.87**	**1,126.39**	**1,033.57**	**701.48**	**304.99**	**120.11**	**675.16**	**1,398.07**	**788.64**	**666.93**	**6,494.52**	**2,119.08**	**71.70**	**52.81**	**135.37**	**15,996.69**	*100.00*
% of Total CRC	*1.92*	*7.04*	*6.46*	*4.39*	*1.91*	*0.75*	*4.22*	*8.74*	*4.93*	*4.17*	*40.60*	*13.25*	*0.45*	*0.33*	*0.85*	***100.00***	

Table E.6A: Asset component proportions per Criticality - Condition grading and per asset facility category (Renewals)

Asset Facility Category	Criticality-Condition Grading (Proportion, %)										
	H - P	**H - VP**	**L - P**	**L - VP**	**M - P**	**M - VP**	**VH - P**	**VH - VP**	**VL - P**	**VL - VP**	**Total**
Buildings	-	-	16.98%	15.09%	30.19%	35.85%	-	-	-	1.89%	**100.00%**
Canals	-	-	47.62%	19.05%	33.33%	-	-	-	-	-	**100.00%**
Dams	16.04%	0.94%	44.34%	-	26.42%	7.55%	0.94%	0.94%	2.83%	-	**100.00%**
Measuring facilities	-	-	9.52%	4.76%	-	-	-	-	76.19%	9.52%	**100.00%**
Pump stations	1.25%	36.25%	3.75%	8.75%	26.25%	3.75%	20.00%	-	-	-	**100.00%**
All Cluster asset components	*6.41%*	*10.68%*	*25.27%*	*7.12%*	*25.62%*	*10.68%*	*6.05%*	*0.36%*	*6.76%*	*1.07%*	***100.00%***

Table E.6B: CRC per asset Criticality - Condition grading and per asset facility category (Renewals)

Asset Facility Category	Criticality-Condition Grading (CRC, R Million)											
	H - P	**H - VP**	**L - P**	**L - VP**	**M - P**	**M - VP**	**VH - P**	**VH - VP**	**VL - P**	**VL - VP**	**Total**	*% of Total CRC*
Buildings			3.17	3.76	9.25	16.57				1.17	**33.92**	15.26
Canals			3.15	0.40	5.18						**8.73**	3.93
Dams	6.05	0.22	61.34		20.64	19.33	3.11	7.73	2.46		**120.89**	54.38
Measuring facilities			8.78	5.82					6.90	0.65	**22.14**	9.96
Pump stations	1.01	1.09	1.08	7.58	6.14	0.23	19.49				**36.61**	16.47
Total	**7.06**	**1.31**	**77.52**	**17.56**	**41.21**	**36.13**	**22.60**	**7.73**	**9.36**	**1.82**	**222.29**	100.00
% of Total CRC	*3.17*	*0.59*	*34.87*	*7.90*	*18.54*	*16.25*	*10.17*	*3.48*	*4.21*	*0.82*	***100.00***	

APPENDIX F – Risk Management

Table F.1 shows generic risks typically associated with the different asset facility categories.

Table F.1: Generic risks per asset facility category

Asset Facility Category	Generic Risks
Water Sources (i.e. Dams. Ground Water, etc.)	▪ Structural failure of embankment, valve tower and cut-off wall ▪ Failure of control valves, pipework and power supply ▪ Contamination of ground water sources ▪ Land instability ▪ Electrical systems within the dam (control system)
Raw Water Conveyance (Canals, tunnels, pipelines)	▪ Structural failure of aqueducts, canals, tunnels, portals and raw water mains ▪ Land instability
Water Pump Stations	▪ Structural failure and land instability ▪ Failure of pumps, valves, pipework, power supply, motors, drives and controls
Water Reservoirs	▪ Structural failure and land instability ▪ Failure of pumps, valves, pipework, power supply, motors, drives and controls ▪ Structural failure of walls due to design and construction deficiencies. ▪ Leaks and excessive overflow.
Telemetry and SCADA	▪ Signals from all types valves, computer systems programming ▪ Ventilation on control room

APPENDIX G – (Blank)

APPENDIX H – Optimal total cost requirement

Table H.1A: Optimal total cost requirement per cost component (scheme-specific)

Cost Component	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
O&M	181.241	192.249	203.972	215.712	229.295	243.181	257.897	273.474	290.186	307.785
Renewal	-	78.653	1.383	49.447	131.211	21.915	147.591	21.534	58.714	45.332
Upgrade & New	-	318.871	38.327	57.068	-	21.160	-	5.628	48.150	-
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**181.241**	**589.772**	**243.682**	**322.227**	**360.505**	**286.256**	**405.488**	**300.636**	**397.050**	**353.117**

Table H.1B: Adjusted Optimal total cost requirement per cost component (scheme-specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
O&M	181.240	192.248	203.972	215.711	229.293	243.179	257.897	273.474	290.187	307.786
Renewal	-	11.798	13.775	20.408	40.370	53.381	79.446	81.973	103.776	122.607
Upgrade & New	-	47.831	60.754	67.116	62.631	61.340	51.687	37.930	48.940	49.754
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**181.240**	**251.877**	**278.501**	**303.235**	**332.294**	**357.900**	**389.030**	**393.377**	**442.902**	**480.147**

Table H.2A: Optimal total cost requirement per cost component (non-scheme-specific)

Cost Component	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
O&M	14.642	15.531	16.478	17.427	18.524	19.646	20.835	22.093	23.443	24.865
Renewal	-	3.474	1.088	-	-	0.300	123.658	-	2.603	-
Upgrade & New	-	-	-	-	-	-	-	-	-	-
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**14.642**	**19.005**	**17.566**	**17.427**	**18.524**	**19.946**	**144.493**	**22.093**	**26.046**	**24.865**

Table H.2B: Adjusted Optimal total cost requirement per cost component (non-scheme-specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
O&M	14.642	15.531	16.478	17.427	18.524	19.646	20.834	22.094	23.443	24.865
Renewal	-	0.521	0.762	0.759	0.681	0.666	25.293	32.547	37.242	35.406
Upgrade & New	-	-	-	-	-	-	-	-	-	-
Disposal	-	-	-	-	-	-	-	-	-	-
Total	**14.642**	**16.052**	**17.240**	**18.186**	**19.205**	**20.312**	**46.127**	**54.641**	**60.685**	**60.271**

Table H.3A: Optimal total cost requirement per asset facility category (scheme-specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	36.723	20.428	21.604	86.199	24.355	40.672	27.389	29.063	30.826
Land	-	-	-	-	-	-	-	-	-	-
WR: Canals	19.149	22.622	59.878	80.892	62.811	46.853	64.594	34.522	82.782	52.517
WR: Dams	114.862	180.992	129.268	157.469	171.403	155.104	229.992	173.315	185.111	206.863
WR: Power Supply	0.031	0.032	0.034	0.263	0.039	0.041	0.043	0.046	0.049	0.052
WR: Pump stations	9.435	28.952	10.618	31.772	13.366	30.954	26.535	14.541	27.872	25.437
WR: Reservoirs	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.911	0.062
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.292	5.492	5.827	6.181
WR: Steel Pipelines	8.373	306.464	9.423	10.337	10.593	11.235	11.915	13.218	46.090	14.219
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.917	0.767	0.814	0.863
WR: Tunnels	-	-	-	-	-	-	-	-	-	-
WR: Water Treatment	0.055	0.058	0.062	0.065	0.069	0.073	0.590	0.083	0.088	0.093
WS: borehole	-	-	-	-	-	-	-	-	-	-
WS: Measuring facility	7.000	9.490	9.261	14.844	10.731	12.026	24.886	31.207	18.444	16.005
Total	**181.241**	**589.772**	**243.682**	**322.227**	**360.505**	**286.256**	**405.488**	**300.636**	**397.050**	**353.117**

Table H.3B: Adjusted Optimal total cost requirement per asset facility category (scheme-specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	18.152	21.874	23.442	24.434	34.932	40.599	44.101	43.021	44.369	43.874
Land	-	-	-	-	-	-	-	-	-	-
WR: Canals	19.149	20.659	27.699	30.219	37.147	45.130	53.519	54.735	73.016	88.237
WR: Dams	114.862	130.712	139.472	157.966	172.229	182.898	201.872	208.880	220.226	231.760
WR: Power Supply	0.030	0.033	0.034	0.070	0.082	0.085	0.082	0.074	0.075	0.072
WR: Pump stations	9.435	12.849	13.886	17.379	18.695	23.063	26.167	25.674	30.362	35.555
WR: Reservoirs	0.037	0.039	0.041	0.043	0.047	0.049	0.053	0.056	0.314	0.455
WR: Roads and bridge	3.639	3.861	4.096	4.332	4.604	4.883	5.202	5.522	5.860	6.212
WR: Steel Pipelines	8.373	53.518	60.757	58.230	52.957	48.332	41.605	32.830	40.796	42.753
WR: Telemetry	0.508	0.539	0.572	0.605	0.643	0.682	0.762	0.817	0.870	0.916
WR: Tunnels	-	-	-	-	-	-	-	-	-	-
WR: Water Treatment	0.055	0.058	0.061	0.065	0.069	0.073	0.180	0.215	0.238	0.233
WS: borehole	-	-	-	-	-	-	-	-	-	-
WS: Measuring facility	7.000	7.735	8.442	9.891	10.890	12.105	15.488	21.553	26.776	30.079
Total	**181.240**	**251.877**	**278.501**	**303.235**	**332.294**	**357.900**	**389.030**	**393.377**	**442.902**	**480.147**

Table H.4A: Optimal total cost requirement per asset facility category (non-scheme-specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facilities	14.642	19.005	17.566	17.427	18.524	19.946	144.493	22.093	26.046	24.865
Total	**14.642**	**19.005**	**17.566**	**17.427**	**18.524**	**19.946**	**144.493**	**22.093**	**26.046**	**24.865**

Table H.4B: Adjusted Optimal total cost requirement per asset facility category (non-scheme-specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facility	14.642	16.052	17.240	18.186	19.205	20.312	46.127	54.641	60.685	60.271
Total	**14.642**	**16.052**	**17.240**	**18.186**	**19.205**	**20.312**	**46.127**	**54.641**	**60.685**	**60.271**

Table H.5: Adjusted Optimal total cost requirement per scheme

Scheme Name	Financial Year (Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Bevenson Dam	0.015	0.368	0.422	0.398	0.353	0.313	0.256	0.181	0.162	0.130
Bizana Dam	6.508	6.903	7.324	8.134	8.729	9.261	10.860	11.635	12.386	12.856
Bushmans River GWS -Wagendrift Dam	2.658	4.146	4.517	4.815	5.468	5.863	6.297	6.705	7.253	7.513
Hammersdale Dam	0.018	0.019	0.020	0.021	0.023	0.024	0.025	0.027	0.029	0.030
Hluhluwe River GWS -Hluhluwe Dam	2.869	6.014	6.673	6.783	7.036	7.106	6.892	6.928	7.358	7.379
Lavumisa GWS	0.627	4.824	5.488	5.237	4.733	4.350	3.835	3.018	2.844	2.505
Mdloti River GWS (Hazelmere Dam)	3.558	4.953	5.360	5.509	6.082	6.480	6.681	6.619	7.031	7.264
Mnyamvubu River-Cragie Burn Dam	1.821	2.493	2.695	3.106	3.552	3.872	4.055	4.509	4.854	4.891
Mooi-Mgeni River GWS	58.793	62.421	66.261	70.880	75.969	81.526	89.276	94.840	113.218	125.440
Ngagane River GWS -Ntshingwayo Dam	4.577	5.735	6.164	7.136	9.012	10.060	13.823	15.025	16.063	16.204
Pongola River GWS	21.389	23.255	30.472	41.790	51.456	60.485	67.881	67.039	85.075	99.132
Pongolapoort GWS	17.912	20.122	21.449	23.439	26.542	28.658	34.186	36.024	38.142	38.930
Qedusizi	1.709	1.891	2.014	2.119	2.284	2.429	2.880	3.094	3.297	3.418
Singizi	2.064	2.190	2.323	2.457	2.637	2.806	3.112	3.324	3.534	3.718
Tugela Mhlathuze Rivers GWS	18.579	61.341	68.806	70.199	67.806	67.888	63.401	56.976	60.016	63.776
Tugela River GWS - Spioenkop	2.630	4.509	4.955	5.098	5.353	5.483	6.107	6.065	6.444	6.493
Umgeni River GWS	24.681	29.043	31.164	32.938	40.782	45.763	51.195	51.816	54.302	58.402
White Mfolozi River GWS -Klipfontein Dam	10.835	11.651	12.394	13.177	14.481	15.535	18.266	19.553	20.895	22.062
Subtotal	**181.243**	**251.877**	**278.500**	**303.237**	**332.297**	**357.902**	**389.029**	**393.377**	**442.900**	**480.144**
Non-Scheme Specific	14.642	16.052	17.240	18.186	19.205	20.312	46.127	54.641	60.685	60.271
Total	**195.885**	**267.929**	**295.740**	**321.422**	**351.503**	**378.214**	**435.155**	**448.019**	**503.585**	**540.414**

APPENDIX I – Maintenance Strategy, Works and Cost Forecast

1. INTRODUCTION

'Maintenance' is *"The actions required to enable an asset to achieve its expected life – recurrent work necessary to preserve or maintain an asset so it can be used for its designated purpose. In other words, recurrent work necessary to prevent deterioration. Maintenance work can be planned or unplanned. Planned maintenance is work to prevent known failure modes and can be time or condition-based. Maintenance includes all of the actions necessary for retaining an asset as near as practicable to its original condition, but excludes renewals.*

2. MAINTENANCE STRATEGY

Refer to the DWS Infrastructure Maintenance Strategy. Table I.1 summarises the Maintenance Strategy applied per Asset Condition Grading in this AMP.

Table I.1: Maintenance Strategy per Asset Condition Grading

Condition Grade	Description	Maintenance Strategy
3	Fair	Significant/improved maintenance required.
4	Good	Target condition maintenance. Preventive maintenance.
5	Very Good	Preventative and Normal Maintenance

3. MAINTENANCE WORKS

Table I.2: Maintenance Works (scheme specific)

Asset Facility Category	Maintenance Strategy (No. of Asset Components)			Total
	Improved	Preventive	Normal	
Buildings	233	81	3	317
Canals	185	366		551
Dams	294	327	151	772
Measuring facilities	20	38	7	65
Pipelines	15	22	23	60
Power supply	2			2
Pump stations	97	61	73	231
Reservoirs	6		1	7
Roads	4	1	4	9
Telemetry	2		3	5
Water Treatment	2		1	3
Total	**858**	**896**	**265**	**2 022**

Table I.3: Maintenance Works (non-scheme specific)

Asset Facility Category	Maintenance Strategy (No. of Asset Components)			Total
	Improved	Preventive	Normal	
Measuring facilities	88	30	11	129
Total	**88**	**30**	**11**	**129**

For scheme specific maintenance work, and its prioritisation, refer to the relevant Scheme AMP.

4. FINANCIAL FORECAST – OPERATIONS AND MAINTENANCE

The forecasted maintenance financial requirements for the next 10 years are in Table I.4.

Table I.4: Operations and Maintenance Costs per Asset Facility Category Forecast (scheme specific)

Asset Facility Category	Expenditure Class	Expenditure Type	Financial Year (Amounts in Million Rands)									
			2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	O&M	O	1.621	1.719	1.824	1.929	2.050	2.175	2.306	2.445	2.595	2.752
		M	16.531	17.535	18.605	19.675	20.914	22.181	23.523	24.944	26.468	28.073
WR: Canals	O&M	O	4.477	4.749	5.039	5.329	5.664	6.007	6.371	6.756	7.169	7.603
		M	14.672	15.563	16.512	17.462	18.562	19.686	20.877	22.138	23.491	24.916
WR: Dams	O&M	O	37.794	40.090	42.534	44.983	47.815	50.711	53.780	57.028	60.513	64.183
		M	77.068	81.749	86.734	91.726	97.501	103.406	109.664	116.287	123.394	130.877
WR: Power Supply	O&M	O	0.010	0.011	0.011	0.012	0.013	0.013	0.014	0.015	0.016	0.017
		M	0.020	0.022	0.023	0.024	0.026	0.027	0.029	0.031	0.033	0.035
WR: Pump stations	O&M	O	2.775	2.943	3.123	3.303	3.511	3.723	3.949	4.187	4.443	4.712
		M	6.660	7.064	7.495	7.926	8.425	8.936	9.476	10.049	10.663	11.310
WR: Reservoirs	O&M	O	0.005	0.005	0.005	0.005	0.006	0.006	0.007	0.007	0.007	0.008
		M	0.032	0.034	0.036	0.038	0.041	0.043	0.046	0.049	0.051	0.055
WR: Roads and bridge	O&M	O	-	-	-	-	-	-	-	-	-	-
		M	3.639	3.861	4.096	4.332	4.604	4.883	5.179	5.492	5.827	6.181
WR: Steel Pipelines	O&M	O	0.761	0.807	0.857	0.906	0.963	1.021	1.083	1.149	1.219	1.293
		M	7.612	8.074	8.567	9.060	9.630	10.213	10.831	11.486	12.188	12.927
WR: Telemetry	O&M	O	0.091	0.096	0.102	0.108	0.115	0.122	0.129	0.137	0.146	0.154
		M	0.417	0.443	0.470	0.497	0.528	0.560	0.594	0.630	0.668	0.709
WR: Water Treatment	O&M	O	0.018	0.019	0.020	0.021	0.023	0.024	0.026	0.027	0.029	0.031
		M	0.037	0.039	0.041	0.044	0.046	0.049	0.052	0.055	0.059	0.062
WS: Measuring facilities	O&M	O	2.303	2.443	2.592	2.741	2.914	3.091	3.278	3.475	3.688	3.912
		M	4.697	4.982	5.286	5.590	5.942	6.302	6.683	7.087	7.520	7.976
Total	**O&M**	**O**	**49.855**	**52.883**	**56.108**	**59.338**	**63.074**	**66.894**	**70.942**	**75.227**	**79.824**	**84.665**
		M	**131.386**	**139.365**	**147.864**	**156.374**	**166.221**	**176.287**	**186.955**	**198.247**	**210.362**	**223.120**

Table I.5: Operations and Maintenance Costs per Asset Facility Category Forecast (non-scheme specific)

Asset Facility Category		Expenditure Type	Financial Year (Amounts in Million Rands)									
			2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facilities	O&M	O	4.818	5.110	5.422	5.734	6.095	6.464	6.855	7.270	7.714	8.182
		M	9.824	10.421	11.056	11.693	12.429	13.182	13.979	14.824	15.729	16.683
Total	**O&M**	**O**	**4.818**	**5.110**	**5.422**	**5.734**	**6.095**	**6.464**	**6.855**	**7.270**	**7.714**	**8.182**
		M	**9.824**	**10.421**	**11.056**	**11.693**	**12.429**	**13.182**	**13.979**	**14.824**	**15.729**	**16.683**

Table I.6: Operation and Maintenance Cost Requirements Forecasts (scheme and non-scheme specific)

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Bevenson Dam	0.015	0.016	0.017	0.018	0.02	0.021	0.022	0.023	0.025	0.026
Bizana Dam	6.508	6.903	7.324	7.746	8.233	8.732	9.26	9.82	10.42	11.052
Bushmans River GWS -Wagendrift Dam	2.658	2.819	2.991	3.163	3.362	3.566	3.782	4.01	4.255	4.513
Hammersdale Dam	0.018	0.019	0.02	0.021	0.023	0.024	0.025	0.027	0.029	0.03
Hluhluwe River GWS -Hluhluwe Dam	2.869	3.044	3.229	3.415	3.63	3.85	4.083	4.33	4.594	4.873
Lavumisa GWS	0.627	0.665	0.705	0.746	0.793	0.841	0.892	0.946	1.003	1.064
Mdloti River GWS (Hazelmere Dam)	3.558	3.774	4.004	4.235	4.501	4.774	5.063	5.369	5.697	6.042
Mnyamvubu River-Cragie Burn Dam	1.821	1.932	2.05	2.168	2.304	2.444	2.592	2.748	2.916	3.093
Mooi-Mgeni River GWS	58.793	62.363	66.166	69.975	74.381	78.885	83.659	88.712	94.133	99.842
Ngagane River GWS -Ntshingwayo Dam	4.577	4.854	5.151	5.447	5.79	6.141	6.512	6.906	7.328	7.772
Pongola River GWS	21.389	22.688	24.071	25.457	27.06	28.698	30.435	32.273	34.246	36.322
Pongolapoort GWS	17.912	18.999	20.158	21.318	22.661	24.033	25.487	27.027	28.678	30.417
Qedusizi	1.709	1.812	1.923	2.034	2.162	2.293	2.431	2.578	2.736	2.902
Singizi	2.064	2.19	2.323	2.457	2.612	2.77	2.937	3.115	3.305	3.505
Tugela Mhlathuze Rivers GWS	18.579	19.707	20.909	22.112	23.505	24.928	26.437	28.033	29.747	31.551
Tugela River GWS - Spioenkop	2.63	2.79	2.96	3.13	3.328	3.529	3.743	3.969	4.211	4.467
Umgeni River GWS	24.681	26.18	27.776	29.375	31.224	33.115	35.119	37.241	39.516	41.913
White Mfolozi River GWS -Klipfontein Dam	10.835	11.493	12.194	12.896	13.708	14.538	15.418	16.349	17.348	18.4
Subtotal	**181.243**	**192.248**	**203.971**	**215.713**	**229.297**	**243.182**	**257.897**	**273.476**	**290.187**	**307.784**
Non-Scheme Specific	14.642	15.531	16.478	17.427	18.524	19.646	20.834	22.094	23.443	24.865
Total	**195.885**	**207.779**	**220.449**	**233.14**	**247.821**	**262.828**	**278.731**	**295.57**	**313.63**	**332.649**

APPENDIX J – Renewals Strategy, Works and Expenditure Forecast

1 INTRODUCTION

'**Renewals Expenditure**' is: *"Expenditure on the replacement or rehabilitation of an asset." It is expenditure on an existing asset which returns the service potential or the life of the asset to that which it had originally. It is periodically required expenditure, and relatively large (material) in value compared with the value of the components or sub-components of the asset being renewed. Renewals may reduce operating and maintenance expenditure if completed at the optimum time."*

It is very important that the NWRI always clearly distinguishes between New Capital/Upgrade Capital expenditure and Renewals Capital expenditure. The rate at which renewal work is being carried out *over time* compared with the annual provision for depreciation (the cost of consumption – the rate at which the assets are being used) is a good indicator of the extent to which the assets are being maintained, are improving, or are deteriorating.

2. RENEWALS STRATEGY

Table J.1 summarises the Renewal Strategy applied per Asset Condition Grading in this AMP.

Table J.1 Renewal Strategy per Asset Condition Grading

Condition Grade	Description	Renewal Strategy
0	Not Working	Complete replacement of the asset before operations can be revived
1	Very Poor	Stop operating immediately and renew the asset. Replacement needed (>50%)
2	Poor	Significant renewal required.

3. RENEWAL WORKS

Table J.2: Number of components per facility category for renewal works (scheme specific) – 2016/17

Asset Facility Category	Renewal Strategy (No. of Asset Components)		Total per facility category
	Stop operating immediately and renew the asset	Significantly renew	
Buildings	28	25	**53**
Canals	4	17	**21**
Dams	7	96	**103**
Measuring facilities	1		**1**
Pipelines			
Power supply			
Pump stations	39	41	**80**
Reservoirs			
Roads			
Telemetry			
Water Treatment			
Total	**79**	**179**	**258**

Table J.3: Number of components per facility category for renewal works (non-scheme specific) – 2016/17

Asset Facility Category	Renewal Strategy (No. of Asset Components)		Total per facility category
	Stop operating immediately and renew the asset	Significantly renew	
Measuring facilities	2	18	**20**
Total	**2**	**18**	**20**

Table J.4: Renewal Works (asset components per facility category requiring renewal works)

<Refer to soft copy>

4. FINANCIAL FORECAST

The forecasted renewals requirements for the next 10 years are in Table J.4.

Table J.5A: Identified Optimal Renewals Expenditure Forecasts (scheme specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings		16.271	-	-	63.235	-	14.843	-	-	-
WR: Canals		2.310	-	1.032	38.585	-	37.346	-	3.972	19.998
WR: Dams		42.200	-	20.760	26.086	0.987	66.549	-	1.204	11.803
WR: Power Supply		-	-	0.227	-	-	-	-	-	-
WR: Pump stations		15.807	-	20.543	1.430	18.295	13.110	0.305	12.766	9.415
WR: Reservoirs		-	-	-	-	-	-	-	0.853	-
WR: Roads and bridge		-	-	-	-	-	0.114	-	-	-
WR: Steel Pipelines		-	-	0.372	-	-	-	0.584	32.683	-
WR: Telemetry		-	-	-	-	-	0.193	-	-	-
WR: Water Treatment		-	-	-	-	-	0.512	-	-	-
WS: Measuring facilities		2.065	1.383	6.512	1.875	2.633	14.925	20.645	7.236	4.117
Total		**78.653**	**1.383**	**49.447**	**131.211**	**21.915**	**147.591**	**21.534**	**58.714**	**45.332**

Table J.5B: Adjusted Optimal Renewals Expenditure Forecasts (scheme specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	-	2.441	2.807	2.636	11.798	16.094	18.152	15.551	15.237	12.995
WR: Canals	-	0.347	0.398	0.529	6.310	9.077	16.153	16.461	18.421	25.272
WR: Dams	-	6.330	7.280	9.950	13.803	15.365	26.917	27.309	28.904	30.835
WR: Power Supply	-	-	-	0.034	0.043	0.045	0.039	0.028	0.026	0.020
WR: Pump stations	-	2.371	2.727	5.642	6.313	10.014	12.429	11.227	15.073	19.394
WR: Reservoirs	-	-	-	-	-	-	-	-	0.256	0.392
WR: Roads and bridge	-	-	-	-	-	-	0.023	0.030	0.033	0.031

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WR: Steel Pipelines	-	-	-	0.056	0.070	0.074	0.064	0.192	10.051	15.284
WR: Telemetry	-	-	-	-	-	-	0.039	0.050	0.056	0.053
WR: Water Treatment	-	-	-	-	-	-	0.102	0.133	0.150	0.140
WS: Measuring facility	-	0.310	0.564	1.560	2.034	2.712	5.527	10.991	15.568	18.191
Total	**-**	**11.798**	**13.775**	**20.408**	**40.370**	**53.381**	**79.446**	**81.973**	**103.776**	**122.607**

Table J.6A: Identified Renewals Expenditure Forecasts (non-scheme specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facilities		3.474	1.088	-	-	0.300	123.658	-	2.603	-
Total		**3.474**	**1.088**	**-**	**-**	**0.300**	**123.658**	**-**	**2.603**	**-**

Table J.6B: Adjusted Renewals Expenditure Forecasts (non-scheme specific)

Asset Facility Category	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facilities	-	0.521	0.762	0.759	0.681	0.666	25.293	32.547	37.242	35.406
Total	**-**	**0.521**	**0.762**	**0.759**	**0.681**	**0.666**	**25.293**	**32.547**	**37.242**	**35.406**

Table J.7A: Identified Renewal Cost Requirements Forecasts (scheme and non-scheme specific)

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Bevenson Dam	-	2.346	-	-	-	-	-	-	-	-
Bizana Dam	-	-	-	2.586	0.074	-	5.694	-	-	-
Bushmans River GWS -Wagendrift Dam	-	4.365	-	1.461	3.833	0.271	2.48	2.294	0.437	0.497
Hammersdale Dam	-	-	-	-	-	-	-	-	-	-
Hluhluwe River GWS -Hluhluwe Dam	-	4.835	0.189	0.837	2.677	-	0.472	2.294	0.462	-

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Lavumisa GWS	-	-	-	-	-	0.299	0.557	-	-	-
Mdloti River GWS (Hazelmere Dam)	-	3.3	-	-	3.087	0.202	0.621	-	0.552	0.026
Mnyamvubu River-Cragie Burn Dam	-	3.738	-	2.218	2.006	0.388	0.926	2.294	-	-
Mooi-Mgeni River GWS	-	0.384	0.189	5.39	3.265	3.845	15.017	0.584	41.759	1.051
Ngagane River GWS -Ntshingwayo Dam	-	5.874	-	4.914	9.773	0.198	18.685	2.294	-	1.129
Pongola River GWS	-	3.78	-	1.748	41.465	0.395	39.2	2.294	3.972	20.125
Pongolapoort GWS	-	2.049	-	6.055	11.21	-	22.537	-	-	-
Qedusizi	-	0.526	-	-	0.315	-	1.647	-	-	-
Singizi	-	-	-	-	0.164	-	0.697	-	-	-
Tugela Mhlathuze Rivers GWS	-	17.989	0.123	20.668	6.377	14.464	4.588	9.481	10.183	12.771
Tugela River GWS - Spioenkop	-	11.458	0.123	0.6	1.75	-	3.641	-	0.497	-
Umgeni River GWS	-	16.958	0.636	2.378	41.933	1.853	21.219	-	0.56	8.837
White Mfolozi River GWS -Klipfontein Dam	-	1.051	0.123	0.592	3.279	-	9.61	-	0.291	0.897
Subtotal	**-**	**78.653**	**1.383**	**49.447**	**131.208**	**21.915**	**147.591**	**21.535**	**58.713**	**45.333**
Non-Scheme Specific		3.474	1.088	-	-	0.3	123.658	-	2.603	-
Total		**82.127**	**2.471**	**49.447**	**131.208**	**22.215**	**271.249**	**21.535**	**61.316**	**45.333**

Table J.7: Adjusted Renewal Cost Requirements Forecasts (scheme and non-scheme specific)

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Bevenson Dam	-	0.352	0.405	0.380	0.333	0.292	0.234	0.158	0.137	0.104
Bizana Dam	-	-	-	0.388	0.496	0.529	1.600	1.815	1.966	1.804
Bushmans River GWS -Wagendrift Dam	-	0.655	0.753	0.926	1.469	1.740	2.069	2.394	2.737	2.800
Hammersdale Dam	-	-	-	-	-	-	-	-	-	-
Hluhluwe River GWS -Hluhluwe Dam	-	0.725	0.862	0.943	1.278	1.393	1.319	1.591	1.892	1.840
Lavumisa GWS	-	-	-	-	-	0.060	0.183	0.208	0.226	0.207
Mdloti River GWS (Hazelmere Dam)	-	0.495	0.569	0.535	0.932	1.138	1.163	0.943	1.068	1.018
Mnyamvubu River-Cragie Burn Dam	-	0.561	0.645	0.938	1.248	1.428	1.463	1.761	1.938	1.798

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Mooi-Mgeni River GWS	-	0.058	0.095	0.905	1.588	2.641	5.617	6.128	19.085	25.598
Ngagane River GWS -Ntshingwayo Dam	-	0.881	1.013	1.689	3.222	3.919	7.311	8.119	8.735	8.432
Pongola River GWS	-	0.567	0.652	0.875	7.085	10.122	17.506	18.271	20.469	27.254
Pongolapoort GWS	-	0.307	0.353	1.240	3.108	3.949	8.158	8.631	9.147	8.271
Qedusizi	-	0.079	0.091	0.085	0.122	0.136	0.449	0.516	0.561	0.516
Singizi	-	-	-	-	0.025	0.036	0.175	0.209	0.229	0.213
Tugela Mhlathuze Rivers GWS	-	2.698	3.122	6.037	7.410	10.664	11.121	11.496	15.145	20.668
Tugela River GWS - Spioenkop	-	1.719	1.995	1.968	2.025	1.954	2.364	2.096	2.233	2.026
Umgeni River GWS	-	2.544	3.021	3.218	9.256	12.383	15.864	14.432	14.662	16.395
White Mfolozi River GWS -Klipfontein Dam	-	0.158	0.200	0.281	0.773	0.997	2.848	3.204	3.547	3.662
Subtotal	**-**	**11.798**	**13.775**	**20.408**	**40.370**	**53.380**	**79.445**	**81.973**	**103.775**	**122.607**
Non-Scheme Specific	-	0.521	0.762	0.759	0.681	0.666	25.293	32.547	37.242	35.406
Total	**-**	**12.319**	**14.538**	**21.166**	**41.051**	**54.047**	**104.738**	**114.520**	**141.017**	**158.012**

APPENDIX K – Upgrades and New Capital Strategy and Cost Forecast

1. INTRODUCTION

'**New and Upgrade Capital**' is:

'Expenditure that is used to create new assets, or to increase the capacity of existing assets beyond their original design capacity or service potential'.

2. NEW & UPGRADE CAPITAL STRATEGY

Table K.1 summarises the Renewal Strategy applied per Asset Condition Grading in this AMP.

Table K.1: New and Upgrade Capital Strategy per Asset Utilisation Grading

Utilisation Grade	Description	New and Upgrade Capital Strategy
5	Exceeding Capacity/Stressed	Consider upgrading the asset component

3. UPGRADE AND NEW CAPITAL WORKS

Table K.2 shows the numbers of asset components per asset facility category that are exceeding their design capacities (stressed), and require upgrading, further split into scheme-specific and non-scheme-specific.

Table K.2: Asset components requiring upgrades based on utilisation

Asset Facility Category	Asset Components Exceeding Capacity / Stressed (Require Upgrading)					
	Cluster Total		Scheme Specific		Non-Scheme Specific	
	No.	CRC (R million)	No.	CRC (R million)	No.	CRC (R million)
Buildings	1	2.40	1	2.40	-	-
WR: Canals	-	-	-	-	-	-
WR: Dams	34	56.51	34	56.51	-	-
WR: Power Supply	-	-	-	-	-	-
WR: Pump stations	34	6.27	34	6.27	-	-
WR: Reservoirs	-	-	-	-	-	-
WR: Roads and bridge	-	-	-	-	-	-
WR: Steel Pipelines	21	297.58	21	297.58	-	-
WR: Telemetry	-	-	-	-	-	-
WR: Water Treatment	-	-	-	-	-	-
WS: Measuring facilities	-	-	-	-	-	-
Total	**90**	**362.76**	**90**	**362.76**	-	**0.00**

Table K.3: Utilisation-based upgrade works (asset components exceeding capacity in utilisation)

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	WR: Steel Pipelines	Pipeline Section	Pipe line intake	Pipeline- Steel	Pipeline	500007331_0	3	3	5	4.479
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	Buildings	Residential Housing	Hluhluwe dam Compound Single Quaters	Main Building	Main building	500021556_0	3	3	5	2.395
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Dam Outlet - Pipework- Steel	HLUHLUWE DAM outlet pipes	500009266_13	5	4	5	0.442
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Dam Outlet - Pipework- Steel	HLUHLUWE DAM outlet pipes	500009266_14	5	4	5	1.327
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Dam Outlet - Pipework- Steel	HLUHLUWE DAM outlet pipes	500009266_15	5	4	5	1.327
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Dam Intake Gates	Hluhluwe Dam stoplogs	500009266_28	4	3	5	1.034

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Intake Gates - Casing	HLUHLUWE DAM - intake gate - casing	500009266_5	4	4	5	2.283
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Intake Gates - Mechanism	HLUHLUWE DAM - intake gate - mechanism	500009266_6	4	4	5	1.167
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Cranes	Hluhluwe dam crane top (block & tackle)	500009266_21	4	5	5	2.568
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Outlet Valves - Casing	HLUHLUWE DAM - outlet valve 1 - casing	500009266_9	3	4	5	2.211
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Outlet Valves - Mechanism	HLUHLUWE DAM - outlet valve 1 - mechanism	500009266_10	3	4	5	0.778
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Outlet Valves - Casing	HLUHLUWE DAM - outlet valve 2 - casing	500009266_11	3	4	5	2.211
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	HLUHLUWE DAM	Dam Outlet Valves - Mechanism	HLUHLUWE DAM - outlet valve 2 - mechanism	500009266_12	3	4	5	0.778
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Dam Outlet - Pipework- Steel	Hluhluwe dam - outlet pipe - top midle	500009266_17	3	4	5	1.383
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Electric Network	Hluhluwe Dam electric network	500009266_22	2	2	5	2.889
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Auxilliary Equip. Main Damwall	Hluhluwe Dam handrails	500009266_23	2	2	5	2.295
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Auxilliary Equip. Main Damwall	Hluhluwe Dam lighting	500009266_24	2	2	5	1.632
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Auxilliary Equip. Main Damwall	Hluhluwe Dam staircases	500009266_26	2	2	5	2.295
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Auxilliary Equip. Main Damwall	Hluhluwe Dam safety boom & buoys	500009266_25	2	3	5	2.295
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Auxilliary Equip. Main Damwall	Hluhluwe Dam control room and equipment	500009266_20	2	4	5	3.211
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Dams	Main Damwall	Hluhluwe Dam	Cranes	Crane	500009266_16	2	5	5	2.074
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Steel Pipelines	Pipeline Valve Chamber	Hluhluwe Domestic & Industrial Pipeline Chamber	Pipeline Valve Chamber	not componentised	500009224_0	3	3	5	1.123
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Steel Pipelines	Pipeline Section	Hluhluwe Dam Outlet Conrete Pipe	Pipeline- Concrete	Pipeline	500009547_0	3	3	5	2.386
LAVUMISA GWS	WR: Steel Pipelines	Pipeline Section	Lavumisa low lift	Pipeline- Steel	Pipeline	500009869_0	3	3	5	1.870

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
LAVUMISA GWS	WR: Steel Pipelines	Pipeline Section	Lavumisa high lift	Pipeline- Steel	PipelinePipeline	500009869_1	3	3	5	25.855
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Cranes	Crane	500009061_14	4	5	5	1.637
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Outlet Valves - Casing	Hazelmere Dam - outlet valve - casing	500009061_8	3	4	5	1.154
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Outlet Valves - Mechanism	Hazelmere Dam - outlet valve - mechanism	500009061_9	3	4	5	0.410
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Outlet - Pipework- Steel	Hazelmere dam wall left main pipe 1	500009061_19	3	4	5	2.731
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Outlet - Pipework- Steel	Hazelmere dam wall left main pipe 2	500009061_20	3	4	5	2.731
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Outlet - Pipework- Steel	Hazelmere Dam Scour Outlet Pipes	500009061_18	3	5	5	0.196
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Electric Network	Hazelmere dam electric network	500009061_21	2	2	5	1.964
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	Hazelmere dam lighting	500009061_23	2	2	5	0.873
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	hydraulic power pack (Jet flow valves)	500009061_11	2	3	5	0.546
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	hydraulic power pack (ring follower 1)	500009061_12	2	3	5	0.546
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	hydraulic power pack (ring follower 2)	500009061_13	2	3	5	0.546
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	Hazelmere dam hydraulic power pack (Sleeve valves)	500009061_22	2	3	5	0.546
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	Hazelmere dam safety boom & buoys and winch	500009061_24	2	3	5	1.091
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Dam Meter & Instrumentation	Flow meter	500009061_15	1	5	5	0.239
PONGOLAPOORT GWS	WR: Steel Pipelines	Pipeline Section	Pongolapoort outlet pipeline	Pipeline- Steel	Pipeline	500007332_0	3	3	5	5.437
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Casing	Madungela PS electric motor 2 - casing	500009587_23	5	2	5	0.306

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Casing	Madungela PS electric motor 3 - casing	500009587_24	5	2	5	0.306
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Casing	Madungela PS electric motor 4 - casing	500009587_25	5	2	5	0.306
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Rotor	Madungela PS electric motor 2 - rotor	500009587_26	5	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Rotor	Madungela PS electric motor 3 - rotor	500009587_27	5	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Rotor	Madungela PS electric motor 4 - rotor	500009587_28	5	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Casing	Pumpstation Pump - pump - casing	500009587_41	5	3	5	0.299
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Casing	Pumpstation Pump - pump - casing	500009587_42	5	3	5	0.299
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Casing	Pumpstation Pump - pump - casing	500009587_43	5	3	5	0.299
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Control Valves - Casing	Madungela PS control valve 1 - casing	500009587_48	4	1	5	0.111
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Control Valves - Casing	Madungela PS control valve 2 - casing	500009587_49	4	1	5	0.111
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Control Valves - Mechanism	Madungela PS control valve 1 - mechanism	500009587_50	4	1	5	0.037
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Control Valves - Mechanism	Madungela PS control valve 2 - mechanism	500009587_51	4	1	5	0.037
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Casing	Madungela PS intake butterfly valve 3 - casing	500009587_17	4	3	5	0.254
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Casing	Madungela PS outlet butterfly valve 4 - casing	500009587_18	4	3	5	0.254
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Mechanism	Madungela PS intake butterfly valve 3 - mechanism	500009587_19	4	3	5	0.085
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Mechanism	Madungela PS outlet butterfly valve 4 - mechanism	500009587_20	4	3	5	0.085

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Casing	Madungela PS check valve - casing	500009587_21	4	4	5	0.198
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Valves - Mechanism	Madungela PS check valve - mechanism	500009587_22	4	4	5	0.066
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Switchgear	Madungela PS electric motor 2 - switchgear	500009587_29	3	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Switchgear	Madungela PS electric motor 3 - switchgear	500009587_30	3	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Switchgear	Madungela PS electric motor 4 - switchgear	500009587_31	3	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Power Supply Switchgear	Madungela PS electric switch gear 1	500009587_32	3	2	5	0.121
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Power Supply Switchgear	Madungela PS electric switch gear 2	500009587_33	3	2	5	0.121
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Power Supply Switchgear	Madungela PS electric switch gear 3	500009587_34	3	2	5	0.121
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Power Supply Switchgear	Madungela PS electric switch gear 4	500009587_35	3	2	5	0.121
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Electric Motor - Switchgear	Madungela electric motor - switchgear	500009587_53	3	2	5	0.102
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Rotor	Pumpstation Pump - pump - rotor	500009587_44	3	3	5	0.100
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Rotor	Pumpstation Pump - pump - rotor	500009587_45	3	3	5	0.100
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Pumpstation Pump - Rotor	Pumpstation Pump - pump - rotor	500009587_46	3	3	5	0.100
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Auxilliary Equipment Pump Stat	Madungela PS hydraulic power pack 1	500009587_36	2	1	5	0.345
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Auxilliary Equipment Pump Stat	Madungela PS hydraulic power pack 2	500009587_37	2	1	5	0.345
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Auxilliary Equipment Pump Stat	Madungela PS fence	500009587_47	2	2	5	0.460
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Pump stations	Pump Station	Madungela Pump Station	Auxilliary Equipment Pump Stat	Madungela PS staircase	500009587_52	2	4	5	0.575

Scheme (Cost Ctr Name)	Asset Facility Category	Facility Type	Facility Name (Asset description)	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 3	Pipeline Valves	Pipeline 3 pipeline valves	500003373_2	4	3	5	1.222
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 2 valves	Pipeline Valves	Pipeline 2 pipeline valves	500004258_2	4	4	5	11.070
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 1	Pipeline Valves	Pipeline 1 pipeline valves	500004259_2	4	4	5	0.114
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Pipeline 4	Pipeline Valves	Pipeline 4 pipeline valves	500006623_2	4	4	5	0.276
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Pipeline 3	Pipeline- Steel	Pipeline 3 pipeline	500003373_0	3	3	5	19.551
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 3	Pipeline Lining-Cement-Mortar	Pipeline 3 pipeline lining	500003373_1	3	3	5	3.666
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	New venture pipe line	Pipeline- Steel	Pipeline	500006324_0	3	3	5	0.115
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Gravity pipe line	Pipeline- Steel	Pipeline	500007232_0	3	3	5	1.400
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam inlet Pipe	Pipeline- Steel	Pipeline	500003374_0	3	4	5	1.291
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 2	Pipeline- Steel	Pipeline 2 pipeline	500004258_0	3	4	5	177.120
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam pipeline 2 lining	Pipeline Lining-Cement-Mortar	Pipeline 2 pipeline lining	500004258_1	3	4	5	33.210
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 1	Pipeline- Steel	Pipeline 1 pipeline	500004259_0	3	4	5	1.817
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Dam Pipeline 1	Pipeline Lining-Cement-Mortar	Pipeline 1 pipeline lining	500004259_1	3	4	5	0.341
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Pipeline 4	Pipeline- Steel	Pipeline 4 pipeline	500006623_0	3	4	5	4.412
TUGELA MHLATHUZE R GWS -GOEDETROUW (124)	WR: Steel Pipelines	Pipeline Section	Goedertrouw Pipeline 4	Pipeline Lining-Cement-Mortar	Pipeline 4 pipeline lining	500006623_1	3	4	5	0.827
UMGENI RIVER GWS	WR: Dams	Main Damwall	Albert Falls Dam	Dam Wall-Height>60m	Albert Falls dam wall concrete.	500009183_39	4	4	5	7.099

3. FINANCIAL FORECAST

Table K.4A: Identified upgrades and new capital expenditure forecast (scheme specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2017/18	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	-	1.198	-	-	-	-	-	-	-	-
WR: Canals	-	-	38.327	-	-	21.160	-	5.628	48.150	-
WR: Dams	-	16.954	-	57.068	-	-	-	-	-	-
WR: Pump stations	-	3.137	-	-	-	-	-	-	-	-
WR: Steel Pipelines	-	297.582	-	-	-	-	-	-	-	-
Total	**-**	**318.871**	**38.327**	**57.068**	**-**	**21.160**	**-**	**5.628**	**48.150**	**-**

Table K.4B: Adjusted upgrades and new capital expenditure forecast (scheme specific)

Cost Component	Financial Year (Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	-	0.180	0.207	0.194	0.170	0.149	0.119	0.081	0.070	0.053
WR: Canals	-	-	5.749	6.899	6.611	10.360	10.117	9.380	23.935	30.446
WR: Dams	-	2.543	2.925	11.307	13.110	13.416	11.511	8.256	7.414	5.865
WR: Pump stations	-	0.471	0.541	0.508	0.446	0.390	0.312	0.211	0.183	0.140
WR: Steel Pipelines	-	44.637	51.333	48.208	42.294	37.025	29.627	20.003	17.338	13.250
Total	**-**	**47.831**	**60.754**	**67.116**	**62.631**	**61.340**	**51.687**	**37.930**	**48.940**	**49.754**

Table K.5: Upgrades and new capital expenditure forecast (non-scheme specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2017/18	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	-

Table K.6A: New and Upgrade Capital Projects per scheme

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Bevenson Dam	-	-	-	-	-	-	-	-	-	-
Bizana Dam	-	-	-	-	-	-	-	-	-	-
Bushmans River GWS -Wagendrift Dam	-	4.479	-	-	-	-	-	-	-	-
Hammersdale Dam	-	-	-	-	-	-	-	-	-	-
Hluhluwe River GWS -Hluhluwe Dam	-	14.968	-	-	-	-	-	-	-	-
Lavumisa GWS	-	27.725	-	-	-	-	-	-	-	-
Mdloti River GWS (Hazelmere Dam)	-	4.563	-	-	-	-	-	-	-	-
Mnyamvubu River-Cragie Burn Dam	-	-	-	-	-	-	-	-	-	-
Mooi-Mgeni River GWS	-	-	-	-	-	-	-	-	-	-
Ngagane River GWS -Ntshingwayo Dam	-	-	-	-	-	-	-	-	-	-
Pongola River GWS	-	-	38.323	57.069	-	21.16	-	5.625	48.15	-
Pongolapoort GWS	-	5.437	-	-	-	-	-	-	-	-
Qedusizi	-	-	-	-	-	-	-	-	-	-
Singizi	-	-	-	-	-	-	-	-	-	-
Tugela Mhlathuze Rivers GWS	-	259.57	-	-	-	-	-	-	-	-
Tugela River GWS - Spioenkop	-	-	-	-	-	-	-	-	-	-
Umgeni River GWS	-	2.13	-	-	-	-	-	-	-	-
White Mfolozi River GWS -Klipfontein Dam	-	-	-	-	-	-	-	-	-	-
Sub-Total	**-**	**318.872**	**38.323**	**57.069**	**-**	**21.16**	**-**	**5.625**	**48.15**	**-**
Non-Scheme Specific	-	-	-	-	-	-	-	-	-	-
Total	**0**	**318.872**	**38.323**	**57.069**	**0**	**21.16**	**0**	**5.625**	**48.15**	**0**

Table K.6B: Adjusted New and Upgrade Capital Projects per scheme

SCHEME_NAME	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Bevenson Dam	-	-	-	-	-	-	-	-	-	-
Bizana Dam	-	-	-	-	-	-	-	-	-	-
Bushmans River GWS -Wagendrift Dam	-	0.672	0.773	0.726	0.637	0.557	0.446	0.301	0.261	0.199
Hammersdale Dam	-	-	-	-	-	-	-	-	-	-
Hluhluwe River GWS -Hluhluwe Dam	-	2.245	2.582	2.425	2.127	1.862	1.490	1.006	0.872	0.666
Lavumisa GWS	-	4.159	4.783	4.491	3.940	3.450	2.760	1.864	1.615	1.234
Mdloti River GWS (Hazelmere Dam)	-	0.684	0.787	0.739	0.649	0.568	0.454	0.307	0.266	0.203
Mnyamvubu River-Cragie Burn Dam	-	-	-	-	-	-	-	-	-	-
Mooi-Mgeni River GWS	-	-	-	-	-	-	-	-	-	-
Ngagane River GWS -Ntshingwayo Dam	-	-	-	-	-	-	-	-	-	-
Pongola River GWS	-	-	5.748	15.458	17.311	21.666	19.940	16.495	30.360	35.555
Pongolapoort GWS	-	0.816	0.938	0.881	0.773	0.676	0.541	0.365	0.317	0.242
Qedusizi	-	-	-	-	-	-	-	-	-	-
Singizi	-	-	-	-	-	-	-	-	-	-
Tugela Mhlathuze Rivers GWS	-	38.936	44.776	42.050	36.891	32.295	25.842	17.448	15.123	11.557
Tugela River GWS - Spioenkop	-	-	-	-	-	-	-	-	-	-
Umgeni River GWS	-	0.320	0.367	0.345	0.303	0.265	0.212	0.143	0.124	0.095
White Mfolozi River GWS -Klipfontein Dam	-	-	-	-	-	-	-	-	-	-
Sub-Total	**-**	**47.831**	**60.754**	**67.116**	**62.631**	**61.339**	**51.686**	**37.929**	**48.938**	**49.753**
Non-Scheme Specific	-	-	-	-	-	-	-	-	-	-
Total	**-**	**47.831**	**60.754**	**67.116**	**62.631**	**61.339**	**51.686**	**37.929**	**48.938**	**49.753**

APPENDIX L – Asset Impairment, Disposal, Disposal Strategy and Cost Forecast

1 INTRODUCTION

This Appendix covers the: asset disposal strategy; impaired assets; under-utilised or not-in-use assets; as well as assets to be disposed of.

2 DISPOSAL STRATEGY

Refer to the DWS Disposal Strategy for Immovable Assets.

3 IMPAIRED ASSETS

Table L.1: Impaired asset components (based on zero asset carrying values) per facility category

Asset Facility Category	Impaired Asset Components					
	Cluster Total		Scheme Specific		Non-Scheme Specific	
	No.	CRC (R million)	No.	CRC (R million)	No.	CRC (R million)
Buildings	1	0.89	1	0.89	-	-
WR: Canals	2	1.40	2	1.40	-	-
WR: Dams	6	22.68	6	22.68	-	-
WR: Power Supply	-	-	-	-	-	-
WR: Pump stations	-	-	-	-	-	-
WR: Reservoirs	-	-	-	-	-	-
WR: Roads and bridge	-	-	-	-	-	-
WR: Steel Pipelines	-	-	-	-	-	-
WR: Telemetry	-	-	-	-	-	-
WR: Water Treatment	-	-	-	-	-	-
WS: Measuring facilities	5	12.34	-	-	5	12.34
Total	**14**	**37.31**	**9**	**24.97**	**5**	**12.34**

Table L.2: Impaired asset components (based on zero asset carrying values) per scheme and per facility category

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
BEVENSON DAM	WR: Dams	Main Damwall	Bevenson Dam	Dam Outlet - Pipework- Steel	Bevenson Dam outlet pipes	500005829_4	3	1	3	0.055
BEVENSON DAM	WR: Dams	Main Damwall	Bevenson Dam	Dam Outlet Valves - Casing	Bevenson Dam - outlet valve - casing	500005829_5	3	1	2	0.055
BEVENSON DAM	WR: Dams	Main Damwall	Bevenson Dam	Dam Outlet Valves - Mechanism	Bevenson Dam - outlet valve - mechanism	500005829_6	3	1	2	0.020
										0.000
HAMMERSDALE DAM	WR: Dams	Main Damwall	Hammersdale Dam	Dam Wall-15m<Height<30m	Hammersdale Concrete Wall	500009487_3	5	3	4	11.972
										0.000
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Hydrological Station	Polela River @ Coxhill	Hydrological Station	not componentised	500002161_0	2	2	4	4.389
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Hydrological Station	Mkomazi River @ Delos Estate	Hydrological Station	not componentised	500002024_0	2	3	2	6.869
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47898	Geohydrological Station	not componentised	500004086_0	1	1	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G45867	Geohydrological Station	not componentised	500004095_0	1	2	4	0.431
										0.000
MAN: HYDRO EASTERN	WS: Measuring facility	Meteorological Station	Louis Botha Airport @ Durban	Meteorological Station	not componentised	500001649_0	1	3	4	0.218
										0.000
PONGOLA RIVER GWS	WR: Canals	Canal Section	Mbega 1 Earth canal	Canal Fencing	Canal Fence Left	500007229_7	1	4	3	0.702
PONGOLA RIVER GWS	WR: Canals	Canal Section	Mbega 1 Earth canal	Canal Fencing	Canal Fence Rigth	500007229_8	1	4	3	0.702
										0.000
TUGELA MHLATHUZE R GWS - GOEDETROUW (124)	WR: Dams	Separate Dam Abstraction	Goedertrouw Dam Outlet Tower	Dam Outlet - Intake Tower	Goedertrouw Outlet Tower - Tower	500009237_3	3	3	4	5.457
TUGELA MHLATHUZE R GWS - GOEDETROUW (124)	WR: Dams	Separate Dam Abstraction	Goedertrouw Dam Outlet Tower	Dam Outlet Structure	Goedertrouw Outlet Tower - Tunnel	500009237_4	3	3	4	5.116
										0.000
UMGENI RIVER GWS	Buildings	Office Building	Midmar Dam Personnel Office	Main Building	Midmar Dam Main building	500003489_0	3	3	2	0.893

4 UNDER-UTILISED OR NOT-IN-USE ASSETS

Table L.3: Under-utilised asset components per facility category

Asset Facility Category	Under-Utilised Asset Components					
	Cluster Total		Scheme Specific		Non-Scheme Specific	
	No.	CRC (R million)	No.	CRC (R million)	No.	CRC (R million)
Buildings	25	10.72	25	10.72	0	-
WR: Canals	0	-	0	-	0	-
WR: Dams	5	1.57	5	1.57	0	-
WR: Power Supply	2	0.46	2	0.46	0	-
WR: Pump stations	0	-	0	-	0	-
WR: Reservoirs	1	2.39	1	2.39	0	-
WR: Roads and bridge	4	0.28	4	0.28	0	-
WR: Steel Pipelines	0	-	0	-	0	-
WR: Telemetry	2	1.66	2	1.66	0	-
WR: Water Treatment	0	-	0	-	0	-
WS: Measuring facility	17	13.56	0	-	17	13.56
Total	**56**	**30.65**	**39**	**17.09**	**17**	**13.56**

Table L.4: Under-utilised asset components per scheme and per facility category

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
BEVENSON DAM	WR: Dams	Main Damwall	Bevenson Dam	Dam Outlet Valves - Casing	Bevenson Dam - outlet valve - casing	500005829_5	3	1	2	0.055
BEVENSON DAM	WR: Dams	Main Damwall	Bevenson Dam	Dam Outlet Valves - Mechanism	Bevenson Dam - outlet valve - mechanism	500005829_6	3	1	2	0.020
BIZANA DAM	WR: Reservoirs	Reservoir	Ludeke dam	Reservoir	Ludeke pipeline	500019854_0	2	5	2	2.392

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
					delivery chamber-Reservo					
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	WR: Roads and bridge	Road Section	Wagendrift dam concrete road section 1	Road Section		500021842_0	1	3	2	0.056
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	WR: Roads and bridge	Road Section	Wagendrift dam gravel road section 2	Road Section		500021843_0	1	3	2	0.127
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	WR: Roads and bridge	Road Section	Wagendrift dam gravel road section 4	Road Section		500021844_0	1	3	2	0.033
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	WR: Roads and bridge	Road Section	Wagendrift dam tar road section 3	Road Section		500021845_0	1	3	2	0.066
BUSHMANS RIVER GWS - WAGENDRIFT DAM(14)	Buildings	Stores	Wagendrift "Garage,Store"	Main Building	Main building	500003434_0	3	4	2	0.519
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Telemetry	Telemetry Station	Hluhluwe - VSAT	Telemetry Instrument VSAT Dish	Hluhluwe 2.4m Satellite dish	500010295_0	3	3	2	1.212
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Telemetry	Telemetry Station	Hluhluwe- VSAT	Telemetry Instrument VSAT Equi	Hluhluwe Ancillary equipment	500010295_1	3	3	2	0.449
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	WR: Power Supply	Power Supply Generator	Hluhluwe Generator Room	Power Supply Generator	Hluhluwe dam generator	500021603_0	2	3	2	0.228
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	Buildings	Residential Housing	Hluhluwe dam residential 5 (garage)	Outbuildings	Garage & Carports	500021463_0	2	3	2	0.194
HLUHLUWE RIVER GWS-	Buildings	Residential Housing	Hluhluwe dam residential 6 (garage)	Outbuildings	Garage & Carports	500021464_0	2	3	2	0.194

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
HLUHLUWE DAM (42)										
HLUHLUWE RIVER GWS-HLUHLUWE DAM (42)	Buildings	Boat House	Hluhluwe Boat House	Boat House	Boat House	500003407_0	2	4	2	0.172
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Hydrological Station	Mkomazi River @ Delos Estate	Hydrological Station	not componentised	500002024_0	2	3	2	6.869
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47898	Geohydrological Station	not componentised	500004086_0	1	1	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	2731DC00099	Geohydrological Station	not componentised	500004081_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	W7163	Geohydrological Station	not componentised	500004087_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47084	Geohydrological Station	not componentised	500005283_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47079	Geohydrological Station	not componentised	500005284_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47083	Geohydrological Station	not componentised	500005286_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47912	Geohydrological Station	not componentised	500005291_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47905	Geohydrological Station	not componentised	500005292_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47158	Geohydrological Station	not componentised	500005299_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47151	Geohydrological Station	not componentised	500005300_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G47152	Geohydrological Station	not componentised	500005301_0	1	2	2	0.431

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	G45913	Geohydrological Station	not componentised	500005303_0	1	2	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	2731DC00112	Geohydrological Station	not componentised	500004083_0	1	3	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	2729DD00064	Geohydrological Station	not componentised	500005279_0	1	3	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	2730CA00087	Geohydrological Station	not componentised	500005280_0	1	3	2	0.431
HYDROMETRY KWAZULU NATAL	WS: Measuring facility	Geohydrological Station	W71620	Geohydrological Station		500021841_0	1	4	2	0.228
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	WR: Dams	Main Damwall	Hazelmere Dam	Auxilliary Equip. Main Damwall	Hazelmere dam boat slipway	500009061_35	4	3	2	0.380
MDLOTI RIVER GWS (HAZELMERE DAM) (72)	Buildings	Stores	Hazelmere Dam Shed	Main Building	Main building	500002369_0	3	3	2	0.390
MNYAMVUBU RIVER-CRAGIE BURN DAM (76)	Buildings	Residential Housing	Craigie Burn dam Ablution	Main Building	Main building	500021466_0	3	1	2	0.104
MNYAMVUBU RIVER-CRAGIE BURN DAM (76)	Buildings	Residential Housing	Craigie Burn Ablution BLock 2	Outbuildings	Ablution BLock 2	500002384_0	2	1	2	0.138
MNYAMVUBU RIVER-CRAGIE BURN DAM (76)	Buildings	Office Building	Craigie Burn Gaurdroom	Outbuildings	Main building	500002385_0	2	1	2	0.046
MNYAMVUBU RIVER-CRAGIE BURN DAM (76)	Buildings	Residential Housing	Craigie Burn Ablution Block 1	Outbuildings	Ablution Block 1	500002805_0	2	1	2	0.138
MNYAMVUBU RIVER-CRAGIE BURN DAM (76)	Buildings	Residential Housing	Craigie Burn Old Quaters&Ablution Block	Outbuildings	Old Quaters Ablution Block	500002807_0	2	1	2	0.280
NGAGANE R - NTSHINGWAYO DAM (84)	Buildings	Residential Housing	Ntshingwayo dam Guest house A (Carport)	Outbuildings	Garage & Carports	500021467_0	2	3	2	0.074

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
NGAGANE R - NTSHINGWAYO DAM (84)	Buildings	Residential Housing	Ntshingwayo dam residential house 1 (Garage)	Outbuildings	Garage & Carports	500021468_0	2	3	2	0.216
PONGOLA RIVER GWS	Buildings	Residential Housing	Pongola house 5	Main Building	Main building	500005699_0	3	3	2	0.440
PONGOLA RIVER GWS	Buildings	Residential Housing	Pongola house 6	Main Building	Main building	500006465_0	3	3	2	0.440
PONGOLA RIVER GWS	Buildings	Stores	Pongola Store	Main Building	Store	500006469_0	3	4	2	0.669
PONGOLAPOORT GWS	Buildings	Residential Housing	Pongolapoort Dam public ablution	Outbuildings	Ablution building	500009966_0	2	2	2	0.215
SINGIZI	WR: Dams	Main Damwall	Singisi Dam	Dam Outlet Valves - Casing	Singisi Dam - outlet valve - casing	500009505_5	3	3	2	0.819
SINGIZI	WR: Dams	Main Damwall	Singisi Dam	Dam Outlet Valves - Mechanism	Singisi Dam - outlet valve - mechanism	500009505_6	3	3	2	0.299
TUGELA MHLATHUZE R GWS - GOEDETROUW (124)	Buildings	Residential Housing	Goedertrouw Compound Single Quaters	Main Building	Main building	500003302_0	3	3	2	0.884
TUGELA MHLATHUZE R GWS - GOEDETROUW (124)	Buildings	Office Building	Goedertrouw Gaurd House	Outbuildings	Main building	500003301_0	2	2	2	0.108
UMGENI RIVER GWS	Buildings	Residential Housing	ALBERT FALLS HOUSE5	Main Building	Main building	500006495_0	3	3	2	0.417
UMGENI RIVER GWS	Buildings	Office Building	Midmar Dam Personnel Office	Main Building	Midmar Dam Main building	500003489_0	3	3	2	0.893
UMGENI RIVER GWS	Buildings	Office Building	Inanda Washing Bay 3	Outbuildings	Outbuilding	500000136_0	2	3	2	0.903
UMGENI RIVER GWS	Buildings	Office Building	Inanda Washing Bay 1	Outbuildings	Outbuilding	500000165_0	2	3	2	0.903
UMGENI RIVER GWS	Buildings	Office Building	Inanda Washing Bay 2	Outbuildings	Outbuilding	500000166_0	2	3	2	0.903
UMGENI RIVER GWS	Buildings	Office Building	Inanda Washing Bay 4	Outbuildings	Outbuilding	500000167_0	2	3	2	0.903

Scheme	Facility Category	Facility Type	Facility Name	Component Type	Component Name	Component UID	Criticality	Condition	Utilisation	CRC 2016 (R Million)
WHITE MFOLOZI R -KLIPFONTEIN DAM (138)	WR: Power Supply	Power Supply Generator	Klipfontein Generator Room	Power Supply Generator	Klipfontein dam generator	500021604_0	2	3	2	0.228
WHITE MFOLOZI R -KLIPFONTEIN DAM (138)	Buildings	Residential Housing	Klipfontein Single Quaters	Main Building	Main building	500009562_0	3	3	2	0.581

5 ASSETS TO BE DISPOSED OF

Table L.5: Assets to be disposed of

Facility Category (Asset Class)	Facility Type	Facility Name (Asset Description)	Component Type	Component Name (Additional Description)	Component No.	Comment
-	-	-	-	-	-	-
-	-	-	-	-	-	-

APPENDIX M – Infrastructure Assets Movement

Table M.1:1 Accumulated acquisition cost per asset facility category for scheme assets (scheme specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	117.597	135.066	135.066	135.066	198.300	198.300	213.143	213.143	213.143	213.143
WR: Canals	308.109	310.420	348.747	349.779	388.364	409.524	446.870	452.498	504.620	524.618
WR: Dams	5 426.177	5 485.330	5 485.330	5 563.159	5 589.245	5 590.232	5 656.781	5 656.781	5 657.985	5 669.787
WR: Power Supply	0.165	0.165	0.165	0.392	0.392	0.392	0.392	0.392	0.392	0.392
WR: Pump stations	113.240	132.184	132.184	152.727	154.157	172.453	185.563	185.868	198.634	208.049
WR: Reservoirs	2.784	2.784	2.784	2.784	2.784	2.784	2.784	2.784	3.636	3.636
WR: Roads and bridge	85.829	85.829	85.829	85.829	85.829	85.829	85.942	85.942	85.942	85.942
WR: Steel Pipelines	308.758	606.341	606.341	606.712	606.712	606.712	606.712	607.296	639.979	639.979
WR: Telemetry	6.987	6.987	6.987	6.987	6.987	6.987	7.180	7.180	7.180	7.180
WR: Water Treatment	0.577	0.577	0.577	0.577	0.577	0.577	1.089	1.089	1.089	1.089
WS: Measuring facility	102.002	104.067	105.450	111.962	113.836	116.470	131.394	152.039	159.275	163.392
Total	**6 472.225**	**6 869.749**	**6 909.459**	**7 015.974**	**7 147.184**	**7 190.259**	**7 337.850**	**7 365.012**	**7 471.876**	**7 517.209**

Table M.1. 2: Accumulated acquisition cost per asset facility category for non-Scheme specific assets (Non-Scheme Specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
WS: Measuring facility	177.594	181.067	182.155	182.155	182.155	182.456	306.114	306.114	308.717	308.717
Total	**177.594**	**181.067**	**182.155**	**182.155**	**182.155**	**182.456**	**306.114**	**306.114**	**308.717**	**308.717**

Table M.2:1 Accumulated depreciation cost per asset facility category for scheme specific assets (Scheme Specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Buildings	62.128	67.625	71.869	76.113	82.441	88.723	95.098	101.473	107.848	114.223
WR: Canals	122.162	131.030	137.974	145.753	154.740	164.822	175.897	186.972	198.128	210.924
WR: Dams	664.928	733.405	784.823	837.372	891.399	962.723	1 033.921	1 105.120	1 176.322	1 247.912
WR: Power Supply	0.119	0.127	0.135	0.155	0.174	0.191	0.207	0.224	0.241	0.257
WR: Pump stations	55.417	59.883	64.246	69.313	74.934	80.877	87.500	94.134	100.919	108.227
WR: Reservoirs	0.500	0.542	0.576	0.611	0.646	0.689	0.731	0.774	0.821	0.868
WR: Roads and bridge	6.140	8.099	9.857	11.614	13.371	15.348	17.325	19.302	21.279	23.256
WR: Steel Pipelines	86.473	98.320	110.484	122.661	134.800	146.617	158.434	170.251	183.622	196.993
WR: Telemetry	0.875	0.977	1.080	1.168	1.256	1.357	1.460	1.562	1.665	1.768
WR: Water Treatment	0.292	0.304	0.316	0.327	0.339	0.352	0.371	0.391	0.410	0.430
WS: Measuring facility	25.715	29.136	31.833	34.216	38.585	45.700	52.918	56.969	70.375	85.691
Total	**1 024.750**	**1 129.450**	**1 213.193**	**1 299.305**	**1 392.685**	**1 507.398**	**1 623.864**	**1 737.173**	**1 861.630**	**1 990.548**

Table M.2:2 Accumulated depreciation cost per asset facility category for Non-Scheme specific assets (Non-Scheme Specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
WS: Measuring facility	67.055	73.266	76.866	80.584	84.301	91.302	97.362	103.423	109.701	115.979
Total	**67.055**	**73.266**	**76.866**	**80.584**	**84.301**	**91.302**	**97.362**	**103.423**	**109.701**	**115.979**

Table M.3:1 Asset carrying value per asset facility category for scheme assets (Scheme Specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Buildings	55.469	67.441	63.197	58.953	115.860	109.577	118.045	111.670	105.295	98.921
WR: Canals	185.947	179.388	210.772	204.026	233.623	244.702	270.972	265.525	306.492	313.694
WR: Dams	4 761.248	4 751.925	4 700.508	4 725.787	4 697.846	4 627.509	4 622.860	4 551.661	4 481.663	4 421.876
WR: Power Supply	0.045	0.038	0.030	0.237	0.217	0.201	0.184	0.168	0.151	0.134
WR: Pump stations	57.831	72.301	67.938	83.414	79.224	91.576	98.062	91.734	97.715	99.822
WR: Reservoirs	2.284	2.242	2.208	2.173	2.138	2.095	2.053	2.010	2.815	2.768
WR: Roads and bridge	79.689	77.729	75.972	74.215	72.457	70.481	68.618	66.641	64.663	62.686
WR: Steel Pipelines	222.285	508.020	495.857	484.051	471.912	460.095	448.278	437.045	456.358	442.986
WR: Telemetry	6.112	6.010	5.907	5.819	5.731	5.630	5.721	5.618	5.515	5.413
WR: Water Treatment	0.285	0.273	0.261	0.250	0.238	0.225	0.718	0.698	0.678	0.659
WS: Measuring facility	76.287	74.961	73.616	77.745	75.252	70.770	80.376	95.222	88.981	78.688
Total	**5 447.483**	**5 740.329**	**5 696.266**	**5 716.669**	**5 754.499**	**5 682.862**	**5 715.887**	**5 627.992**	**5 610.328**	**5 527.647**

Table M.3:2 Asset carrying value per asset facility category for Non-Scheme specific assets (Non-Scheme Specific)

Asset Facility Category	Financial Year (Amounts in Million Rands)									
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
WS: Measuring facility	110.563	107.801	105.290	101.572	97.854	91.154	208.752	202.691	199.016	192.738
Total	**110.563**	**107.801**	**105.290**	**101.572**	**97.854**	**91.154**	**208.752**	**202.691**	**199.016**	**192.738**