

BEAUFORT WEST MUNICIPALITY

WATER SERVICES DEVELOPMENT PLAN FOR 2022-2027

FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS



DRAFT

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WATER SERVICES DEVELOPMENT PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

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ABBREVIATIONS AND DEFINITIONS

AADD	Average Annual Daily Demand
AMP	Asset Management Plan
AMR	Automatic Meter Reading
AOI	Area of Interest
BH	Borehole
CAFES	Conserving, Adequate, Fair, Enforceable and Simple
CMA	Catchment Management Agency
COD	Chemical Oxygen Demand
CRC	Current Replacement Cost
CRR	Cumulative Risk Ratio
CV	Carrying Value
DM	District Municipality
DO	Dissolved Oxygen
DoH	Department of Health
DORA	Division of Revenue Act
DSVI	Dissolved Sludge Volume Index
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EHP	Environmental Health Practitioner
EPWP	Expanded Public Works Programme
GIS	Geographic Information Systems
GPS	Global Positioning System
HL	High Level
IAMP	Infrastructure Asset Management Plan
IBT	Inclining Block Tariff
ICT	Information and Communication Technology
IDP	Integrated Development Plan
ILI	Infrastructure Leakage Index
IMP	Incident Management Protocol
IMQS	Infrastructure Management Query System
IRIS	Integrated Regulatory Information System
IT	Information Technology
IWA	International Water Association
KI	Kilolitre
KPI	Key Performance Indicator
l/c/d	Litre per Capita per Day
l/p/d	Litre per Person per Day
l/s	Litre per Second
LM	Local Municipality
LOFLOS	Low Flow On-Site
MFMA	Municipal Finance Management Act
MIG	Municipal Infrastructure Grant
MI	Mega Litre
MI/a	Mega Litre per Annum

ABBREVIATIONS AND DEFINITIONS

ML/d	Mega Litre per Day
MLE	Modified Ludzack-Ettinger
MLSS	Mixed Liquor Suspended Solids
MNF	Minimum Night Flow
MSDF	Municipal Spatial Development Framework
MTEF	Medium-Term Expenditure Framework
NGO	Non-Governmental Organization
NRW	Non-Revenue Water
NWA	National Water Act
O&M	Operation and Maintenance
OC	Opening Cost
PC	Process Controller
PRV	Pressure Reducing Valve
PS	Pump Station
RAS	Return Activated Sludge
RUL	Remaining Useful Life
SANS	South African National Standard
SCADA	Supervisory Control and Data Acquisition
SDBIP	Service Delivery and Budget Implementation Plan
SDF	Spatial Development Framework
SFWS	Strategic Framework for Water Services
SMP	Sewer Master Plan
SOPs	Standard Operating Procedures
SST	Secondary Settling Tank
SVI	Sludge Volume Index
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
UCT	University of Cape Town
VIP	Ventilated Improved Pit
WARMS	Water use Authorisation and Registration Management System
WC/WDM	Water Conservation / Water Demand Management
WDM	Water Demand Management
WMP	Water Master Plan
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Services Provider
WTW	Water Treatment Works
W ₂ RAP	Wastewater Risk Abatement Plan
WWTW	Waste Water Treatment Works

ANNEXURE A (Water and Sewer Master Plans)

Figure BWW 4.1 (a):	Potential Future Land Developments – Beaufort West
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ANNEXURE B (Future Water Requirements Projections)

Beaufort West Water Projection

Merweville Water Projection

Nelspoort Water Projection

Murraysburg Water Projection

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WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 1: SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

1. SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

Table 1.1: Master Plan for Settlement Demographics and Public Amenities		
Section	Master Plan	Yes / No
Settlements Summary (Population, Households, Household size, Settlements)	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Settlement Group (Rural / Urban)	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Settlement Type	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Amenities Summary	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes

1.1 SETTLEMENT DEMOGRAPHICS

The purpose of the SDF is to guide growth and development in the municipal area or space in a sustainable manner. Hence, future growth, development and land use planning departs from a vision and principles that underscore the protection, creation (development) and support (change) of integrated, sustainable settlements and liveable environments to enable economic and social prosperity.

The spatial concept for the municipality focusses on Sustainable development, resilience and partnerships. The four strategies of the municipal wide spatial concept are:

- A region that protects the environment, enhances resilience, and capitalizes on and honours the Karoo charm in support of a vibrant people and economy;
- Improve regional and rural accessibility and mobility for people and goods in support of a resilient economy;
- Allocate government resources, infrastructure and facilities in a manner that uplifts and skills people and focusses on maximizing impact on the most possible people, while providing a basic level of service for all; and
- Partnership-driven governance and administration towards improved financial and non-financial sustainability and resilience.

How the above translates spatially in the region is described as follows:

- Protect and enhance the natural systems of the municipality, ensuring continuity in the natural systems Karoo (such as the Karoo National Park, the Onder-Sneeuberg and Nuweberg mountain ranges) and ensure the river corridors in the region (Gamka river – and its tributaries) are provided with the necessary buffers and setbacks (of at least 32m from the side of each riverbank) to preserve continuity and integrity of biodiversity systems. Prioritise the protection of Critical Biodiversity Areas and Environmental Support Areas from development.
- Protect and enhance water catchment areas and water resources by demarcating Critical Biodiversity Areas and Environmental Support Areas and preventing inappropriate development within these areas.
- Capitalise on the tourism appeal of the various assets that exist in the Karoo, such as the heritage appeal of existing town centres, as well as the Karoo National Park. Ensure that all development in the Karoo is compatible with the sense of place, Karoo character and charm. This intrinsic value create lifestyle, tourism, and hospitality opportunities, as is seen in Merweville, and hence creates employment opportunities and assists in poverty alleviation.

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TOPIC 1: SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

- Ensure the development and maintenance of a road network that provides good access and mobility for the region, as well as ensure the regional rail network is equipped to provide for the movement needs. The N1, N12 and R62 corridors are key economic and social assets in the Municipality area as well as the District which requires regular maintenance and upgrading. Attention should be placed on appropriate measures to ensure road safety in the municipality.
- Specific focus is also needed on non-motorised transport within the region. Non-motorised transport, particularly pedestrian movement, is the primary transport mode among residents. Key interventions for implementation in this area are pedestrian walkways, bridges and underpasses, and cycle paths. An important consideration in the planning of such interventions is safety, security particularly for the most vulnerable members of society, which provides good lighting, visual surveillance as well as shelter from the heat.
- Ensure that the town of Beaufort West, as the Regional Development Anchor, provides the primary regional services and facilities in the region. Business opportunities within the town are to be maximised to encourage the multiplier effect of investment and expenditure. From a governance, capital investment and maintenance perspective, Beaufort West town is a crucial driver of growth and development opportunities.
- Strongly encourage value-add, industrial and agri-processing industries locating in the Regional Development Anchor of Beaufort West town to create jobs and add value to the region's agricultural goods and services. Specifically, Beaufort West and Murraysburg present opportunities for value-add and agri-processing activities.
- Focus government investment, facilities, services and housing opportunities in Beaufort West and to a much lesser extent Murraysburg. Prevent the creation of new low-income settlements in low growth, job deficient towns that have little prospect of creating employment opportunities.
- Seek partnerships to enhance various interventions, with a focus on the top 3 most impactful and critical interventions for the municipality. These will have to be determined based on the priorities of the municipality and the transversal nature of the issues. Currently water, gas and energy, and rural mobility are three areas of potential partnership between all spheres of government and civil society (Beaufort West MSDF)

Beaufort West Municipality's SDF includes main proposals for each of the towns, with regard to the following categories:

- Core landscape and agricultural areas;
- Urban development;
- Heritage areas;
- Urban restructuring; and
- Urban Edge Amendments.

Beaufort West Municipality's 2024/2025 IDP list the following housing needs for the four towns.

Table 1.1.1: Beaufort West Municipality's Housing Needs			
Town	IRDP	GAP / FLISP	Total
Beaufort West	4 822	381	5 203
Merweville	189	11	200
Nelspoort	285	19	304
Murraysburg	834	14	848
Total	6 130	425	6 555

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TOPIC 1: SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

1.2 PUBLIC AMENITIES

All schools and medical facilities in the urban areas in Beaufort West Municipality are provided with a higher level of water and sanitation service (Water connection inside the erven and a waterborne sewer system) and no specific strategies with regard to the provision of water and sanitation services for the educational and medical facilities in the urban areas were therefore developed.

The existing service levels (Water and Sanitation) of the two primary schools in the rural areas need to be verified. All schools in the rural areas without basic water and sanitation services need to be provided with at least basic services.

1.3 SOCIO ECONOMIC BACKGROUND

1.3.1 Population and Households

The table below gives a summary of the projected population for the various schemes in Beaufort West Municipality's Management Area.

Table 1.3.1.1: Projected future population							
Scheme	Projected Population 2023/2024	Future Estimated Growth (%/a)	Projected Population				
			2028	2033	2038	2043	2048
Beaufort West	40 753	1.50%	43 902	47 295	50 950	54 888	59 130
Merweville	1 903	1.50%	2 051	2 209	2 380	2 564	2 762
Nelspoort	1 914	1.00%	2 012	2 115	2 223	2 336	2 455
Murraysburg	6 061	1.50%	6 529	7 034	7 577	8 163	8 794
Farms	7 581	0.50%	7 773	7 969	8 170	8 377	8 588
TOTALS	58 213	1.24%	62 267	66 622	71 300	76 327	81 729

The population is likely to be influenced by economic opportunities and job creation. The table below gives an indication of the estimated future number of households per distribution system, as calculated from the projected future population figures.

Table 1.3.1.2: Estimated number of permanent future households							
Scheme	Projected Number of HH 2023/2024	Estimated Persons / Household	Estimated future number of permanent households				
			2028	2033	2038	2043	2048
Beaufort West	10 619	3.84	11 440	12 324	13 277	14 303	15 408
Merweville	532	3.58	573	617	665	717	772
Nelspoort	460	4.16	483	508	534	561	590
Murraysburg	1 501	4.04	1 616	1 741	1 876	2 021	2 177
Farms	2 231	3.40	2 287	2 345	2 404	2 465	2 527
TOTALS	15 342	3.79	16 400	17 536	18 756	20 066	21 474

1.3.2 Population Growth Rates

The historical population growth rates between 2001 and 2011 were used to estimate the future projected population growth rates for the various towns. The 2022 population Census data is not yet available per Community Profile. The 2023/2024 population was estimated by applying the annual growth rates as indicated in Table 1.3.1.1 to the 2011 Census data. The current population figures and the annual population growth percentages used in the WSDP Report are aligned with the figures used in DWS's GeoDatabase.

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TOPIC 1: SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

1.3.3 Age and Gender Profile

The table below indicates the population composition per age cohorts. These groupings are also expressed as a dependency ratio, which in turn indicates who are part of the workforce (Age 15 – 64) and those, who are depending on them (children and senior citizens). A higher dependency ratio implies greater pressure on social systems and the delivery of basic services.

Year	Children 0 – 14 Years	Working Age 15-64 Years	Aged 65+	Dependency Ratio
2022	15 700	31 151	4 731	65.6
2024	15 816	31 428	4 756	65.5
2026	16 139	31 556	4 771	66.3
Growth	0.7%	0.3%	0.2%	

Source: 2022 Socio-Economic Profile Beaufort West Municipality

Between 2022 and 2026 the largest population growth is recorded in the children category with a rate of 0.7% followed by the working age population and the aged population at 0.3% and 0.2% respectively. The dependency ratio is therefore, expected to increase slightly from 65.6% in 2022 to 66.3% in 2026. This is due to the expected growth in the children's cohort, which will result in an overall increase in the dependency ratio towards 2026.

1.3.4 Employment Profile

Unemployment leads to poverty which impacts negatively on the Municipality's income as it reduces the ability of people to pay for services and people become dependent on indigent grants which the Municipality has to finance through its equitable share as well as other grants provided by other government agents.

Beaufort West Municipality is conscious of the challenges of poverty in the area and strives to contribute towards the alleviation thereof by means of e.g. the Indigent Policy, Labour intensive projects, LED projects and the use of their Supply Chain Management Policy as an instrument to enforce the maximum use of local labour.

A critical aspect of infrastructure development is the obligation and commitment to create jobs. Direct job creation takes place through the development, operation and management of water infrastructure, which indirect job creation flows from the associated water supplies to economic activities such as mining, manufacturing, power generation and agriculture.

Investment in infrastructure development could create employment for local workers and provide skills development and work experience at a number of levels, from the highly technical jobs to manual labour, particularly where labour-intensive construction methods are used. The operation and management of water infrastructure also offers opportunities for job creation.

It is therefore important for Beaufort West Municipality to focus on labour intensive construction methods (EPWP projects) when implementing new projects. This process involves attacking poverty through job creation in the delivery of sustainable services. The Guidelines for the Implementation of Labour Intensive Infrastructure Projects under the Expanded Public Works Programme is available to assist Municipalities.

1.3.5 Household Income

Low household income in poverty areas is aggravated by poor quality of basic services, long walking distances to health and welfare facilities and long distances to the main employment opportunities. In recognition of the urgency to address poverty in the area Beaufort West Municipality adopted various measures of assistance to indigents such as incentives in respect of assessment rates and basic services and the provision of housing. Participation from other spheres of government and NGOs are also encouraged in order to meet with the demand.

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TOPIC 1: SETTLEMENT DEMOGRAPHICS AND PUBLIC AMENITIES

The key element of the WSDP is the assessment of affordability of the service to consumers. In order to adequately understand affordability, typical monthly bills need to be assessed against what people are earning. This needs to be looked at in terms of how the Equitable Share will be allocated and the Indigent Policy of the municipality. It should be noted that the overall total municipal bill, which includes all municipal services and rates (i.e. not just water and sanitation) for low income earners, should not be greater than about ten (10) percent of income.

Beaufort West Municipality needs to collaborate with the private sector and local non-profit organizations to provide needed skills at all levels, commission a skills audit and gap assessment and a skills development exercise focusing on specific priorities. The projects should focus on socio-economic upliftment, as part of Beaufort West Municipality's strategy to bring about poverty alleviation through job creation whilst enhancing the prospects of reducing outstanding municipal consumer debt. The main objectives of these projects should be as follows:

- Create employment
- Reduce poverty
- Reduce outstanding municipal debts
- Transfer / develop skills
- Create facilities, build infrastructure and improve service delivery
- Draw people into the economy (opening bank accounts)
- Build pride of ownership in the community
- Involve communities in developing their areas

Beaufort West Municipality's Indigent Policy caters for a proportion of the population not being able to afford water and sanitation services. The proportion of the population who cannot afford water and sanitation is also examined each year during the budgeting and tariff setting process and tariffs are adjusted accordingly. Households that cannot afford to pay can register as Indigent.

Certain initiatives from the Beaufort West Municipality aim to create job opportunities by means of:

- Labour intensive public work programmes;
- Procurement Policy in which preference is given to local contractors and contractors who employ local labour.

Labour Intensive methods must be used as far as possible for the following water services activities:

- Bulk and internal water reticulation networks
- Bulk and internal sewer drainage networks
- Provision of basic services on farms.

2. SERVICE LEVELS PROFILE

The Strategic Framework for Water Services (SFWS) places an appropriate focus on the imperative of ensuring universal access by households to at least a basic water supply and sanitation service. However, the provision of effective and efficient water services to meet the economic demand of all consumers (domestic and non-domestic) is equally important.

One of the visions of the Sector is that all people living in South Africa have access to adequate, safe, appropriate and affordable water and sanitation services, use water wisely and practise safe sanitation (SFWS).

One of the goals of the Sector is that water and sanitation services are provided (SFWS):

- Equitably (adequate services are provided fairly to all people);
- Affordably (no one is excluded from access to basic services because of their cost);
- Effectively (the job is done well);
- Efficiently (resources are not wasted);
- Sustainably (services are financially, environmentally, institutionally and socially sustainable; and
- Gender sensitively (taking into account the different needs and responsibilities of women and men with regard to water services and sanitation).

Basic services (the first step). As a priority it is the responsibility of Beaufort West Municipality to make sure that adequate and appropriate investments are made to ensure the progressive realisation of the right of all people in its area of jurisdiction to receive at least a basic level of water and sanitation services. The grants provided by national government in the form of the municipal infrastructure grant (MIG) will be adequate to ensure universal provision of at least a basic water supply facility and a basic sanitation facility within a reasonable period of time. This is called a universal service obligation and is the most important policy priority.

Whilst the provision of basic water services is the most important and immediate priority, WSAs are expected to provide intermediate and higher levels of services (for example, water on-site) wherever it is practical and provided it is financially viable and sustainable to do so.

PLANNING FOR BASIC LEVELS OF SERVICE

The primary constitutional obligation resting on WSAs is the provision of at least a basic level of services to all people living within their area of jurisdiction. The WSDP must show how the WSA plans to meet this universal service obligation.

PLANNING FOR HIGHER LEVELS OF SERVICE

Notwithstanding the primary constitutional obligation of basic services provision set out above (the first step), Beaufort West Municipality is expected to plan to move households up the water services ladder by providing higher levels of service wherever these are practical, financially viable and sustainable.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 2: SERVICE LEVELS PROFILE

Key issues to be taken into account when formulating a service level policy are as follows:

Socio-economic issues:

- The extent of cross-subsidization to support the provision of free or low cost services to poor and indigent members of the community is dependent on the make-up of the community in terms of the percentages of households that can afford to pay as well as the extent of commercial and industrial development.
- Population growth often tends to be greater in terms of the poorer members of society than the wealthier. Hence the future economic profile may tend towards a greater proportion of residents requiring subsidized services. This could be reversed in societies with high economic growth level.
- The health profile of communities is usually a result of a range of issues, including water supply, sanitation and health awareness. Experience has indicated that all three of these issues must be addressed in order to have a marked impact on the water and sanitation related health profile of a community.
- The implementation of water and sanitation projects can themselves make an impact on the employment and income profile of a community. The approach taken will govern the extent to which employment on the projects is facilitated, and whether the employment is short or long term.

Technical issues:

- The different options for water supply and sanitation systems have significantly different capital costs and operating costs. The local authority or WSP must ensure that these costs are affordable in terms of tariffs and subsidization possibilities.
- The different service level options usually have different water supply needs. Generally higher levels of service imply the need to supply more water per household and to a higher level of reticulation. It is critical to ensure that the water source is adequate and that the abstraction and reticulation systems are adequate and will not be subject to major leaks to ensure an ongoing reliable water supply.
- The risk of pollution of groundwater and surface water resources will be different for the different sanitation technology options. The risk of pollution from any particular system will also vary depending on the level operation and of the maintenance system. Hence a poorly operated and maintained waterborne sanitation system may have a significantly higher pollution risk than VIP sanitation systems, whereas a well operated and maintained waterborne sanitation system may result in a very low risk of pollution.
- The size and density of a settlement may be an important factor in the selection of technical options. The risks of pollution from dense settlements will usually be greater than from less dense settlements. It is also less costly to provide higher levels of services to more dense settlements than to disperse settlements.
- Different service levels have different operational demands, with off-site sanitation options placing more demands on the WSA and on-site options placing higher demands on households.

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- Experience with existing water and sanitation services may influence choices for new systems. It must be remembered that a negative experience associated with a particular system need not necessarily be as a result of a technological fault. Adequate human resource capacity and technical skills in operating these systems are also very relevant to their sustainable and affordable operation.

Water resources:

- South Africa is a water-scarce country with limited water resources. Opting for higher levels of service that require significantly more water at each household may not be compatible with the available resources. In the Western Cape in particular, rainfall occurs during periods of lowest demand for water (winter) and considerations such as storage (surface and aquifer) become important in order to store surplus winter water for the summer.
- Other water resources options that may be considered include demand management, aquifer recharge and water re-use at a local level and desalination of sea-water or of treated effluent. Groundwater sources must be carefully managed to ensure that abstraction does not exceed recharge potential and that the impact of abstraction on the surface water flow is monitored.
- The option of groundwater mining (i.e. pumping more than the annual recharge) should be avoided at all costs.
- Options of dual reticulation could be considered where fresh water supplies are limited. The second reticulation system may carry re-used water or saline groundwater and used for toilet flushing, gardens and laundry.

Water conservation / water demand management

From an urban water demand management perspective, there are many options which can be considered for implementation. Private initiatives include:

- Rainwater tanks. In the Western Cape, this option is not well suited for garden watering purposes as the available storage is limited.
- Private well-points and boreholes. This is only suited to those users able to afford the high installation costs, and where groundwater is accessible.
- Grey-water systems. These are also private initiatives and are relatively expensive. There may be associated health concerns, particularly if systems are not properly maintained.
- Retro-fitting of existing plumbing fittings with water efficient alternatives. Also dependent on the willingness of the users to pay for this privately.

Options for consideration by WSAs include:

- Pressure reduction interventions in conveyance networks to reduce leaks during periods of high pressure (common at night when demand is low).
- Dual reticulation systems where the second reticulation system carries treated effluent or saline groundwater for use in toilet flushing, gardens and laundry. May only be affordable to install in new developments.

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TOPIC 2: SERVICE LEVELS PROFILE

- Irrigation exchange. This involves the exchange of treated effluent with equal volumes of fresh raw water used for irrigation. There may social, religious and market related objections to this.
- Retro-fitting of plumbing fittings in existing municipal owned premises and promulgation of by-laws to enforce use of water efficient fittings only in new private developments. These include waterless urinals, removal of automatic flush urinals, use of dual flush toilets and low consumption shower heads.
- Adequately stepped tariff structures, particularly in the high consumption range, where water remains cheap to those who are able to afford it.
- Public awareness and education programmes.

The proposed WC/WDM strategy of the WSA should be assessed and the relevant sections that may influence the choice of water and sanitation systems should be taken into account.

Water service infrastructure

- The availability of water supplies with sufficient capacity within close proximity may significantly reduce the costs of providing a higher level of water and sanitation services to communities. The development of local infrastructure such as boreholes remain options well suited to the more remote areas.
- The availability of sewers and sewage treatment works within close proximity will significantly reduce the capital costs of providing a higher level of sanitation service, and reduce the incremental operational costs associated with the scheme. The availability of adequate resources to operate and maintain such systems is important.
- The existing services provided to one section of a community may often govern the choice of service levels to be provided to other sections of the community. However the sustainability, cost effectiveness and level of subsidization of the existing system should also be taken into consideration.

Water services institutional profile:

- Any new sanitation scheme requires ongoing care, maintenance and management. These services must usually be undertaken by the Water Services Provider (WSP). The requirements for these services depend on the type of sanitation system installed. The capacity of the WSP to be able to undertake these tasks, and the additional training requirements, must be considered when formulating a service delivery policy for sanitation services.

Customer service profile:

- Aspirations, concerns and past complaints of residents should be considered when formulating a sanitation service delivery policy.
- The associated awareness of health and hygiene education programmes should be based on the current level of knowledge of residents, and be formulated in consultation with community representatives.

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Financial profile:

- Financial considerations are one of the most important aspects that should be taken into account when considering a services delivery policy. Considerations include aspects of affordability, providing services to the poor, and the need to create jobs.
- Previous income and sales information may be relevant in the formulation of a way forward. It should be recognized that it takes considerable time to change from a low payment rate to an intermediate or high level of payment of tariffs.

Water and Sanitation Services on Privately Owned Land Policy (November 2023)

The roles and responsibilities of the WSA are as follows:

- The role of the WSAs is to comply with the regulatory and support mandates of DWS over provision of water services and resources to residents living on privately owned land.
- WSAs must integrate this policy with their respective local mandates in terms of the Strategic Framework for Water Services.
- WSAs must ensure Water Service Providers perform their responsibilities, which include Operation, maintenance and capital development of water and sanitation services infrastructure outside the boundary and / or within the servitude / of the end user.
- WSAs must identify, register and regulate Water Service Intermediaries / Providers according to their policies, bylaws, national norms and standards.

The roles and responsibilities of the Private Landowner / Water Services Intermediary are as follows:

- Private landowners must provide basic water services to their employees (and the families of employees) living on their land.
- WSAs must ensure that this policy is implemented and must identify, register and regulate water services intermediaries according to their bylaws and national norms and standards.
- Landowners must make an appropriate contribution to the capital cost of basic services.
- While water and sanitation assets, which WSAs install, remain under the ownership of the State, landowners will however have economic rights to the infrastructure once they become intermediaries, and those economic rights will be linked to a contract term.
- Operations and maintenance (and capital development of water and sanitation services on privately owned land) remain the responsibility of property owners.
- The private landowner is encouraged to enter into a contract with the WSA and perform the duties of a Water Services Provider as stipulated in Section 25(1) and (2) of the Water Services Act.
- Private Landowners / Water Services Intermediaries / Water Services Providers should:
 - Support the regulatory and support mandates of DWS over the water services and resources provided to residents living on privately owned land.
 - Integrate and implement this policy in terms of their planning and implementation to ensure compliance with all relevant legislation concerning provision of water services on private land; and to

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- Ensure that this policy is communicated to any person, party or organization affiliated to the “private land” sector.
- The employers is responsible for providing water and sanitation services to their labourers / employees as per Section 8(1) of the Occupational Health and Safety Act (Act 85 of 1993).

National Sanitation Policy, 2016.

Problem Statement: The ineffectual interpretation and implementation of the Section 78 of the Municipal Systems Act (No. 32 of 2000) process has contributed to municipalities primarily keeping the sanitation provision function in-house, even when the capacity to do so adequately was lacking. They are not appropriately implementing Section 78 provisions. WSAs are not responding to key responsibilities assigned to them in legislation and the SFWS.

Where a WSA has contracted a WSP to provide sanitation services, the responsibility of the two parties is not always clear in the contracts. There is a need for effective contract regulation.

A WSA have the following responsibility:

- Implementation of the Municipal Systems Act (Act 32 of 2000) and Water Services Act (Act 108 of 1997) provisions.
- Prepare sanitation plans such as WSDPs etc., aligned to national sanitation planning.
- Ensure the realisation of the right to access to sanitation services, particularly basic sanitation services, subject to available resources. This includes people living on privately-owned land, in recognised permanent informal settlements and vulnerable groups and others who are provided services by Water Services Intermediaries. Wherever practical and sustainable, Water Services Authorities are expected to plan for and provide higher levels of service.
- Ensure the provision of effective, efficient and sustainable sanitation services. The provision of sanitation services also includes communication activities related to, amongst other things, Hygiene Education, end-user education and the wise use of water.
- Develop an asset management strategy, a maintenance and rehabilitation plan and a register of sanitation services assets and must then put in place a system to manage these assets.
- Provide information concerning the provision of sanitation services as reasonably requested by the Provincial or National governments, end-users and / or organisations.
- Develop an appropriate institutional structure to adequately respond to key WSA functions and responsibilities.
- Account, as per the Municipal Finance Management Act (No. 56 of 2003), to the province and National Treasury for resource allocation (financial, human etc.).
- Provide sanitation hygiene and end user education.

Water Services Authorities have a right but not an obligation to accept industrial, agricultural and mining wastewater within their area of jurisdiction.

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Water Services Authorities must adhere to the following requirements in a transparent manner and in close contact with end-users:

- Sanitation services must be designed, planned and implemented to consider operations and maintenance requirements and to reduce the environmental impact of unmanaged grey-water, human excreta and wastewater disposal.
- Sanitation services must be appropriate and minimise impact on and use of water resources. WSA should strive for systems which utilise minimal water resources.
- Sanitation technologies which consider settlement types.
- Geo-hydrological testing before use of on-site groundwater sources or on-site sanitation services. Exceptional situations may require independent review and advice.
- Technology choices must be appropriate and affordable.
- Roles and responsibility for payments for operations and maintenance must be clear.
- Only appropriate sanitation technologies must be adopted.
- The quality of all building materials used for construction must be durable and fully compliant with the requirements, norms and standards
- Local availability of materials and skills must be part of the choice of technology or construction method. The design of sanitation services facilities must maximise the use of local resources.
- Sanitation technology selection should include resources to develop the necessary local institutional capacity to manage the day to day and future operational needs. In some circumstances there may be considerable merit in engaging a sanitation services provider to carry out certain functions on behalf of a local authority. Government does encourage local authorities to consider various options in this regard.
- Social and cultural practices and preferences should be considered in the selection of appropriate sanitation technology.

WSA must have the billing systems in place to raise sufficient revenue for sanitation services.

WSA must ensure sufficient funds are transferred for a WSP to perform the agreed functions.

WSA must regulate all aspects of sanitation services provision locally.

The WSA is accountable to its citizens.

Sanitation services planning by WSAs should be in conjunction with municipal Environmental Health Practitioners, as well as other stakeholders and departments involved in the sector.

Water Service Level Policy

A separate water service level policy is not in place, but the water service levels to be provided by the Municipality to the consumers in their Management Area are however included in By-law Relating to Water Supply. All water services provided by Beaufort West Municipality to consumers within the Municipal Management Area are linked to the Municipality's Tariff Policy (June 2022) and poor households are incorporated through Beaufort West Municipality's Indigent Policy (June 2023).

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Sanitation Service Level Policy

A separate sanitation service level policy is not in place, but the sanitation service levels to be provided by the Municipality to the consumers in their Management Area are however included in the By-law Relating to Wastewater. All sanitation services provided by Beaufort West Municipality to consumers within the Municipal Management Area are linked to the Municipality's Tariff Policy (June 2022) and poor households are incorporated through Beaufort West Municipality's Indigent Policy (June 2023).

A Water and Sanitation Services Policy needs to be compiled for Beaufort West Municipality.

Beaufort West Municipality works towards providing all households in the towns with a water connection inside the erven and connecting all households to a waterborne sanitation system. It is however important to consider the Municipality's capacity (financial and institutional) to operate and maintain complex sewage systems if opting for higher service levels and in particular waterborne sanitation.

Table 2.1: Master Plan for Service Levels		
Section	Master Plan	Yes / No
Direct Backlog Water	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Direct Backlog Sanitation	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Residential Water Services Infrastructure Supply Level Profile	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Residential Water Reliability Profile	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Residential Sanitation Services Infrastructure Supply Level Profile	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Residential Sanitation Reliability Profile	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Water Services Education	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Water Services Health	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Sanitation Services Education	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Sanitation Services Health	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Health and Education Facilities	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes

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The National Norms and Standards for Domestic Water and Sanitation Services, as published in the Government Gazette No.41100 of 8 September 2017, make provision for the following norms and standards for levels of water supply and sanitation services.

Table 2.2: Norms and standards for levels of water supply services			
Full level of service: People access and pay for more than 90 l/c/d at high pressure.	Interim Full	Full provision: People access a minimum of 50 l/c/d of SANS241 quality water on demand at the boundary of the yard, metered and tariffed.	↑
Middle level of service: People access and pay for 51-90 l/c/d at medium pressure.	Interim Upper	Upper provision: People access a maximum of 90 l/c/d of SANS241 quality water from an improved source at the boundary of the yard, metered and tariffed.	↑
	Interim Intermediate	Intermediate provision: People access more than 50 l/c/d but less than 90 l/c/d of SANS241 quality water from an improved source at the boundary of the yard, metered and tariffed.	↑
Minimum level of service: People access 25-50 l/c/d at low to medium pressure, use of more than 25 l/c/d is paid for.	Interim Basic Plus	Basic Plus provision: People access more than 25 l/c/d but less than 50 l/c/d of SANS241 quality water from an improved source at the boundary of the yard, metered and tariffed.	↑
	Interim Basic	Basic provision: People access a minimum of 25 l/c/d of SANS241 quality water from an improved source at the boundary of the yard, metered and tariffed.	↑
	Interim Free Basic	Free basic provision: People access a minimum of 25 l/c/d of SANS241 quality water from an improved source at the boundary of the yard, metered.	↑
	Intermittent	Intermittent provision: People access a minimum of 1500 l/household/week of acceptable quality water on a weekly basis within 100m, which is metered.	↑
Bulk service: Source of potable water to be provided to people, which is metered in all circumstances.			
No service / provision = backlog: People access water from insecure or unimproved sources, or sources that are too distant, too time consuming or are of poor quality.			

Interim provision: People access a minimum of 25 l/c/d of acceptable quality water within 24 hours of disruption, normal service to be restored within 7 days.

Table 2.3: Norms and standards for levels of sanitation services		
Hygiene promotion; Prevention of pollution; Re-use / recycle; Operation and Maintenance; Metering and tariffing; Solid Waste Management; Asset Management		
Full level: Full concern for human health, environment and sustainability of interconnected systems.	Full services	In-house facility: Storm water, wastewater/excreta, greywater, solid waste are collected and managed to achieve maximum benefits from treatment and re-use of water and nutrients. In-house facility: Access to a pleasant, safe, reliable and properly maintained facility for 24 hours a day, with control of nutrients in human excreta, wastewater and greywater.
Basic level: Remove excreta from the environment through treatment, pathogen reduction, resource recovery and nutrient reuse.	Free basic services	Toilet with functional hand washing facility in the yard: Access to a pleasant, safe and reliable facility for 24 hours a day, including privacy, personal safety and shelter through a subsidy for free. Maintenance of the facility is for free and is the responsibility of services provider.
	Basic services	Toilet with functional hand washing facility in the yard. Access to a pleasant, safe and reliable facility for 24 hours a day, including privacy, personal safety and shelter through a capital subsidy. Maintenance of the facilities is not for free and is the responsibility of the household / owner.
Interim level: Blocking the spread of faecal-oral diseases through proper excreta containment at a fixed point.	Excreta containment	Household, shared or communal toilets with functional hand washing facilities: Access to safe, reliable and properly maintained toilet and hand washing facility, free of charge, within 200m of the dwelling, which at a minimum safely contains human excreta. Maintenance is the responsibility of the services provider. To be phased out by 2030.
No service / provision = backlog: People practice open defecation or access an unimproved sanitation facility, such as pit toilets and bucket toilets. To be completely eliminated by 2030.		

Proper disposal, clean platform, vector and rodent control, resource use and health protection.

Emergency level: People access pleasant, safe, reliable and properly maintained improved toilets and hand washing facility on the premises in close proximity to the temporary dwelling within 24 hours and for duration of event.

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The National Norms and Standards for Domestic Water and Sanitation Services also include the following interim water and sanitation services (Communal services for informal areas):

Table 2.4: Interim water and sanitation services (National Norms and Standards for Domestic Water and Sanitation Services)
Intermittent provision of water at a minimum level of water supply services
<ul style="list-style-type: none"> • A minimum volume of 1 500 litres of potable water shall be made available to a household per week. • The water provided shall comply with the SANS241 quality standards. • The access/delivery point shall be at a minimum a communal standpipe, or a storage facility in the yard (water container, yard tank, roof tank) of at least a volume of 1 500 litres. • In the case of a communal standpipe, it shall be within a reasonable walking distance of no more than 100m from the farthest household. • In the case of a storage facility in the yard (water container, yard tank, roof tank), it shall be refilled by a water tanker with potable water at least once a week. • The water shall be made available for 52 weeks per year. • All water use and/or supply shall be metered, but not tarified. • Maintenance of the infrastructure for this level of service is the responsibility of the WSA. • Point-of-use water treatment systems and methods shall be advocated. • Efforts shall be made to ensure user acceptance and understanding for this level of service. • Users shall be educated in effective water use and hygiene. • This level of service shall be phased out by 2030 to comply with the National Development Plan's requirement of providing a basic service of at least a yard connection for water.
Interim sanitation services (Communal and shared facilities)
<ul style="list-style-type: none"> • Users shall be consulted on the siting and design, and the responsible cleaning and maintenance of shared toilets. Clean toilets are more likely to be frequently used. • Plumbing in and for communal and shared facilities needs to be more robust than that installed on private premises, and shall comply with the general principles of the National Building Regulations. Precautions need to be taken in the design against vandalism, theft and misuse. • Efforts shall be made to provide people living with chronic illnesses, such as HIV and AIDS, with easy access to a toilet as they frequently suffer from chronic diarrhoea and reduced mobility. • Where possible, communal and shared toilets must be provided with lighting, or users provided with torches. The input of the users must be sought with regard to ways of enhancing the safety of users. • Efforts to build a sense of communal ownership and pride of possession shall be made so that cooperation is voluntarily given or assured by peer pressure. • Sufficient sanitation facilities shall be provided for the number of users <ul style="list-style-type: none"> ➢ Communal toilet: Toilet seats – 1 seat per 50 users; Urinal units – 1 unit per 100 users; Hand washing – 1 basin per 10 toilet seats. ➢ Shared toilet mostly used all the time: Toilet seats – 1 seat per 20 users; Urinal units – 1 unit per 50 users; Hand washing – 1 basin per 4 toilet seats. • Shared and communal facilities shall have separate toilet blocks for men and women with separate entries; waste bins with lids in toilet block for women – emptied once a week and disposed of appropriately; urinal facilities for men; seats for children in the section for women; waiting / circulating area; separate washing cubicles for men and women; facility to store large volumes of water (water-borne sanitation); appropriate wastewater disposal system; and store room for keeping the cleaning material / equipment.

2.1 RESIDENTIAL WATER PROFILE

All the formal households in the urban areas of Beaufort West Municipality's Management Area are provided with water connections inside the erven. Standpipes are provided in the informal areas as a temporary emergency service. The current water service levels are included under Section 2.1 of the Administration, Information and Comprehensive Overview Report.

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Communal standpipes represent probably the weakest part of a network's water supply services. Standpipes must be constructed in ways that can withstand excessive use and should not be neglected in terms of operation and maintenance. Malfunctioning standpipes may adversely affect the health of its already vulnerable and poor users. Communal standpipes are also used by poor households who normally do not pay for water. Poor people are the ones that suffer the most from water-related diseases due to:

- Poor quality and maintenance of standpipes and their surroundings. Standpipes are often leaking and poor drainage around standpipes results in standing pools of water and muddy soil.
- Standpipes are not protected and animals lick the taps.
- When people have to walk long distances to fetch water, it is used sparingly and not enough water is used for hygiene.
- Even if water is clean when it leaves the standpipe tap, it is often contaminated by dirty containers used for carrying and storage.

Beaufort West Municipality is committed to support the private landowners as far as possible with regard to addressing the basic water services backlog that might still exist on the farms in the rural areas once clear and practical policy guidelines are available from the DWS and funding is made available. Water Service Levels in the WSDP for the farms are based on the 2011 Census data, because the 2022 Census Community Profiles are not yet available.

The Central Karoo District Municipality takes various water quality samples on the farms in the rural areas of Beaufort West Municipality's Management Area on request and the water quality information needs to be shared with the private landowners, also the risks associated with storage of water in open reservoirs or tanks and where no filtration or disinfection takes place.

2.2 RESIDENTIAL SANITATION PROFILE

All the formal households in the urban areas of Beaufort West Municipality's Management Area are provided with waterborne sanitation connection points inside the erven. Communal ablution facilities are provided in the informal areas as a temporary emergency service. The current sanitation service levels are included under Section 2.2 of the Administration, Information and Comprehensive Overview Report.

Beaufort West Municipality is faced with various challenges with regard to the provision of services on private owned land in a financial sustainable manner (enabling the on-going operation of services and adequate maintenance and rehabilitation of the assets), which include the following:

Free basic water policy:

- The provision of the infrastructure (facilities) necessary to provide access to water to all households in a sustainable and economically viable manner.
- The development of subsidy mechanisms which benefit those who need it most.

Free basic sanitation policy:

- Provision of the most appropriate sanitation facility to the poor household.
- Health and hygiene promotion must be provided in a co-ordinated manner and must be properly managed and adequately funded if free basic sanitation is to become a reality. This requires close collaboration between the EHPs of the Central Karoo District Municipality responsible for environmental health and Beaufort West Municipality.

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- Subsidising the operating and maintenance costs. If the basic service is to be provided free to the poor then Beaufort West Municipality must ensure that the costs of providing the service are covered by the local government equitable share and / or through cross-subsidies within Beaufort West Municipality's Management Area.

The ownership of water services assets may be in the hands of the person owning the land where an “on-site” water or sanitation facility is provided to a household. There is no legal impediment to the use of government grants to fund infrastructure for a poor household on private land not owned by that household, provided that the intermediary (the private land owner) makes a financial contribution (this is because the intermediary becomes the owner of the infrastructure once it is installed). Government is looking at specific policies with regard to the appropriate level of contribution.

Beaufort West Municipality will investigate the following types of sanitation technology options when they provide sanitation services to communities.

- VIP latrines and approved Eco-San dry, on-site sanitation systems.
- Low flow on site (LOFLOS) systems
- Septic tanks
- LOFLOS or septic tanks with solids-free sewers also referred to as septic tank effluent drainage (STED) systems.
- Full water-borne sanitation

2.3 PUBLIC AMENITIES

2.3.1 Water Services

All public institutions within the towns receive uncontrolled water supply from Beaufort West Municipality. The Municipality is committed to keep on providing good quality of water to these public institutions and industries.

All the clinics and hospitals in Beaufort West Municipality's Management Area have adequate and safe water supply and sanitation services. All the tertiary education facilities and schools in the urban areas of Beaufort West Municipality's Management Area have adequate and safe water supply and sanitation services. **The water service levels of the two primary schools in the rural areas need to be verified.**

It is important for the schools to focus on Water Demand Management activities and for Beaufort West Municipality to support the schools with WDM initiatives. This will not only aid in Beaufort West Municipality's demand management initiative directly by reducing the water consumption, but the education of learners at a young age regarding wise water use is a key component for sustainable supply in the long term.

It is not anticipated that the percentage distribution of residential, industrial and commercial consumers for the various distribution systems will change drastically in the nearby future. The water usage per sector is also presented graphically per distribution system in Annexure C of the Administration, Information and Comprehensive Overview Report.

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TOPIC 2: SERVICE LEVELS PROFILE

Education Plan

All education facilities in the urban areas of Beaufort West Municipality's Management Area are provided with adequate water services and no specific strategies, with regard to the provision of water services to these facilities, were therefore identified. Beaufort West Municipality is however committed to work with the Education Department to address any possible shortcomings with regard to the provision of water services that might still exist at any of the schools in the rural areas.

Health Plan

Beaufort West Municipality will strive to continue to ensure that the minimum required SANS241:2015 water quality standards are met through the systematic upgrading of their WTWs. The monitoring of provision of basic minimum services to farm dwellers remains a challenge, in view of the limited funding and human resources.

The establishment and functioning of effective health systems and health care services is critical for not only the upliftment of communities but more so for the sustainability of communities. Health services are rendered throughout the area by a network of clinics. The environmental health function is currently with the Central Karoo District Municipality. Typical functions of the Central Karoo District Municipality, with regard to health services, include the following:

- Households to meet the minimal health safety requirements
- Monitoring water quality
- Waste management
- Food control
- Schools to meet health requirements
- Contagious disease control
- Community development: Making communities aware of environmental health issues and communicates with farm workers regarding sanitation services.

The Municipal Health Services of the Central Karoo District Municipality also report monthly to the Department of Health on water quality. The quality of life of the people within a Municipality is influenced by the available health care. Various factors influence the health conditions of people in any region, for example access to clean water, good sanitation, proper nutrition and adequate housing.

It is important that a co-operative relationship exist between the Central Karoo District Municipality and Beaufort West Municipality with regard to environmental health issues and that a good communication protocol is followed between the District Municipality and Beaufort West Municipality to report on health issues.

The most vulnerable groups within Beaufort West Municipality's Management Area are the persons living in informal areas with shared services. It is therefore of outmost importance that the communal standpipes are properly maintained, to promote better health and hygiene among users. It is necessary to:

- keep the standpipe area clean and free from stagnant water;
- avoid water spillage by keeping the tap closed when not in use;
- report and rectify leakages immediately;
- keep straying animals away from standpipe area; and

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- keep the tap outlet, standpipe slab and soak away clean.

Promote health and hygiene awareness amongst standpipe users by focusing on the following:

- users must use the standpipe only for the filling of containers;
- no body or clothes washing is allowed at standpipes;
- no house pipes or other objects may be attached to the standpipes;
- use clean containers and close containers with a suitable lid when transporting water;
- disinfect containers when necessary; and
- immediately report any irregularities, contamination, tampering or vandalism at standpipes.

Damp and sometimes unsanitary conditions present in informal settlements provide an ideal breeding environment for bacteria. Some of the challenges WSAs phase in the informal settlements include the following:

- It is difficult to supply toilets to the dense informal settlements.
- Grey water pollution.
- Grey water run-off from standpipes.

2.3.2 Sanitation Services

The clinics and hospitals in Beaufort West's Management Area have adequate and safe sanitation services. All the tertiary facilities and the schools in the urban areas of Beaufort West's Management Area have adequate and safe sanitation services. **The sanitation service levels of the two primary schools in the rural areas however need to be verified.**

Education Plan

All education facilities in the urban areas in Beaufort West Municipality's Management Area are provided with adequate sanitation services and no specific strategies, with regard to the provision of sanitation services to these facilities, were therefore identified. Beaufort West Municipality is however committed to work with the Education Department to address any possible shortcomings, with regard to the provision of sanitation services that might exist at any of the schools in the rural areas.

Health Plan

Beaufort West Municipality's long term goal is to connect all households to a waterborne sanitation system in order to prevent any future grey water problems that might occur and to reduce the possible risk of groundwater pollution from soak-aways. Beaufort West Municipality primarily focus over the next few years will be on addressing the existing housing backlogs.

The supply of basic sanitation services on the farms needs to be linked to the provision of health and hygiene education. Improved health requires behaviour change, which cannot be achieved with a single health education talk given by an outside expert. Behaviour change requires sustained monitoring and promotion within the community. This is the key function of the community health workers employed on sanitation projects.

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Beaufort West Municipality needs to continue to actively engage with service providers and NGO's in the fight against illnesses such as HIV/Aids and TB. A solution to the sustainability of the community health worker's position and employment within the community has been to link their position and function to the activities of the Department of Health. In addition support can be provided to the Community Health Workers through local clinics and through the programmes of the EHPs.

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TOPIC 3: WATER SERVICES ASSET MANAGEMENT

3. WATER SERVICES ASSET MANAGEMENT

Table 3.1: Master Plan for Water Services Asset Management

Section	Master Plan	Yes / No
General Information	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Operation	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Functionality Observation	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Asset Assessment Spectrum	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Water and Sanitation Schemes	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes

The 2023/2024 IDP list the vandalism of boreholes and pump stations and water losses in Beaufort West as the main water services challenges and the vandalism of the sewer pump stations and facilities as the main sanitation services challenges. The Municipality faces budget constraints in relation to the sanitation service. Only MIG funding allocations are available per financial year. The Municipality does not have any own funding to fund the sanitation service.

Other Sanitation challenges / key issues of concern are:

- Operation and Maintenance: No O & M is available;
- Recurring sewer spillages due to aged infrastructure also pump stations;
- Aging infrastructure;
- Asbestos pipes; and
- Struggle to purchase materials due to financial constraints.

3.1 GENERAL INFORMATION

3.1.1 Asset Management Plan

It is essential for any service delivery organisation to compile an Asset Management Plan (AMP) to ensure efficient, effective and optimal management, operation and maintenance of all assets, which includes treatment plants, reservoirs, structures, buildings, pipelines, sites, etc. The purpose of the AMP is to:

- Ensure the operation and maintenance functions are well planned.
- Demonstrate responsible management.
- Justify and communicate funding requirements.
- Service provisioning complies with regulatory requirements.

An AMP normally includes the following:

- documents the nature, extent, age, utilisation, condition, performance and value of the infrastructure work;
- identifies existing and target levels of service, as well as expected changes in demand;
- identifies the life-cycle management needs of the infrastructure (development, renewal, operations and maintenance);
- assesses capital and operational budget needs; and
- identifies infrastructure asset management improvement needs.

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Beaufort West Municipality needs to differentiate between budget allocated towards the operation and maintenance of the water and sewerage infrastructure and the budget allocated towards the replacement of the old water and sewerage infrastructure. A budget of approximately 2% of the total asset value per annum should be allocated towards the replacement of the existing old water and sewerage infrastructure. In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the system remains in good condition.

The objective of an Asset Management Plan is to support the achievement of the strategic goals of the Municipality and facilitate prudent technical and financial decision-making. It is also a vehicle for improved internal communication and to demonstrate to external stakeholders the Municipality's ability to effectively maintain its existing infrastructure as well as the new infrastructure to be developed over the next 20 years.

Priority should be given to rehabilitating existing infrastructure as this generally makes best use of financial resources and can achieve an increase in (operational) services level coverage's most rapidly. The preparation of maintenance plans and the allocation of sufficient funding for maintenance are required to prevent the development of a large condition backlog. The potential renewal projects for water and sanitation infrastructure need to be identified from the Asset Register. All assets with a condition grading of "poor" and "very poor" need to be prioritised.

The Asset Management Plan must be based on the principle of preventative maintenance in order to ensure that, as far as this is practical, damage to assets is prevented before it occurs. Beaufort West Municipality must ensure that the maintenance and rehabilitation plan is part of the WSDP and that the plan is implemented. Assets must be rehabilitated and / or replaced before the end of their economic life and the necessary capital funds must be allocated for this purpose.

One of the key challenges of Beaufort West Municipality is to identify adequate funds for the rehabilitation and maintenance of their existing old infrastructure, which is critical to ensure the sustainability of the services that are provided by the Municipality. It is important for the Municipality to secure adequate funding for major refurbishment and maintenance work, the augmentation of the existing groundwater resources for Beaufort West, the provision of bulk infrastructure and the implementation of measures to reduce the very high NRW and Water Losses, in order to keep up with the high demand for services.

3.1.2 Disaster Management Plan

Disaster Management is continued to be shared with the Central Karoo District Municipality. The Central Karoo District Municipality is responsible for providing Disaster Management Services throughout the Central Karoo Region, which includes municipal areas of Beaufort West, Prince Albert and Laingsburg municipalities. The Disaster Management Centre strives to effectively plan for and minimize the impact of disasters on the community, visitors, infrastructure and environment through:

- Developing sufficient capacity within the Disaster Management Unit and improve communication with stakeholders.
- Managing risk to the environment by conducting risk analysis at municipalities, develop and implement standards.
- Responding to all disasters and provide sufficient support during incidents; and
- Implementing systems to mitigate risks through training, awareness, and communication.

The main hazards which may have a potential disaster-risk impact are (2023/2024 Central Karoo DM IDP):

- | | |
|--------------------|---|
| • Drought; | • Fracking; |
| • Extreme weather; | • Uranium mining; |
| • Floods; | • Bombing / explosion / terrorism; |
| • Snowfalls; | • Fire – structural or effects of pyrotechnics; |
| • Windstorms; | • Aircraft incident; |

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- Disruption of electricity supply / power failure (sustained);
- Hooliganism / Civil Unrest / Rioting / Public Disorder;
- Road traffic incident, including road transportation disruption/blockades/traffic congestion;
- Structural collapse;
- Hazmat incident or chemical or biological agents' or radio-active materials;
- Rail incident;
- Disruption of water supply;
- Disruption of sanitation & stormwater systems;
- Disruption of solid waste removal services;
- Epidemic / major infectious disease outbreak, including food safety issues;
- Environmental pollution – ground / air / water;
- Bomb threat / hostage-taking; and
- Disruption of commercial or governmental activities.

3.1.3 Untreated Effluent Management Plan

There are no known untreated effluent discharges to the environment. The W₂RAPs for the WWTWs and sewer drainage networks need to include Management Procedures and Incident Response and Emergency Protocols to respond to incidents.

3.2 FUTURE WATER AND SEWERAGE INFRASTRUCTURE REQUIREMENTS

3.2.1 Groundwater Infrastructure (Boreholes)

All the production boreholes in the four towns were inspected during the WSDP site visits in May 2024. Some of the boreholes are fenced and locked, with alarms systems also installed. A large number of the boreholes in Beaufort West were however vandalised and some of the boreholes are also not operational. Approximately 47% less safe yield is available from groundwater in Beaufort West, due to the non-operational boreholes. The boreholes with operational problems or which were vandalised and the estimated cost to refurbish these boreholes are indicated in the table below.

Table 3.2.1.1: Boreholes to be refurbished			
Aquifer	Borehole	Status	Estimated Cost (R million)
Gamka Valley Suid	Golfbaan	Vandalised	R0.250
Steenrotsfontein	SR4	Vandalised	R0.500
	SR10	Vandalised	R0.300
Hansrivier	HR10	Vandalised	R1.000
	HR13	Vandalised	R1.000
	HR15	Vandalised	R1.000
	HR16	Vandalised	R1.000
	HR18	Vandalised	R1.250
Small Hansrivier	KH3	Vandalised	R0.250
	KH5	Vandalised	R1.000
Gamka Vallei North	GoG1	Non Operational	R0.100
	GoG2	Non Operational	R0.100
	GoG3	Non Operational	R0.100
Brandwacht	Brandwacht 2	Non Operational	R0.750
	Brandwacht 3	Non Operational	R0.750
	Brandwacht 6	Non Operational	R0.750
Springfontein	Skietbaan	Vandalised	R0.750
	Steenoonde	Vandalised	R1.000
Walkersdam	Walkersdam	Vandalised	R1.000
Total			R12.850

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The last groundwater monitoring report for Beaufort West (5th, 30 September 2021) indicated that various wellfields have missing data for reasons such as vandalism and theft, the specific boreholes are not visited during the monthly monitoring rounds and level loggers are not present and / or faulty telemetry data at the time of writing the report. The table below provides an overview of the wellfield's water level status, as included in the last groundwater monitoring report for Beaufort West.

Table 3.2.1.2: Beaufort West wellfield's water level status	
Brandwacht and Renosterkop Wellfields	
Brandwacht borehole water levels are currently deep (35 – 50 mbgl). From the two boreholes that have telemetry sensors installed and for which continuous monitoring data could be obtained (Brandwacht_1 and Brandwacht_9), it was observed that water levels drop quickly after pumping is initiated, but recover well after pumping is stopped. Little abstraction seems to occur at Brandwacht_9 and the telemetry data indicates good overall recovery during the last few months. If Brandwacht_1 is installed with a flow control valve, the flow should be reduced to about 3.8 L/s. If flow cannot be lowered, allow borehole to recover to about 42mbgl (40 if possible) between pumping periods. Water levels taken manually at Brandwacht_8 indicate a drop in water level. Brandwacht_2, Brandwacht_4, Brandwacht_5 and Brandwacht_6 should be camera logged to review borehole structural integrity and locate fracture depths. These boreholes should then be yield tested according to current conditions together with Brandwacht_9. The telemetry sensor at Brandwacht_9 does not correspond with hand readings and needs to be re-calibrated. For Renosterkop_BH, monthly manual water levels are not being taken regularly.	
Dorpsgebied Wellfield	
Only one borehole is being monitored in this wellfield: HK_NDA. Hand readings have been taken from this borehole monthly since end of 2019 and water levels remain shallow at around 10mbgl. Telemetry sensor stopped working on 7 May and as this is the only sensor installed in this wellfield, it is strongly recommended that sensor be fixed or replaced.	
Gamka Vallei North Wellfield	
Bulkraal_Parkeraad borehole had a telemetry sensor installed, but this is no longer working. Sensor needs to be replaced/fixed. Waterval_Fontein is not currently being used due to lack of pipeline capacity, the telemetry sensor has stopped working although manual water levels still display shallow water levels. Pipeline is not operating to max capacity because of potential limescale build-up or sedimentation. Artesian flow from Gift of the Givers (GOG) could also be used if pipeline capacity is improved. Needs to be addressed and a worthwhile project for funding. As currently none of the boreholes in this wellfield has working continuous monitoring equipment, it is recommended that a logger sensor be installed in at least 1 of the boreholes, the faulty sensor at Waterval_Fontein should be investigated.	
Gamka Vallei South Wellfield	
From the monitoring data available for three of the boreholes in this wellfield, good water level recovery is observed for the last 2 years. Water levels at boreholes for this wellfield have been dropping in the last few months, but because water levels are still well above the pump depth, no immediate action needs to take place although the boreholes should be closely monitored and abstraction periods decreased if water levels drop to below the 40mbgl mark. Vandalism is an issue at Golfbaan borehole, install alarm. It is also recommended that this borehole to camera logged to determine fracture depths. Hand reading do not correspond to telemetry data at Volstruisgat and Sandgat boreholes and this should be investigated. Especially at Volstruisgat as a rest water level of 38 mbgl (from telemetry) at this wellfield would be a source of concern. Uitspan borehole not currently being used, would be good to camera log and yield test this borehole to assess potential as a production borehole.	
Hansrivier Wellfield	
Only HR15 and HR 18 are being monitored, but HR 15 is not currently being used. Abstraction at HR 18 seems sustainable as manual hand readings indicate continued shallow water levels although water levels have been dropping in the last few months (7 mbgl). But because water levels are still well above the pump depth (37 mbgl), no immediate action needs to take place although the borehole should be closely monitored and abstraction periods decreased if water levels drop to 27 mbgl. In a meeting with Municipality on the 27 January 2021 it was noted that HR15 and HR16 have undergone serious vandalism. HR10 has also been taken off the supply system due to high Aluminium concentrations, bore should be sampled to confirm this. Security at the Hansrivier wellfield has been noted as an ongoing issue and needs to be addressed.	
Klein Hansrivier Wellfield	
Flagship borehole's telemetry data indicates sustainable abstraction and no action is needed. For both KH3 and KH5 water levels have recovered well. However, for KH5, water levels seem to have stabilised at about 10 mbgl, a discrepancy between the sensor and the hand readings have been identified and should be investigated further.	
Lemoenfontein Wellfield	
Water levels display good recovery as a response to an increase in rainfall during 2021. This is due to this wellfield being close to the recharge source (the mountainous terrain). They typically respond quicker to rainfall. Water levels have also displayed good recovery at Lemoenfontein_Noord and the discrepancy between the sensor and the hand readings is still apparent and should be investigated further. It is recommended that Lemoenfontein Wes equipped with observation pipe and logger and camera logged. Data should be reviewed in association with fracture depth to assess sustainability.	
Springfontein dam Wellfield	
Water levels display good recovery as a response to an increase in rainfall during 2020 and 2021. Telemetry data for the Council of Geo Science B02H and B04H shows that the boreholes are being pumped sustainably, although levels although water levels have been dropping in the last few months. But because water levels are still well above the pump depth, no immediate action needs to take place although the boreholes should be closely monitored. Discrepancy between telemetry data and hand readings at B02H and Springfontein borehole should be investigated. Vandalism and theft have left the Steenoonde borehole unusable and Springfontein is also not being used. Boreholes should be re-equipped (where needed) and secured against vandalism and theft,	

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TOPIC 3: WATER SERVICES ASSET MANAGEMENT

Table 3.2.1.2: Beaufort West wellfield's water level status

Brandwacht and Renosterkop Wellfields
but this will need a large investment.
Steenrotsfontein Wellfield
Water levels at SR5 have recovered well in the last few months and have stabilized at around 12mbgl (it was around 20mbgl in June). Water levels at SR9 is still rising. Slight drop in water levels in QA2, still well above pump depth but should be monitored closely. No telemetry data or hand readings are available for SR 4 since June and it is unclear how the borehole is performing; this should be investigated. The telemetry data at QA2 and SR10 do not correspond with hand readings and this should be investigated.
Tweeling Wellfield
The water level doesn't reflect recovery from recent rainfall and is still low. Water level seem to fluctuate for the Tweeling_Kuilspoort_SRK4 borehole. It is recommended that a logger be installed in this borehole.
Walkersdam Wellfield
The Walkersdam borehole shows erratic response to rainfall, with overall trend of water level still dropping and falls to pump depth quickly after pumping starts. Borehole likely pumping at a too high rate. Vandalism and theft is an issue.

Beaufort West Municipality will continue with the implementation of their Groundwater Monitoring Programme for their boreholes. The groundwater monitoring data is currently processed, analysed and reported on by an experienced hydrogeologists on an ad-hoc basis in order to ascertain whether the resources are being sustainably utilised and to ensure compliance with the approved Groundwater Monitoring Programme and water use licenses. Managing groundwater for water supply purposes should have the following three main functions:

- Ensure that the aquifer is used optimally: The aquifer should not be over-pumped as that would negatively impact on its long-term sustainable yield or on the environment. It also means that if the aquifer is being under-utilised, this will become known.
- Ensure that the water quality in the aquifer is not negatively affected: This may be as a result of high abstraction from the aquifer, or from poor groundwater protection (from latrines, animal enclosures, etc.).
- Optimise borehole pumping rates so that the pumping equipment operates efficiently: Pumping rates are frequently set too high and this cause unnecessarily high pumping heads, a waste of energy, and at times, pump failure.

An additional function, which is usually captured in the first two points, is to ensure that environmental integrity is maintained. A botanical and streamflow monitoring programme is therefore also required. It is important for Beaufort West Municipality to continue to focus on aquifer protection, groundwater monitoring and wellfield management, in order to meet the town's future water requirements.

The table below gives an overview of the key groundwater management functions.

Table 3.2.1.3: Key groundwater management functions

Activity	Responsible Person	Skills and qualifications required	Resources, tools and equipment	Remarks
Measuring and recording of water levels.	Pump operator	Literacy, numeracy, trained in taking water levels	Dip meter, ruler, log book, pen.	Done as part of operators' regular O&M activities.
Measuring and recording abstraction	Pump operator	Literacy, numeracy, trained in reading water meters.	Log book, pen	Done as part of operators' regular O&M activities.
Providing data to the authority that is responsible for water supply on a regular basis.	Pump operator and pump operator supervisor	Literacy, numeracy, keeping records.	Postal service or public transport.	Including as part of the reporting requirements of the pump operator.
Taking water samples	The authority that is responsible for water supply.	Trained in taking water samples, driving license.	Transport, sample bottles, cooler box.	Sampling routine defined by sampling plan.
Sending water samples for testing.	The authority that is responsible for water	Keeping records.	Transport to laboratory	Sent to nearest accredited laboratory.

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Table 3.2.1.3: Key groundwater management functions

Activity	Responsible Person	Skills and qualifications required	Resources, tools and equipment	Remarks
	supply.			
Defining the monitoring requirements of an individual borehole.	Technical manager of operations or hydrogeologist.	Hydrogeological degree or diploma, experience of hydrogeological conditions.	Reports and records on borehole, monitoring data.	
Ensuring that boreholes are equipped with piezometer tubes for measuring water levels and water meters for measuring abstraction.	The authority that is responsible for water supply.	Project management	In house technical staff, suppliers, contractors, specifications.	
Ensuring that operators have the equipment and skills to do monitoring.	The authority that is responsible for water supply.	Project management	Trainers, suppliers, specifications.	
Monitoring the pump operator's competence to collect and record data.	Pump operator supervisor	Staff supervision, knowledge of pump operators' tasks.	Transport	Done as part of the supervision of O&M activities.
Processing data collected at the local level	Data clerk	Data capture, record keeping, filing, trained in operating software.	Computer, spreadsheet or groundwater management software, files.	Maintains an electronic and physical record of data.
Studying water level, water quality and abstraction data on a regular basis.	Technical manager of operations.	Technical training, operations experience.	Project files, monitoring data	Done as part of the management of O&M
Revising pumping recommendations and adjusting the monitoring requirements. Ensuring the recommendations are carried out and monitoring the implementation of the recommendations.	Technical manager with hydrogeologist as required.	Technical training, operations experience.	Reports and records on borehole, monitoring data, operational information.	Ongoing management of operations and groundwater resources.
Reporting to council and pump operator, providing summary data to the CMA.	Data clerk with supervision from technical manager.	Training in operating software.	Computer, spreadsheet or groundwater management software, printer.	Summary data defined by license (frequency, what data, form of data)

Detail information regarding the groundwater sources is available under Sections 3 of the Administration, Information and Comprehensive Overview Module.

3.2.2 Surface Water Infrastructure (Abstraction Points)

Section 6.1 of Topic 6 gives an overview of the years in which the annual water requirement is likely to exceed the licence volumes.

The preventative maintenance activities, as included under Section 4.1.2, are to be implemented by Beaufort West Municipality for their surface water infrastructure.

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3.2.3 Bulk Water Pipeline and Water Reticulation Network Infrastructure

The Water Master Plan (2021) has indicated that based on the most likely land-use development scenario, the following future bulk water pipeline and water reticulation infrastructure components will be necessary.

Table 3.2.3.1: Future bulk water pipeline and water reticulation infrastructure required						
Scheme	Year	Project	Length	Diameter	Estimated Cost	
			m	mm	(R million)	
Beaufort West	2025	Inter-connection pipe to improve network conveyance.	8	110	R0.037	
	2025	Inter-connection pipe to improve network conveyance.	10	110	R0.039	
	2025	Interconnection from 600mm bulk pipeline to the Dorp PRV supply pipeline.	5	315	R0.131	
	2025	Replace existing 150mm and 200mm dia. pipe to improve supply capacity to Dorp PRV.	127	400	R0.255	
	2025	Replace existing 25mm pipe to improve network conveyance (verify dia. of existing pipe first)	89	315	R0.131	
	2025	To improve network conveyance and redundancy.	124	160	R0.225	
	2025	Replace existing 75mm pipe to improve network conveyance	267	160	R0.247	
	2025	Inter-connection pipe to improve network conveyance.	87	160	R0.155	
	2025	Inter-connection pipe to improve network conveyance.	5	160	R0.036	
	2025	Mew supply pipeline when future area BFW13 develop.	493	160	R0.526	
	2030	Replace existing 125mm pipe to improve network conveyance	249	200	R0.315	
	2030	Replace existing 75mm pipe to improve network conveyance	234	160	R0.216	
	2030	Replace existing 75mm pipe to improve network conveyance	422	110	R0.375	
	2035	Replace existing 75mm pipe to improve network conveyance	222	110	R0.205	
	2040	Replace existing 125mm pipe to improve network conveyance (when future areas BFW5, 6 and 7 develop)	332	315	R0.409	
	2040	Replace existing 200mm pipe to improve network conveyance	254	355	R0.522	
	2040	Replace existing 75mm pipe to improve network conveyance	650	250	R0.568	
	2040	Replace existing 100mm pipe to improve network conveyance	249	250	R0.275	
	2040	Replace existing 75mm pipe to improve network conveyance	1 075	160	R0.929	
	2045	Replace existing 100mm pipe to improve network conveyance (when future areas BFW5, 6 and 7 develop)	607	200	R0.644	
	2045	New supply pipeline when future areas BFW5, 6 and 7 develop	363	200	R0.728	
	2050	Replace exiting 100mm dia. pipes when future areas BFW3 develop.	970	160	R1.019	
	2050	Replace exiting 50mm dia. pipes when future areas BFW3 develop.	238	160	R0.188	
	2050	New supply pipeline when future area BFW5 develop.	478	160	R0.721	
	2050	New supply pipeline when future area BFW10 develop.	728	160	R0.780	
	Sub-total					R9.676
	Merweville	2040	Pipeline required to improve supply to the network (When AADD exceeds 375 kl/d).	272	160	R0.440
2045		Pipeline required when future areas MV3 develop.	255	110	R0.281	
Sub-total					R0.721	
Murraysburg	2025	Pipeline to improve conveyance and fire flow.	367	160	R0.578	
	2025	New supply pipeline to improve network conveyance.	193	160	R0.326	
	2025	Insert and close valve for rezoning.	-	110	R0.094	
	2025	Insert and close valve for rezoning.	-	110	R0.094	
	2025	New supply pipeline to improve network conveyance.	193	110	R0.229	
	2025	Insert and close valve for rezoning.	-	110	R0.094	
	2035	Pipeline for development	409	110	R0.451	
	2040	Replace existing 75mm pipeline to improve network conveyance.	739	160	R0.644	
	Sub-total					R2.510
Total					R12.907	

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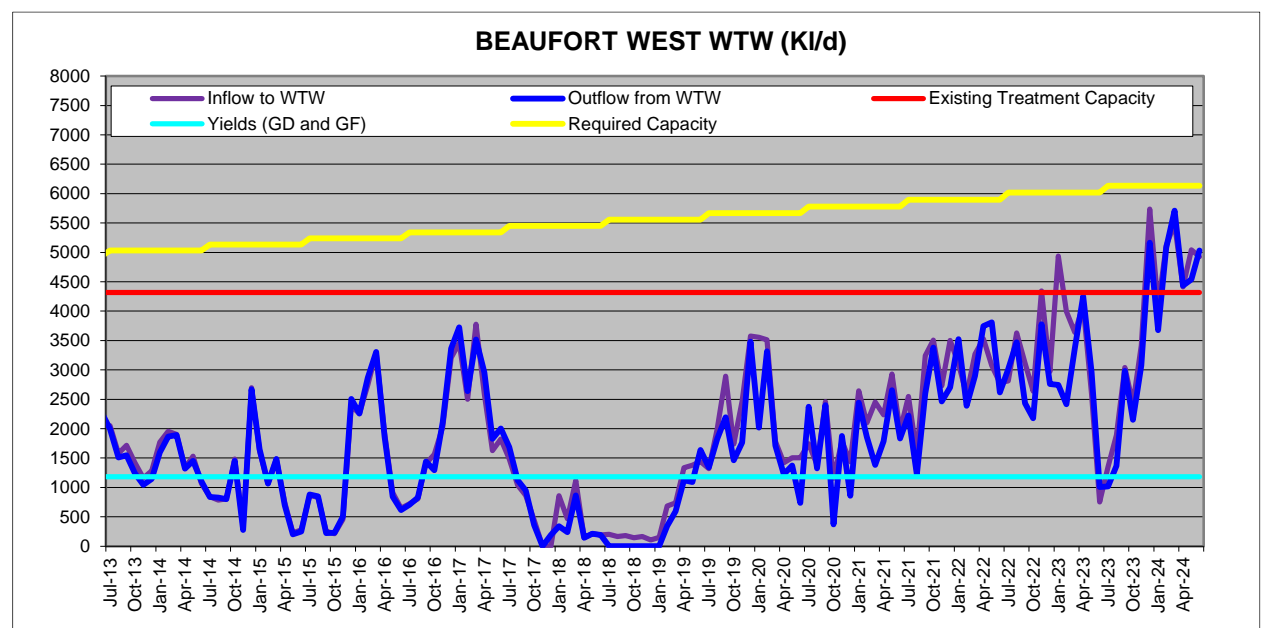
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3.2.4 Water Treatment Works Infrastructure

The existing hydraulic design capacities and the current average daily flows at each of the WTWs are summarised in the table below.

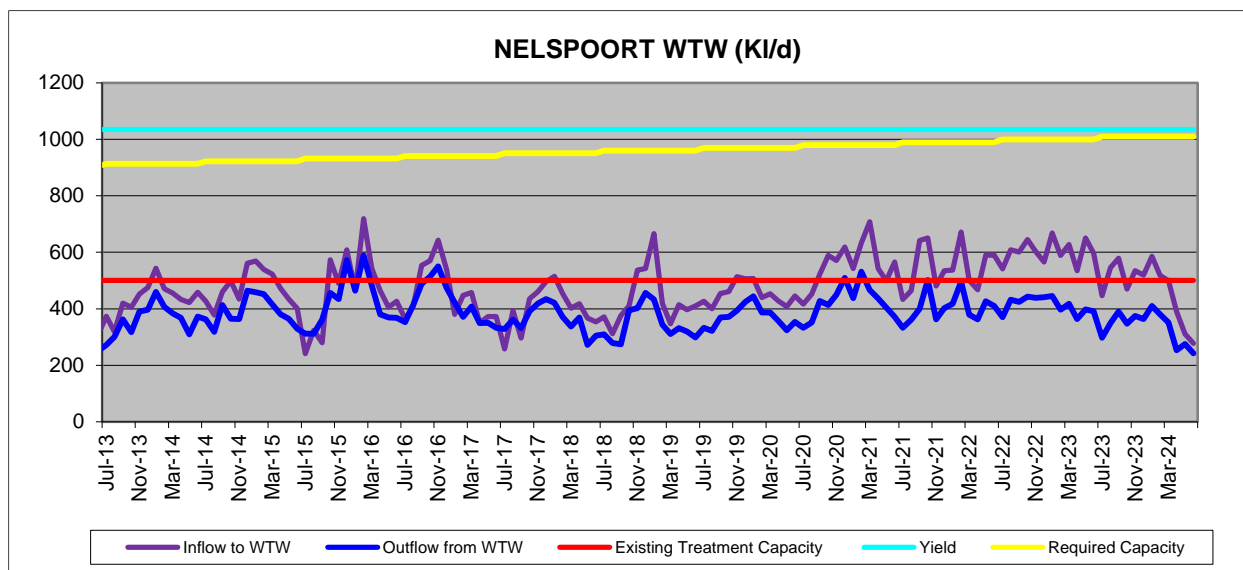
WTW	Existing Hydraulic Capacity	Peak Month Average Daily Flow	Average Daily Flow (Jul 2023 – Jun 2024)	Average Daily Flow as a % of Capacity	Current Required Treatment Capacity (1.5 x AADD10yr)	2023/2024 Water Quality Failures Network (SANS0241:2015)
	MI/d	MI/d	MI/d	%	MI/d	
Beaufort West WTW	4.320	5.736 (Dec)	3.915	90.6	6.136	Turbidity, THM ratio
Beaufort West Reclamation Plant	2.144	2.589 (Feb)	2.113	98.6	2.144	-
Nelspoort WTW	0.500	0.586 (Jan)	0.474	94.8	1.009	Conductivity, Turbidity, Sodium, Chloride, TDS, Sulphate (Aesthetic), Bromoform, THM ratio

The two graphs below gives an overview of the flows at the Beaufort West and Nelspoort WTWs.



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Key issues to be addressed at the WTWs, as identified through the WSDP inspection process during May 2024, are as follows.

- Nelspoort WTW: The current fence around the sand filters are not adequate to keep animals out. The chlorine dosing system was not operational at the time of the site visit (Regulator and dosing pump were in for repairs). Various components of the WTWs need to be refurbished. The estimated cost for the upgrading of the Nelspoort WTW is R18 000 000. The proposed works to address the rehabilitation and upgrading of the works, as included in the January 2024 Technical Report, include the items listed in the table below.

Table 3.2.4.2: Rehabilitation and upgrading required at the Nelspoort WTW	
Component	Rehabilitation and upgrading work required.
Aeration Towers	<ul style="list-style-type: none"> Refurbish the existing aeration tower, currently treating water from Borehole No.1 and No.2 Provide additional aeration capacity in the vicinity of the existing aeration tower to treat water from all borehole sources. Provide a new aeration tower directly upstream of the slow sand filters. Optimize pipework of the existing aeration tower installations to improve the hydraulic capacity thereof.
Slow Sand Filters	<ul style="list-style-type: none"> Replace all filter media and support media. Refurbish mechanical equipment. General maintenance to filters and associated equipment.
Chlorine Dosing	<ul style="list-style-type: none"> Move motive water connection to the raw water reservoirs. Replace chlorine dosing pumps to enable dosing in the final water rising main. Provide new chlorine dosing point on rising main.
Final Water Pumps	<ul style="list-style-type: none"> Make good the existing final water pump building by means of minor building work refurbishments and painting.
Concrete Repair	<ul style="list-style-type: none"> Concrete repair to existing reinforced concrete structures, including the aeration towers, holding tanks, filters, chambers and buildings.
Miscellaneous	<ul style="list-style-type: none"> Remove all unnecessary equipment and material from the water treatment works and clean up the works in general. Provide the necessary training and skills transfer to the Operators.

- The Beaufort West WTW was operated over its design capacity for some of the months during the last financial year. The recycled water PS was vandalised and no recycling is currently taking place at the plant. There is only one Aluminium sulphate dosing pump, no standby. The scales for the chlorine cylinders are not working. There is only one filter backwash pump, no standby. The fence around the WTW was vandalised. The future upgrading of the WTW will depend on the availability of additional water from the Gamka dam or water from the Springfontein or Walkers dams.

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The recommendations from the 2024 WTW Process Audits are included the tables below.

Table 3.2.4.3: Recommendations from 2024 WTW Process Audits		
Problem	Risk	Recommendation
Beaufort West WTW		
One duty coagulant dosing pump.	Reduced water quality / no coagulant dosing in the event of equipment failure.	Reinstate standby dosing pump / system.
Settling tanks too small.	Reduced water quality and additional load on filters.	Provide additional settling tanks.
High filtration rate	Reduced water quality	Provide additional filter area to reduce the filtration rate.
One duty backwash blower.	No redundancy – process failure	Provide standby blower.
One duty backwash pump	No redundancy – process failure	Provide standby pump.
Undefined chemical storage and empty area (no signage or demarcation)	Health and Safety / Process risk if incorrect chemicals are used.	Provide adequate demarcation and signage.
Cracked manhole covers over clearwell.	Health and Safety risk	Replace manhole covers.
No standby chlorine gas bottle on site.	Water Quality risk	Ensure that a standby chlorine gas bottle is kept on site at all times.
Inadequate sample testing	Compliance risk	Ensure the sampling regime is improved to ensure compliance with Blue Drop requirements.
Merweville WTW		
No recommendations		
Nelspoort WTW		
See Table 3.2.4.2 above		
Murraysburg WTW		
No recommendations		

3.2.5 Water Pump Stations

The water pump stations, as inspected during the WSDP site visits in May 2024, are all operational. Duty and Standby pumps are available for all the pump stations, except at the Garcia Street PS. No leaks were observed at any of the water pump stations. The pump stations are also fenced and locked and some of the buildings are supplied with alarms to prevent any illegal access. Some of the issues to be addressed at the water pump stations, as identified through the WSDP inspection process, are as follows.

- Garcia Street Water PS: The PS was not operational, because the one pump was removed for repairs.
- Noordeinde Booster PS No.1: One motor and pump not operational.
- Noordeinde Booster PS No.2: One pump was removed for repairs.
- Nelspoort WTW Final Water PS: One pump was removed for repairs.

The Uitspan Booster PS is the only pump station that will require upgrading in the nearby future at an estimated cost of R4 000 000.

3.2.6 Reservoir Infrastructure

The condition of most of the reservoirs in Beaufort West Municipality's Management Area is good and the reservoirs are well maintained. The levels of some of the reservoirs are monitored through the scada systems. Not all the reservoirs are fenced and locked and some of the covers are not locked. Some of the issues to be addressed at the water reservoirs, as identified through the WSDP inspection process in May 2024, are as follows.

- Beaufort West reservoirs at WTW site: Some of the covers of the valve chambers are missing.
- Beaufort West: Noordeinde and Uitspan reservoirs are not fenced.

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- Beaufort West: Cover of Vaalkoppies reservoir is not locked.
- Merweville 0.200 MI and 0.400 MI reservoirs: Reservoirs adequately fenced, but covers are not locked.
- Murraysburg 0.500 MI: Fence vandalised and removed. Galvanized roof sheets were stolen. The reservoir is leaking at the floor.

The 2023/2024 storage factors of the total reservoir storage capacity for the various towns, based on 1 x PDD (24 hours storage capacity), are 1.0 for Beaufort West, 1.9 for Merweville, 1.3 for Nelspoort and 0.6 for Murraysburg. Even though the overall storage capacity might be adequate for all of the towns there can be distribution zones within some of the towns with inadequate storage capacity, which require additional reservoirs.

The Water Master Plan (2021) has indicated that based on the most likely land-use development scenario, it will be necessary for the following future reservoirs.

Table 3.2.6.1: Estimated cost of future reservoir storage capacities required

Town	Recommendations included in the Water Master Plan	Capacity (MI)	When	Estimated Cost (R million)
Beaufort West	New reservoir to increase reservoir storage capacity (Required when AADD exceeds 7.5 MI/d)	4.500	2025	R15.530
	New reservoir to increase reservoir storage capacity (Required when AADD exceeds 7.5 MI/d)	4.500	2050	R15.530
Merweville	Replace old 250 kl reservoir with new 500 kl reservoir (Required when AADD exceeds 375 kl/d)	0.500	2040	R3.285
Nelspoort	Additional capacity required when AADD exceeds 450 kl/d	0.500	2030	R3.285
Murraysburg	Additional reservoir storage capacity for Murraysburg South and North reservoir zones (<i>New 0.500 MI North and 0.200 MI South reservoirs were recently constructed</i>)	1.500	2025	R7.004
Total				R44.634

3.2.7 Bulk Sewer Pipeline and Sewer Drainage Network Infrastructure

The Sewer Master Plan (November 2008) has indicated that based on the most likely land-use development scenario, the following future sewer reticulation infrastructure components will be necessary.

Table 3.2.7.1: Future bulk sewer pipeline and sewer drainage network infrastructure required

Scheme	Project	Comments	Length	Diameter	Estimated Cost
			m	mm	(R million)
Beaufort West	Upgrade existing outfall sewer	When future area B4 develop	900	200	R2.061
	Upgrade existing outfall sewer	When overflow problems occur	93	250	R0.319
	Upgrade existing outfall sewer	When overflow problems occur	86	300	R0.367
	Upgrade existing outfall sewer	When overflow problems occur	76	200	R0.232
	Upgrade existing outfall sewer	When overflow problems occur	41	200	R0.156
	Upgrade existing outfall sewer	When overflow problems occur	592	200	R1.380
	Upgrade existing outfall sewer	When overflow problems occur	693	450	R3.487
	New outfall sewer	New outfall for future area B5	215	160	R0.391
	New outfall sewer	New outfall for future area B9	792	200	R1.498
	New outfall sewer	New outfall for future area B8 & B9	484	200	R0.939
	Upgrade existing outfall sewer	When overflow problems occur	179	375	R0.685
	Upgrade existing telemetry system	To increase reliability of telemetry	-	-	R0.336
Sub-total					R11.851
Merweville	New outfall sewer	New outfall sewer for existing unserved erven	1 411	160	R2.219
	New outfall sewer	New outfall sewer for existing	2 631	160	R4.081

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Table 3.2.7.1: Future bulk sewer pipeline and sewer drainage network infrastructure required

Scheme	Project	Comments	Length	Diameter	Estimated Cost
			m	mm	(R million)
		unserved erven			
	New syphon	New syphon to cross the river	87	160	R0.415
	Upgrade existing telemetry system	To increase reliability of telemetry	-	-	R0.168
	Sub-total				R6.883
Nelspoort	New outfall sewer	New outfall for future area N2	219	100	R0.398
	New outfall sewer	New outfall for future area N4	386	160	R0.652
	Upgrade existing telemetry system	To increase reliability of telemetry	-	-	R0.336
	Sub-total				R1.386
Murraysburg	Upgrade existing sewer drainage networks	Various sections of the existing sewer drainage network need to be upgraded to ensure adequate capacity.	Unknown	Unknown	R15.000
	Sub-total				R15.000
Total					R35.120

3.2.8 Sewer Pump Stations

Most of the sewer pump stations are fenced and locked, with duty and standby pumps. Key issues to be addressed at the sewer pump stations, as identified through the WSDP inspection process in May 2024, are as follows.

- Prince Valley Sewer PS: One motor and pump were removed for repairs. Regular network blockage results in overflow.
- Kwa Madlenkosi Sewer PS: Huber drum screen is regularly blocked.
- Nelspoort Main Sewer PS: Overflow due to tripped pump. The fence was vandalised. Only one pump is currently operational. The sump capacity was reported to be inadequate.
- Nelspoort Garage Sewer PS: Only one pump, no standby.
- Murraysburg PS: Only one small pump currently operational. The PS is operated manually because the level sensor is faulty. The fence was vandalised. The flow meter is faulty.

It will be necessary for the following future sewer pump stations.

Table 3.2.8.1: Future sewer pump stations required

Drainage System	Recommendations included in the Sewer Master Plan	Capacity (l/s)	Estimated Cost 19/20 (R million)
Nelspoort	Provide additional pump for Garage Sewer PS	-	R0.300
	Upgrade Main Sewer PS	15.0	R1.500
Murraysburg	Refurbishment of main Sewer PS	-	R1.750
Total			R3.550

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3.2.9 Waste Water Treatment Works

The table below gives a summary of the existing hydraulic design capacities and current flows at each of the WWTWs, as well as the final effluent quality compliance percentages for the 2023/2024 financial year.

WWTW	Existing Hydraulic Design Capacity	% of System Input Volume used to estimate flow	Estimated Average Daily Flow (2023/2024)	Average Daily Flow as a % of Design Capacity	Final Effluent Compliance for 2023/2024
Beaufort West *	4.659	40%	4.090	87.8%	No monitoring results
Merweville *	0.111	40%	0.071	64.0%	No monitoring
Nelspoort *	0.240	55%	0.180	75.0%	No monitoring
Murraysburg *	0.500	50%	0.536	107.2%	No monitoring results

Note: * Metered Inflow not available – Average Daily Flow based on % of System Input Volume .

The projected future WWTW flows are included in the future water requirement projection models. The table below gives an overview of the average daily future projected WWTW flows.

WWTW	Existing Hydraulic Capacity	Average Daily Future Projected WWTW Flows					Peak Month Average Daily Future Projected WWTW Flows				
		2028	2033	2038	2043	2048	2028	2033	2038	2043	2048
Beaufort West	4.659	5.691	6.492	7.399	8.425	9.583	7.114	8.115	9.249	10.531	11.979
Merweville	0.111	0.062	0.066	0.070	0.075	0.079	0.078	0.083	0.088	0.094	0.099
Nelspoort	0.240	0.279	0.291	0.304	0.318	0.332	0.349	0.364	0.380	0.398	0.415
Murraysburg	0.500	0.553	0.639	0.733	0.837	0.951	0.691	0.799	0.916	1.046	1.189

Note: The peak month factors used in the above table is 1.25

Beaufort West Municipality evaluates the capacity and suitability of their WWTWs to meet the final effluent quality limits on an annual basis. When the water quality requirements for the final effluent becomes stricter and / or when the inflow to the WWTW has increased to such an extent that the capacity of the plant needs to be increase, the Municipality appoints reputed consulting engineering firms to undertake feasibility studies to perform technical and economical evaluation of the different options available for upgrading or extending the capacity of the treatment works.

The most evident problems at the various WWTW, as summarised in the June 2024 WWTW Process Audit Reports, are as follows:

Beaufort West WWTW:

- The inlet works has only one operational screw pump;
- The Pista Degritter is out of operation and requires mechanical refurbishment;
- One out of the four installed aerators is currently out of operation;
- The activated sludge process only has one SST. At peak wet weather flow, sludge is carried over. This has a negative impact on the sludge age and nitrification;
- The whole system is down if there is a mechanical failure on the SST. This has occurred in the past when one of the wheels broke; and
- The sludge carried over from the SST has a negative impact on the downstream water reclamation plant.

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Merweville WWTW:

- Site security is compromised due to damage to the perimeter fence – risk to the community and the municipal assets that are exposed to vandalism and theft;
- The inlet works building has been vandalised and the wash water system to wash the screen is out of operation (The JoJo tanks for wash water storage were located inside the one Primary Pond).
- The flow meter is not fit for purpose and needs replacement with a venturi flume;
- The ponds required a general cleanup of vegetation;
- The irrigation pump station has been vandalised and is out of operation; and
- Regular raw water sampling is not conducted.

Nelspoort WWTW:

- Site security is compromised due to damage to the perimeter fence – risk to the community and the municipal assets that are exposed to vandalism and theft; and
- Regular raw water sampling is not conducted.

Murraysburg WWTW:

- Site security is compromised due to damage to the perimeter fence – risk to the community and the municipal assets that are exposed to vandalism and theft; and
- Regular raw water sampling is not conducted.

The recommendations from the 2024 WWTW Process Audits were as follows:

Beaufort West WWTW: The existing works experiencing occasional unit process failures. This has a negative impact on the final effluent quality and results in occasional non-compliant effluent. To remedy this, the following recommendations were made:

- Reinstate failed screw pump;
- Provide additional mechanical screen for redundancy / standby;
- Refurbish and reinstate degritter;
- Upgrade the process from a MLE process to a UCT process;
- Provide an additional SST;
- Provide additional aeration capacity;
- Refurbish the equipment which is currently out of operation (RAS pumps, etc.); and
- Improve site security as vandalism and theft is a major issue.

Merweville WWTW:

- Conduct regular raw water sampling to monitor sewage constituents;
- Improve perimeter fence to ensure adequate site security and to limit public and livestock trespassing;
- Provide fit-for-purpose flow measurement by means of an ultrasonic sensor and venturi flume in a secure chamber;
- Reinstate service water / wash water system to enable rinsing of the screens;
- Remove JoJo tanks from the pond and replace in the correct location; and
- Refurbish irrigation pump station.

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Nelspoort WWTW:

- Conduct regular raw water sampling to monitor sewage constituents; and
- Improve perimeter fence to ensure adequate site security and to limit public and livestock trespassing.

Murraysburg WWTW:

- Conduct regular raw water sampling to monitor sewage constituents; and
- Improve perimeter fence to ensure adequate site security and to limit public and livestock trespassing.

The following upgrades are required with regard to the WWTWs.

Table 3.2.9.3: Future upgrades of the WWTWs			
WWTW	Short description	Time Frame	Estimated cost (R Million)
Beaufort West	Upgrade WWTW	Short	R49.800
	New irrigation pump station for final effluent	Short	R17.000
Merweville	Refurbishment at oxidation ponds system and security fence	Short	R5.000
Nelspoort	Install improved security fence	Short	R0.500
Murraysburg	Upgrade oxidation ponds	Short	R10.000
Total			R82.300

3.3 WATER AND SANITATION SCHEMS

3.3.1 Water Schemes

The Water Master Plan (November 2008) has indicated that based on the most likely land-use development scenario, the following future water reticulation infrastructure components will be necessary.

Table 3.3.1.1: Future water reticulation infrastructure required
Beaufort West
<p>Proposed distribution zones</p> <ul style="list-style-type: none"> • The boundaries of the Beaufort West reservoir zone are increased to accommodate future development areas in the zone. • A new Rustdene PRV zone is proposed for water demand management purposes. <p>Proposed future system and required works</p> <ul style="list-style-type: none"> • The existing water distribution system has insufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas. • A few distribution pipelines are required to reinforce water supply within the Beaufort West distribution network. • When pressure problems occur in the northern even of the Kwa Mandlenkosi PRV zone the static and residual pressures can be improved by changing the PRV setting to 35m head.
Merweville
<p>Proposed distribution zones</p> <ul style="list-style-type: none"> • There are no changes to the existing distribution zone. <p>Proposed future system and required works</p> <ul style="list-style-type: none"> • The existing water distribution system has insufficient capacity to supply the future water demands for the fully occupied scenario.
Nelspoort
<p>Proposed distribution zones</p> <ul style="list-style-type: none"> • The only change to the existing distribution zone is that the existing boundary of the existing zone is increased to accommodate future development areas. <p>Proposed future system and required works</p> <ul style="list-style-type: none"> • The existing water distribution system has insufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 3: WATER SERVICES ASSET MANAGEMENT

Table 3.3.1.1: Future water reticulation infrastructure required

Murraysburg
Was not part of the 2008 Water Master Plan

The water master plan figures are included in Annexure A.

3.3.2 Sanitation Schemes

The Sewer Master Plan (November 2008) has indicated that based on the most likely land-use development scenario, the following further sewer reticulation infrastructure components will be necessary.

Table 3.3.2.1: Future sewer reticulation infrastructure required

Beaufort West
<ul style="list-style-type: none"> A new main outfall sewer (Items BWS 2.1 & BWS 2.2) is proposed for future development areas B8 & B9. The outfall sewers in the Blyth Street drainage area should be upgraded according to the master plan, if overflow problems occur when future development areas B1 – B5 develops. The existing pump stations were modelled with assumed scouring velocities in the accompanying rising mains and it is recommended that the duty points of these pump stations be verified by field pumping tests.
Merweville
<ul style="list-style-type: none"> The existing drainage area is increased to accommodate the existing erven in Merweville that are not currently incorporated in the existing sewer system. A new outfall sewer (Items BMS 1.1 & BMS 1.2) is proposed for the existing erven in the Merweville drainage area that are currently not connected to the existing sewer system. A new syphon (Item BMS 1.3) is proposed to cross the river.
Nelspoort
<ul style="list-style-type: none"> The existing Nelspoort Main pump station drainage area is increased to accommodate future development areas N1-N4 that fall within this drainage area. The existing Nelspoort Main pump station should be upgraded to a capacity of 15 l/s when it reaches its capacity. The existing pump stations were modelled with assumed scouring velocities in the accompanying rising mains and it is recommended that the duty points of these pump stations be verified by field pumping tests.
Murraysburg
Was not part of the 2008 Sewer Master Plan

The telemetry system whereby the pump stations are closely monitored should be upgraded and utilized to its full potential in order to assist with the operation and management of the systems. The sewer master plan figures are included in Annexure A.

4 WATER SERVICES OPERATION AND MAINTENANCE

It is important for Councils to understand the value of maintenance and provide the necessary funding to properly operate and maintain infrastructure. There is a conflict of interest in Councils, due to backlogs of basic necessities such as housing and water, sanitation and electricity services, which many poor people urgently need, and expect councillors to provide. They are inclined to prioritise the needs for extending services before maintaining existing services.

It is the responsibility of the municipal and technical managers to educate and inform Councils on this and help councillors explain these issues to their communities. **Successful municipalities depend to a large extent on a single principle – effective and efficient management!**

Much of the routine work of technical departments involves managing and undertaking the O&M of services that is done in-house by municipal staff. A second major aspect of work is managing O&M undertaken by external service providers. The third major area is new or capital projects, also usually undertaken by external service providers.

Each service area in Beaufort West Municipality needs an O&M system that monitors and assesses infrastructure condition and plans the required preventative maintenance, and when necessary, rehabilitation, upgrading or replacement of infrastructure. This is a major part of an overall Asset Management System, which

- records, describes all infrastructure assets;
- monitors and assesses their condition;
- plans and monitors maintenance;
- plans upgrading, rehabilitation and replacement; and
- values assets and the costs of maintenance, upgrading, rehabilitation and replacement.

There is a wide range of **desirable objectives** that should be achieved with the help of maintenance.

- Retain an asset in a serviceable condition during its designed life span.
- Optimize the reliability of equipment and infrastructure.
- Ensure that the equipment and infrastructure are kept in a good condition.
- Ensure prompt emergency repair of equipment and infrastructure to sustain service delivery.
- Take action before repair costs become too high.
- Ensure operation by eliminating breakdown risks or limiting them as much as possible.
- Improve delivery by upgrading infrastructure.
- Enable repairs under the best possible conditions.
- Improve operational safety and remove causes of accidents.
- Reduce the overall management burden through better work preparation and reduced unforeseen production stoppages.
- Protect the environment.

To achieve these objectives, it is necessary to train personnel in specific maintenance skills and to influence their attitudes, as better operational results depend on motivated staff who are committed to proper maintenance procedures and standards.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

Setting up a preventative maintenance programme is one of the most effective ways of reducing breakdowns and keeping equipment and infrastructure in good condition. It is important to implement such a programme as soon as new equipment or infrastructure is put into service.

Implementing a preventative maintenance programme requires a **maintenance plan**, with particular emphasis placed on the following:

- Periodic inspection of equipment according to a pre-established programme so that working conditions may be checked.
- Systematic servicing – the first step in devising this programme is to forecast the life of parts and components subject to wear, i.e. the study of reliability, failure modes and effects and fault analysis.
- Overhauls, which often require considerable work, should be planned during low production periods.

4.1 OPERATION AND MAINTENANCE PLAN

Table 4.1.1: Master Plan for Water Services Operation and Maintenance		
Section	Master Plan	Yes / No
Operation and Maintenance Plan	Is there a Master Plan that addresses this problem?	Partly
	Does this Plan address this problem 100%?	Partly
Resources	Is there a Master Plan that addresses this problem?	Partly
	Does this Plan address this problem 100%?	Partly
Information	Is there a Master Plan that addresses this problem?	Partly
	Does this Plan address this problem 100%?	Partly
Activity Control and Management	Is there a Master Plan that addresses this problem?	Partly
	Does this Plan address this problem 100%?	Partly

The complexity of maintenance activities should be analysed to set up an efficient maintenance plan and to take management decisions, e.g. regarding use of own resources and unskilled or skilled resources. **Five levels of maintenance** can be distinguished, depending on the complexity of the work and the urgency of action.

- Simple adjustments are generally applicable to accessible components and require no dismantling or opening of the equipment. These adjustments involve the completely safe replacement of accessible consumable components such as signal lights or some types of fuses. Servicing of this type may be performed by the operator on site, without tools, following the instructions for use. The stock of consumable parts required is very small.
- Troubleshooting entails minor preventative maintenance operations such as greasing or checking for proper functioning. Servicing of this type may be performed on site by an authorised technician. An authorised technician has received training that enables him/her to perform such maintenance work safely and is well aware of potential problems.
- Breakdowns require identification, diagnosis and repairs by replacing components or working parts. Servicing of this type must be carried out by trained persons, on site or in the maintenance shop, using the documentation (manuals, spare part lists, etc.) necessary for maintenance of equipment.
- Major maintenance work covers all major corrective or preventative work except modernization and rebuilding. Servicing of this type must be carried out by a team that comprises highly skilled technical specialists, using the relevant documentation.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

- Modernising and rebuilding equipment or executing major repairs is usually done by the manufacturer or builder. Resources are specified and usually very similar to those used in the original manufacturing or construction.

In order to ensure **good quality O&M**, technical managers firstly need to ensure that staff responsible for in-house O&M

- understand equipment and infrastructure;
- understand and implement the proper O&M requirements and procedures;
- understand the required service and operating standards;
- have and develop the necessary O&M skills;
- assess equipment and infrastructure conditions;
- understand and identify typical defects and problems;
- solve problems and make necessary repairs, or engage experts to do so; and
- record all activities to provide data for planning and analysis of O&M.

Secondly technical managers must ensure that they contact competent external service providers.

The bulk of O&M activities should be of a preventative nature. That is regular checking all the water and sewerage infrastructure and ensuring that everything is in good operational condition. The sections 4.1.1 to 4.1.10 below include recommended O&M tasks for the various water and sewerage infrastructure components that should be implemented by Beaufort West Municipality.

4.1.1 Groundwater infrastructure

The photos below indicate the vandalised and non-operational boreholes in Beaufort West.



Brandwacht BH No 2 (Motor burned)



Brandwacht BH No 3 (Not operational)



Brandwacht BH No 6 (Motor burned)



Golfbaan BH (Vandalised)



Steenrotsfontein BH SR4 (Vandalised)



Steenrotsfontein BH SR10 (Vandalised)

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE



Hansrivier BH HR10 (Vandalised)



Hansrivier BH HR13 (Vandalised)



Hansrivier BH HR15 (Vandalised)



Hansrivier BH HR16 (Vandalised)



Hansrivier BH HR18 (Vandalised)



Small Hansrivier BH KH3 (Vandalised)



Small Hansrivier BH KH5 (Vandalised)



GoG BH No.1 (Not Operational)



GoG BH No.3 (Not Operational)



Skietbaan BH (Vandalised)



Steenoonde BH (Vandalised)



Walkersdam BH (Vandalised)

Production boreholes for potable water supply are currently in operation for Beaufort West, Merweville, Nelspoort and Murraysburg. There are a number of production boreholes in Beaufort West that are not operational, due to vandalism and other operational problems (See Section 3.2.1 under Topic 3).

Monitoring and control systems (Scada) are in place for some of the boreholes, but not all. The boreholes in Merweville, Nelspoort and Murraysburg are all fenced and locked. Not all the boreholes in Beaufort West are adequately secured and a number of boreholes were vandalised. Abstraction from all production boreholes are monitored and recorded. The groundwater data is monitored by a Geohydrologist on an ad-hoc basis in order to ensure compliance with licence requirements.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

O&M of boreholes has often been neglected by some Municipalities, and when performance declines beyond a prescribed level, they are abandoned and new boreholes are drilled. This waste of and disrespect for scarce water resources has been allowed to continue for years in many municipalities. There are many causes of decreased borehole yields and failure including:

- mechanical failure related to breakdown of the pumping equipment;
- inefficient hydraulic flows in borehole feeding pipes due to incorrect pipe sizes, poorly matched pumps and inefficient use of valves;
- geohydraulic failure as a consequence of over-pumping, which can cause inelastic compression of fractures, pumping of silts, sealing or encrustation of aquifer pores and screen openings by fine particles, or chemical/biological precipitation caused by iron bacteria on the slotted casing; and
- geohydraulic failure can also be caused by poor borehole design, which leads to borehole collapse, or the entry of unacceptably high volumes of sediment.

Maintenance is needed to prevent specific problems, and rehabilitation can restore the optimum efficiency of a borehole. Boreholes often need to be rehabilitated every 15 years, and sometimes as often as every six or nine years. In some cases, major reconstruction may be necessary, such as replacing the screen or a portion of the casing. Three aspects need to be taken into account when considering the implementation of a borehole maintenance or rehabilitation programme.

- Human Factors: It is often difficult to obtain support for a comprehensive maintenance and rehabilitation programme. Such programmes often lack status and excitement, compared to the implementation of new projects. Poor management, pride and reluctance to admit project failure by implementing agents, and an ignorance concerning the importance of regular maintenance are other factors. There is often a belief that as long as a borehole is operating there are no problems and no need to monitor borehole performance. When this perception is prevalent, it is often difficult to identify those problems that could be remedied by rehabilitation at an early and 'curable' stage.
- Economic Factors: It is often cheaper to maintain or rehabilitate a borehole than to replace it, once its performance has deteriorated significantly. Even when rehabilitation is more economical, as is often the case, money for rehabilitation is often more difficult to obtain than money for new projects. New projects are mostly grant funded, while O&M and rehabilitation are funded by municipal income. Since the water services income is not ring-fenced to cover necessary O&M costs related to delivering services, but used for other municipal expenses, this leads to less and less resources being allocated to O&M. It is understandable that desperate technical managers sometimes try to secure O&M resources via new projects, by disguising replacement costs as new infrastructure projects.
- Technical Factors: Technical factors relate to understanding the processes which cause declining borehole performance, and the means by which they can be avoided or rectified. If potential causes of declining performance can be diagnosed, maintenance methods to prevent their occurrence can be planned and included in the O&M budget. But effective preventative maintenance and rehabilitation require that accurate borehole construction records be kept, showing geological conditions and hydraulic performance profiles. Experience has shown that once a borehole's performance drops by about 25 %, expressed as a decline in specific yield, it is time to rehabilitate the borehole.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

It is important for Beaufort West Municipality to implement the following recommended daily, weekly, monthly and six monthly O&M activities for their boreholes.

Table 4.1.1.1: Recommended daily, weekly, monthly and six monthly O&M activities for the boreholes	
O&M Activity	Frequency
Borehole underground condition and equipment	
For a borehole with a rotary pump; pull out the rising main and pump element: - Clean and check the pump element (screen, rotor and stator). - Clean and check all sections of the rising main (columns). - Check the rubber stabilizers and replace any badly worn. Assess if the borehole needs cleaning and/or rehabilitation. Decide when this must be done.	Every three years, depending on the geological formations. In some areas it might be necessary to do it more often.
For a borehole equipped with a submersible pump: start the pump and monitor the full load current to ensure correct operation.	At least once a week.
Remove the submersible pump from the borehole and remove trapped particles and deposits from the inlet screen with a jet of clean water.	Every six months
Change the oil on the submersible pump if the oil can be replaced, some pumps are sealed units.	Every six months
Record water levels: static water level and drawdown during operation or just after operation.	If the borehole is connected to a telemetry system, this is done automatically and daily. Otherwise the operator must take and record the measurements.
Pump house and pump installation above ground	
Check and attend to the condition of the pump house foundation (plug any gaps or holes), walls and roof, door and lock, ventilation bolts and paint condition. Patch up where necessary. Apply a drop of oil on the lock.	Monthly
Start the pump and monitor the full load current and check operating pressure on the delivery pressure gauge. Also check for abnormal vibration, abnormal temperature and strange noise. Check oil level.	Weekly
Check condition of gland packing and adjust to provide a steady drip.	Weekly
Check and tighten base plate mounting bolts.	Weekly
Check the alignment of the drive pulley and pump pulley. Correct if necessary. Listen for any bearing noise. Check that the safety cage is Ok and securely mounted.	Weekly
Check the tension and condition of the v-belt and replace if frayed or worn.	Weekly
Check the operation of the motor cooling fan.	Weekly
Petrol/diesel driven pump: check for any oil or fuel leakage and spill. Check the gaskets and replace if leaking. Check the oil and fuel spill collection sump and take out any spill and it to the workshop. Under no circumstances is it allowed to be dumped in the veld.	Weekly
Other equipment	
Check the operation of the non-return valve. Failure of this valve can result in a sheared pump shaft or a snapped v-belt.	Daily
Check for and attend to leaks from gaskets, joints, and corroded piping, and for ingress of rainfall.	Daily
Take the reading of the flow meter if not automated. Keep the meter clean and check that it is in good order. If automatic reading, check connection to telemetry.	Daily
Check flow switch and pressure switch.	Daily
Check pressure gauge with ball valve on tee.	Daily
Check the scour valve.	Daily
Daily check that the air/pressure release valves are in good order.	Daily
Replace the air valve with a back-up while maintaining the valve in workshop every six months.	Every six months
Borehole yard	
Check that rainfall runoff is directed away from the yard and that there are no puddles in the yard. Check also that there are no other pollution risks in or near the yard.	As necessary after heavy rains, otherwise this is a monthly check point.
Clean the yard of any scrap and discarded containers etc. Never allow any waste to be dumped within the yard and the inner protection zone.	Monthly

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

Table 4.1.1.1: Recommended daily, weekly, monthly and six monthly O&M activities for the boreholes	
O&M Activity	Frequency
Keep the grass and weeds short. Remove any 'emerging' bushes and trees.	Monthly
Check condition of fence, gate, lock, sign board (is the information on the sign still readable, telephone number correct etc.?). Apply a drop of oil on lock. Repair as necessary, immediately. Never allow the borehole yard to be un-protected.	The operator would do these checks every day, but a more thorough inspection to be done monthly.
If the borehole is equipped with a rain gauge, check it as a matter of routine every day and record any rainfall.	Daily
Electrical installations (Note that most of the required activities can only be performed by an electrician)	
Clean the cabinet and the contactors.	Weekly
Check functioning of all starters, contactors and trip mechanisms.	Weekly
Check over/under voltage relay.	Weekly
Start the pumps and other electrical equipment manually and check the operation of all instruments such as am-meters and volt meters for correct functioning.	Weekly
Check that all panel lamps and site lights are working. Replace bulbs where necessary.	Weekly
Check the operation of the control system which may be an ultrasonic sensor, float switches, pressure transducer or a liquid level sensor.	Weekly
Check the operation of the telemetry system (if installed).	Weekly
Listen to all motor bearings for excessive wear.	Weekly
Inspect the entire installation and ensure all equipment is to required specification. Repair or replace all damaged parts of the equipment.	At least every three months
Clean all cabinets and enclosures thoroughly by washing down with a damp cloth on the outside and blowing out all dust, spider webs and insects on the inside using an electrical industrial blower.	At least every three months
Remove and clean all contactors with a solvent approved for electrical components.	At least every three months
Tighten all cable glands and ensure all cables are secured on cable racks and in conduits.	At least every three months
Check all terminations for integrity and signs of corrosion.	At least every three months
Clean level sensors and check the settings.	At least every three months
Inspect all wiring for evidence of heat build-up and tighten motor terminals to avoid hot connections.	At least every three months
Grease all motor bearings.	At least every three months
Inspect frame and tighten mounting bolts.	At least every three months
Measure supply voltage.	At least every three months
Check all earthing systems and lightning arrestors for correct functioning, and replace if faulty.	At least every three months
Ensure all labelling and name plates are in place and readable.	At least every three months
Paint cabinet if required to protect it from corrosion.	At least every three months
Check canopy; tighten mounting bolts and patch up the corrosion protection.	At least every three months
Telemetry System	
Clean the battery terminals.	Monthly
Test the charger and test batteries for 12 volt.	Weekly
Check that the antenna is fixed in the right direction.	Monthly
Check the cabinet frame, canopy, and mounting bolts. Clean cabinet with a blower and a soft cloth. Check for corrosion, and patch up with paint where necessary.	Monthly
Quality control, log books and reports	
Fill in the logbook daily as required.	Daily
Adjust, if necessary, the inspection and maintenance schedules.	Monthly
Measure and record the (turbidity), electric conductivity and pH levels.	Monthly
Take water sample for bacteriological testing.	Monthly or as agreed with DWS
Draft and submit prescribed reports.	Monthly
Up-date records of all production and monitoring boreholes. Most importantly: volumes abstracted during the year, water levels and physical parameters (electrical conductivity, pH, (turbidity) beginning and end of year, and summarise lab reports on bacteriological testing.	Monthly and annually

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

Table 4.1.1.1: Recommended daily, weekly, monthly and six monthly O&M activities for the boreholes

O&M Activity	Frequency
Once a year have a water sample tested for chemical parameters. Compare records with DWS authorization/license and with Management Recommendation, e.g. level of pump intake. Highlight trends and draw conclusions and include in an annual report.	

Note: As can be seen in the table, most activities are part of the daily O&M performed by the operator. Many monitoring activities can also be automated in a telemetry system. If the borehole is connected to a telemetry system, then a maintenance operator or the technical supervisor must visit the borehole at least twice a month and do the checks and associated maintenance. It is important to validate automated records with regular on-site observations and measurements.

4.1.2 Surface water infrastructure



Gamka Dam (Beaufort West)



Garcia Fountain (Beaufort West)



Sout River (Nelspoort)

Surface water resources are used in Beaufort West and Nelspoort and these surface water abstraction points are regularly inspected by the operational personnel to ensure a continuous supply of raw water from these abstraction points.

Some of the O&M activities implemented by Beaufort West Municipality for their surface water abstraction points include the following:

- Routine inspections of all abstraction points;
- Recording of abstraction volumes; and
- Cleaning of inlets when required.

The following preventative maintenance procedures are necessary to ensure satisfactory operation of the abstraction facilities for the surface water sources.

- Operate the intake gates through one cycle at least once a month.
- Clean debris from the intake area as the need arises or at least six times per year.
- Monitor debris build-up on screens continuously.
- Check level of abstraction point, (i.e. not at bottom or too near to top).
- Lubricate the bearings of screens as Scheduled.
- Check cleaning systems of screens periodically.
- Remove screenings daily and dispose in an approved landfill.
- Calibrate raw water meters so that an accurate indication can be obtained of the volume of water that is abstracted and treated. A trained technician must do calibration.
- Clean raw water pump stations and attend to any abnormal noise, smell, excessive heating etc.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

4.1.3 Bulk and water network reticulation and fittings

Some of the water reticulation networks and pipe fittings require maintenance. Most of the bulk water meters and valves are operational and no major leaks were noticed during the WSDP site visits. Not all the water infrastructure is however adequately protected against possible theft and vandalism. Not all the meter chambers are supplied with lockable covers and some of the bulk borehole water meters in Beaufort West were also vandalised.

Some of the O&M activities implemented by Beaufort West Municipality for their bulk and water reticulation networks and fittings include the following:

- Replacement of faulty meters, valves and fittings on an ad-hoc basis;
- Immediately repairing any leaks on the networks or at valves, hydrants or other fittings;
- Scada system that monitors the flows for some of the systems;
- Standby teams over weekends and during holiday periods to attend to any required O&M tasks; and
- Customer complaints system to respond immediately to any possible water complaints.

The table below gives some of the Maintenance actions that can be implemented by Beaufort West Municipality on their water reticulation networks and fittings.

Table 4.1.3.1: Maintenance activities for the water reticulation networks and fittings						
No.	Maintenance Action	Daily	Weekly	Monthly	Annually	Other
1	Pipelines					
1.1	Check for leakages in system (block by block)			X		
1.2	Check and clean chambers. Check chamber lock.			X		
1.3	Stock taking of spares (materials for pipe repairs)			X		
1.4	Flush entire system					X
1.5	Check marker posts and beacons				X	
1.6	Refurbish marker posts and beacons					X
2	Standpipes (Communal and Public Buildings)					
2.1	Check for leakages	X				
2.2	Clean standpipe slab and surroundings		X			
2.3	Clean soak away		X			
2.4	Maintain standpipe equipment / accessories		X			
2.5	Read meters and clean meter chambers			X		
2.6	Replace biptap				X	
3	Bulk Meters					
3.1	Reading of bulk meters			X		
3.2	Cleaning of chambers			X		
3.3	Check for leakages			X		
3.4	Calibration of meters				X	
3.5	Replacement of registering unit					X
3.6	Replacement of entire meter					X
3.7	Check and empty all strainers protecting the bulk meters			X		
4	Consumer Meters					
4.1	Reading of meters			X		
4.2	Cleaning of meter chamber			X		
4.3	Check for leakages			X		
4.4	Check for tampering			X		
4.5	Check meter accuracy					X
4.6	Replacement of entire meter					X

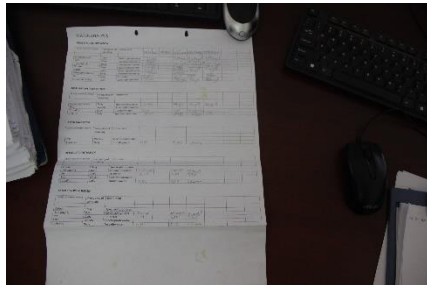
WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

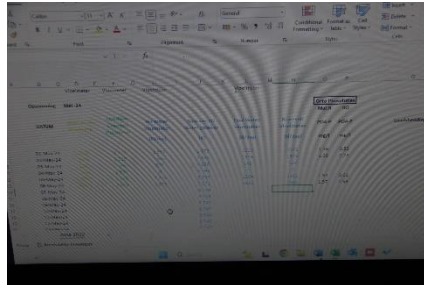
Table 4.1.3.1: Maintenance activities for the water reticulation networks and fittings						
No.	Maintenance Action	Daily	Weekly	Monthly	Annually	Other
5	Valves					
5.1	Open and close isolating valves			X		
5.2	Check functionality of scour valves			X		
5.3	Check functionality of air valves			X		
5.4	Check functionality of pressure reducing valves			X		
5.5	Service pressure management valves (Pressure Controllers) every 2 yrs					X
5.6	Maintain valve equipment / accessories				X	
5.7	Replacement of valves					X
5.8	Clean valve chambers. Check the cover lock			X		
6	Fire Hydrants					
6.1	Check for leakages			X		
6.2	Check and if required refurbish beacon / marker				X	
6.3	Check functionality of hydrants			X	X	
6.4	Test flow rate of hydrants				X	
6.5	Maintain hydrant equipment / accessories				X	
6.6	Replacement of fire hydrants					X
7	Record Keeping and Reporting	X	X	X	X	

Beaufort West Municipality needs to evaluate their existing O&M activities and schedules for their water reticulation networks and fittings against the above recommended daily, weekly, monthly and annual maintenance checklists and needs to ensure that all the required activities are adequately monitored and recorded.

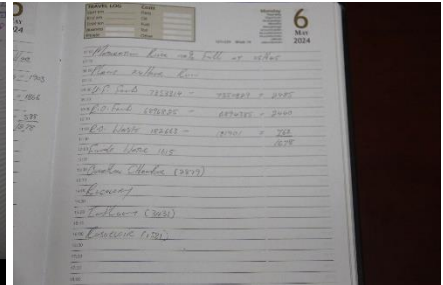
4.1.4 Water Treatment Works



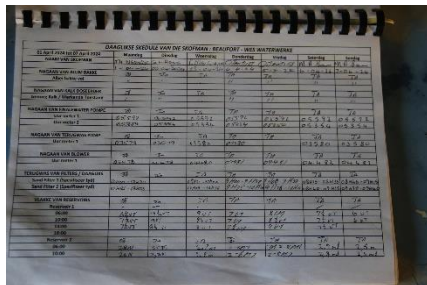
Reclamation Plant: Daily Operational sampling log sheet



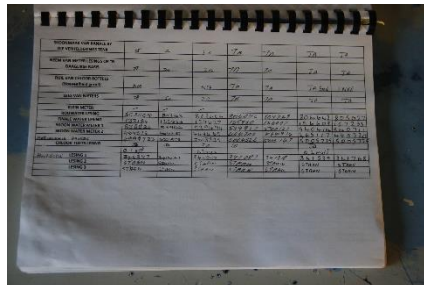
Reclamation Plant: Logging of flows at plant



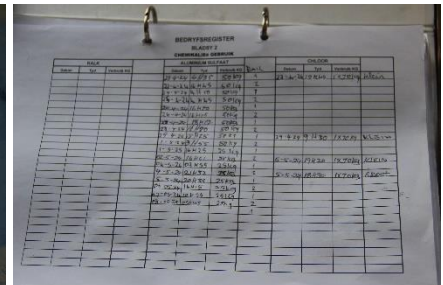
Reclamation Plant: Daily record of flows



Beaufort West WTW: Daily shift schedule control sheet



Beaufort West WTW: Daily reading of bulk water meters control sheet



Beaufort West WTW: Chemical usage control sheet

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 4: WATER SERVICES OPERATION AND MAINTENANCE

The Beaufort West and Nelspoort WTWs and the Reclamation Plant in Beaufort West are well maintained and operated with adequate control and monitoring systems in place to ensure proper process control. The identified O&M problems to be addressed at the WTW are summarised under Section 3.2.4 of Topic 3.

Larger plants generally employ maintenance staff to carry out maintenance tasks, and even outsource more technical tasks to external contractors. At smaller works, some maintenance tasks can be carried out by the operators. The amount and level of maintenance that operating staff can carry out depends on their skills. The complexity of tasks relative to the skill of the operators should be decided by the technical manager or supervisor.

Coagulation and Flocculation: Effective coagulation and flocculation are critical for the successful operation of subsequent treatment processes. Problems associated with coagulation-flocculation processes will result in high turbidity water in the overflow of the sedimentation tank and/or the filtered water.

- Perform jar tests on raw water samples when significant raw water quality changes occur (such as after heavy rainfall), in order to determine new coagulant dosages and mixer speeds.
- Clean accumulated precipitate and sludge from rapid-mix and flocculation basins when the need arises, or at least every six months.
- Ensure that chemical feeders are calibrated every month (by the supplier).
- Check that the chemicals supplied comply with the specifications and adjust feed rates as indicated by the analysis and jar tests.

Sedimentation: Sedimentation can typically remove 80% to 95% of suspended solids and will result in better filter performance and longer filter runs. However, the performance of sedimentation tanks is dependent on effective coagulation-flocculation. Operational problems associated with sedimentation tanks typically relate to ineffective sludge removal or short-circuiting. Ineffective sludge removal is commonly associated with equipment problems or inadequate sludge removal practices. Short-circuiting is typically the result of poor inlet or outlet design. This occurs when the water is able to find a short route between the inlet and outlet, reducing retention time and resulting in poor sedimentation and poor quality water. Short-circuiting can also be the result of wave action, density currents, hydraulic overloading or temperature currents. The aim is to have a settled turbidity of < 5 NTU.

Preventative maintenance at the sedimentation tanks include the following:

- Clean launder and overflow weir daily. Launder is the channel in the sedimentation tank in which the water overflows.
- Remove floating solids daily
- Clean the tanks annually to remove any accumulated sludge and algae growth
- Maintain sludge collection equipment as recommended by the manufacturer
- Test turbidity of effluent daily and whenever the raw water quality or flow rate changes.

Filtration: The operation and maintenance of the filters at the works is aimed at ensuring that clear water is produced. The aim is to have a filtered turbidity of less than 1 NTU. When the water leaving the filters is not acceptable, the following questions should be asked (in this order)

- Can the measurements be trusted?
- Is the pre-treatment sufficient for the water currently being treated?
- Is the operation correct and suitable for the water currently being treated?
- Is the maintenance up to date?

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The four checks below provides an indication of the seriousness of the implications in terms of the cost and time required to rectify a problem. Each of the four questions forms the focus of a series of investigations that are listed below. The maintenance of the filter components should be done on a routine, preventative basis. The success of filtration depends not only on whether equipment is working, but on equipment working effectively and accurately. For this reason, frequent calibration, lubrication and overhaul according to the manufacturer's specifications should form the basis of the maintenance programme.

- Check No.1: Measurement (Ensure you can trust what your instrument tells you)
 - Check whether the turbidimeters are calibrated correctly
 - Check the measuring cylinders for cleanliness and scratches
 - Check whether the sample is representative and well mixed
 - Check whether the sampling procedure is sound
 - Check expiry date of calibration standards.
- Check No.2 Pre-treatment (Pre-treatment issues that may cause filter turbidity problems)
 - Check if anything is blocking the chemical dosing points
 - Check for proper chemical mixing
 - Check that the coagulant dose is set at the correct rate
 - Verify the dosing rates required with jar tests and visually inspect that this is applicable in practice
 - Check for poor floc retention in the tanks
 - Check that chemical feeder tanks are not empty
 - Check that dilution/carrier water supplies are functioning acceptably
 - Check that turbidity of water is less than 5 NTU.
- Check No.3 Operation (Operating issues that may cause filter turbidity problems)
 - Check current position of the filter in the filtration cycle. Has the filter run extended into breakthrough or is the filter still within a ripening stage?
 - Check the backwash operation and take the filter out of operation if the previous backwash was not performed properly
 - Check that the flow rate is acceptable and that the filter is not operating outside of acceptable limits
 - Check that the filter is not being operated at excessive pressure
 - Carry out a backwash to end the filter run
 - Consider implementing techniques for managing filter ripening (becoming dirty)
 - Check that turbidity is less than 1 NTU.
- Check No.4 Maintenance (Maintenance issues that may cause filter turbidity problems)
 - Check that the filter contains the correct depth of filter media
 - Check the filter media condition. Look for an even flat surface, watch out for mud balls and cracks
 - Watch filter backwash. Check for even distribution of air scour and backwash water
 - Check backwash bed expansion
 - Check backwash rates.

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Disinfection:

Routine and preventative maintenance of chlorine systems and ancillaries include the following:

- Visually inspect and report on complete system (Daily);
- Clean complete installation thoroughly so that leaks would be obvious when they occur (Weekly);
- Check, service, repair and clean dosing apparatus from blockages (Monthly);
- Corrosion protect all equipment and ancillaries (Whenever necessary);
- Check for and repair all leaks. Report leaks. (Monthly);
- Check dosing rate and reset regulators if necessary (Monthly); and
- Measure residual chlorine in the drinking water system (At least daily).

SABS 0298 must also be adhered to in the routine preventative maintenance of vacuum systems for gas chlorination.

The following two daily and monthly O&M tasks are provided as a guide of actions that should be carried out to ensure the proper functioning of a WTW. Some of these actions are already included in the existing O&M schedules of the WTWs.

Table 4.1.4.1: Recommended daily O&M tasks for the WTW			
Item	Component	Monitor	Remarks
Screens / Grids	Screens / Grids	Clean screens/grids and check for debris or distortion/breakage. Remove all debris, leaves, etc.	Replace screens/grids if damaged
Raw water pumps	Motor / Gearbox	Check oil level	Refill if necessary
		Check for vibrations and / or bearing noise	Stop and inspect if necessary. Replace bearing if vibrating or noisy
		Inspect for leakages	Repair
	Coupling	Inspect coupling between motor and pump	Repair if damaged If cover has been removed, replace
	Pump	Record pressure reading at output/delivery	If pressure is low, pump is damaged or suction pipe is blocked
	Pressure gauge	Record pressure gauge reading before and after pumps	Compare with previous day's reading. If suction pipe pressure builds up, suction pipes are blocked. If delivery side builds up, delivery pipes are blocked.
Chemicals	Quantity	Inspect bulk supply container	If level is lower than half, order new supply
		Inspect mixing tanks	Fill up daily and monitor regularly
Chlorine dosing	Chlorine dosing	Inspect venturi	Repair
		Check sufficient chlorine in cylinders / tanks	Switch tank / re-order
		Test for gas leaks	Repair
		Inspect switch on chlorine regulator	Repair if necessary
Dosing pumps	Pump and motor	Check for vibration and noise	Repair if necessary
		Check oil	Refill
	Dosing rate	Set dosing rate	Set rate based on quality of inflow and jar tests that have been carried out
Settling tanks	Valves	Inspect valves for leakages	Replace or repair
	Desludging	Desludge settling tank at least three times a day	Inspect desludged water and stop if water runs clear

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Table 4.1.4.1: Recommended daily O&M tasks for the WTW

Item	Component	Monitor	Remarks
	Overflow / top water	Do visual inspection of quality of overflow water and sludge blanket	If quality reduces, change dosing or desludge on a more regular basis
	Bridge	Check rotating bridges for free operation.	Free obstructions. Repair if damaged.
		Check desludging mechanism and ensure free operation.	Free obstructions. Repair if damaged.
	Distribution box	Inspect the distribution box	Remove all settled solids. Clean the weirs, gates and walls as necessary.
	Effluent box	Inspect the effluent box. Measure the head over the weir routinely	Clean the weir and walls if necessary. Record.
	General	Check for floating solids	Remove
		Inspect inside exposed vertical walls and channels	Clean if necessary
Filter pumps	Motor / gearbox	Check oil	Refill if necessary
		Check for vibrations and/or bearing noise	Stop and inspect, if necessary. Replace bearings if vibration or noise increases.
		Check for leaks	Repair
	Coupling	Inspect coupling between motor and pump.	Repair if damaged. If cover has been removed, replace.
	Pump	Record pressure reading at output/delivery side.	If pressure reduces, pump is damaged or suction pipe is blocked
	Pressure gauge	Record pressure before and after pumps.	Compare with previous day's reading. If suction pipe pressure builds up, suction pipes are blocked. If delivery side builds up, delivery pipes are blocked.
Filters	Valves	Inspect valves for leaks.	Repair or replace
	Pressure gauges	Inspect pressure gauge readings before and after filters.	If pressure increases over filters, backwash. If pressure remains unchanged, check meters are operating.
	Back wash	Inspect pattern of backwash water and air.	If patterns are uneven, there are damaged nozzles.
		Check sand level.	If the sand level is falling, check if nozzles are damaged or sand is being washed out with backwash water. Fill up with sand. Monitor and replace nozzles if necessary.
Switchboard	Switch	Check switchboard for any alarms.	Reset and inspect fault
Water samples	Take water samples	Take water samples at identified sampling points.	Keep record of all readings and take corrective action if quality decreases.
Control equipment	Level-control	Inspect level-control equipment at the clear water reservoir.	If levels given are faulty, repair.
Record keeping / Diary	Recording	A record should be kept of all daily activities and inspections.	If record is not kept properly, implement immediately.

Table 4.1.4.2: Recommended monthly O&M tasks for the WTW

Item	Component	Monitor	Remarks
Screens / Grids	Screens / Grids	Inspect working of screens/grids	Replace any component if necessary. Clean and tidy
Raw water pumps	General	Clean motor and pump	Paint and clean if necessary
Pipelines	Pipes and valves	Inspect pipelines for blockages	Flush and clean pipes if necessary
Settling tanks	Structure	Check for leaks	Repair

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The O&M schedules need to be signed by the Process Controller and the Supervisor for each specific plant. The Supervisor for each plant should also carry out the following **weekly** tasks:

- Check work of operators and discuss performance.
- Check logbooks and action where necessary.
- Check gauge readings and calibrate if necessary.
- Check samples of final outflow and send for analysis. This can also be done on a monthly basis.
- Check that pumps and mechanical equipment are being maintained.
- Check the working of the chlorine dosing unit where applicable.
- Check for any other issues that may need attention.

According to the Water Act, an independent person must visit a WTW **quarterly** and do the following:

- Take and test a sample of the inflow and final outflow.
- Check the mechanical equipment.
- Check that the recommendations of the previous visit have been implemented.
- Write and submit a report to the Supervisor and the DWS.

Beaufort West Municipality needs to evaluate the existing O&M schedules for the Beaufort West and Nelspoort WTWs against the above recommended O&M tasks and needs to ensure that all required activities are adequately monitored and recorded.

Record keeping and reporting for the WTWs generally occurs on the following three levels.

- Level 1: The plant operator collects and records data.
- Level 2: The plant supervisor uses the Level 1 data to inform the technical manager on a weekly or monthly basis.
- Level 3: The technical manager must submit a monthly report to the DWS's Regional Office on water quality. The technical manager should also submit a quarterly report to the Council describing issues such as capital expenditure, O&M costs as well as other pertinent matters.

The monthly report from the WTW supervisor to the technical manager should contain the following information.

- Status of personnel: Number of operators; details of vacancies; and other notes such as work hours lost due to injury or illness, training needed and safety issues that need attention.
- Production figures: Total monthly volume of raw water abstracted; average daily flow; total monthly volume of potable water produced; total monthly volume of sludge produced; and water quality status as per own tests and lab report.
- Consumed items: Chlorine consumption and stock for month; value of consumed chlorine; coagulation chemicals consumption for month; value of coagulation chemicals consumed; diesel consumption and stock for month; value of consumed diesel; electricity consumption for the month; maximum electricity demand for month; value of consumed electricity; and total value of consumed items for the month.

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- General remarks: A short report on the repair of the mechanical equipment and any other activities and/or problems experienced at the plant during the past month. Also include major planned maintenance and repair activities for the next month.

It is recommended that Beaufort West Municipality ensure that at least the following four record types are kept and maintained for the Beaufort West and Nelspoort WTWs.

- Daily Occurrence Book: Should record the daily activities as well as any unusual occurrences at the works during the day e.g. visitors, breakdowns, power failures, etc.
- Daily Operational Log: Should provide a record of operational details such as flow, meter readings, chemical usage, times of desludging and pumping, etc. The data can be recorded hourly, two hourly or once per shift as required.
- Analytical Data Log: Is a record of the results of any analysis. Some of this data may not be determined at the works, but by outside laboratories. Such data should also be filed and kept at the works. The operators can use the results of these tests to effect operational adjustments as and when required.
- Order Book Record: Is a record of the orders placed for chemicals, parts and tools.

4.1.5 Water Pump Stations

There are only water pump stations in Beaufort West and Nelspoort. The Steenrots Booster PS and the Vaalkoppies PS are in a good condition and adequately maintained and secured against possible theft or vandalism. The Noordeinde Booster PS and the Uitspan Booster PS are not in such a good condition. Mobile generators are available for some of the pump stations for use during load shedding periods and the Vaalkoppies PS, the Noordeinde Booster PS and the Garcia Fountain PS are supplied with permanent generators, which are adequately protected. Control and monitoring systems are also in place to ensure adequate operation and maintenance of the water pump stations, with weekly inspections by the operational personnel.

Pump Maintenance: Most pumps require limited maintenance, if correctly selected and of sufficient quality. All pumps require at least weekly attention. All pump stations should be inspected at least once a week, whether maintenance is required or not. Always follow the manufacturer's O&M instructions. The following minimum **WEEKLY** maintenance is required with conventional centrifugal pumps.

- Check oil level;
- Check condition of gland packing and adjust to provide a steady drip;
- Lightly grease the threads of the gland follower studs with a copper coat or water-resistant grease;
- Check tightness of the base plate mounting bolts;
- Check for abnormal vibration;
- Check for abnormal temperature;
- Listen for any strange noises (bearing whine or cavitation);
- Start the pump and monitor the full load current;
- Check operating pressures on the delivery pressure gauge;
- Check the alignment on the motor shaft to pump shaft coupling;
- Check the condition of the coupling and coupling guard; and
- Check the operation of the non-return valve.

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The above maintenance actions are fairly generic to most types of pumps including positive displacement pumps.

Electrical Maintenance: The municipality should have either an in-house maintenance electrician or an arrangement with a private contractor to conduct regular preventative maintenance. A maintenance electrician should visit all pump stations at least **WEEKLY** to do the following basic maintenance.

- Check functioning of all starters, contractors, trip mechanisms and overloads, etc.
- Check over/under voltage relay operation;
- Start the pump manually and check the operation of all instruments, such as ammeters and voltmeters;
- Check that all panel lamps and site lights are working;
- Check the operation of the level control system, if the pump station is equipped with one;
- Check operation of the telemetry system (if installed);
- Listen to all motor bearings for excessive wear (a worn bearing makes a cyclic whining noise which can be heard by putting your ear against a screwdriver which is touching the bearing housing); and
- Clean the distribution and control panels.

In addition to weekly inspections, the following general quarterly electrical maintenance, **EVERY THREE MONTHS**, should be done.

- Clean all enclosures thoroughly by washing down with a wet cloth on the outside and blowing out all dust, spider webs and insects on the inside with an electrical industrial blower;
- Remove and clean all contactors with a solvent approved for electrical components;
- Tighten all cable glands;
- Ensure that cables are properly secured on cable racks and in conduits;
- Check all terminals for integrity, signs of corrosion and “hotspots”
- Clean level sensors and check settings;
- Check and tighten motor terminals;
- Grease all motor bearings; and
- Check all earthing systems and lightning arrestors for correct functioning and replace if faulty.

Preventative maintenance should also be carried out on a three monthly basis on the transformers and surge arrestors and on a weekly basis for the generators, compressors and air blowers.

Beaufort West Municipality needs to evaluate their existing O&M schedules for their water pump stations against the above recommended weekly and monthly maintenance O&M tasks and needs to ensure that all required activities are adequately monitored and recorded. The operational personnel needs to continue to inspect all the water pump stations on a weekly basis.

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4.1.6 Reservoirs



Merweville 0.400 MI Reservoir
(Cover not locked)



Merweville 0.200 MI Reservoir
(Cover not locked)



Murraysburg 0.300 MI steel reservoir
(Currently not in use)



Murraysburg 0.500 MI reservoir (Leaking)



Murraysburg 0.500 MI. Fence was vandalized and removed.
Galvanised roof sheets were stolen



Not all the reservoirs in Beaufort West Municipality's Management Area are fenced. Most of the covers of the reservoirs are locked and the air vents of the reservoirs are also covered. The Operational Personnel regularly inspect the reservoirs. The O&M problems to be addressed at the various reservoirs, as identified during the WSDP site visits, are summarised under Section 3.2.6. of Topic 3.

The four general problems that can affect reservoirs include contamination of open reservoirs, silt build-up in the reservoir, overly long retention times in large reservoirs and sabotage. The recommended daily, weekly, monthly and annual O&M activities for the reservoirs, the associated piping and fittings and the reservoir premises include the following.

Daily:

- Check fence, gate and gate lock and repair (replace lock if broken) immediately if necessary.
- Check that the water meters are running properly and that there are no leaks in valve chambers. Attend to any leaks. Dysfunctional water meters should be repaired or replaced immediately.
- Check for any leaks in the pump house. Check the pressure gauge and ensure that the pump is pumping against the right pressure. Check the chlorinator devices in the pump house if applicable. Investigate and attend to any problems.
- Walk along the pipeline route and check for any leaks. Check the pipe connections to reservoirs for leaks. Ensure all valves are in the correct position (closed or open).
- Inspect the exterior of the reservoir for leaks and report for immediate action. Check the discharge for any water from the under floor drainage.
- Check that lamps in pump house and on the premises are OK. Replace bulbs or repair faulty lamps.

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Weekly:

- Check water level indicators. Move them a little up and down to ensure they are OK. If necessary, grease the outside indicator rail. Patch up the level markings when necessary.
- Clean yard and keep grass short. Remove any vegetation on roof and around the concrete reservoir apron and stormwater and scour/drainage channel. Make sure that any drainage water can flow freely out from the premises. Remove all potential bushes and trees within the premises.

Monthly:

- Check all valve and meter chambers and the various installations in them to ensure that they are in good operational order. Clean chambers from any sand and mud intrusion. Open the strainer and remove any trapped solids. Take the meter readings and wipe off the meters. Check the chamber lids and locks, and oil the hinges.
- Check all valves by partly opening and closing all inlet, outlet, scour and other valves on the premises. Attend to any leaking valves. Wipe off spindles and handles, patch up any corrosion protection. Be careful when opening and closing any gate valve to avoid damages to the piping system through water hammer.
- Check the pump house door lock, gate lock and access manhole cover lock and oil them. Oil the access lid hinges and the locks.
- Check that the text on the entrance sign is clearly legible.
- Check pH, turbidity and free residual chlorine at the outlet from the premises. Take water samples for water quality testing at laboratory.
- Take the water meter readings. Compare the readings of the inlet and the outlet meters. Investigate any abnormalities. Take the electrical meter reading. Compile all information regarding production, consumption and O&M activities in a brief monthly report. Edit the records and report and share it with the municipal manager, O&M Support Unit and others as required.
- Grease movable parts on all valves (Every three months).

Once a year:

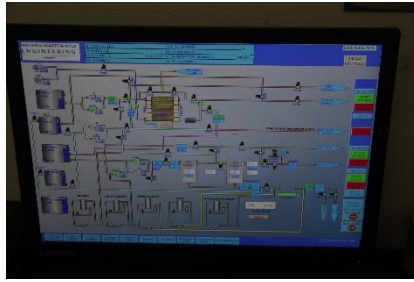
- Drain and clean the reservoir. Check the roof for leakages and remove any obstacles to rainwater runoff.
- Organise for a specialised contractor or engineer to do a thorough inspection of the interior and exterior of the reservoirs. Attend to any rust, cracks and potential leaks. Pay special attention to the joints and call for a specialised contractor if the joints and sealants have deteriorated to the extent that there is a risk of leaks. This inspection should be done in conjunction with the annual cleaning of the reservoir.
- Draft and submit annual O&M summary report.

Beaufort West Municipality needs to evaluate their existing O&M schedules for the reservoirs and water towers against the above recommended maintenance activities and needs to ensure that all the required activities are adequately monitored and recorded.

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4.1.7 Remote Monitoring and Control Systems



Reclamation Plant: Scada system for plant



Merweville BH MV5 MCC with flow meter



Merweville BH MV5 (Scada system)

SCADA systems are in place for the reclamation plant in Beaufort West, as well as for the production boreholes in Merweville, Nelspoort and Murraysburg. Some of the production boreholes in Beaufort West are also linked to the Scada system.

Maintenance of a SCADA system has many facets and is much wider than just telemetry equipment technical functionality. It involves the equipment, which is being monitored and controlled, as well as the ancillary equipment necessary for the successful operation of such equipment. If this equipment is not in good functioning order, the SCADA system loses much of its purpose.

Telemetry Equipment: All the equipment used for signal processing and communication is grouped under this heading. The electronic equipment, including radios, does not require maintenance as such, apart from ensuring it is clean and protected from excessive heat and environmental threats (rain, dust, insects, etc.). The central station equipment is housed indoors and is well-protected. The cabinet and equipment should be inspected on a **four monthly** basis for damage, signs of overheating and dust ingress. The latter should be carefully blown out by low pressure air, or removed by vacuum extraction.

Outstations are more vulnerable and prone to environmental damage. The panels and equipment should be inspected and cleaned as described above on a **two monthly** basis, or more frequently, depending on local conditions. Outdoor-type outstations must be protected against direct sunlight, and I/O terminals should be tightened annually. The following in particular must be attended to:

- Door seals – to prevent dust and sand ingress;
- Moisture ingress – the source must be identified and eliminated;
- Paintwork – external paint finishes must be kept in good condition and damage repaired immediately. Any internal and external rust detected must be treated immediately;
- Cable glands must be checked for tightness;
- Insect ingress – the point of entry must immediately be sealed off; and
- Earthing arrangement of the antenna and steelwork – connections must be checked for tightness and the earth resistance should be checked annually.

Batteries: Batteries both at outstations and at the central stations should be checked at the scheduled intervals, at least **twice a year**. The battery charges and battery voltage should be checked. A subsequent load test in accordance with the manufacturer's recommendation for the specific battery must also be done to determine whether the battery is serviceable or should be replaced.

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Central station computer and outstation input/output modules: The computer does not require any specific maintenance other than making sure that it is well ventilated and operating in a relatively dust-free room at normal room temperature. The computer internal cooling fans must be checked **daily**. This is done by feeling the airflow or listening to hear that the fan is operating. The outstation I/O needs to be verified for correct functioning approximately **once a year** to ensure the integrity of the system. This serves the dual purpose of testing the control and protection functions of protection equipment and instrumentation.

Follow up on alarms: An important aspect of I/O maintenance is the follow-up of alarms. Any alarm is the result of some sort of failure. Whether it is a real alarm caused by system failure or a protection device, or a false alarm caused by a component failure or human error, it needs to be investigated and the cause established, to retain system integrity. Sometimes a recurrent alarm due to a system malfunction is just ignored as a nuisance, instead of rectifying the cause. This could lead to an actual system failure without warning, or to the system being seen as unreliable, so that other critical alarms are ignored.

Maintenance Management: One person within the organisation must have overall responsibility for the maintenance function. This person must have a reasonable electrical background and a thorough understanding of overall system functioning. They can do the maintenance themselves, if they have the necessary skills, or only manage the maintenance function, with an external service provider doing the actual work.

It may be a viable option to let an external service provider do the specialised maintenance on a contract basis. There is no general rule and the needs of each system must be assessed individually. Factors to consider are the available in-house expertise and the cost of outsourcing, which depends on the distance from the service centre, the size of the system, the number of outstations, the area involved and accessibility (e.g. boreholes on private property). Most service providers can also provide an online diagnostic service on a dial-in basis. A typical contract would include the following main items

- Conditions of service such as overall purpose of the contract, what needs to be done, how and when, how often, costs and terms of payment
- A description of the system to be maintained
- Inspections and reports
- Instrumentation
- Work, travel and time schedules
- Charge schedule
- Capacity building of departmental staff
- After hours call-outs.

Even if the maintenance is outsourced, there must still be a responsible person in the department to manage the contract, to be accountable and report to management. The contract must clearly define the scope of work to be performed, and work done must be fully documented and auditable.

A comprehensive O&M Manual specific to the system can be compiled once all of the above has been put in place.

Routine Inspections: Each system is unique and therefore warrants a unique inspection schedule. Many items, as listed below, need to be checked twice a year. Some of the items can be checked by in-house staff; others require specialist competence. The municipality needs to agree with their service provider what maintenance can be done in-house, depending on the competence of available staff, and how selected staff members should be trained on-the-job by the service provider. Routine inspections of the antennas, batteries, computers, earthing, mains and power supply, mimic panel, outstation commissioning, radio, solar panel, telemetry enclosure and UPS can be necessary.

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Beaufort West Municipality needs to continue to maintain their SCADA systems and maintenance checklists need to be compiled for the above activities.

4.1.8 Sewer Pump Stations



Kwa Madlenkosi Sewer PS



Prince Valley S8 Sewer PS



Prince Valley Sewer PS



Nelspoort Main sewer PS



Nelspoort Garage sewer PS



Murraysburg sewer PS

The sewer pump stations are adequately protected against possible theft or vandalism. Control and monitoring systems are in place for the sewer pump stations to ensure adequate operation and maintenance of the sewer pump stations, with weekly inspections by operational personnel. The sewer pump stations are not provided with backup generators at the pump stations, but mobile generators are available for some of the pump stations during emergency situations and load shedding periods. The O&M problems to be addressed at the sewer pump stations, as identified during the WSDP site visits, are summarised under Section 3.2.9 of Topic 3.

It is important to maintain accurate information concerning the sewer pump stations. Another important issue for technical managers and supervisors is to respond rapidly to any overflow or wastewater. Failure to do so can create a health hazard in the community. The law also requires that overflows be reported to the DWS. All sewer pump stations should be inspected at least once a week, whether maintenance is required or not. Submersible pumps require limited maintenance, if correctly selected and of sufficient quality. Regular horizontal end-suction centrifugal pumps require at least weekly attention.

Submersible pumps require the following **regular** maintenance:

- Remove blockages from the impellor when required.
- Start the pump and monitor the full load current to ensure correct operation, at least once a week.
- Remove the pump from the sump every six months and remove coagulated grease and fat deposits with a jet of clean water.
- Change the oil at least once a year.

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The following minimum **weekly** maintenance is required for centrifugal pumps:

- Check oil level.
- Check condition of gland packing and adjust to provide a steady drip.
- Check tightness of the base plate mounting bolts.
- Check for abnormal vibration.
- Check for abnormal temperature.
- Listen for any strange noises.
- Start the pump and monitor the full load current.
- Check operating pressures on the delivery pressure gauge.
- Check the alignment of the motor shaft to the pump shaft coupling.
- Check the condition of the coupling and coupling guard.
- Check the operation of the non-return valve (failure of this valve can result in a sheared pump shaft).
- Check operation of the motor cooling fan.

Sump maintenance: Beaufort West Municipality needs to ensure that a schedule exist for the cleaning of pump station sumps. It is preferable to clean out all sumps at least once a year, depending on the volume of solids and grit in the wastewater stream.

Electrical Maintenance: The municipality should have either an in-house maintenance electrician or an arrangement with a private contractor to conduct regular preventative maintenance. A maintenance electrician should visit all sewer pump stations at least **WEEKLY** to do the following basic maintenance.

- Check functioning of all starters, contactors, trip mechanisms, etc.
- Check over/under voltage relay operation;
- Start the pump manually and check the operation of all instruments, such as ammeters and voltmeters;
- Check that all panel lamps and site lights are working;
- Check the operation of the level control system;
- Check operation of the telemetry system (if installed); and
- Listen to all motor bearings for excessive wear (a worn bearing makes a cyclic whining noise which can be heard by putting your ear against a screwdriver which is touching the bearing housing).

In addition to weekly inspections, the following general quarterly electrical maintenance, **EVERY THREE MONTHS**, should be done.

- Clean all enclosures thoroughly by washing down with a wet cloth on the outside and blowing out all dust, spider webs and insects on the inside with an electrical industrial blower;
- Remove and clean all contactors with a solvent approved for electrical components;
- Tighten all cable glands;
- Ensure that cables are properly secured on cable racks and in conduits;
- Check all terminals for integrity and signs of corrosion.
- Clean level sensors and check settings;
- Check and tighten motor terminals;

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- Grease all motor bearings; and
- Check all earthing systems and lightning arrestors for correct functioning and replace if faulty.

Beaufort West Municipality needs to evaluate their existing O&M schedules for the sewer pump stations against the above recommended weekly and quarterly maintenance activities and needs to ensure that all the required activities are adequately monitored and recorded. The operational personnel needs to continue to inspect all centrifugal pump stations on at least a weekly basis.

Procedures in case of wastewater overflow: The following steps must be taken as soon as becoming aware of an overflow/spillage:

- Try to contain the spilled wastewater by placing earth berms around the spill.
- Call a suction tanker to remove spilled wastewater and empty the pump sump.
- Sprinkle the area affected by the spill with HTH granular chlorine or slaked lime after excess liquids have been removed. It will combat odour and prevent the breeding of flies and other nuisance causing insects.
- Assess the cause of the problem – electricity failure, pump failure, etc.
- In case of electricity failure, contact the local electrical department to restore the supply.
- In case of a pump failure, remove the faulty pump and replace it with a stand-by unit as soon as possible.
- In many cases, a simple blockage in the pump is the cause of an overflow. The pump may be running, but not pumping a drop of liquid. Nylon stockings are notorious for blocking pump impellers. In such a case, stop the pump, remove it from the piping to gain access to the impellor and remove the stocking by cutting it out with a knife. Place the pump back into position and reconnect the piping.
- As soon as the pump station is operational again, organise the clean-up operation. This entails removal of any liquid, faeces and debris from the spillage area. These materials must be disposed of at the sewage treatment plant, or by incineration.
- Sprinkle lime over the area affected by the overflow to control flies.

4.1.9 Bulk and sewer drainage networks

Bulk and sewer drainage networks: Municipalities should clean their entire collection system, including all pipes and manholes, at least once a year. This requires dedicated teams equipped with the correct tools and instruments. Annual, monthly and weekly schedules or team activity programmes should be drawn up by the technical manager or supervisor.

A **weekly** schedule and programme should include the following:

- Name of the team supervisor.
- Name of the area to be cleaned that week.
- Sewer network to be cleaned from manhole number – to manhole number.
- A map of the specified area.
- A section to record what cleaning materials and equipment were removed from the store.
- A section to record debris and foreign objects removed and measured from the sewers.
- Proof of how foreign materials were disposed of, i.e. delivered to the sewage treatment plant, incinerated or buried.

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Regular cleaning of sewer lines is the most typical O&M issue that should be carried out in a systematic and scheduled way so as to cover the whole system over a year's time (Rodding, Flushing, Jetting, Handling emergencies and clearing blockages, chemical cleaning, bio-augmentation, root removal, etc.)

Record Keeping: It is of utmost importance that all blockages and their precise locations are recorded. This serves several purposes. Firstly, a recurring blockage in the same place warrants further investigation. There may be a problem with either the design or faulty construction of the system. Secondly, it allows the technical manager to budget for the operational expenses incurred by the sewer cleaning team, and to determine if staffing is sufficient. In addition, members of the public usually report these blockages. The reaction time from the complaint until the blockage is cleared is an excellent performance indicator for the municipality. The aim should be to make this as short as possible, and provide excellent service to consumers who pay rates and taxes.

4.1.10 Waste Water Treatment Works

Beaufort West WWTW: Flow meter readings

Beaufort West WWTW: Daily Shift Log sheet

Beaufort West WWTW: Operational Sampling

The Beaufort West WWTW is fenced and locked with access control. The fence at the Merweville WWTW has been vandalised and the office building has been vandalised, with the doors removed and cables stolen. The fence at the Nelspoort WWTW has been vandalised and the gate is not locked. The fence at the Murraysburg WWTW has been vandalised and parts thereof stolen.

The Merweville oxidation pond system is in a very poor condition, with not flow between the different ponds (Pipes blocked). The current control and monitoring systems that are in place for the various WWTWs will be addressed in detail in the WWTW Process Audits, with which the Municipality is currently busy. The identified O&M problems to be addressed at the WWTWs, as identified during the WSDP site visits, are summarised under Section 3.2.10 of Topic 3.

Oxidation Pond Systems: Oxidation ponds require a much smaller operational input than conventional plants, due to the nature of the processes and the fact that very few parameters can be controlled. O&M duties of the operators, supervisors and technical manager for oxidation pond systems include the following:

- set chemical dosages and feed rates (if the final effluent is chlorinated);
- monitor flow rates;
- desludge ponds;
- monitor the condition of plant and equipment;
- manage irrigation using plant effluent;
- keep records and submit reports;
- analyse basic plant parameters and take corrective action;
- perform and follow-up regular maintenance activities;

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- monitor quality of treatment; and
- maintain safety procedures.

It is essential for the successful functioning of an oxidation pond system that the work carried out is recorded in a suitable format.

The Plant Superintendent should inspect and sign the log sheets daily, to ensure that they are filled in properly, and also to obtain any information that may require action by him or her. The same principle applies to basic analysis of results. The Plant Supervisor should scrutinize the results daily, as these are a barometer of plant efficiency. Major items in log sheets, analysis sheets and the occurrence book should be summarized in a monthly report to the Technical Manager.

Parameters that should be recorded in a typical log sheet, occurrence book page and in the monthly report include the following:

- **Log Sheet:** Day and date, incoming wastewater flow, incoming wastewater flow rate, consumption of potable service water, pump running hours, volume of screenings removed, number of night soil buckets received, volume of night soil received, electricity consumption and electricity – maximum demand should be recorded in a logbook. The total volume passing through the plant should be read and recorded in the plant logbook once every **24 hours** by the operator. The operator should clean recording and measuring devices daily.
- **Occurrence Book Page:** Typical parameters that should be recorded in a log/occurrence book are date and day, time of shift, name of Process Controller on duty, hourly entries of occurrences and activities, process readings, signature of Process Controller and signature of Supervisor.
- **Monthly Report:** A monthly report should be generated from the above logs by the Plant Supervisor for the Technical Manager. The report should include the Status of Personnel (Number of operators, details of any vacancies), Production figures (Monthly volume treated, average daily flow, volume of screenings removed for the month and volume of night soil received for the month) and Consumed items (Electricity consumption for the month, electricity maximum demand for the month, value of consumed electricity and total value of consumed items for the month).

The table below gives a typical checklist for the O&M tasks for Process Controllers at an oxidation pond system.

Table 4.1.10.1: O&M tasks for Process Controllers at an oxidation pond system								
No.	O&M Tasks	06:00	08:00	10:00	12:00	14:00	16:00	18:00
1	Inlet Works							
1.1	Check operation of Automated Screen (if fitted)							
1.2	Operate air-lift pump to remove grit from grit trap							
1.3	Operate grit classifier to remove grit from wastewater stream							
1.4	Use rake to remove screenings from hand-raked screen bars							
1.5	Allow screenings to dry out and place in a wheelbarrow for disposal							
1.6	Count number of wheelbarrows for the day and record							
1.7	Bury or burn dry screenings							
1.8	Check operation of flow measurement system							
1.9	Check operation of flow data recorder							
2	Grit Removal							
2.1	Check operation of channels							
2.2	Block off one channel and drain liquid							
2.3	Remove grit from channel							

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Table 4.1.10.1: O&M tasks for Process Controllers at an oxidation pond system								
No.	O&M Tasks	06:00	08:00	10:00	12:00	14:00	16:00	18:00
2.4	Place grit in wheelbarrow and record volume							
2.5	Bury or burn removed grit							
3	Main Pump Station							
3.1	Check for any RED lights on electrical panel (trip indication)							
3.2	Check pumps for temperature							
3.3	Check pressure gauge readings							
3.4	Inspect gland packings for excessive leakage and adjust							
3.5	Check liquid level in suction sump							
4	Primary Ponds							
4.1	Check inlet valve operation. Close and open completely							
4.2	Scrub off algal growth on inlet and outlet structures							
4.3	Check pond water level. Increase in level indicates an outlet blockage							
4.4	Check for different smell of the pond							
4.5	Check for colour changes in the pond contents							
4.6	Remove screenings from the surface							
4.7	Remove weeds from embankments and water fringes							
5	Facultative Pond							
5.1	Scrub off algal growth on inlet and outlet structures							
5.2	Check for different smell of the pond							
5.3	Check for colour changes in the pond contents							
5.4	Check pond water level. Increase in level indicates an outlet blockage							
5.5	Remove screenings from the surface							
5.6	Remove weeds from embankments and water fringes							
6	Secondary Ponds							
6.1	Scrub off algal growth on inlet and outlet structures							
6.2	Check for different smell of the pond							
6.3	Check for colour changes in the pond contents							
6.4	Check pond water level. Increase in level indicates an outlet blockage							
6.5	Remove screenings from the surface							
6.6	Remove weeds from embankments and water fringes							
7	Connector Piping							
7.1	Ensure pipes are open and flowing freely							
7.2	Remove any stones, rags from pipe inlets							
7.3	Clean out stilling chambers and weirs							
8	Chlorination							
8.1	Check the scale and record the chlorine mass							
8.2	Check all gas connections with ammonia vapor for leaks							
8.3	Test the Chlorine gas alarm operation							
8.4	Ensure that the chlorine gas rotameter indicates the correct flow of gas							
8.5	Ensure that all service water valves are open							
8.6	Take a sample of Final Effluent and test the Free Chlorine level (record)							
8.7	Adjust the Chlorine dosage to maintain 1 mg/l free chlorine content							
9	Final Effluent Storage Pond							
9.1	Check available storage capacity							
9.2	If dam is full, operate irrigation outlet valve							
9.3	Irrigate the effluent on the demarcated irrigation area							
10	Administrative Activities							

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Table 4.1.10.1: O&M tasks for Process Controllers at an oxidation pond system								
No.	O&M Tasks	06:00	08:00	10:00	12:00	14:00	16:00	18:00
10.1	Record incoming flow reading in log							
10.2	Record service water flow in log							
10.3	Record average flowrate (l/s) in log							
10.4	Record total consumption of chlorine for 24 hours in log (kg)							
10.5	Record average chlorine dosage in log							
10.6	Record hour meter readings of pumps							
10.7	Record storage dam level and indicate if irrigation was done or not							
11	General							
11.1	When handing over the shift, walk through the plant with next operator							
11.2	Check the perimeter fence for holes and repair if required							
11.3	Operator on dayshift must ensure that gates are locked at 17:00							
11.4	Answer all telephone and radio calls to the plant							
	Time of required activity							

Conventional Plants:

The various aspects in the operation of a WWTW are as follows:

- Operation: Physical activities required to treat the water.
- Supervision: Overseeing of operating activities by a competent person.
- Control: The processes and routines that ensure operation of a suitable standard.
- Management: The activities to ensure overall proper functioning and sustainability, such as long-term planning, etc.
- Public relations: An important function that provides feedback on the acceptability and quality of the wastewater treated and services.

The operational tasks of the Process Controllers at the WWTW include the following:

- Monitoring flow rates;
- Setting chemical dosages and feed rates;
- Basic analysis of plant parameters and corrective actions;
- De-sludging of sedimentation tanks;
- Monitoring the condition of plant and equipment;
- Basic first-line maintenance;
- Start-up and shut-down of plant;
- Sampling for process control analysis;
- Record keeping;
- Maintenance Schedules;
- Safety procedures;
- Handling of chemicals; and
- Retraining of operators.

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It is essential for the successful functioning of a WWTW that the work carried out is recorded in a suitable format.

- Parameters that should be recorded in a log sheet are day and date; incoming wastewater flow; incoming wastewater flow rate; consumption of potable service water; diesel consumption by incinerator; mass reading of chlorine scale; chlorine consumption; pump running hours; storage dam flow meter reading; volume of grit/sand removed; volume of rags/screenings removed; number of night soil buckets received; volume of night soil received; electricity consumption; electricity – maximum demand; number of drying beds emptied; volume of dried sludge in stock; and volume of dried sludge sold.
- Parameters that should be recorded in an occurrence book are date and day; time of shift; name of Process Controller on duty; name of works assistant on duty; hourly entries of occurrences and activities; process readings; time of handover to next shift, and names of next shift Process Controller; signature of Process Controller; signature of Supervisor.
- Monthly Report: A monthly report should be generated from the above logs by the Plant Supervisor for the Technical Manager. The report should include the Status of Personnel (Number of operators, number of plant assistants, number of labourers, details of any vacancies), Production figures (Monthly volume treated, average daily flow, volume of screenings removed for the month, volume of grit/sand removed for the month and volume of night soil received for the month), Consumed items (Chlorine consumption, value of consumed chlorine, diesel consumption for month, value of consumed diesel, electricity consumption for the month, electricity – maximum demand for month, value of consumed electricity and total value of consumed items for the month) and Sales of Dried Sludge (Volume of dried sludge at the beginning of the month, volume of dried sludge produced during the month, volume of dried sludge sold during the month and total volume of dried sludge in stock at the end of the month).

The table below gives a typical checklist for the O&M tasks for Process Controllers at a conventional WWTW.

Table 4.1.10.2: O&M tasks for Process Controllers at a conventional WWTW								
No.	O&M Tasks	06:00	08:00	10:00	12:00	14:00	16:00	18:00
1.	Main Pump Station							
1.1	Check for any RED lights on electrical panel (trip indication)							
1.2	Check pumps for temperature							
1.3	Check pressure gauge readings							
2.	Lifting Station							
2.1	Inspect gland packings for excessive leakage and adjust							
2.2	Check pumps for temperature							
2.3	Check liquid level in suction sump							
3.	Primary Settling Tanks							
3.1	Check rotating bridges for free operation							
3.2	Check desludging mechanisms for free operation							
3.3	Desludge the primary settling tanks by operating desludge valve							
3.4	Remove any floating debris such as rags and plastic off the surface							
3.5	Observe the colour of the tank contents (change of colour indicates a problem)							
4.	Inlet Works							
4.1	Check operation of Automated Screen							
4.2	Operate air-lift pump to remove grit from grit trap							
4.3	Operate Grit Classifier to remove grit from wastewater stream							
4.4	Check operation of Flow Measurement system							
4.5	Check operation of Flow Data Recorder							
5.	Biological Filters							

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Table 4.1.10.2: O&M tasks for Process Controllers at a conventional WWTW								
No.	O&M Tasks	06:00	08:00	10:00	12:00	14:00	16:00	18:00
5.1	Check operation of Flow Division Box							
5.2	Check operation of Biofilter Distributors (leakage and scraping of arms)							
5.3	Check biofilter effluent canals and clean if needed							
6.	Activated Sludge Reactor							
6.1	Check aerator motors for excess temperature and vibration							
6.2	Measure the DO Levels and record (must be more than 2 mg/l)							
6.3	Ensure that aerators change over automatically							
6.4	Check that the odour of the mixed liquor is healthy							
6.5	Measure the pH level and record the reading							
6.6	Measure the settleable solids content of the mixed liquor and record							
6.7	Check that the Waste Activated Sludge outlet sluice is set correctly							
6.8	Ensure that the Return Activated Sludge stream is running.							
7.	Return Activated Sludge Pump Station							
7.1	Check for any RED lights on electrical panel (trip indication)							
7.2	Check pumps for temperature							
7.3	Check pressure gauge readings							
7.4	Check operation of automated level control							
7.5	Check oil levels of the pumps							
7.6	Sweep out dust and wipe electrical panels							
8.	Secondary Settling Tanks (Clarifiers)							
8.1	Check rotating bridges for free operation							
8.2	Check desludging mechanisms for free operation							
8.3	Check for carry-over of sludge at the overflow weirs							
8.4	Adjust continuous desludging valves to maintain sufficient rate.							
8.5	Observe the colour of the overflow liquid (should be clear)							
9.	Chlorination							
9.1	Check the scale and record the chlorine mass							
9.2	Check all gas connections with ammonia vapor for leaks							
9.3	Test the Chlorine gas alarm operation							
9.4	Ensure that the chlorine gas rotameter indicates the correct flow of gas							
9.5	Ensure that all service water valves are open							
9.6	Take sample of Final Effluent and test the Free Chlorine level (record)							
9.7	Adjust the Chlorine dosage to maintain 1 mg/l free chlorine content							
10.	Control Room							
10.1	Record incoming flow reading in log							
10.2	Record service water flow in log							
10.3	Record average flowrate (l/s) in log							
10.4	Record total consumption of chlorine for 24 hours in log (kg)							
10.5	Record average chlorine dosage in log							
10.6	Write down at what time Primary Tanks were desludged							
10.7	Record hour meter readings of pumps							
10.8	Record Storage Dam level and indicate when return pump is started							
11.	General							
11.1	When handing over the shift, walk through the plant with next operator							
11.2	Operator on Dayshift must ensure that gates are locked at 17:00							
11.3	Answer all telephone and radio calls to the plant							
	Time of required activity							

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Operating and maintaining a conventional treatment plant is a complex and challenging endeavour. It requires the best of managerial skills and committed staff. The plant itself is an expensive municipal asset with a long expected life span that needs to be cared for properly. The service it delivers is a national priority due to its importance for the improved health, dignity and living standards of people. Effective wastewater treatment is also essential to protect the environment and water resources, which in turn affects public health and the quality of life.

Beaufort West Municipality needs to evaluate their existing O&M schedules for their oxidation pond systems in Merweville, Nelspoort and Murraysburg and the conventional WWTW in Beaufort West against the above recommended O&M tasks and needs to ensure that all required O&M activities are adequately monitored and recorded.

Beaufort West Municipality's Operational and Maintenance Plans, as required by the DWS, are included at the end of this Topic. The plans provide a framework for further development and aim to address those aspects of the assessment that do not meet the minimum required level.

DWS's minimum requirements for a Maintenance Team at WTWs and WWTWs are as follows:

- An organogram of the Maintenance Team used for general maintenance work at the plant (both Mechanical and Electrical);
- In cases where the maintenance function is outsourced, a copy of the contract between the Municipality and the Service Provider is required to serve as evidence of engagement of external maintenance expertise;
- Proof is required on team competency (internal or external). The Municipality must present evidence on the Qualification and Experience of the supervisors of the Mechanical, Electrical and Civil sections of the Maintenance Team individual. A trade-test certificate is accepted as adequate evidence, and
- Records of planned maintenance schedules and planned and reactive maintenance undertaken for selected infrastructure must be presented to indicate that maintenance does take place on an on-going basis.

Responding to breakdowns cannot be scheduled, but Beaufort West Municipality needs to plan and prepare for such situations. Scheduled O&M should not be allowed to occupy the entire workforce 100% of the time. There must always be a certain percentage of time and other resources reserved for responding to emergencies and breakdowns.

The entire staff must be organised in a flexible manner, and the more staff that are multi-skilled, the better. Rigid job descriptions should be abandoned in favour of multi-skilling, multi-tasking and flexibility. The motto must be "the best of services to our customers at all times!" Every staff member must be focused on quality services, resulting from the best of their collective ability. Individual staff members must be able and willing to step in to help each other whenever needed.

Planned and proactive O&M should be systematic and scheduled and activities need to be recorded and reported. **Without records, there is no history as a basis for professional planning and budgeting.** Pipes can last a long time, but not forever. Certain parts of the network are more seriously affected by irregular pressure or other factors and are prone to have more leaks than other sections, and thus need to be checked more often.

The future O&M Expenditure and Income budgets for water and sanitation services for the next three financial years are included under Topic 7, Sections 7.1.3. and 7.2.1.

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A budget of approximately 2% of the total asset value per annum should be allocated towards the replacement of existing old infrastructure. In the case of the operations and maintenance of the systems, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the systems remain in good condition (Best Practice).

The table below gives an overview of the Opening Costs (OC) and Carrying Values (BV) of the water and sewerage infrastructure included in Beaufort West Municipality's Asset Register (June 2023). The recommended budgets for the replacement of the existing infrastructure and the operation and maintenance of the existing infrastructure, based on the CRC of the water and sewerage infrastructure included in the WSDP, are also indicated.

Table 4.1.10.3: Recommended budgets for the replacement and the operation and maintenance of the existing water and sewerage infrastructure.					
Asset Type	Asset Register June 2023		CRC of water and sewerage infrastructure in WSDP	Recommended Annual Replacement Budget (Best Practice)	Recommended Annual O&M Budget (Best Practice)
	Opening Cost	Carrying Value		2.0% of CRC	1.5% of CRC
Water Infrastructure					
Boreholes	R23 166 084	R18 600 474	R101 954 000	R2 039 080	R1 529 310
Dams and weirs	R7 010 935	R2 055 858	R17 000 000	R340 000	R255 000
Bulk water pipelines	R34 015 907	R20 778 939	R46 804 700	R936 094	R702 071
Water reticulation	R11 000 744	R5 441 592			
Water pump stations	R6 548 546	R4 148 100	R27 850 000	R557 000	R417 750
Reservoirs	R42 839 316	R26 011 128	R70 574 000	R1 411 480	R1 058 610
WTWs	R18 914 626	R9 898 951	R136 625 000	R2 732 500	R2 049 375
Total Water	R143 496 158	R86 935 042	R400 807 700	R8 016 154	R6 012 116
Sewerage Infrastructure					
Sewer drainage networks	R34 146 897	R14 750 211	R205 327 000	R4 106 540	R3 079 905
Sewer pump stations	R11 794 625	R4 901 249	R13 750 000	R275 000	R206 250
WWTWs	R59 905 584	R3 667 726	R115 680 000	R2 313 600	R1 735 200
Total Sewerage	R105 847 106	R44 560 041	R334 757 000	R6 695 140	R5 021 355
Total Water and Sewerage	R249 343 264	R131 495 083	R735 564 700	R14 711 294	R11 033 471

4.1 WATER SERVICES OPERATION AND MAINTENANCE: OPERATIONAL PLAN													
Item	EXISTING GROUND WATER INFRASTRUCTURE				EXISTING SURFACE WATER INFRASTRUCTURE			EXISTING WASTE WATER TREATMENT WORKS INFRASTRUCTURE			EXISTING WATER TREATMENT WORKS INFRASTRUCTURE		
	Function	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan
4.2 Resource	Staff	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	External Resources	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-
	Spare Parts	Below min. requirement	Adequate spare parts for boreholes when there is failures	Ensure sufficient back-up spare parts for boreholes	Min. basic requirement	-	-	Below min. requirement	Adequate spare parts for WWTWs for when there is failures	Ensure sufficient back-up spare parts for WWTWs for mechanical and electrical equipment	Below min. requirement	Adequate spare parts for WTWs for when there is failures	Ensure sufficient back-up spare parts for WTWs for mechanical and electrical equipment
	Tools and Equipment	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Budget	Below min. requirement	Adequate O&M Budget allocation for operation of boreholes	Increase O&M and Capital Budget allocations towards vandalised and non functional boreholes	Min. basic requirement	-	-	Below min. requirement	Adequate O&M Budget allocation for operation of WWTWs	Increase O&M and Capital Budget allocations towards non-functional WWTW components	Below min. requirement	Adequate O&M Budget allocation for operation of WTWs	Increase O&M and Capital Budget allocations towards non-functional WTW components
4.3 Information	Manuals	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Asset Register	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	As-built Information	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Contingency and Safety plan	Below min. requirement	Water Safety Plan, which also address groundwater risks	Compile Water Safety Plan, which include groundwater risks	Below min. requirement	Water Safety Plan, which also address surface water risks	Compile Water Safety Plan, which include surface water risks	Below min. requirement	W ₂ RAP, which also address WWTW risks	Compile W ₂ RAP, which include WWTW risks	Below min. requirement	Water Safety Plan, which also address WTW risks	Compile Water Safety Plan, which include WTW risks
4.4 Activity Control and Management	Policies and Procedures	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Record Keeping	Above min. requirement	-	-	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Quality Control	Above min. requirement	-	-	Above min. requirement	-	-	Above min. requirement	-	-	Above min. requirement	-	-
	Risk Management	Below min. requirement	Vandalised and non-functional boreholes prioritised as a risk	Compile Water Safety Plan, which highlight priority risks	Below min. requirement	Insufficient yield from surface water resources prioritised as a risks	Compile Water Safety Plan, which highlight priority risks	Below min. requirement	Detail WWTW Process Audits, which indicate the the shortcomings at the WWTWs	Compile WWTW Process Audits regularly, which highlight the priority risks	Below min. requirement	Detail WTW Process Audits, which indicate the the shortcomings at the WTWs	Compile WTW Process Audits regularly, which highlight the priority risks
	Reporting	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
Item	EXISTING PUMP STATION INFRASTRUCTURE				EXISTING BULK PIPELINE INFRASTRUCTURE			EXISTING RESERVOIR & WATER TOWER INFRASTRUCTURE			EXISTING RETICULATION INFRASTRUCTURE		
	Function	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan
4.2 Resource	Staff	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	External Resources	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-
	Spare Parts	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Tools and Equipment	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Budget	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
4.3 Information	Manuals	Below min. requirement	O&M Manuals for all water pump stations	Compile O&M Manuals for the water pump stations	Below min. requirement	O&M Manuals for the bulk water pipeline infrastructure	Compile O&M Manuals for the bulk water pipeline infrastructure	Below min. requirement	O&M Manuals for the reservoirs	Compile O&M Manuals for the reservoirs	Below min. requirement	O&M Manuals for the water reticulation infrastructure	Compile O&M Manuals for the water reticulation infrastructure
	Asset Register	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	As-built Information	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Contingency and Safety plan	Below min. requirement	Water Safety Plan, which also address water pump stations risks	Compile Water Safety Plan, which include water pump station risks	Below min. requirement	Water Safety Plan, which also address bulk water pipeline risks	Compile Water Safety Plan, which include bulk water pipeline risks	Below min. requirement	Water Safety Plan, which also address reservoirs risks	Compile Water Safety Plan, which include reservoirs risks	Below min. requirement	Water Safety Plan, which also address water reticulation infrastructure risks	Compile Water Safety Plan, which include water reticulation infrastructure risks
4.4 Activity Control and Management	Policies and Procedures	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Record Keeping	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Quality Control	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Risk Management	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Reporting	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-

4.1 WATER SERVICES OPERATION AND MAINTENANCE: MAINTENANCE PLAN													
Item	EXISTING GROUND WATER INFRASTRUCTURE				EXISTING SURFACE WATER INFRASTRUCTURE			EXISTING WASTE WATER TREATMENT WORKS INFRASTRUCTURE			EXISTING WATER TREATMENT WORKS INFRASTRUCTURE		
	Function	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan
4.2 Resource	Staff												
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Below min. requirement	Staff trained wrt maintenance of groundwater sources	Identify staff to be trained wrt maintenance of groundwater sources and provide training	Below min. requirement	Staff trained wrt maintenance of surface water sources	Identify staff to be trained wrt maintenance of surface water infrastructure and provide training	Below min. requirement	Staff trained wrt maintenance of WWTWs	Identify staff to be trained wrt maintenance of WWTWs components	Below min. requirement	Staff trained wrt maintenance of WTWs	Identify staff to be trained wrt maintenance of WTWs components
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
	External resources												
	●Condition monitoring	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-
	●Planned maintenance	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-
	●Unplanned maintenance	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-
	Spare Parts												
	●Condition monitoring	Below min. requirement	Adequate spare parts for condition monitoring and maintenance of boreholes	Ensure sufficient back-up spare parts for condition monitoring and maintenance of boreholes	Min. basic requirement	Adequate spare parts for maintenance of surface water infrastructure	Ensure sufficient back-up spare parts for maintenance of surface water infrastructure	Below min. requirement	Adequate spare parts for condition monitoring and maintenance of WWTWs	Ensure sufficient back-up spare parts for condition monitoring and maintenance of WWTWs	Below min. requirement	Adequate spare parts for condition monitoring and maintenance of WTWs	Ensure sufficient back-up spare parts for condition monitoring and maintenance of WTWs
	●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
	Tools & Equipment												
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of boreholes	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of surface water infrastructure	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of WWTWs	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of WTWs
Budget													
●Condition monitoring	Below min. requirement	Adequate O&M Budget allocation for condition monitoring and maintenance of boreholes	Increase O&M Budget allocation towards condition monitoring and maintenance of boreholes	Min. basic requirement	Adequate O&M Budget allocation for maintenance of surface water infrastructure	Increase O&M Budget allocation towards maintenance of surface water infrastructure	Below min. requirement	Adequate O&M Budget allocation for condition monitoring and maintenance of WWTWs	Increase O&M Budget allocation towards condition monitoring and maintenance of WWTWs	Below min. requirement	Adequate O&M Budget allocation for condition monitoring and maintenance of WTWs	Increase O&M Budget allocation towards condition monitoring and maintenance of WTWs	
●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						

4.3 Information	Manuals												
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Asset Register												
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	As-built information												
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Contingency and Safety plan												
	●Condition monitoring	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of boreholes	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of surface water infrastructure	Below min. requirement	W ₂ RAP, which address the risks associated with inadequate condition monitoring and maintenance	Compile W ₂ RAP, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of WWTWs	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of WTWs
	●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					

4.4 Activity Control and Management	Policies and Procedures												
	●Condition monitoring	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Record keeping												
	●Condition monitoring	Above min. requirement	-	-	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Quality Control												
	●Condition monitoring	Above min. requirement	-	-	Above min. requirement	-	-	Above min. requirement	-	-	Above min. requirement	-	-
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-
	Risk management												
	●Condition monitoring	Below min. requirement	Lack of adequate condition monitoring and maintenance of boreholes prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate condition monitoring and maintenance	Below min. requirement	Lack of adequate condition monitoring and maintenance of surface water infrastructure prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate condition monitoring and maintenance	Below min. requirement	Lack of adequate condition monitoring and maintenance of WWTWs prioritised as a risk	Compile W ₂ RAP, which highlight prioritised risks wrt the lack of adequate condition monitoring and maintenance	Below min. requirement	Lack of adequate condition monitoring and maintenance of WTWs prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate condition monitoring and maintenance
	●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement					
Reporting													
●Condition monitoring	Above min. requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
●Planned maintenance	Min. basic requirement	-	-	Below min. requirement	Report on maintenance requirements of surface water infrastructure	Identify and report on the maintenance requirements of the surface water infrastructure	Below min. requirement	Report on maintenance requirements of WWTWs	Identify and report on the maintenance requirements of the WWTWs	Below min. requirement	Report on maintenance requirements of WTWs	Identify and report on the maintenance requirements of the WTWs	
●Unplanned maintenance	Min. basic requirement	-	-	Below min. requirement			Below min. requirement			Below min. requirement			

4.1 WATER SERVICES OPERATION AND MAINTENANCE: MAINTENANCE PLAN

Item	EXISTING PUMP STATION INFRASTRUCTURE				EXISTING BULK PIPELINE INFRASTRUCTURE			EXISTING RESERVOIR & WATER TOWER INFRASTRUCTURE			EXISTING RETICULATION INFRASTRUCTURE			
	Function	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	Status Quo	Requirements (to comply with basic requirements)	Action Plan	
4.2 Resource	Staff													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Below min. requirement	Staff trained wrt maintenance of water pump stations	Identify staff to be trained wrt maintenance of water pump stations and provide training	Below min. requirement	Staff trained wrt maintenance of bulk water pipeline infrastructure	Identify staff to be trained wrt maintenance of bulk water pipelines and provide training	Below min. requirement	Staff trained wrt maintenance of reservoirs	Identify staff to be trained wrt maintenance of reservoirs and provide training	Below min. requirement	Staff trained wrt maintenance of water reticulation networks	Identify staff to be trained wrt maintenance of water reticulation networks and provide training	
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
	External resources													
	●Condition monitoring	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-	
	●Planned maintenance	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-	
	●Unplanned maintenance	Not required	-	-	Not required	-	-	Not required	-	-	Not required	-	-	
	Spare Parts													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Below min. requirement	Adequate spare parts for maintenance of water pump stations	Ensure sufficient back-up spare parts for maintenance of water pump stations	Below min. requirement	Adequate spare parts for maintenance of bulk water pipelines	Ensure sufficient back-up spare parts for maintenance of bulk water pipelines	Below min. requirement	Adequate spare parts for maintenance of reservoirs	Ensure sufficient back-up spare parts for maintenance of reservoirs	Below min. requirement	Adequate spare parts for maintenance of water reticulation networks	Ensure sufficient back-up spare parts for maintenance of water reticulation networks	
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
	Tools & Equipment													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of water pump stations	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of bulk water pipelines	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of reservoirs	Below min. requirement	Sufficient tools and equipment for unplanned maintenance	Ensure sufficient tools and equipment for unplanned maintenance of water reticulation networks	
Budget														
●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-		
●Planned maintenance	Below min. requirement	Adequate O&M Budget allocation for maintenance of water pump stations	Increase O&M Budget allocation towards maintenance of water pump stations	Below min. requirement	Adequate O&M Budget allocation for maintenance of bulk water pipelines	Increase O&M Budget allocation towards maintenance of bulk water pipelines	Below min. requirement	Adequate O&M Budget allocation for maintenance of reservoirs	Increase O&M Budget allocation towards maintenance of reservoirs	Below min. requirement	Adequate O&M Budget allocation for maintenance of water reticulation networks	Increase O&M Budget allocation towards maintenance of water reticulation networks		
●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement							
4.3 Information	Manuals													
	●Condition monitoring	Below min. requirement	O&M Manuals for water pump stations, which include condition monitoring and maintenance requirements	Compile O&M Manuals for the water pump stations, which include condition monitoring and maintenance requirements.	Below min. requirement	O&M Manuals for bulk water pipelines, which include condition monitoring and maintenance requirements	Compile O&M Manuals for the bulk water pipelines, which include condition monitoring and maintenance requirements.	Below min. requirement	O&M Manuals for reservoirs, which include condition monitoring and maintenance requirements	Compile O&M Manuals for the reservoirs, which include condition monitoring and maintenance requirements.	Below min. requirement	O&M Manuals for boreholes, which include condition monitoring and maintenance requirements	Compile O&M Manuals for the water reticulation networks, which include condition monitoring and maintenance requirements.	
	●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
	Asset Register													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	As-built information													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	Contingency and Safety plan													
	●Condition monitoring	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of water pump stations	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of bulk water pipelines	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of reservoirs	Below min. requirement	Water Safety Plan, which address the risks associated with inadequate condition monitoring and maintenance	Compile Water Safety Plan, which include an Improvement / Upgrade plan to ensure adequate condition monitoring and maintenance of water reticulation networks	
	●Planned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
4.4 Activity Control and Management	Policies and Procedures													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	Record keeping													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	Quality Control													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Unplanned maintenance	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	Risk management													
	●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	
	●Planned maintenance	Below min. requirement	Lack of adequate maintenance of water pump stations prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate maintenance	Below min. requirement	Lack of adequate maintenance of bulk water pipelines prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate maintenance	Below min. requirement	Lack of adequate maintenance of reservoirs prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate maintenance	Below min. requirement	Lack of adequate maintenance of water reticulation networks prioritised as a risk	Compile Water Safety Plan, which highlight prioritised risks wrt the lack of adequate maintenance	
	●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement						
Reporting														
●Condition monitoring	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-	Min. basic requirement	-	-		
●Planned maintenance	Below min. requirement	Report on maintenance requirements of water pump stations	Identify and report on the maintenance requirements of the water pump stations	Below min. requirement	Report on maintenance requirements of bulk water pipelines	Identify and report on the maintenance requirements of the bulk water pipelines	Below min. requirement	Report on maintenance requirements of reservoirs	Identify and report on the maintenance requirements of the reservoirs	Below min. requirement	Report on maintenance requirements of water reticulation networks	Identify and report on the maintenance requirements of the water reticulation networks		
●Unplanned maintenance	Below min. requirement			Below min. requirement			Below min. requirement							

5. CONSERVATION AND DEMAND MANAGEMENT

The National Development Plan stresses that economic growth should be environmentally sustainable and that Water Conservation must be a priority to ensure sufficient water to support equitable economic growth and to support the achievement of the national developmental goals. Thus, all sectors of the economy need to prioritise Water Conservation in their development plans.

Beaufort West Municipality can also develop a vision and mission for their WC/WDM Strategy. The vision should deal on the one hand with the quantity and quality of the water provided and on the other hand with the efficient and equitable use of water.

A number of key features flowed from the vision statement of the City of Cape Town with regard to WC/WDM and could be included similarly in the Municipality's Vision.

Equitable: A tariff system that ensures that large consumers pay the appropriate tariff rate. A flat tariff for water usage is counterproductive to Water Conservation. One of the key principles of water conservation is in fact addressing the tariff structure. This promotes equity since consumers who use more than their equal share of existing water resources should be made liable / accountable for any new bulk infrastructure and water resources.

People Centred: The WC/WDM model should place an emphasis on the consumers, the environment and their needs. The availability and supply of water in surrounding rural areas needs to be addressed as critical component of water services.

Affordable: The WC/WDM Strategy and implementation plan should be affordable and measurable. The process to ensure affordability will be to capitalise on the projects that have a sustained saving factor, e.g. Pressure Management.

Sustainable: Limited water resources generally threaten the sustainability of water services. WC/WDM can extend the assurance of supply of the existing water resources and can go a long way in reconciling future demand and supply.

Services to All: WC/WDM can greatly increase the ability to supply water services to all by reallocating existing bulk capacity and water resources from inefficient use to new consumers and ensuring that new water supply projects are sustainable and affordable.

Some of the current causes / challenges that contribute to high NRW and Water Losses for water distribution systems in South Africa are as follows:

- Water lost during pipe breakages or leakages, which include underground leakages, is difficult to quantify. It include the flushing of the networks after repairs.
- By-passed water meters in certain areas, especially consumers with pre-paid water meters.
- Inaccurate billed metered consumption, due to inaccurate domestic or conventional meter readings (Old water meters and prepaid water meters).
- There has been a growing concern about the lack of action by municipalities to attend to high water consumption caused by water leaks in households.
- Vandalism and theft of water infrastructure.
- Building contractors of low cost housing projects not metering their water usage.
- Ageing infrastructure and insufficient funds for adequate replacement and refurbishment is one of the biggest challenges. Water losses will not drop to below 15% and might even increase as water networks deteriorate and collapse.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

WC/WDM Strategy

Water is scarce and it is important that water be used wisely and that due attention be paid to water conservation and water demand management. One of the visions of the Sector is that water is used effectively, efficiently and sustainably in order to reduce poverty, improve human health and promote economic development.

A Water Distribution Losses Policy was approved by Council on the 6th of June 2023. The following control and monitoring activities are included in the Policy.

- To keep the losses to a minimum, the metering of water must be monitored sufficiently;
- The water losses must be monitored on a monthly basis;
- Distribution meters must be installed to obtain meaningful meter data, to calculate losses accurately in terms of volume and per distribution area, if possible (ward etc.);
- A formal system of communication should be maintained or put in place to ensure effective and efficient communication between the revenue department and the technical department. This will ensure that meters replaced, meters reset, disconnections, last readings, etc. being accounted for to ensure that the municipality suffer no losses in this regard; and
- The billing system must be used to detect possible cases of illegal connections (deviation / exception reporting). If theft is detected, the water supply to the premises will be disconnected and a fine need to be paid at a rate as published in the municipal tariffs applicable to the financial year it relates to. Action will be taken as in terms of the municipal policy relating to customer care, credit control and debt collection and criminal charges should be considered.

The Municipality must have the intention to keep the losses of water below a specified percentage of the total water purified and distributed.

The Policy stipulates that the water losses must be reported to the Director: Infrastructure on a monthly basis by means of a monthly report. Other reporting requirements include the following:

- Quarterly reporting to the DWS regarding water losses;
- Reporting on a quarterly basis in terms of section 52 of the MFMA;
- The total water losses incurred, must be made public in the annual financial statements of the municipality;
- Water losses are also reported in the Mid-Year Performance Report of the municipality.

The water losses reporting on in terms of financial reporting, must be clearly indicate the quantity in terms of the units (KI) lost as well as the financial implication of the losses.

DWS's Municipal Scorecard for assessing the potential for WC/WDM efforts in Municipalities was used to assess the potential for WC/WDM efforts in Beaufort West Municipality. The status quo score for Beaufort West Municipality is 62 out of 100 suggesting that there is sufficient areas that can be further improved with regard to the implementation of specific WC/WDM activities.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

The proposed WC/WDM Strategy for Beaufort West Municipality is based on the 25 items included in the Scorecard and the sections below discuss each of these items in detail.

ITEM 1: DEVELOPMENT OF A STANDARD WATER BALANCE

<p>Introduction: The development of a standard water balance based on the IWA methodology is considered as one of the most important actions that all water utilities must undertake in order to establish the levels of water loss and NRW in their supply systems.</p>
<p>Situation in Beaufort West LM:</p> <p>Detail IWA Water Balances are available for each of the water distribution systems. The percentage NRW and Water losses for the systems are summarised in Table 5.3.2 under Topic 5 of the Administration, Information and Comprehensive Overview Report. The billed metered consumption volumes are however not accurate and it is therefore not possible to calculate the NRW and water losses accurately for the various systems.</p> <p>A WSDP Performance- and Water Services Audit Report, which include the IWA water balances, was not compiled for the last number of years by the municipality, as required by legislation.</p>
<p>Recommendation and Strategy:</p> <ul style="list-style-type: none"> Continue with the monthly updating of the IWA Water Balances for all the systems and reporting on the NRW and Water Losses for each of the systems to management. Continue to manage NRW analysis on a monthly basis. Draft an annual WSDP Performance and Water Services Audit Report, as required by the Water Services Act, which include the IWA Water Balances. Implement the recommended WC/WDM activities in order to reduce the NRW and Water Losses. Phase out all "Cashflow" prepaid water meters and ensure that the volumes of estimated accounts are also recorded in the billing system. Determine all unbilled authorized consumption by firstly identify all the relevant consumers, e.g. Municipal buildings, parks, fire services, sport fields, etc. Unbilled consumption do not generate income, but will enable the municipality to better quantify their actual water losses.
<p>Funding and Budget Requirements:</p> <p>The IWA Water Balances for the systems need to be updated on a monthly basis by the municipality.</p>
<p>Scorecard Result:</p> <p>2 out of 4: Indicating that the municipality has developed reliable water balance and results indicating UAW/NRW at more than 40%.</p>

ITEM 2: PRESSURISED SYSTEM AT ALL TIMES

<p>Introduction: All water utilities must aim to keep their reticulation systems pressurised 100% of the time as any level of intermittent supply can lead to serious health problems as well as causing damage to the reticulation system.</p>
<p>Situation in Beaufort West LM:</p> <p>The water reticulation networks are always pressurised. There are therefore no intermittent supply, which can lead to serious health problems and can cause damage to the reticulation networks.</p>
<p>Recommendation and Strategy:</p> <ul style="list-style-type: none"> Adequate human resources, technical skills and O&M budgets need to be allocated towards the operation, maintenance and refurbishment of the existing infrastructure, in order to ensure that the systems are always pressurised. Ensure proper maintenance of the existing PRVs in Beaufort West. The Water Master Plans to be consulted in conjunction with the WC/WDM priority projects to identify future areas where pressure reduction can be implemented.
<p>Funding and Budget Requirements:</p> <ul style="list-style-type: none"> Budgets as indicated under the individual items of the WC/WDM Strategy. Increase O&M budget allocations towards the refurbishment and replacement of old water infrastructure. A budget of R5 000 000 is required for the implementation of additional PRV zones.
<p>Scorecard Result:</p> <p>3 out of 4: Indicating that the municipality maintains a pressurised supply to all areas within the water distribution network however pressure drops below 10m in certain areas.</p>

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

ITEMS 3 AND 4: METERING SYSTEM

<p>Introduction: Beaufort West Municipality needs to continue to properly meter and bill all consumers. It is important that systems are in place to undertake monthly meter reading and billing with the necessary back-up customer complaint services.</p>
<p>Situation in Beaufort West LM:</p> <p>It is estimated that between 50% - 75% of all residential connections and 75% - 98% of all non-residential connections, including fire supply connections, are metered and billed on a monthly basis based on metered water usage. Required systems are also in place to undertake monthly meter readings and billing with the necessary back-up customer complaint services.</p>
<p>Recommendation and Strategy:</p> <ul style="list-style-type: none"> • All "Cashflow" prepaid water meters to be phased out. • All un-metered water connections need to be provided with water meters. Meters need to be read on a monthly basis and consumers need to be billed monthly according to their actual water usage. In addition to water theft, many water accounts go unnoticed in the system or have some type of data inconsistency that results in no revenue being generated for the particular water use event. The SWIFT data needs to be used to clean the Treasury data and the municipality needs to identify and correct any inaccurate data in the system (Linkage of Treasury data with cadastral data). • Consumer consumption checks / investigations need to be carried out where water usage are very low, but there are households on the property (Use SWIFT data). This project will give a clear indication of where illegal or unregistered connections is being made and whether the meter is under reading the actual consumption, thus water is being used but not billed or recorded. • Use the SWIFT data to identify all unmetered erven and all meters with zero consumption. All illegible / broken / old meters should be replaced. Any un-metered stands should be metered and meter readings in the billing system should be updated where required. All meter boxes should also be cleaned as part of the inspections. • Municipality needs to continue with the implementation of their Meter Management / Replacement program. An effective Meter Management / Replacement Program needs to achieve the following objectives: <ul style="list-style-type: none"> ➢ Determine the on-going meter replacement programme; ➢ Determine exception reports on meters which are suspected to be faulty; ➢ Test and replace faulty meters; and ➢ Size meters correctly. <p>The activities of this program that needs to be budgeted for are as follows:</p> <ul style="list-style-type: none"> ➢ SWIFT analysis of treasury data. ➢ Research and development of a meter replacement policy and meter management / replacement programme; ➢ Implementation of a uniform meter management information system; ➢ Testing and replacing faulty meters reported by consumers (Part of reticulation function). ➢ Replacement of domestic meters with AMR enabled format (where appropriate) in accordance with meter management / replacement programme.
<p>Funding and Budget Requirements:</p> <p>Allow a budget of approximately R200 000 for an annual SWIFT analysis to identify unmetered erven and erven with no or very low consumption. Estimated annual budget required for the installation of individual water meters is R2 500 000.</p>
<p>Scorecard Result:</p> <p>Residential Metering System: 2 out of 4: 50%-75% of connections are metered and billed.</p> <p>Non Residential Metering System: 3 out of 4: 75%-98% of all non-residential connections, including fire supply connections, are metered and billed based on metered use.</p>

ITEM 5: EFFECTIVE AND INFORMATIVE BILLING SYSTEM

<p>Introduction: An effective and informative billing system is used to help consumers understand how much water they are using and how their water bill is made up. It is usually very helpful in explaining how the block-tariffs are applied to each customer so that they can see exactly what they pay for water in each block. This in turn will encourage many customers to reduce their water use and, in this regard, such informative billing becomes another WDM intervention.</p>
<p>Situation in Beaufort West LM:</p> <ul style="list-style-type: none"> • The Municipality tries to ensure that all customer meters are read on a monthly basis and customers are billed on a monthly basis according to the actual volume of water used for the specific month. A large percentage of the monthly accounts are however still estimated. The estimated volumes are not included in the billed metered consumption volumes. • Commercial data analysis is not yet done on the billed metered consumption data, which include the identification of un-metered erven, investigating meters with zero consumption, investigating abnormal low and high consumption readings, oversized / undersized meters, etc.
<p>Recommendation and Strategy:</p> <ul style="list-style-type: none"> • Municipality needs to continue to ensure that all customer's meters are read on a monthly basis and that the customers are billed on a monthly basis according to the actual volume of water used for the specific month.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

<ul style="list-style-type: none"> • Municipality needs to start with commercial data analysis on the billed metered consumption data, which include the identification of un-metered erven, investigating meters with zero consumption, investigating abnormal low and high consumption readings, oversized / undersized meters, etc. • The Municipality can consider the following additional measures to make the current consumer bills more informative. <ul style="list-style-type: none"> ➢ Adding a graph of the previous 12 months' consumption and helpful hints on effective water usage on the monthly bills. ➢ Alert consumers of possible leaks on their properties. For instance if the consumption for a particular month is >25% than the average consumption of the previous months the consumer may be alerted of a possible leak on the property. ➢ Monitor trends and follow up telephonically.
Funding and Budget Requirements: Estimated cost to enhance the user friendliness of the municipal bill is R400 000.
Scorecard Result: 1 out of 4: Indicating that the municipality has an uninformative billing system in place.

ITEMS 6 AND 7: GENERAL COMPLAINTS SYSTEM

Introduction: Every municipality should have a complaints system where consumers can lodge technical or billing complaints and where water leaks can be reported. Residents should be encouraged to report any leaks they find. This is one of the key elements of an efficient WC/WDM strategy since most leaks repaired in South Africa result from such Passive Leakage Control and not Active Leakage Control.
Situation in Beaufort West LM: A Customer Complaints System is implemented by the municipality. The Customer Complaints System include the logging of complaints, response times to address complaints and the reporting of complaints and response times to management. Help-desks were developed at all the municipal administrations with the objective to assist customers. Disabled people are supported to do business from the help-desks. Requests by the illiterate are being captured and forwarded to the relevant official / section. After hour emergency requests are being dealt with by the control room on a twenty-four hour basis. Requests are furthermore captured through the Complaints system to ensure execution thereof.
Recommendation and Strategy: The municipality needs to continue to ensure that all consumers are familiar with the telephone numbers to lodge complaints and report leaks. Telephone numbers to lodge complaints and report leaks should be included on the monthly water bills and on the Municipality's website. Suggestions would be to also include it on strategically located notice boards, radio broadcasts, etc. The projects and measures that can be implemented for passive leakage control are as follows: <ul style="list-style-type: none"> • Improve the help-line and install an automated answering system. • Advertise the help-line. • Investigate current problems in responding to leaks and allocate adequate resources to avoid lengthy delays. • Review and develop a policy regarding responses to leaks with the aim of reducing response time, prioritising and keeping consumers informed. • Develop a monitoring system and quality assurance measures to ensure problems are resolved adequately. Link such a KPI to the SDBIP. A Consumer Services Charter should be drafted, which include the following information: <ul style="list-style-type: none"> • Commitment to deliver excellent services to our clients (Executive Mayor and Municipal Manager). • Standards of services (Enquiries written and telephonic; Accounts enquiries and distribution of accounts). • Response times for different services (Water: Repairs to networks, installation of new household water connections, etc.) • Contact details for different areas.
Funding and Budget Requirements: Budget requirement for improved customer awareness raising with regard to the Municipality's Complaints System R150 000/annum.
Scorecard Result: 3 out of 4: Indicating that efficient reporting systems are in place for both network (leakage) complaints (90% of reported leaks are repaired within 48 hours) and billing and metering complaints (90% dealt with within one month).

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

ITEM 8: ASSET REGISTER FOR WATER INFRASTRUCTURE

<p>Introduction: It is essential for all water utilities to establish a proper asset register as a pre-requisite to some form of asset management programme. Unless a proper asset register has been developed, the water utility cannot allocate the appropriate maintenance budget to ensure that the water reticulation system is kept in good condition.</p>
<p>Situation in Beaufort West LM:</p> <p>An Asset Register is in place, which include most of the water and sewerage infrastructure. The Asset Register include the Opening Cost, Carrying Value, RUL, Age and condition of the infrastructure. See Topic 3 of the Administration, Information and Comprehensive Overview Report for the summary of the different components.</p>
<p>Recommendation and Strategy:</p> <ul style="list-style-type: none"> Continue with the annual updating of the Asset Register. Continue to ensure that all the existing water and sewerage infrastructure are included in the Asset Register.
<p>Funding and Budget Requirements:</p> <p>None - To be done as part of the annual updating of the Asset Register by the municipality.</p>
<p>Scorecard Result:</p> <p>3 out of 4: Indicating that the municipality has a partially completed accurate asset register in place.</p>

ITEM 9: ASSET MANAGEMENT CAPITAL WORKS

<p>Introduction: Water utilities should allocate a budget of approximately 2% of the total asset value per annum to undertake replacement of existing infrastructure. The 2% is calculated based on an approximate design life of 50 years for the different infrastructure components. If components of the system has a design life of 100 years then at least 1% of the asset value should be spend annually on replacing those components of the system. It is important to differentiate between budget allocated to maintenance of the water infrastructure and budget for the replacement of the infrastructure.</p>
<p>Situation in Beaufort West LM:</p> <p>The historical capital expenditure for water and sewerage infrastructure is included in Table 7.1.4.1.1 and Table 7.1.4.2.1 of Topic 7 of the Administration, Information and Comprehensive Overview Report. It is estimated that less than 1% of the value of the existing water infrastructure is invested annually into new capital works.</p>
<p>Recommendation and Strategy:</p> <p>Allocate a budget of at least 2% of the total water asset value (CRC) per annum towards the replacement of existing infrastructure. Municipality needs to differentiate in their capital budget between new projects and projects that are for the replacement of existing infrastructure, in order to accurately calculate the annual percentage allocated towards the replacement of existing infrastructure (Best Practice).</p>
<p>Funding and Budget Requirements:</p> <p>Capital budget of at least 2% of the total water and sewerage asset value (CRC) allocated annually towards the replacement of the existing water and sewerage infrastructure (Best Practice).</p>
<p>Scorecard Result:</p> <p>2 out of 4: Indicating that less than 1% of the value of the water network is invested annually into new capital works related to the existing infrastructure.</p>

ITEM 10: ASSET MANAGEMENT OPERATION AND MAINTENANCE

<p>Introduction: Lack of maintenance of water infrastructure is one of the key problems facing most municipalities in South Africa. It is important for a water utility to differentiate between budget allocated to maintenance of the water infrastructure and budget for the replacement of infrastructure. In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system (CRC) is typically required to ensure that the system remains in good condition.</p> <p>(The 1% - 2% guideline is based on discussions with technical staff from some municipalities and will obviously vary from area to area. Very few municipalities in South Africa spend enough on operations and maintenance and as a result, there is a serious backlog of maintenance developing in many areas – and the problem continuous to grow with each year that insufficient maintenance budget is allocated to the water infrastructure.)</p>
<p>Situation in Beaufort West LM:</p> <p>The current O&M Budget allocated towards the refurbishment and maintenance of the existing water and sewerage infrastructure is inadequate. The historical water and sewerage O&M expenditure are indicated in Tables 7.1.3.1.1 and 7.1.3.2.1 of the Administration, Information and Comprehensive Overview Report. The water and sewerage infrastructure currently included in the municipality's asset register is included under Topic 3 of the Administration, Information and Comprehensive Overview Report.</p>
<p>Recommendation and Strategy:</p> <p>The municipality needs to differentiate between budget allocated towards the operation and maintenance of the water infrastructure and the budget allocated towards the replacement of the old water and sewerage infrastructure. A budget of approximately 1% to 2% of the value of the system (CRC) is typically required for the operations and maintenance of the system and to ensure that the system remains in good condition.</p>

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

The municipality needs to compile an Asset Management Plan (AMP) to ensure efficient, effective and optimal management, operation and maintenance of all assets, which includes treatment plants, reservoirs, structures, buildings, pipelines, sites, etc. The purpose of the AMP is to:

- Ensure the operation and maintenance functions are well planned;
- Demonstrate responsible management;
- Justify and communicate funding requirements; and
- Service provisioning complies with regulatory requirements.

An AMP normally includes the following:

- documents the nature, extent, age, utilization, condition, performance and value of the infrastructure work;
- identifies existing and target levels of service, as well as expected changes in demand;
- identifies the life-cycle management needs of the infrastructure (development, renewal, operations and maintenance);
- assesses capital and operational budget needs; and
- identifies infrastructure asset management improvement needs.

It is important for the municipality to develop an AMP from their Asset Register. The objective of an AMP is to support the achievement of the strategic goals of the Municipality and facilitate prudent technical and financial decision-making. It is also a vehicle for improved internal communication and to demonstrate to external stakeholders the Municipality's ability to effectively manage its existing infrastructure as well as the new infrastructure to be developed over the next 20 years.

This plan must be based on the principle of preventative maintenance in order to ensure that, as far as this is practical, damage to assets is prevented before it occurs. The municipality needs to ensure that the maintenance and rehabilitation plan is part of the WSDP and that the plan is implemented. Assets must be rehabilitated and / or replaced before the end of their economic life and the necessary capital funds must be allocated for this purpose. Priority should be given to rehabilitating existing infrastructure as this generally makes best use of financial resources and can achieve an increase in (operational) services level coverage's most rapidly. The preparation of maintenance plans and the allocation of sufficient funding for maintenance are required to prevent the development of a large condition backlog. The potential renewal projects for the water infrastructure need to be identified from the Asset Register. All assets with a condition grading of "poor" and "very poor" need to be prioritised.

The O&M Budget allocated towards repairs and maintenance should include the replacement of malfunctioning and old bulk water meters and consumer water meters, clearing of meter chambers, buying replacement mechanisms for bulk water meters, speedy repair of leaks, leak detection in areas with high water losses and NRW and higher than expected night flows, etc. The budget should also be used for preventative maintenance, which include the following:

- Inspection of isolation valves and packing.
- Control valve inspection and maintenance.
- Inspection of cathodic protection of steel pipes.

Funding and Budget Requirements:

Additional budget should be allocated towards the repairs and maintenance of the existing water and sewerage infrastructure. The additional budget should be determined by the municipality once an AMP is developed. A budget of approximately 1% to 2% of the value of the system (CRC) is typically required for the operations and maintenance of the system to ensure that the system remains in good condition (Best Practice).

An estimated budget for the drafting of an AMP for all the water and sewerage infrastructure is R750 000.

Scorecard Result:

2 out of 4: Indicating that less than 1% of the value of the water network is invested annually into the maintenance of the existing infrastructure.

ITEM 11: DEDICATED WC/WDM SUPPORT

Introduction: Municipalities should have a dedicated section that deals with WC/WDM initiatives.

Situation in Beaufort West LM:

The municipality currently does not have staff only dedicated to WC/WDM. The managers and operational personnel within the various towns all assist with WC/WDM where possible.

Recommendation and Strategy:

The municipality should allocate at least one (1) person to head WC/WDM for a start. The number of people involved with WC/WDM measures can later be increased as and when required.

Funding and Budget Requirements:

The municipality may be able to use one of their existing staff members. If a new person has to be appointed the municipality can determine the costs involved with such an appointment.

Scorecard Result:

0 out of 4: Indicating that a WDM section is not in place and no intention to create a WDM section.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

ITEM 12: ACTIVE LEAKAGE CONTROL

<p>Introduction: Active Leakage Control involves sending teams out to search for unreported leaks as opposed to Passive Leakage Control which involves relying on residents to report leaks.</p>
<p>Situation in Beaufort West LM: The overall NRW and Water Losses are extremely high, because of inaccurate billed metered consumption volumes. No visible leakages were noticed during the WSDP site visits. The IWA Water Balances and the night flow analysis should be used to identify zones with higher than expected night flows (leakages).</p>
<p>Recommendation and Strategy: The following process needs to be followed for active leakage control of the reticulation network: <u>Decide on how the work will be undertaken:</u></p> <ul style="list-style-type: none"> Option 1: The appointment and training of additional staff. Option 2: The training of existing staff. Option 3: Appoint an external contractor in the first few years with the objective of using this contractor to train the internal teams and build capacity to do all work internally. Option 4: Complete outsourcing of the activity. <p>The first three options need to include the purchase or re-allocation of equipment.</p> <p><u>Leak detection:</u> Identify areas with highest leaks and send teams into the field to detect leaks.</p> <p><u>Repair of leaks once identified:</u> Once leaks were detected they will need to be repaired. Depending on the extent of the leaks and other workloads, the leak repairs need to be carried out by either the internal teams or a contractor.</p>
<p>Funding and Budget Requirements: R300 000 to undertake leak detection in zones with high excess night flows. In addition allocate approximately R100 000 per year for general visual leak inspections.</p>
<p>Scorecard Result: 2 out of 4: Indicating that active leakage detection and repair is undertaken on an ad-hoc basis</p>

ITEM 13: SECTORIZATION OF RETICULATION SYSTEMS

<p>Introduction: In order to manage a large water reticulation system it is necessary to split the system into smaller zones which can then be monitored individually in order to identify and localize key problem areas. This process is called Sectorization and is one of the key elements of an effective WC/WDM programme.</p>
<p>Situation in Beaufort West LM: The individual water reticulation systems have already been sectorized in reservoir and PRV supply zones. These zones have however not yet regularly checked for discreteness.</p>
<p>Recommendation and Strategy: The billed metered data is currently linked to the distribution systems and should also be linked to the different zones in the future where possible, in order to accurately determine the NRW and water losses for the specific zones in the future. Faulty bulk water meters need to be replaced and new meters need to be installed for the zones with no bulk water meters. The current bulk water meters are indicated in Table 5.1.2.3.1 of Topic 5 of the Administration, Information and Comprehensive Overview Report.</p> <p>The Financial Department needs to provide the billed metered consumption data separately for the different zones in the future in order to assist with the following:</p> <ul style="list-style-type: none"> Clear indication of how much water is being used per area / zone. Areas with high NRW and water losses can easily be identified. Leakage and pressure control can be better managed. Water demand per area / zone can be determined. <p>Night flows need to be measured for zones with expected high water losses. It is recommended to re-log the night flows every few years to determine if there was an increase in leakage.</p>
<p>Funding and Budget Requirements: The estimated cost for the logging of flows and pressures for zones with expected high water losses is R500 000. The logging exercise should be repeated at least every three years.</p> <p>A budget should be allocated to investigate and resolve possible zone interconnections. It is however difficult to price such investigations at this stage.</p>
<p>Scorecard Result: 3 out of 4: Indicating that the reticulation network has been sectorised, but is not checked regularly to ensure discrete zones.</p>

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

ITEM 14: EFFECTIVE BULK METERING MANAGEMENT SYSTEM

Introduction: Bulk meters are typically used to measure the water supplied from the source, at the inlet and outlet of the WTWs, on the rising mains of the water pump stations and on the inlet and outlet of storage reservoirs.
Situation in Beaufort West LM: The existing bulk water meters are summarised in Table 5.1.2.3.1 of Topic 5 of the Administration, Information and Comprehensive Overview Report. Most of the bulk water meters are adequately protected from possible vandalism and are in a good condition. Some of the current challenges with regard to the bulk water meters are as follows: <ul style="list-style-type: none"> Adequately protecting the meters from vandalism, especially for those boreholes outside the town area. Some of the zones are not supplied with bulk water meters and the meter readings are not always taken of the zone bulk water meters. This makes the calculation of the actual water usage for specific zones sometimes difficult.
Recommendation and Strategy: <ul style="list-style-type: none"> Municipality needs to continue to read all the bulk water meters at the existing WTWs, reservoirs, pump stations and on the bulk supply pipelines for specific zones and need to record the readings on at least a monthly basis. All bulk water meters need to be installed in lockable meter chambers and reservoir sites and water pump stations need to be secured in order to prevent unauthorised access and possible damage to the water meters. New bulk water meters need to be installed correctly. Ideally a straight pipe section upstream of the meter of at least 5x the meter dia. and 3x the meter dia. downstream of the meter. Strainers need to be installed to protect the meters. These strainer elements must be removable from the top, for ease of cleaning. Gate valves are required for maintenance before and after meters. Every informal area with unmetered communal services to be supplied with a bulk water meter in order to determine the unbilled metered consumption. All discrete zones are to be supplied with a bulk water meter. The meter readings must be recorded on at least a monthly basis. The readings can be used to quantify both the water supplied and the leakage for a specific area.
Funding and Budget Requirements: <ul style="list-style-type: none"> Allow an annual budget of approximately R400 000 for the installation of new bulk water meters, the replacement of faulty bulk water meters and to adequately protect existing bulk water meters.
Scorecard Result: 3 out of 4: Indicating all bulk water sources to the WSA are metered by the WSA.

ITEM 15: EFFECTIVE ZONE METER MANAGEMENT AND ASSESSMENT OF NIGHT FLOWS

Introduction: Zone meters are used to monitor the water supplied into the zones with particular emphasis on the recording of the MNFs. From the analyses of the MNF it is possible to establish the level of leakage and/or wastage in each zone after which selective WDM interventions can be properly prioritised.
Situation in Beaufort West LM: Most of the reservoir and PRV zones are metered, but all the readings of the bulk water meters at the reservoirs, the pump stations and on the bulk supply pipelines of specific zones are not always recorded. The night flows for all the various zones are not yet all monitored.
Recommendation and Strategy: See recommendations under Item 14.
Funding and Budget Requirements: See funding and budget requirements included under Item 14.
Scorecard Result: 3 out of 4: Indicating that all inlet points to discrete zones are metered and accurate, but no Minimum Night Flow analyses are undertaken.

ITEM 16: PRESSURE MANAGEMENT

Introduction: Pressure management is one of the key WDM interventions that can be used to reduce leakage and extend the life of the reticulation system in areas which experience high leakage. The basic principle is that any reduction in pressure will result in a reduction of water leakage. The volume of losses experienced as well as the volume of water used by consumers is related to the pressure in the system. The concept of pressure management is to reduce the excess system pressure in order to reduce leakage, the occurrence of pipe bursts and also reduce excessive consumption by consumers.
Situation in Beaufort West LM: See Item 2.
Recommendation and Strategy: See Item 2.
Funding and Budget Requirements:

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TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

See Item 2.

Scorecard Result:

3 out of 4: Indicating that the reticulation is comprehensively sectorised into pressure zones which are all discrete. PRVs are only maintained when problems become apparent.

ITEM 17: AS-BUILT DRAWINGS OF BULK AND RETICULATION INFRASTRUCTURE

Introduction: Proper “as-built” drawings are essential to any water utility. In many parts of South Africa it is found that even if the municipality has drawings of the reticulation system the drawings do not always match the pipes as laid in the ground and this in turn can result in operational difficulties and water supply problems.

It is therefore necessary for a water utility to have some form of system whereby the drawings can be updated to reflect the “as-built” conditions and that measures are taken to clarify the situation in areas where it is known that the available drawings may not be accurate.

Situation in Beaufort West LM:

As-built drawings are available for all water reticulation networks in Beaufort West Municipality.

Recommendation and Strategy:

Continue with the updating of as-built drawings on an ongoing basis. Continue also with the regular updating of the Water and Sewer Master Plans.

Funding and Budget Requirements:

Allow a budget of approximately R2.000 million for the updating of the Water and Sewer Master Plans every five years.

Scorecard Result:

4 out of 4: Indicating that accurate as-built drawings are available digitally for all water reticulation networks.

ITEM 18: SCHEMATIC LAYOUTS OF WATER RETICULATION SYSTEMS

Introduction: Schematic layouts of the water distribution systems are necessary in order to understand the systems better and to indicate the position of the sources, WTWs, reservoirs, pump stations and bulk water meters. The schematic layouts also assist with the development of an accurate water balance.

Situation in Beaufort West LM:

Schematic layouts are available for all the systems (Annexure C of the Administration, Information and Comprehensive Overview Report).

Recommendation and Strategy:

Municipality needs to continue to update the schematic layouts on a regular basis, in order to ensure they remain accurate.

Funding and Budget Requirements:

None

Scorecard Result:

4 out of 4: Indicating that up-to date and detailed schematic of the whole bulk reticulation network is available showing all bulk mains, pumps, reservoirs, meters and control valves.

ITEM 19: REGULATION AND BYLAWS

Introduction: Water Services By-laws need to be in place and enforced by the WSA. Water utilities should regulate the type of water fittings that may be installed in buildings and enforce the use of these fittings through by-laws. Water utilities should also have by-laws that relates to water conservation and effective water usage and enforce these by-laws when required.

Situation in Beaufort West LM:

By-laws relating to Water Supply (Notice No.148/2005) and Wastewater (Notice No.145/2005) are in place. The Water Supply By-law includes the following “Water Conservation” sections:

- Interference with water supply system;
- Water restrictions;
- Waste of water; and
- Water demand management.

Recommendation and Strategy:

The existing Water Supply and Wastewater By-laws need to be updated, in order to ensure that the by-law adequately allow for WC/WDM measures.

Funding and Budget Requirements:

Allow a budget of R180 000 for the updating of the existing Water Supply and Wastewater By-law.

Scorecard Result:

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TOPIC 5: CONSERVATION AND DEMAND MANAGEMENT

3 out of 4: Indicating that Regulation and Bylaws are in place, which address WDM issues, but are not enforced.

ITEM 20: TARIFFS

<p>Introduction: Wasteful or inefficient use of water is discouraged through an increased step block tariff system. The determination of tariff policies should seek to address both commercial and social welfare concerns. The CAFES-principles are outlined below:</p> <ul style="list-style-type: none"> • Conserving: Tariffs should encourage consumers to purchase enough water to meet their needs without being wasteful. • Adequate: Future investment should also be considered when setting the tariffs. • Fair: The utility should achieve financial sustainability while maintaining access for poor communities. • Enforceable: Tariffs that cannot be enforced are unlikely to be sustained. • Simple: The tariffs should be easy for the Municipality to administer and easy for customers to understand. Consumers generally show greater willingness to pay water bills that they understand.
<p>Situation in Beaufort West LM:</p> <p>The existing water tariff structure adequately differentiate between the different type of consumers. The current step block tariff structure discourages the wasteful or inefficient use of water to some degree, but can be further improved. Beaufort West Municipality's existing water and sanitation tariffs are summarised in Table 7.3.1 under Topic 7 of the Administration, Information and Comprehensive Overview Report.</p>
<p>Recommendation and Strategy:</p> <p>See Section 7.3 under Topic 7.</p>
<p>Funding and Budget Requirements:</p> <p>Financial study to determine the impact of changing the sanitation tariff structure from a fixed annual amount to a stepped tariff based on water consumption in the future. Estimated cost of a financial analysis is R250 000.</p>
<p>Scorecard Result:</p> <p>4 out of 4: Indicating that the municipality has rising block tariffs in place that encourage water use efficiency</p>

ITEM 21: TECHNICAL SUPPORT TO CUSTOMERS

<p>Introduction: Municipalities should be able to offer support to customers (especially large customers) on WC/WDM initiatives.</p>
<p>Situation in Beaufort West LM:</p> <p>Beaufort West Municipality only provides technical support on WDM to any of their consumers on a reactive basis.</p>
<p>Recommendation and Strategy:</p> <p>The objective of a Technical Support programme is not limited to assisting consumers in reducing their water demand, but is also to look at wastewater, monitor compliance with by-laws and service conditions and offer general customer support. Once a dedicated person has been allocated to WC/WDM it is recommended to engage with large customers and to identify areas where the municipality can provide assistance. The proposed activities of this programme that can be budgeted for are as follows:</p> <ul style="list-style-type: none"> • Train existing staff; • Identify and visit large consumers (Checking that large consumers are correctly metered and billed, providing tips on WC/WDM, test the accuracy of all large consumer meters, install data-loggers on all large consumer meters and informing consumers of any sudden change in consumption patterns). • Arrange leakage inspections in public buildings; • Provide assistance and technical know-how for large consumers; and • Introduce compulsory water management plan for large consumers.
<p>Funding and Budget Requirements:</p> <p>No additional funding – pending the appointment of a dedicated person for WC/WDM.</p>
<p>Scorecard Result:</p> <p>2 out of 4: Indicating that the municipality only offers technical support on WDM on a reactive basis.</p>

ITEM 22: REMOVAL OF UN-AUTHORISED CONNECTIONS

<p>Introduction: Illegal or un-authorised water connections is a serious problem in South Africa and one with which very few municipalities can deal with effectively. Un-authorised connections directly impacts on the NRW and can also negatively impact on the operation of the system if too many illegal connections are made in one area.</p>
<p>Situation in Beaufort West LM:</p> <p>Smart prepaid water meters were installed in Merweville and the Municipality also busy with the installation of these meters in Nelspoort and Murraysburg. All "Cashflow" prepaid water meters will also be phased out. The Municipality needs to do a SWIFT</p>

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analysis of their financial billing system, in order to identify any potential unmetered erven.

Recommendation and Strategy:

Beaufort West Municipality should continue to remove un-authorised connections as and when they are detected. See Section 5.1.1.5.

Funding and Budget Requirements:

Estimated annual budget of R500 000 is required to install water meters at any unmetered erven.

Scorecard Result:

3 out of 4: The municipality selectively monitors and removes unlawful connections.

ITEM 23: COMMUNITY AWARENESS ON WDM

Introduction: Community awareness programmes are required to ensure that any WDM interventions are clearly understood and supported by the community they are designed to serve. In many cases, WDM interventions that are technically sound and have been properly implemented fail due to the fact that they do not carry the support of the community. It is therefore essential that any water utility wishing to promote water use efficiency or any form of WC/WDM intervention has a proper community awareness programme in place to support any technical interventions.

Situation in Beaufort West LM:

See Section 5.1.3 under Topic 5 of the Administration, Information and Comprehensive Overview Report. Awareness is being done on an ad-hoc basis via pamphlets, notices, newspaper articles and the local radio stations.

Recommendation and Strategy:

See Section 5.1.3

Funding and Budget Requirements:

It is estimated that R150 000 / year should be allocated for WC/WDM awareness campaigns and activities, material to be included with monthly water bills, placing notices in newspapers, billboards, competitions, etc.

Scorecard Result:

2 out of 4: Indicating that the municipality has very little involvement with workshops on water conservation within the communities.

ITEM 24: SCHOOLS EDUCATION ON WDM

Introduction: Schools are often key problem areas with regard to water wastage and often the situation within schools is so bad that they are not fit to house the scholars they teach. Education on the value of water and how to conserve water does not form part of any formal curriculum in schools and where such training is provided, it is normally through the local water service provider.

Situation in Beaufort West LM:

See Section 5.1.3.1 under Topic 5 of the Administration, Information and Comprehensive Overview Report.

Recommendation and Strategy:

See Section 5.1.3.1

Funding and Budget Requirements:

Allow a budget of approximately R50 000 per year for the implementation of WC/WDM measures at schools (Competitions, Awareness Raising events, etc.). The DWS can also assist the municipality with pamphlets and posters on WC/WDM initiatives.

Scorecard Result:

1 out of 4: Indicating that the municipality currently does not conduct workshops on water conservation within the schools, however these interventions are proposed.

ITEM 25: RETROFITTING

Introduction: In the context of WDM, retrofitting refers to projects that focus on fixing internal leaks and fitting of water efficient devices (i.e. water savings toilets, taps, etc.). In South Africa these types of projects have been mostly undertaken in the following buildings:

- Houses of Indigent users with high internal plumbing leakage, where consumers don't always have the funds or knowledge to fix the leaks themselves or to purchase water efficient devices.
- Public buildings with high internal plumbing leakage (i.e. schools, prisons, police stations, hospitals, etc.) It is a common problem in South Africa that many public buildings have high internal plumbing leakage and that water inefficient devices are still being used in the ablution facilities. One of the key contributors to water wastage in public buildings is tip-tray urinals. These urinals flush continuously and can be retrofitted with push button flush mechanisms, which will only flush when activated by a user.

Situation in Beaufort West LM:

See Sections 5.1.2.1 and 5.1.2.2 of the Administration, Information and Comprehensive Overview Report.

Recommendation and Strategy:

See Sections 5.1.2.1 and 5.1.2.2

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Funding and Budget Requirements:

Leak repair assistance programmes: R250 000 per annum for ongoing exercise to repair leakages at indigent properties using in excess of 20 kl/month. WSIG funding or "War on Leaks" funding from DWS can be requested in this regard.
Retrofitting: R500 000 for a pilot project in one of the public buildings.

Scorecard Result:

1 out of 4: Indicating that the municipality has not undertaken internal plumbing repairs in public buildings or inside properties of indigent users.

The way forward for Beaufort West Municipality with the implementation of the proposed WC/WDM Strategy is as follows:

- Develop a detailed methodology for measuring the performance criteria for each of the twenty-five (25) WC/WDM Strategy items;
- Allow for budget required to implement the various measures;
- Monitor the impact of all WC/WDM measures on an on-going basis;
- Develop key benchmarks for all KPIs and categories and assign responsibility; and
- Review WC/WDM Strategy as necessary.

Beaufort West Municipality needs to ensure that adequate funding is allocated under their Capital and Operational budgets towards the implementation of the WC/WDM Strategy. Key WDM projects to be taken into account during Beaufort West Municipality's capital budgeting process are as follows:

- Replacement of old water networks, implementation of Pipeline Replacement Programme (Areas with regular pipe bursts);
- Replacement of old bulk and consumer water meters (Implementation of meter management and replacement programme);
- Telemetry systems to provide for early warning;
- Installation of zone meters;
- Pressure Management;
- Leak detection; and
- Data loggers to establish MNFs

The WDM initiatives can deliver excellent return on investment if well implemented and well managed. All external funding that could be utilised by Beaufort West Municipality for this purpose should be sourced. The O&M Budget allocated to repairs and maintenance should be increased to address amongst other tasks the following:

- Replacement of malfunctioning and old bulk water meters and consumer meters;
- Construction of meter chambers for all bulk water meters not adequately protected against vandalism;
- Cleaning of bulk water meter boxes;
- Buying replacement mechanisms for bulk meters;
- Speedy repair of leaks; and
- Leak detection in areas with higher than expected night flows.

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5.1 WATER RESOURCE MANAGEMENT

Table 5.1.1: Master Plan for Water Resource Management		
Section	Master Plan	Yes / No
Reducing Unaccounted for Water and Water Inefficiencies	Is there a Master Plan that addresses this problem?	WC/WDM Strategy
	Does this Plan address this problem 100%?	Yes
Leak and Meter repair programmes	Is there a Master Plan that addresses this problem?	Part of Water Distribution Losses Policy and WC/WDM Strategy
	Does this Plan address this problem 100%?	Yes
Consumer/end-use demand management: Public Information and Education Programmes	Is there a Master Plan that addresses this problem?	Part of WC/WDM Strategy
	Does this Plan address this problem 100%?	Yes
Conjunctive use of surface- and groundwater	Is there a Master Plan that addresses this problem?	No
	Does this Plan address this problem 100%?	-
Working for Water	Is there a Master Plan that addresses this problem?	No
	Does this Plan address this problem 100%?	-

5.1.1 Reducing Unaccounted Water and Water Inefficiencies

During droughts (as experienced in the Western Cape over the period 2015-2017), some WC/WDM measures are often enforced by local government through water restrictions; however, and appropriate municipal water control (metering) and pricing structure (billing and revenue collection) could ensure that these measures become routine. The sustainability of future water services will largely depend on the ability of municipalities to properly maintain the reticulation systems, to minimise household plumbing leakages and to maintain pressurised supplies (assurance of supply) to justify payment from their clients for those services.

Beaufort West Municipality has responded to the need to address NRW and water losses within their jurisdiction by implementing various WC/WDM initiatives over the last number of years. The Municipality will also continue to actively implement the proposed WC/WDM Strategy in order to reduce the percentage of NRW and Water Losses and to improve water use efficiency within the various schemes as follows.

Table 5.1.1.1: Commitment to reduce NRW and water inefficiencies				
Distribution System	2023/2024		Committed Future NRW	
	NRW (%/a)	Water Losses (%/a)	2028 (%/a)	2048 (%/a)
Beaufort West	77.1%	76.9%	30.0%	15.0%
Merweville	46.5%	46.3%	30.0%	10.0%
Nelspoort	63.1%	62.9%	30.0%	15.0%
Murraysburg	93.4%	93.2%	30.0%	15.0%

Accurate billed metered consumption volumes from the billing system is the most critical element to accurately manage and reduce the NRW and water losses for the various water distribution systems.

Beaufort West Municipality needs to identify all their Large Water Users. Non-residential large users in Beaufort West Municipality have potential to reduce water consumption via reuse of water. It is suggested that meetings should be arranged with these large users. These meetings should be informative on the current water consumption status; potential water saving volumes; cultivate a water saving awareness within each large user and at least involve 50% of the large water users. Issues to be taken into account include the end user, the water quality and the infrastructure required.

5.1.1.1 Night flow metering

The implementation of a WC/WDM strategy does not only refer to measures that reduce water wastage and inefficient use, but also include measures to effectively manage and sustain efficiency targets. Some of the priority requirements are to install systems that measure and identify certain key parameters such as MNFs and systems to enable detailed and regular water audits and water balances.

Ongoing night flow analyses should be implemented as part of the normal operational activities of the Municipality. This will provide information on system performance and give direction for interventions. Night flow analysis is one of the most practical and economical ways to identify water leaks and losses.

Beaufort West Municipality needs to monitor the MNFs for specific zones in order to identify areas for the implementation of specific WDM activities (Pressure Management, Repair of leaks, etc.). The Municipality will also install zone meters in the future for the various distribution systems and link these to the financial data, in order to accurately determine the percentage of NRW for the specific zones.

The minimum night flow / average daily demand ratio needs to be used to prioritize leak detection for cost effectiveness (Note: 80% of losses come from 20% of leaks). The key performance indicators to be measured before and after the implementation of the various water demand management measures include the following:

- Total Consumption (MI / annum)
- Consumption per person (l / person / day)
- Consumption per property (KI / property / month)
- Minimum night flow (litres / second)
- Excess night flow (litres / second)
- Expected night flow (litres / second)

5.1.1.2 Day flow metering

Beaufort West Municipality is committed to continue to monitor the abstraction from all their sources, the raw water supply to all their WTWs, the final water from all their WTWs (System Input Volumes) and to meter all water used by consumers within the various towns.

The Municipality will also continue with the reading of all the internal bulk zone meters to enable the identification of poor performing and leaking distribution infrastructure for specific zones. The following considerations need to be taken into account when zone meters are installed.

- A suitable strainer needs to be fitted with every zone meter (three to five pipe diameters before). For ease of cleaning these strainer elements must be removable from the top.
- Gate valves for maintenance before and after meters.
- Select meters with accurate forward and reverse flow capability.
- High frequency bi-directional pulse outputs capability.
- Pressure tapping for downstream pressure monitoring.
- Consider meters with fully shrouded pre-calibrated as-sized mechanisms.
- Counter sealed meters to IP68 to prevent condensation.

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The Municipality needs to try to measure and analyse the MNFs at least every three years. The Municipality needs to keep stock of the meters at the depot so that meters can be replaced as soon as the Municipality becomes aware of a faulty meter.

A SWIFT analysis need to be done to determine all the unmetered erven and the metered erven with no consumption and very low consumption. The unmetered erven should be metered and consumers in the billing system should be updated where required. All meter boxes should also be cleaned regularly.

5.1.1.3 Reticulation leaks

In addition to the current practices regarding the repair of reticulation leaks Beaufort West Municipality also needs to progress to the point of actively identifying and repairing reticulation leaks that are not visible to the human eye. Beaufort West Municipality therefore needs to focus on active leak detection in the future. The Municipality also needs to continue with their pipeline replacement programme.

Leak detection should be conducted by means of a specialized leak detection company in areas of high MNF. The activity can be performed after the MNFs were calculated and the specific areas with high MNFs were determined.

The location of all pipe failures (Leaks) should be recorded per system with accurate GPS coordinates. This would improve the integrity of the pipeline replacement programme.

The leakage management programme should focus on system operations by considering each of the following:

- **Raw water supply and treatment.** The focus should fall on bulk water metering, reduced filtration loss at the WTWs and staff training.
- **Distribution system:** The focus should fall on pressure management, leak repair, consumer metering and billing and staff training.
- **End-users.** The focus should fall on awareness campaigns (to encourage high-income users to reduce on-property leaks) and on water audits and leak repair at individual properties (for low-income users in the free-basic water category).

Table 5.1.1.3.1: Tasks and tools that can be included in the Leakage Management component of a WDM Strategy

Question/Solution	Task
How much water is being lost? Measure components	IWA Water balance <ul style="list-style-type: none"> ▪ Improved estimation/measurement techniques ▪ Meter calibration policy ▪ Meter checks ▪ Identify improvements to recording procedures
Where is it being lost from? Quantify leakage Quantify apparent losses	Network audit <ul style="list-style-type: none"> ▪ Leakage studies (reservoirs, transmission mains, distribution network) ▪ Operational/customer investigations
Why is it being lost? Conduct network and operational audit	Review network practices Investigate: <ul style="list-style-type: none"> ▪ Historical reasons ▪ Poor practice ▪ Quality management ▪ Procedure ▪ Poor materials/infrastructure ▪ Local/political influences ▪ Cultural/social/financial

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Table 5.1.1.3.1: Tasks and tools that can be included in the Leakage Management component of a WDM Strategy

Question/Solution	Task
<i>How to improve performance?</i> Upgrade the network Design a strategy and action plans	Strategy development <ul style="list-style-type: none"> ▪ Update record systems ▪ Introduce zoning ▪ Introduce leakage monitoring ▪ Address causes of apparent losses ▪ Initiate leak detection/repair policy ▪ Design short/medium/long term action plans
<i>How to sustain performance?</i> Ensure sustainability with appropriate staffing and organisational structures	Training and O&M <ul style="list-style-type: none"> ▪ Improve awareness ▪ Increase motivation ▪ Transfer skills ▪ Introduce best practice/technology ▪ Community involvement ▪ Water conservation/demand management programmes ▪ Monitor action plan recommendations ▪ Introduce O&M procedures

5.1.1.4 Illegal connections

Beaufort West Municipality needs to monitor all erven with 0 kl consumption on a monthly basis from their financial data in order pick up on any illegal connections. The Swift Analysis should be used to identify erven with zero consumption (See Table 5.1.1.4.1 of the Administration, Information and Comprehensive Overview Report). A new Swift Analysis needs to be done. The Municipality will prioritise the installation of new water meters at the households with no meters or where the meters are faulty.

Types of illegal connections / use that can be identified include the following:

- Illegal use from fire hydrants;
- Illegal connections by consumers not currently serviced;
- Illegal individual household connections by consumers who are authorised for yard or standpipe delivery; and
- Illegal connections by developers and construction companies.

The disconnection of illegal connections can be sensitive if it involves consumers who are not currently serviced by the Municipality. It is therefore necessary to develop appropriate policies and procedures on how to deal with such situations. The activities of such a programme that needs to be budgeted for are as follows:

- Review / develop policies, procedures and by-laws regarding illegal connections;
- Carry out an investigation to identify illegal connections throughout the Municipality;
- Disconnect or legalise existing illegal connections;
- Check fire hydrant seals every three years; and
- Police and enforce by-laws with regards to water connections for developers.

5.1.1.5 Un-metered connections

All potential un-metered consumer connections, as identified through the recommended Swift analysis, need to be provided with meters and the Municipality needs to continue to read all the meters on a monthly basis. All parks, which make use of irrigation water, and all communal facilities should also be provided with meters.

In addition to water theft, many water accounts go unnoticed in the system or have some type of data inconsistency that results in no revenue being generated for the particular water use event. Beaufort West Municipality therefore needs to continue with the cleaning of the data in the financial billing system in order to identify and correct any inaccurate data in the system. The Swift analysis should also be used for this purpose.

5.1.2 Leak and Meter Repair Programmes

5.1.2.1 Leak Repair Assistance Programmes

Beaufort West Municipality should prioritise assistance programmes in the informal and low cost housing development areas. Such assistance programmes should include a number of measures that will ensure efficient water usage and build trust between consumers and the Municipality. Houses in these areas are not always adequately maintained, which often result in significant plumbing leaks. A Leak Repair and Assistance Programme that investigates and repairs leaks at all domestic households in low cost housing developments and poor areas with consumption above 15 kl / month should be implemented. Leak programmes should include the following tasks:

- Identify areas with high MNFs. Record these flows before the project starts in order to ensure that the overall savings achieved by the project can be calculated.
- Visit properties occupied by indigent households on a prioritized basis (highest consumption first).
- Educate the customer about the project and water saving measures.
- Audit of properties for plumbing leaks and repair the leaks.
- Charge the owner for the plumbing repairs through the municipal account. If the consumption is maintained at a reasonable level for a period of 6 months and the current account is paid monthly and on time, the water arrears can be negotiated with the owner.
- Meters found to be faulty should be replaced.
- Identify where there may be inefficient water usage and water wastage.
- Identify the number of people living at the property so as to determine a reasonable water usage.
- Determine an affordable consumption.
- Social intervention – Awareness campaigns, education, public participation, etc.

Mechanisms for ensuring the customer repairs new water leaks, maintains an affordable consumption and does not build up arrears need to be addressed in the early stages of such a project, in order to ensure a sustainable solution (ongoing water and cost savings) is achieved. The consumptions of the repaired properties need to be monitored so that rapid action can be taken should leaks re-occur. Further efforts should be made to ensure that those who qualify as “Indigent” on an income basis will also qualify on a water consumption basis.

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The challenges of effective management of water supply in low-income areas are significantly different from water supply in middle and higher income residential areas. Some of the common problems often linked to low-income areas that have existing individual house connections are as follows:

- Plumbing leaks (past the consumer meter) in excess of 20 kl / month;
- Poverty;
- Inferior or inadequate reticulation system;
- Inadequate consumer metering and billing;
- Very low levels of payment;
- High levels of reticulation losses;
- Very high levels of inefficient water usage;
- Consumer apathy; and
- Inferior plumbing installations

The aim of a comprehensive water management programme in low-income areas is to introduce a holistic approach that will capacitate consumers to take responsibility for their Water Services. The programme will introduce a combination of social, technical and regulatory interventions that will meet the requirements of the consumer and at the same time reduce non-revenue demand to sustainable levels. This approach recognises the social, technical and historical background of the many water supply problems and instead of focusing on getting the consumer to pay for excessive water demand, it assists the consumer in reducing and controlling the demand to affordable levels. It recognizes that rather than increase income to meet the cost of water supply in low-income areas, it is preferable to reduce the water supply and the costs to affordable levels for both the community and the Council.

The proposed comprehensive water management programme for low-income areas will vary to the specific conditions of each area, but will generally consist of the following elements:

- Social Interventions: Awareness; Communication; Education; Public participation; and Refining and improving the Indigent Policy.
- Technical Interventions – Household: The installation or repair of meters or alternatively the installation of flow limiters and / or prepayment meters; the repair of plumbing leaks; and Retro fitting of toilets, taps and showers.
- Technical Interventions – Reticulation: Rehabilitation of reticulation system; Installation of pressure reducing valves; Leak detection and repair; and Installation of zones valves and meters.
- Regulatory / Financial Interventions: Credit Control; Enforcement of by-laws; Signing of service agreements; and Validation and correction of billing information.
- Maintenance Programme: Water forum; On-going awareness; and Establishment and support of a community water task team.

5.1.2.2 Retro-fitting of water efficient toilets

Lawn irrigation and toilet use are the two end-uses with the biggest impact on water demand in relation to other end-uses, with outdoor irrigation having by far the largest saving potential. In addition, water at these end-uses is not needed at potable standards. Improved, practical techniques for water supply and reuse with regards to garden watering and toilet flushing should be sought in addition to improved efficiency of use.

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The nature of retro-fit projects can include the following:

- Change existing toilets to dual flush cisterns;
- Install high efficiency shower heads;
- Install flow controllers on taps and mixers;
- Balance plumbing systems (to be paid fully by consumer)
- Automated irrigation systems.

The retro-fit measures need to include education campaigns. Other considerations to take into account in considering the retrofit programmes are as follows:

- Limited experience of such projects in South Africa;
- Constraints on available products;
- Constraints on existing plumbing installations in households (i.e. should not install water efficient showers in a non-balanced system)
- Possible resistance by consumers;
- Overcoming the logistics of investing Council money in private properties.

Beaufort West Municipality needs to focus on the installation of water saving devices (specific water efficient toilets) in all their municipal buildings. The Municipality also needs to focus on raising awareness regarding conservation projects and the installation of these products in order to reduce the water demand and their percentage of NRW.

The use and installation of these fittings should be included as a condition for the approval of building plans as well as provided for in the Water Supply By-law, which needs to be updated.

5.1.2.3 Meter repair programme

Beaufort West Municipality should place a very high priority on maintaining water meters in a good state or order by replacing old meters with new ones on a regular basis, and by identifying problem-meters for repair or replacement. All bulk water meters should also be located in meter chambers that adequately protect the meter from vandalism. Meter chambers also need to be cleaned regularly.

All consumer meters not working, as identified through the recommended Swift analysis and follow-up inspections, need to be replaced and any leaks identified during the site inspections need to be repaired. The Municipality also needs to focus on a phased pro-active meter replacement programme in the future, where all the old water meters are replaced systematically.

Replacing all meters after a certain age is not economically feasible and a more sophisticated approach needs to be developed and implemented, which recognises that certain meters under certain conditions may be accurate for several more years than others. An effective meter repair programme needs to achieve the following objectives:

- Determine an ongoing meter replacement programme;
- Determine exceptions reports on meters which are suspected to be faulty;
- Test and replace faulty meters; and
- Size meters correctly.

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A rough estimate of the number of meters that need to be replaced every year is the number of meters divided by 12, assuming that the life of the meters is not more than 12 years. Although it is assumed that the average lifespan of a meter is 12 years for budgeting purposes, it is necessary to carry out research to determine the most optimal replacement of age for each type of meter in various circumstances. The research should identify the different types of meters, in different pressure zones and carry out accuracy tests for a number of samples at different ages. In this way a policy can be developed of when each type of meter under various circumstances should be replaced. It is also recommended that, where deemed necessary new meters should be specified with AMR capacity to allow for remote meter reading. Such meters will assist in reducing meter-reading errors significantly.

The monthly consumption of all consumers should be checked to immediately identify a problem meter (where a reading suddenly becomes very high) and have it inspected. This will ensure that faulty or leaking meters are replaced as soon as possible and thus resulting in less water wastage and a greater income for the Municipality. Volume controllers can also be installed in areas where people cannot afford to pay for water. This ensures less water being wasted in the event of a leak or a tap left running.

5.1.3 Consumer / End-use Demand Management: Public Information and Education Programmes

The approach of promoting WC/WDM to consumers and society can be divided into a general consumer awareness education campaign for all consumers and a specific awareness campaign associated with focused projects such as plumbing leak repair, retrofitting projects, etc. The measures and projects that can be implemented are as follows:

- Generic consumer awareness campaign
- School education (Focus on schools)
- Special events
- Develop a WC/WDM web page

5.1.3.1 Schools Targeted by Education Programmes

Schools are considered to have a good potential to achieve water savings in the Beaufort West Municipality's area and of course have the added advantage of user education for the future generation. An extensive schools programme, which might also include annual competitions between schools (say with a prize for the lowest consumption, the lowest per capita consumption and for the best WDM-strategy poster design, etc.) can be implemented.

Water saving by schools often forms the basis of WDM programmes elsewhere, because it also involves learners who experience implementation of WDM measures first hand. Schools should be encouraged to make WDM programmes part of a long term project, where learners should be actively involved. A schools WDM programme should receive a high priority. The activities of such a programme can include the following:

- Develop and distribute additional literature to schools;
- Hold school competitions (link to Water Week); and
- Assist / promote water audits, retrofitting of plumbing and use of boreholes.

5.1.3.2 Consumers Targeted by Public Information Programmes

Beaufort West Municipality will continue with their current approach of adding helpful hints on effective water usage to the monthly bills. Community awareness programmes are required to inform consumers of the importance of WC/WDM. These awareness programmes ensure that any WDM interventions are clearly understood and supported by the community they are designed to serve. In many cases, WDM interventions that are technically sound and have been properly implemented fail due to the fact that they do not carry the support of the community. It is therefore essential that any Municipality wishing to promote water use efficiency or any form of WC/WDM intervention has a proper community awareness programme in place to support any technical interventions.

Education and awareness-raising campaigns are important mechanisms to bring the need for WC/WDM to the public and to trigger committed public actions and response. Social awareness is one of the key pillars of WC/WDM and is essential for the balanced and sustained use of South Africa's water resources. Engagement with the public and stakeholders through media and other mediums will highlight important principles of the efficient use of water, to ensure that relevant information is shared and the public is educated and that the profile of WC/WDM is heightened to achieve buy-in, involvement and accountability from citizens.

The outcome of an awareness campaign may be difficult to measure and it is for this reason that it is difficult to determine the amount of resources and intensity of such campaigns. It is also important to keep such campaigns fresh and interesting in order to ensure a progress impact on behaviour change.

The objectives of a generic WC/WDM awareness campaign are as follows:

- Inform consumers on the reason why water needs to be saved;
- Inform consumers on how to save water (link to programmes to promote water-wise gardening, water-efficient plumbing fittings, use of alternative resources and large users); and
- Inform consumers of various projects or initiatives that may have an impact on them.

The activities and programmes that need to be budgeted for are as follows:

- Press releases
- Development and distribution of leaflets, fliers and posters;
- Distribution of small gadgets and stickers;
- Billboards, shopping centres and washrooms;
- Competitions;
- Develop a WC/WDM information help-line (can be a recording)
- Hold public workshops and seminars.

5.1.4 Conjunctive Use of Surface- and Groundwater

The DWS developed an Artificial Recharge Strategy, which outlines all the environmental benefits of artificial recharge and details the global and southern African history of the technique. It also provides hydrogeological maps showing the areas with the greatest potential storage volumes. Clear criteria are also outlined for successful implementation, including high-quality surface water that is geo-chemically compatible with the existing groundwater and aquifer hydraulics which must allow for the recharged water to enter the aquifer rapidly and be contained within it. There is several management and technical issues around artificial recharge and good feasibility planning and testing are essential, with the correct siting of borehole injection points being an important factor. Clogging is identified as the key problem in most

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schemes around the world. Methods to prevent this from happening are detailed in the document along with the principles of 'safe yield' to ensure that groundwater levels are not raised or lowered beyond critical points.

The additional supply from groundwater will also reduce the risk of no bulk water supply to the areas during drought periods. The potential for the artificial recharge of the aquifers in Beaufort West Municipality's Management Areas are options that will be investigated by Beaufort West Municipality in the future.

A large number of the existing production boreholes in Beaufort West were vandalized over the last number of years, which resulted in a lower level of assurance of supply from the groundwater resources. Approximately 46.7% of the safe yield of the groundwater resources of Beaufort West is currently not available, due to non-operational or vandalised boreholes.

5.1.5 Working for Water

Working for Water Programme of the DWS is currently clearing invasive alien plants in many of the catchments in the Western Cape. This initiative creates employment for previously disadvantaged communities as part of the Expanded Public Works Programme. The focus is on removing invasive alien plants from riparian zones and mountain catchments.

It is important for Beaufort West Municipality to identify ways in which they can support these initiatives of which the objectives should be as follows:

- Job creation and poverty relief through the eradication of alien invasive plant species.
- Provision of a sustainable source of drinking quality water.
- Protection of biodiversity through eradication of alien invasive species.
- Reducing the risk of fire in catchment areas.

Apart from the increased runoff gained from alien vegetation clearing these projects are often funded from "outside" and could thus become a valuable source of job creation and income to the Beaufort West Municipality's poorer population areas that are typically employed to conduct the clearing operations.

5.1.6 Water Resource Management Projects

Beaufort West Municipality is committed to ensure that adequate funding is allocated under their Capital and Operational budgets towards the implementation of the WC/WDM initiatives. All external funding that could be utilised by Beaufort West Municipality for this purpose should be sourced.

The O&M Budget allocated to repairs and maintenance should be increased to address amongst other tasks the following:

- Replacement of malfunctioning and old consumer meters;
- Clearing of meter boxes;
- Buying replacement mechanisms for bulk meters;
- Speedy repair of leaks; and
- Leak detection in areas with higher than expected night flows.

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Key WDM projects to be taken into account during the capital budgeting process are as follows:

- Replacement of old water networks (Implementation of Pipeline Replacement Programme);
- Replacement of old bulk and consumer water meters (Implementation of Meter Management and Replacement Programme);
- Telemetry systems to provide for early warning;
- Installation of zone meters;
- Pressure Management;
- Leak detection; and
- Data loggers to establish MNFs.

The WDM initiatives can deliver excellent return on investment if well implemented and well managed.

5.2 WATER BALANCE

A segregated single variable future water requirement model was developed for the WSDP and is available in electronic format. The projected future water requirement models for the various schemes are included in Annexure B. The future water requirement for each of the schemes is obtained by means of this model. It is used in this analysis to estimate the future water requirement for each of the distribution systems. The model differentiates between the different income levels. Different litre per capita per day (l/c/d) was allocated for the different income levels, and also for the different time steps evaluated where necessary. The model was calibrated by balancing the measured demands for 2023/2024 with the projected water requirements for 2023/2024, by changing the allocated litre per capita per day (l/c/d).

Input variables for the water requirement model include the population for 2023, the litre per capita per day (l/c/d), the percentage NRW as well as the quantity (kl/d) of water used by industrial and other water users. The commercial and other water users' demands for 2023 were calculated from the 2023/2024 billed metered consumption data. The future growth rate of the commercial and other water usages were estimated at 2% per year for Beaufort West and 1% per year for Merweville, Nelspoort and Murraysburg.

The projected future water requirements for the various distribution systems are included in Annexure B. Beaufort West Municipality is committed to address the challenges with regard to the flow meters at the various WWTWs for the inflow to the plants, the quantity of treated effluent re-used and the quantity of treated effluent returned to the Water Resource System.

Water services must be provided in a manner that is consistent with the broader goals of integrated water resources management. There is therefore a need for an integrated planning approach between the development of water services and water resources.

The Infrastructure Leakage Index (ILI) can be used by Beaufort West Municipality to determine an appropriate benchmark for managing the water losses according to their own specific circumstances. This ILI can also be compared with the averages for other towns within South Africa. The annual water losses within the various towns' distribution networks are therefore important indicators of the performance of the water supply and distribution systems.

Beaufort West Municipality should assess the strategic gaps in their IWA water balance data (See Sections 5.2.1 to 5.2.4) and record those flows, both water and sewerage, which are strategic in terms of medium to long term planning. A prioritisation of these locations should subsequently follow with budget allocated to improve the availability and accuracy of the IWA water balance data.

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Beaufort West Municipality should continue to update their IWA water balance models on a monthly basis in order to determine the locations of wastage and to enable the Municipality to manage their NRW and Water Losses. The water balance will not directly lead to the reduction of the demand, but is an imperative management tool that will inform the implementation of demand side management initiatives.

Beaufort West Municipality is committed to keep record of all bulk meter readings, flows at their WTWs and WWTWs and to update the IWA water balance models on a monthly basis in order to determine locations of wastage and to enable Beaufort West Municipality to actively implement the WC/WDM Strategy in order to reduce their current NRW and water losses. **All bulk zone water meters need to be recorded on at least a monthly basis (Meters at reservoirs and pump stations).**

5.2.1 Water Balance for Beaufort West

The following areas need to be focused on for the IWA water balance of the Beaufort West system.

- Continue to ensure that all borehole meters, WTW meters, meters at reservoirs and pump stations and meters on bulk supply pipelines are read and recorded on at least a monthly basis.
- Continue to ensure that all borehole meters and meters at reservoirs and on bulk supply pipelines are read and recorded on at least a monthly basis. All bulk water meters to be adequately protected in lockable meter chambers to prevent vandalism and damage to the meters.
- Financial Department needs to ensure that all meters are read and billed on a monthly basis (No estimates). The volume of water of any estimated account needs to be included in the billing system, in order to ensure that the billed metered consumption figures are accurate.
- All “Cashflow” prepaid water meters need to be phased out.
- Swift analysis needs to be carried out in order to identify unmetered erven, erven with a meter, but with zero consumption, erven with very low consumption and erven not included in the billing system.
- Inflow and outflow meter readings at WWTW to be recorded and made available for the WSDP.

5.2.2 Water Balance for Merweville

The following areas need to be focused on for the IWA water balance of the Merweville system.

- Continue to ensure that all borehole meters and meters at reservoirs and on bulk supply pipelines are read and recorded on at least a monthly basis.
- Financial Department needs to ensure that all meters are read and billed on a monthly basis (No estimates). The volume of water of any estimated account needs to be included in the billing system, in order to ensure that the billed metered consumption figures are accurate.
- All “Cashflow” prepaid water meters need to be phased out.
- Swift analysis needs to be carried out in order to identify unmetered erven, erven with a meter, but with zero consumption, erven with very low consumption and erven not included in the billing system.
- WWTW flow at the oxidation pond system to be metered.

5.2.3 Water Balance for Nelspoort

The following areas need to be focused on for the IWA water balance of the Nelspoort system.

- Bulk water meters need to be adequately protected in lockable meter chambers.
- Continue to ensure that all bulk water meters are read and recorded on at least a monthly basis.
- Financial Department needs to ensure that all meters are read and billed on a monthly basis (No estimates). The volume of water of any estimated account needs to be included in the billing system, in order to ensure that the billed metered consumption figures are accurate.
- All “Cashflow” prepaid water meters need to be phased out.
- Swift analysis needs to be carried out in order to identify unmetered erven, erven with a meter, but with zero consumption, erven with very low consumption and erven not included in the billing system.
- Faulty flow meter at the main sewer pump station to be repaired and readings to be recorded on a daily basis.

5.2.4 Water Balance for Murraysburg

The following areas need to be focused on for the IWA water balance of the Murraysburg system.

- Continue to ensure that all borehole meters and meters at reservoirs and on bulk supply pipelines are read and recorded on at least a monthly basis.
- Financial Department needs to ensure that all meters are read and billed on a monthly basis (No estimates). The volume of water of any estimated account needs to be included in the billing system, in order to ensure that the billed metered consumption figures are accurate.
- All “Cashflow” prepaid water meters need to be phased out.
- Swift analysis needs to be carried out in order to identify unmetered erven, erven with a meter, but with zero consumption, erven with very low consumption and erven not included in the billing system.
- Faulty flow meter at the main sewer pump station to be repaired and readings to be recorded on a daily basis. Meter readings of the meter at the irrigation pump station at the WWTW to be read and recorded on a daily basis.

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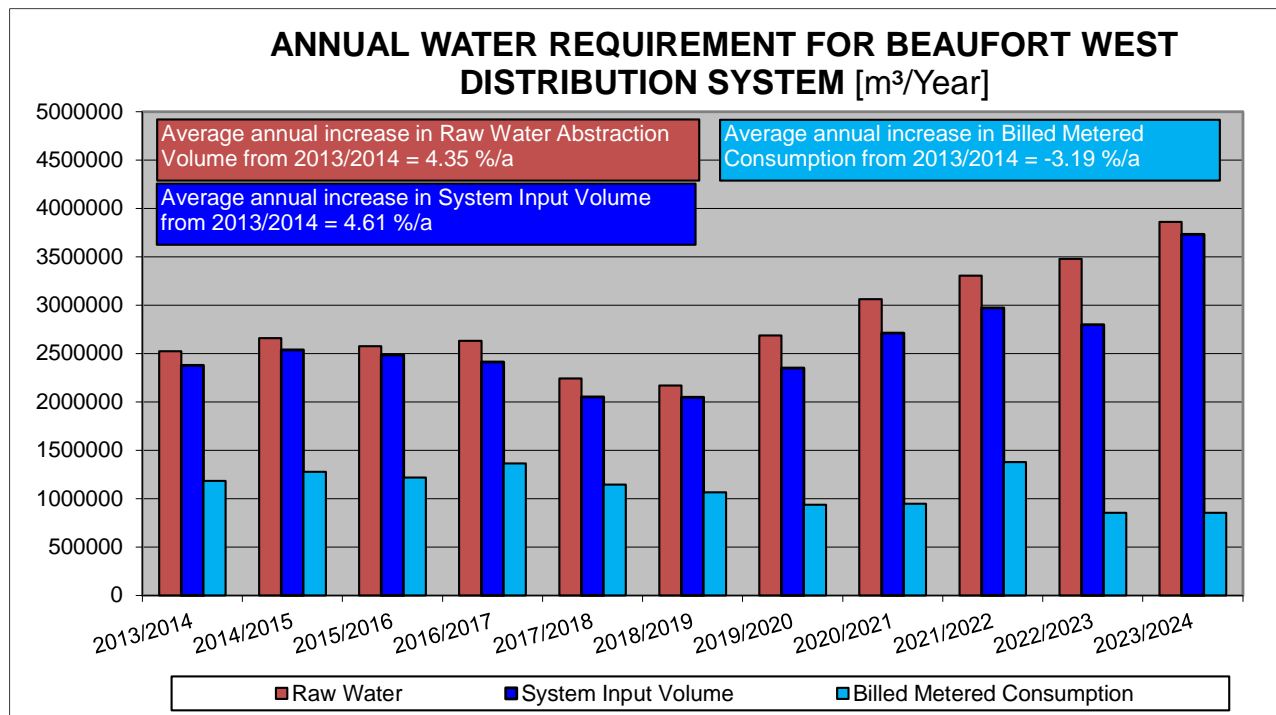
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5.3 WATER LOSSES

The IWA Water Balances for the various schemes are included in Annexure C of the Administrative, Information and Comprehensive Overview Report. Water losses from distribution systems are inevitable and cannot be completely eliminated. Such losses may be due to infrastructure-related problems, administrative related problems or theft and do have financial implications for Beaufort West Municipality.

The effective implementation of the proposed WC/WDM Strategy will enable Beaufort West Municipality to reduce their current extremely high NRW and Water Losses for the various distribution systems over the next five years.

Beaufort West: The treatment losses at the WTW (5.8% for 23/24) and the bulk water distribution losses (1.1% for 23/24) are at excellent levels. The NRW and Water Losses are however extremely high and above DWS's NRW target of 30%. It can be noted on the graph below that there were a constant growth in raw water volume and system input volume over the last six financial years, but the billed metered consumption volume decreased over this six year period.

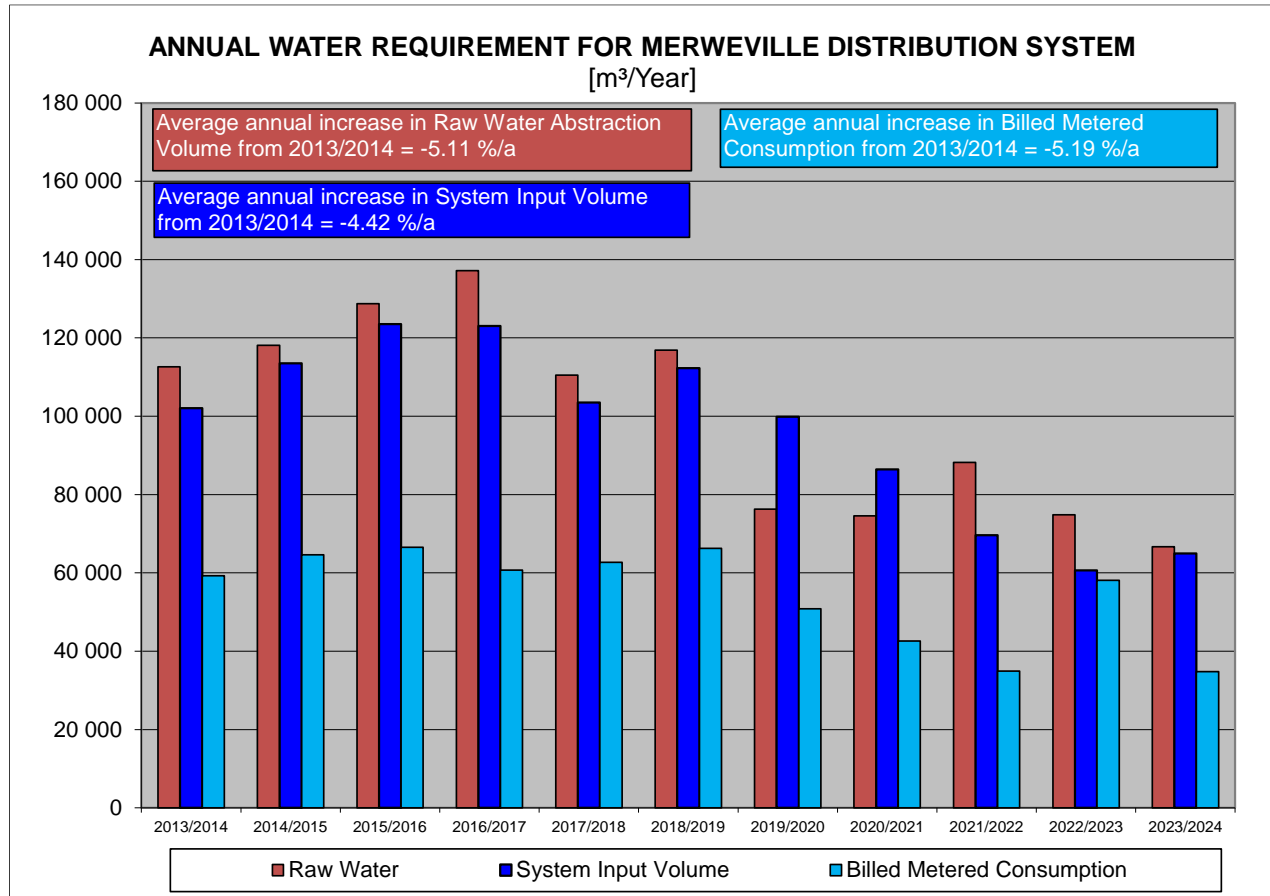


The billed metered consumption figures from the billing system is not accurate, because estimated volumes (Metered connections where the readings were estimated for a specific month) are not recorded in the billing system and the volumes of the "Cashflow" prepaid water meters are also not recorded in the system. It is therefore not possible to accurately calculate the NRW and Water Losses for Beaufort West. The Municipality needs to work towards a NRW target of 30% and water losses target of 25% for Beaufort West. The ILI of 12.35 indicates a bad management system, which requires immediate water loss reduction interventions.

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Merweville: The total borehole abstraction volume and the system input volume compares well for Merweville, with only 2.55% bulk distribution losses for the 2023/2024 financial year. The installation of the smart prepaid water meters resulted in a decrease of the raw water volume and the system input volume, which is good. The estimated volumes for the “Cashflow” prepaid water meters were too high during the 2022/2023 financial year, therefore the very low NRW (4.1%) and water losses (3.9%) for the 2023/2024 financial year.

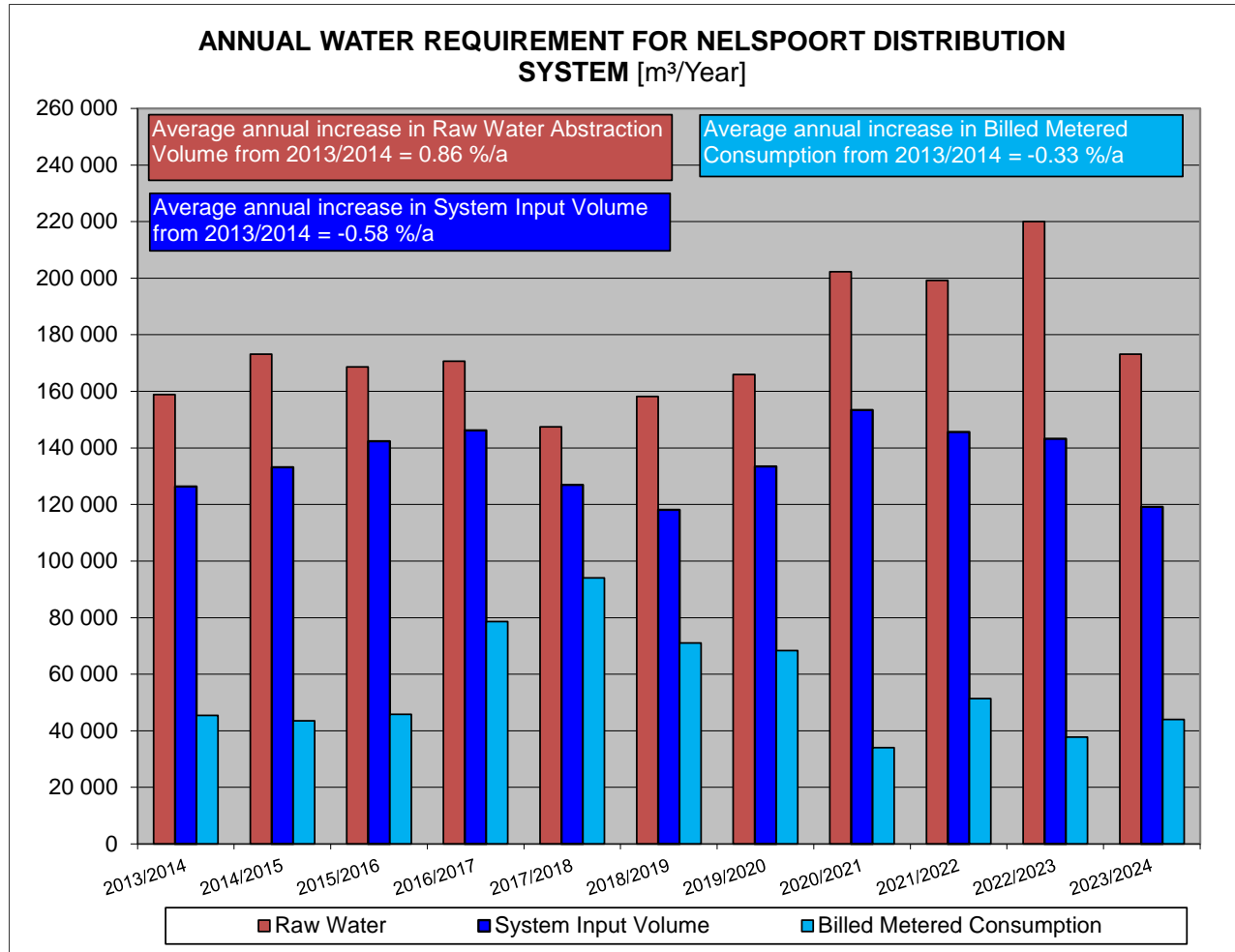


The NRW of 46.5% for the 2023/2024 financial year is above DWS's NRW target of 30%. The Municipality needs to work towards a NRW target of 30% and water losses target of 25% for Merweville. The ILI of 6.23 indicates a poor management system, which requires attention.

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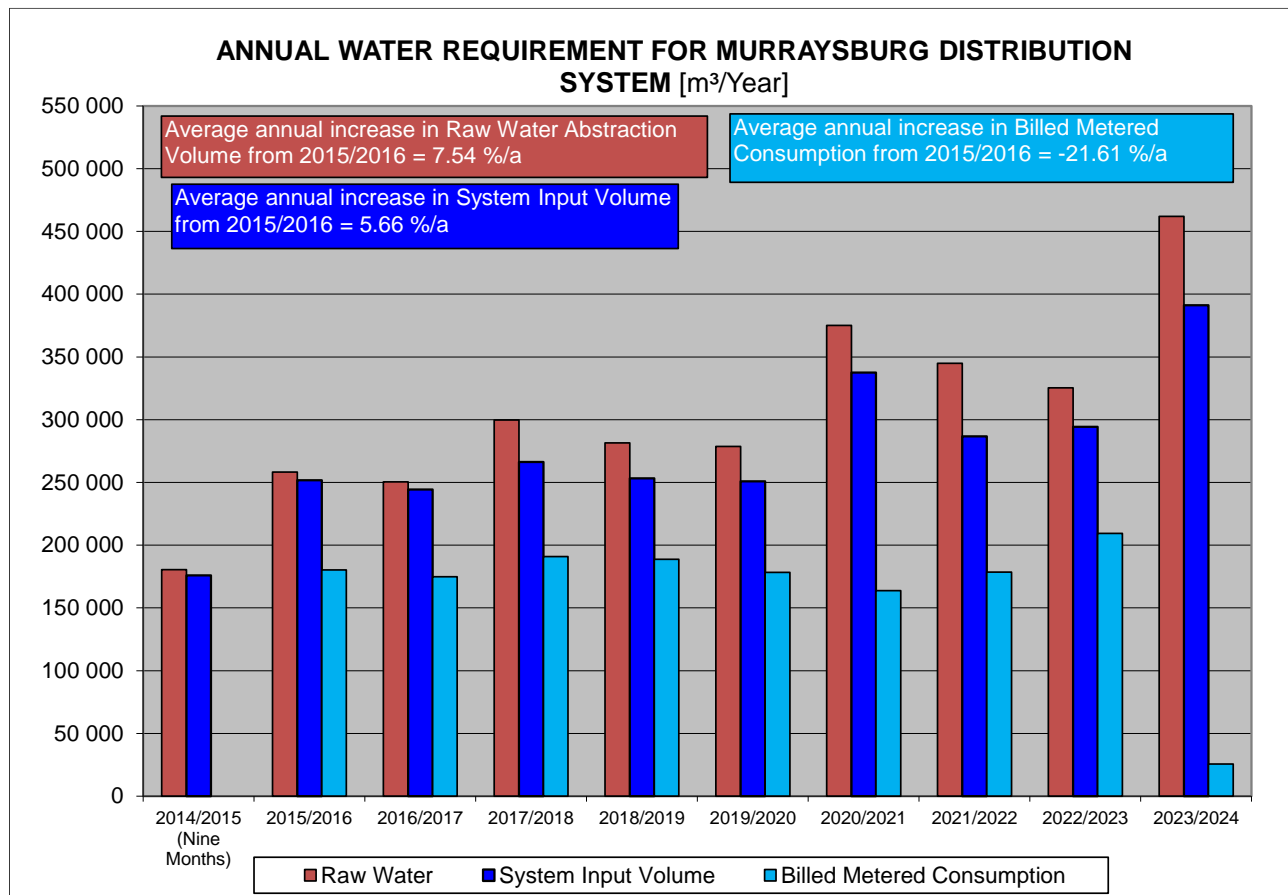
Nelspoort: The treatment losses of 28.9% for the last financial year is high and the Municipality can implement measures to reduce the treatment losses to acceptable levels. The bulk distribution losses is very low, which is excellent. The Municipality started with the installation of smart prepaid water meters, which resulted in a reduction of the raw water and system input volumes, which is good. The NRW of 63.1% for the 2023/2024 financial year is extremely high and above DWS's NRW target of 30%. The Municipality needs to work towards a NRW target of 30% and water losses target of 25% for Nelspoort. The ILI of 6.97 indicates a poor management system, which requires attention.



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Murraysburg: The billed metered consumption volume decreased drastically during the last financial year. The NRW therefore increased from 28.85% in 2022/2023 to 93.43% in 2023/2024. The billed metered consumption figures from the billing system is not accurate, because estimated volumes (Metered connections where the readings were estimated for a specific month) are not recorded in the billing system and the volumes of the “Cashflow” prepaid water meters are also not recorded in the system. It is therefore not possible to accurately calculate the NRW and Water Losses for Murraysburg. The Municipality started with the installation of smart prepaid water meters and the phasing out of the “Cashflow” prepaid water meters, which will improve the billed metered consumption volumes.



It is currently not possible to accurately calculate the NRW and Water Losses of the various towns in Beaufort West Municipality, because of inaccurate billed metered consumption volumes from the Financial System, as discussed under Section 5.2 of Topic 5 of the Administration, Information and Comprehensive Overview Report. The following measures need to be put in place to accurately calculate the billed metered consumption volumes for each of the towns.

- Financial Department needs to ensure that all meters are read and billed on a monthly basis (No estimates). The volume of water of any estimated account needs to be included in the billing system, in order to ensure that the billed metered consumption figures are accurate.
- All “Cashflow” prepaid water meters need to be phased out.

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TOPIC 6: WATER RESOURCES

6. WATER RESOURCES

The key water resources strategic messages flowing from the DWS's detailed Reconciliation Strategies can be summarised as follows:

- WC/WDM is extremely important in all areas. South Africa cannot afford to waste any more water, anywhere.
- Groundwater is important, is currently under-valued and is under-used.
- There is huge potential for increasing re-use of waste water, at the coast as well as in inland systems.
- There is limited opportunity for more dams and transfer schemes, but this option is inevitable in certain areas; however, at great cost.
- Desalination:
 - Small-scale seawater desalination is already being used in certain areas;
 - Mine water desalination is becoming more important; and
 - Desalination of seawater on a large scale is imminent.
- Catchment rehabilitation, clearing of invasive alien plants and rainwater harvesting is growing in importance.
- It is possible to make more water available anywhere in the country in the future, but at sharply rising costs.
- The cost of water at the coast will, over the long term, increase and approach the cost of the desalination of seawater. However, it will be very expensive to support the inland areas with desalinated seawater as this option will require significant transfer costs.
- Additional water for increasing irrigation in South Africa is very limited and moving some water from irrigation to other uses is already being considered in certain areas.
- There is a debate about virtual water and importing food from neighbouring countries with high food production. The potential for this option must be broadened. No water should be used to produce bio-fuels under irrigation.

Table 6.1: Master Plan for Water Resources

Section	Master Plan	Yes / No
Current Water Sources	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Additional Sources Available	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Monitoring	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Water Quality	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes
Operation	Is there a Master Plan that addresses this problem?	Yes
	Does this Plan address this problem 100%?	Yes

6.1 SOURCES AND VOLUMES

WSAs have the responsibility to comply with the NWA with regard to water resources management as follows.

- WSAs have the right to use water for any of the uses defined in Section 21 of the NWA, subject to conditions that may be set by the relevant authority (either the DWS or the relevant CMA), including the provision of water services to its constituent.
- WSAs have the responsibility to apply for water use licences for any water use defined in Section 21 of the NWA in accordance with the procedures and requirements defined in the Act, specifically noting the requirements of Section 27 of the NWA.
- Where the provision of water services has been contracted to a WSP in terms of a service delivery agreement or contract, such agreement or contract should specifically determine who is responsible for application of water use licences. If no such provision is made in the agreement or contract, it shall be assumed that this responsibility remains with the WSA.
- As an owner, controller or occupier of land where an installation may cause pollution of a water resource, such as a WWTW and effluent discharge works, the WSA must take all reasonable measure to prevent pollution from occurring, as provided for in Section 19 of the NWA, and must comply with the conditions set in any licence permitting effluent disposal.

Metering of all water supplied is one of the most significant steps in order to properly plan and manage water sources. Without metering no management is possible. Beaufort West Municipality needs to continue with the monthly reading of all their existing bulk water meters, which is a valuable source of information.

The uncertainty in projected water-related climate change impacts is one of the biggest challenges facing water managers. The managers must understand how this uncertainty influences the management decisions to be made and that decisions must be appropriate to a possible range of scenarios. A critical tool in this regard is adaptive management, in which water resource systems are carefully monitored and management actions are tailored and revised in relation to the measured changes on the ground. One cannot predict climate change impacts with any certainty, and the recognition of this uncertainty must be built into all climate change response strategies.

The Central Karoo Region experience regular droughts, with limited surface water resources available in the Region. Most of the towns are therefore largely dependent on groundwater resources. Drought restriction measures often needs to be implemented to reduce the water requirements of the towns. WC/WDM measures to lower the extremely high NRW and Water Losses of Beaufort West Municipality and the future water requirements of Beaufort West are critical at this stage. The existing non-operational and vandalised boreholes in Beaufort West need to be put back into operation as soon as possible. The augmentation of the existing water resources with additional groundwater sources are also critical.

Future water requirement projection models were developed for each of the towns within Beaufort West Municipality's Management Area and are included in Annexure B. These models include the future projections up to 2048 and were calibrated by using historic billed metered consumption data and bulk metered abstraction data. The percentage NRW was determined for each of the distribution systems and growth in demand was based on agreed population and growth figures. The reduction in NRW, as indicated in Table 5.1.1.1, was taken into account for the projected future water requirements.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 6: WATER RESOURCES

The table below gives an overview of the different future water requirement projections for the various distribution systems.

Table 6.1.1: Projected future water requirements of towns						
Distribution System	Model	PROJECTED FUTURE WATER REQUIREMENTS (MI/a)				
		2028	2033	2038	2043	2048
Beaufort West	2.0% Annual Growth	4 260.685	4 704.141	5 193.751	5 734.321	6 331.154
	3.5% Annual Growth	4 583.322	5 443.548	6 465.228	7 678.662	9 119.842
	WSDP Model	3 841.959	3 955.323	4 078.157	4 210.832	4 353.771
	Yield surplus (+) / shortfall (-) *	-615.383	-728.747	-851.581	-984.256	-1 127.195
	Yield surplus (+) / shortfall (-) **	+1 109.741	+996.377	+873.544	+740.869	+597.929
Merweville	1.0% Annual Growth	70.060	73.634	77.390	81.338	85.487
	2.0% Annual Growth	73.598	81.258	89.716	99.053	109.363
	WSDP Model	66.978	70.082	73.371	76.855	80.546
	Yield surplus (+) / shortfall (-)	+90.072	+86.967	+83.678	+80.195	+76.503
Nelspoort	1.0% Annual Growth	181.936	191.217	200.971	211.222	221.997
	2.0% Annual Growth	191.123	211.015	232.978	257.226	283.999
	WSDP Model	169.571	174.397	179.430	184.678	190.148
	Yield surplus (+) / shortfall (-)	+207.923	+203.097	+198.064	+192.816	+187.346
Murraysburg	1.0% Annual Growth	485.558	510.327	536.358	563.718	592.473
	2.0% Annual Growth	510.076	563.166	621.780	686.496	757.947
	WSDP Model	458.405	478.161	499.071	521.207	544.645
	Yield surplus (+) / shortfall (-) ***	+223.298	+203.542	+182.632	+160.496	+137.059

Notes: * Status Quo, yield from vandalised and non-operational boreholes not available

** All vandalised and non-operational borehole put back into operation

*** Exclude available yield from three Steenwerke boreholes

The table below gives an overview of the years in which the annual water requirements are likely to exceed the safe yields of the various resources for the different systems. The information is also presented on the graphs in the future water requirement projection models included in Annexure B.

Table 6.1.2: Years in which the annual water requirements are likely to exceed the safe yields of the various resources				
Distribution System	Safe yields of all sources (MI/a)	Annual Growth on 2023/2024 Demand (Low Growth)	Annual Growth on 2023/2024 Demand (High Growth)	WSDP Projection Model
Beaufort West	3 226.576 (Status Quo)	Over (2.0%)	Over (3.5%)	Over
	4 951.700 (All BHs operational)	2035 (2.0%)	2030 (3.5%)	> 2048
Merweville	157.049	> 2048 (1.0%)	> 2048 (2.0%)	> 2048
Nelspoort	377.494	> 2048 (1.0%)	> 2048 (2.0%)	> 2048
Murraysburg	681.703 *	> 2048 (1.0%)	2043 (2.0%)	> 2048

Note: * Exclude available yield from three Steenwerke boreholes.

Beaufort West: The town is at extreme risk of inadequate supply and running out of water. The safe yield from the production boreholes is 47% less (Yield of 1 725 MI/a not available), because of vandalised and non-operational boreholes. The current water requirement of the town of 3 859 MI/a is already exceeding the current available yield of 3 227 MI/a from the Gamka dam and the current production boreholes that are in operation. The existing vandalised and non-operational boreholes need to be put back into operation and the augmentation of the existing groundwater sources with additional boreholes are critical.

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TOPIC 6: WATER RESOURCES

The Feasibility Study for Additional Wellfields to supply Beaufort West (Aurecon and GEOSS, 20 February 2019) list the following four AOI for the augmentation of the groundwater resources of Beaufort West.

Table 6.1.3: Future groundwater augmentation options for Beaufort West									
Area of Interest	Expected Yield		Points	Expected Quality (mS/m)	Points	Total Cost (Pipelines and Power)	Points	Total Points	Rank
	l/s	ML/d							
AOI 1: Kamferskraal	10	0.86	4	70 – 400	3	R42 350 000	3	10	5 th
AOI 2: Soutrivier / Aberdeen Road	20	1.73	3	500 – 1500	4	R22 900 000	2	9	4 th
AOI 3: Ryst Kuil	25	2.16	2	130 – 220	2	R45 750 000	4	8	2 nd
AOI 4: KNP	20	1.73	3	70 – 180	1	R20 700 000	1	5	1 st
Combined pipes for AOI 1, 2 and 3	55	4.75	1	70 – 1200	2.5	R90 900 000	5	8.5	3 rd

Each AOI has its own specific challenges relevant to groundwater development namely, but not limited to 1) cost of infrastructure, 2) varying yields, 3) poor groundwater quality and 4) reluctance of private land owners to allow access to their properties. Although the determining factor for selecting an AOI to undergo groundwater development should be hydrogeological potential, the abovementioned challenges will influence the outcome of the decision.

Once the AOI (or combination of AOI) has been selected, groundwater exploration must commence immediately to quantify yield and quality of the chosen AOI. A facilitation team should be formed to guide landowners in the way forward for allowing access to their farms for exploration, and possibly further groundwater development, if exploration results are favourable.

Additional wellfield development cannot be put on hold, as droughts will continue and the population and water demand of Beaufort West, if not regulated, will continue to increase. The four wellfield options and the combination of the wellfields to the east provide medium- and long-term solutions to the current water shortage. If a wellfield is developed successfully, it is recommended that the current town supply boreholes are alternated with the new wellfield/s to allow the town aquifers to recover.

Merweville: New boreholes were recently put into operation and the safe yields from the existing production boreholes are adequate to meet the town's future water requirements.

Nelspoort: The safe yields from the existing three production boreholes and the additional surface water supply from the Sout River are adequate to meet the town's future water requirements.

Murraysburg: New boreholes were recently put into operation and the safe yields from the existing production boreholes are adequate to meet the town's future water requirements.

The DWS is currently busy with the updating of the All Towns Reconciliation Strategies for the Western Cape, but updated strategies for Beaufort West Municipality are not yet available. The table below gives an overview of the recommended potential future water resources, as included in the February 2015 All Towns Reconciliation Strategies, for the towns in Beaufort West Municipality.

Table 6.1.4: Potential future water resources for the various towns (Recommended summary options of DWS's All Towns Reconciliation Strategies, February 2015)	
Distribution System	Recommended Summary Options
Beaufort West	<p>The current water supply will meet the future water requirements for all growth scenarios if the implementation of the WC/WDM Strategy is successful. The following interventions are recommended for implementation, in order of priority and implementation sequence:</p> <ul style="list-style-type: none"> • Full implementation of the WC/WDM Strategy. • Integration of recently drilled and developed boreholes. • Development and implementation of integrated operating rules for the dam, the wellfields and the reclamation scheme to possibly increase the yield of the whole system. • Further incremental groundwater development.

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Table 6.1.4: Potential future water resources for the various towns (Recommended summary options of DWS's All Towns Reconciliation Strategies, February 2015)

Distribution System	Recommended Summary Options
Merweville	<p>The yields from the existing groundwater resources are adequate to meet the future growth scenarios. The existing water losses and NRW for the town are however extremely high, and there should be a major drive to reduce the existing losses. The following interventions are recommended for implementation, in order of priority and implementation sequence:</p> <ul style="list-style-type: none"> • Full implementation of the WC/WDM Strategy measures. • Further Groundwater development. • Artificial recharge of groundwater from Vanderbijliskraal River.
Nelspoort	<p>The current water sources have adequate supply to cater for the medium and longer-term future water requirements. However existing water losses and NRW for the town are extremely high and there should be a major drive to reduce existing losses. The following interventions are recommended for implementation, in order of priority and implementation sequence:</p> <ul style="list-style-type: none"> • Full implementation of the newly developed WC/WDM Strategy. • Incremental groundwater development. • Further abstraction from the Sout River.
Murraysburg	<p>If the implementation of the Water Conservation and Water Demand Management Strategy measures is successful to reduce water consumption by more than 20%, the current yield should be adequate to cater for the future water requirements. The following interventions are recommended for implementation, in order of priority and implementation sequence:</p> <ul style="list-style-type: none"> • Implement WC/WDM Strategy measures. • Compile a drought plan, monitor abstraction and recharge against pre-set warning points and manage the borehole abstraction. • If and when needed a further borehole can be developed.

Re-use of water is becoming more acceptable and feasible because of increasing water shortages, improved purification technology and decreasing treatment costs. Improvements in membrane technologies and their affordability have made a significant contribution in recent years. At present, up to 14% of water use is reused, mostly through wastewater return flows to rivers from which it is abstracted downstream for indirect re-use. Re-use of return flows could be significantly increased, particularly in coastal cities where wastewater ordinarily drains into the sea.

The direct re-use of treated wastewater can pose a risk to public health and safety; must be managed carefully and be subject to water quality management and control. Advanced treatment and proper monitoring of all processes and quality of potable water produced is essential. Public perceptions and opinions vary on the topic of water re-use, specifically as it relates to direct potable water re-use. Public perceptions are strongly informed by the general awareness of the poor operation, maintenance and performance of municipal wastewater treatment plants at present. This poses a significant challenge to building public acceptance of direct water re-use in the current situation. The performance of municipal wastewater and effluent treatment plants nationwide will have to be improved to meet high standards, resulting in consistently good quality discharges to the environment before direct water re-use can be placed on the national water supply agenda.

6.2 MONITORING

6.2.1 Percentage of Water Abstracted Monitored: Surface Water

The surface water supply to Beaufort West and Nelspoort are metered and the volumes are recorded monthly by Beaufort West Municipality, which is a valuable source of information in terms of the IWA water balances for these two systems.

Beaufort West Municipality is committed to continue with the monitoring of all surface water sources supplying the different systems with bulk raw water. The Municipality can also investigate the potential to upgrade their Scada system for their bulk water meters, which will allow real-time data collection, immediate

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alerts to faulty meters and easy manipulation of bulk meter data to synchronize with timings of the Financial Department's consumer meter readings.

6.2.2 Percentage of Water Abstracted Monitored: Groundwater

Beaufort West Municipality will keep on monitoring the volume of water abstracted from all their productions boreholes for all four towns. Monitoring of abstraction and groundwater levels is essential to ensure sustainable management of groundwater sources, by increasing understanding of the available water resource and to inform of any potential aquifer depletion. It will also indicate if an aquifer has potential to store surplus surface water and whether artificial groundwater recharge should be considered.

Beaufort West Municipality needs to continue with the implementation of the proposed well-field monitoring programmes (i.e. abstraction, water quality and water levels). Water quality indicators are useful tools for predicting stresses in the groundwater system. The key groundwater management functions that need to be implemented by Beaufort West Municipality are summarised in Table 3.2.1.1. See also Table 3.2.1.2.

6.2.3 Percentage of Water Abstracted Monitored: External Sources (Bulk Purchase)

No bulk water is supplied by any external WSP to any of the towns in Beaufort West Municipality's Management Area and it is not expected to change in the near future.

6.2.4 Surface Water Levels

Beaufort West Municipality will keep on monitoring the water levels of all their surface water sources. The daily and monthly rainfall data also needs to be recorded for each of the towns.

6.2.5 Groundwater Levels

The water level data of the various production boreholes will enable Beaufort West Municipality to identify the development of "red flag" situations timeously and to take preventative action. All boreholes should have two observation pipes installed vertically from the pump depth to the surface. One should be 40mm OD (Class 10) for a water level logger and the other big enough for a manual water level measurement. The pipe must be closed at the bottom and the bottom 10m – 20m slotted. See also Table 3.2.1.2.

6.2.6 Water Quality for Formal Schemes

Beaufort West Municipality is committed to continue with their current Operational and Compliance Water Quality Sampling Programmes for all their formal schemes and to implement the additional recommended sampling, as indicated in this WSDP. The Municipality will further continue to load all the water quality compliance sample results for the various distribution systems onto DWS's IRIS on a monthly basis.

It is recommended that raw water quality samples also be collected for each of the production boreholes on at least an annual basis.

As safeguard against water borne diseases it is strongly recommended that Beaufort West Municipality continue to ensure that all water used for human consumption are adequately disinfected by chlorination or other methods.

6.2.7 Water Quality for Rudimentary Schemes

Beaufort West Municipality is not involved with the water quality monitoring on farms in the rural areas, where farmers utilise their own water sources.

6.2.8 Borehole Abstraction

Beaufort West Municipality will keep on monitoring the abstraction and the sustainable yields of all their production boreholes in the four towns, in order to prevent any over abstraction of the aquifers and to ensure that the aquifers are managed in a sustainable manner.

To safeguard the boreholes against over-abstraction, low level cut-off switches need to be installed in all production boreholes. The monitoring data needs to be analysed by a geohydrologist on an annual basis in order to assess the effects of abstraction and recharge on the boreholes and aquifer. All production boreholes need to be fitted with a sampling tap and flow volume meter for monitoring purposes.

Beaufort West Municipality will continue with their groundwater monitoring on at least a monthly basis. Monthly monitoring of water levels, water chemistry and abstraction need to be conducted by the Municipal staff. Beaufort West Municipality also needs to ensure that all electronic data (i.e. dataloggers) are downloaded quarterly by a geohydrologist. Monitoring data needs to be reviewed at least annually by a geohydrologist.

The above will increase the understanding of the aquifer response to abstraction and the possible interconnections between surface water sources and the aquifers. Furthermore, the monitoring programme serves to detect the impact of natural changes in the hydrological cycle on ecosystems and other water users.

6.3 WATER QUALITY

WATER SAFETY PLAN – IMPROVEMENT

Water Safety Plans need to be compiled for all the WTWs and water distribution systems in Beaufort West Municipality's Management Area. The Water Safety Plan Team of Beaufort West Municipality needs to meet regularly to review the implementation and all the aspects of the Water Safety Plans, in order to determine whether the field assessments, monitoring results and trend analyses need updates or modifications, once compiled.

The Municipality needs to implement the Water Safety Plans and specific the Improvement / Upgrade Plans. Data from the verification and validation measures need to be used to evaluate the accuracy of the Water Safety Plans. The evaluation will give an indication whether certain aspects of the risk assessment need to be updated or modified and whether there exists any gaps in the Water Safety Plans.

If the analyses indicates that critical limits are not achieved at critical control points, despite the implementation of control measures and preventative action plans, then it points to:

- risks have been identified incorrectly;
- control measures are insufficient;
- control measures were identified incorrectly; or
- the critical limits are inappropriate

The Water Safety Plan is a dynamic document and should be reviewed:

- every three years;
- after an incident as part of the debriefing;
- after any significant change in the value (production) chain; for example, a new water source is developed, major treatment improvements are planned and brought into use, or after a major water quality incident;

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- when a weakness in the Water Safety Plan has been identified; and
- additional information is received that warrant a revised risk level for that system.

Beaufort West Municipality's Incident Management Protocol (IMP) and Emergency Response Plans should clearly specify responsibilities for co-ordinating measure to be taken, a communication plan to inform / alert users of supply and plans for providing / distributing emergency supplies of water. Key areas to be addressed in emergency response plans include the following:

- Response actions – including increased monitoring.
- Plans for emergency water supplies in order to ensure safe drinking water for the duration of the problem.
- Roles and responsibilities of individuals and organizations are clearly outlined to avoid miscommunication and duplication of effort.
- Communication strategies and protocols including notification procedures to alert and inform users of the supply and other stakeholders, with staff contact details (internal, regulatory body, media, public, emergency services), in order to ensure that all stakeholders are kept fully informed.
- Mechanisms for increased public health surveillance.
- Responsibilities for coordinating measures to be taken in an emergency.
- Training to ensure that employees have the skills and knowledge to effectively manage any potential incident and/or emergency.
- A programme to review and revise documentation as required.

The goal of Water and Safety Management Procedures is to highlight the procedures / protocols implemented and adhered to by Beaufort West Municipality and forms part of Beaufort West Municipality's Incident Management Protocol.

The Incident Management Protocol must be aligned to the communication requirements stipulated in the Compulsory National Standards for the Quality of Potable Water under Section 9 of the Water Services Act. The Compulsory National Standards for the Quality of Potable Water states that a Water Services Institution must ensure that a Drinking Water Quality Advisory is issued within 12 hours of confirmation of drinking water quality failure:

- A Drinking Water Quality Advisory must be issued when analysis results indicates a health risk associated with the domestic use of the sampled water. The Drinking Water Quality Advisory must specify the nature of the risk presented; indicate rectification measures taken by the Water Services Institution and indicate risk minimization measure to be taken by the public.
- A Boil Water Notice should be issued when the quality of drinking water poses a risk which can be adequately addressed by boiling the water in accordance with the notice, prior to human consumption.
- A Do Not Use Water Notice should be issued when there is a risk which cannot be adequately mitigated by means of domestic treatment.

It is not known whether Beaufort West Municipality issued any Drinking Water Quality Advisory, as summarised above, for the last number of years. Mechanisms to issue such notices need to be put in place, should it become necessary to inform the public of any drinking water quality failure.

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Beaufort West Municipality needs to ensure that evidence of adherence to the requirements of this protocol be recorded, preferably in the form of an Incident Register as summarised in Table 6.3.1 below.

Table 6.3.1: Example of Drinking Water Quality Incident Register						
Trigger	Sample Point	Nature of Incident	Risk Rating	Corrective Action	Communication of failure	Reference Documents
Laboratory reported E.Coli Failure	High Level Reservoir	9 E.Coli per 100 ml recorded on 24 May 2011	Alert Level 2 – Moderate Risk	Laboratory informed Operations, Water Quality Advisory issued, additional chlorine dosed, resampled on 26, 28 and 30 Jun 2011. All resample results 0 E.Coli per 100 ml	Failure, corrective action and resample results communicated to WSA Manager, DWS and DoH.	Water Quality Advisory and evidence of communication stored on network drive.

Following any incident or emergency, an investigation should be undertaken and all individuals involved in the Water Safety Plan should be updated and a discussion of the performance of the Water Safety Plan and issues or concerns must be addressed. The investigation should consider factors such as the following:

- What was the initiating cause of the problem?
- Was the hazard already identified in the Water Safety Plan risk assessment?
- How was the problem first identified or recognised?
- What were the most essential actions required and were they carried out?
- If relevant, was appropriate and timely action taken to warn consumers and protect their health?
- What communication problems arose and how they were addressed?
- What were the immediate and long term consequences of the emergency?
- How well did the emergency response plan work?

W₂RAP – IMPROVEMENT

W₂RAPs for the various WWTWs and sewer drainage networks are not yet in place. The W₂RAP Team of Beaufort West Municipality, once established, needs to meet regularly to review all aspects of the W₂RAPs to ensure that they are still accurate. Operational monitoring results and trends need to be assessed. In addition to the regular three year review, the W₂RAPs also need to be reviewed when, for example, a new WWTW is developed, major treatment improvements are planned and brought into use, or after a major wastewater incident.

Improvement / Upgrade Plans need to be developed, as part of the W₂RAPs, for all the existing significant risks where the existing controls are not effective or absent and the Plans need to be implemented by Beaufort West Municipality over the next few years.

An Incident Response Management Protocol needs to be put in place and needs to be implemented by Beaufort West Municipality. The purpose of the Incident Response Management Protocol is to plan for failures at the WWTWs and subsequent methods to address such failures. An incident is any situation where loss of control over the system occurs, or where there is any reason to suspect non-compliance or danger to the environment or a health risk. Significant deviations in the operational monitoring such as where critical limits are exceeded, is also referred to as an “incident”.

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Some incident triggers can include the following:

- Non-compliance with operational monitoring criteria;
- Inadequate performance of a sewage treatment plant discharging to source water;
- Spillage of a hazardous substance into source water;
- Sewer losses during reticulation and pumping of wastewater – not arriving at treatment plant;
- Failure of the power supply to an essential control measure;
- Extreme rainfall in a catchment;
- Detection of unacceptable levels of metals, ammonia, etc.;
- Unusual odour or appearance of returned effluent water;
- Detection of microbial indicator parameters, including unusually high faecal indicator densities and unusually high pathogen densities in returned effluent; and
- Public health indicators or a disease outbreak for which water is a suspect vector.

Following any incident or emergency, an investigation should be undertaken involving all concerned staff. The investigation should consider factors such as:

- What was the cause of the problem?
- How was the problem first identified or recognised?
- What were the most essential actions required?
- What communication problems arose and how were they addressed?
- What were the immediate and longer-term consequences?
- How well did the emergency response plan function?
- Did the turnaround plan match the seriousness of the incident?
- Should documentation (e.g. SOPs) be updated or reviewed?

Appropriate documentation and reporting of the incident or emergency should also be established. The Municipality should learn as much as possible from the incident or emergency to improve preparedness and planning for future incidents. Review of the incident or emergency may indicate necessary amendments to existing protocols.

Beaufort West Municipality understands the importance of documentation and up-dated records of information as it becomes available, because it forms an essential part of their management processes. It enables the municipality to have control over the wastewater treatment systems, notice trends, taking effective corrective actions when non-compliance trends are noticed, etc. It also reduces the amount of work at the end of the operational year when the W₂RAP is reviewed or when Green Drop Assessments takes place.

A set of Compliance Alert Levels, corresponding to the requirements of the General Standard (at present), is in place and monitored on a monthly basis. **The proposed Operational Alert Levels, as included in Table 6.3.2.1, should be used by Beaufort West Municipality to ensure that the various unit processes in the plants perform optimally.** If these pre-determined Alert Levels are exceeded at any of the control points where samples are taken for operational purposes, specific actions need to be taken to bring the operational parameters back to within the target ranges.

6.3.1 Reporting on Quality of Water Taken From Source: Urban and Rural

Regular sampling and reporting is part of Beaufort West Municipality's operating procedures and the Municipality is committed to ensure that the results are given through to the DWS. Beaufort West Municipality realises the importance of good communication with its inhabitants in the various towns to ensure consumer trust and confidence. Total transparency is therefore one of the main objectives when public notifications are distributed. High on the list of priorities in these communications should be the regular communication on water quality and in particular how efficient the water treatment plants performs and whether the required standards are met.

Beaufort West Municipality therefore understands the importance of involving community members on a regular basis and not only when there is a crisis. Community Members should be made aware of safe handling of water, hygienic sanitation practices and how to conserve and not misuse water. Good communication ensures consumer trust and confidence.

Beaufort West Municipality needs to make their water quality results available to the inhabitants in their Management Area through their annual WSDP Performance and Water Services Audit Report, which needs to be compiled annually. The water quality notifications or reports can also be inserted in one or more of the following media used for communicating with the public: the municipality's website, newsletters accompanying the bills and the local newspapers. Beaufort West Municipality can also make this information available to the learners at the local schools in the future, so that they can learn about the importance of effective water quality management. Involving the public at every stage means:

- Making monitoring results or summaries available and easily accessible, such as on the Internet or via newsletters and public fora;
- Notifying the public about risks to their health and what the WSA is doing to address the risks;
- Issuing regular reports about drinking water systems, including improvements and areas that need further attention;
- Educating the public on a number of issues, including: the benefits of disinfection over the risks of microbiological contamination and disease, the difference between health-related and aesthetic drinking water quality failures and the true cost of providing safe drinking water;
- Incorporating public consultations into decision-making processes which affect public health, including the development process for new guidelines and regulations, and
- Education about water resource protection and conservation issues.

Percentage compliance to Drinking Water Acceptable Limits:

Beaufort West Municipality is committed to continue with the taking of chemical and bacteriological samples on a monthly basis at all sample sites as included in their Water Quality Monitoring Programme. The Municipality will also continue with the loading of the compliance sampling results onto DWS's IRIS on a monthly basis. The detail WTW Process Audits (2024) include various recommendations to further improve the overall water quality compliance percentages for the various towns, which will be implemented by the Municipality.

The target towards which Beaufort West Municipality needs to work is 99% Compliance for microbiological results and at least 95% compliance for chemical results. DWS's requirements and penalties for drinking water quality compliance are included in Table 6.3.2 of the Administration, Information and Comprehensive Overview Report.

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Number of Monitoring Points for Drinking Water Sufficient:

See Table 8.1.7.2 under Section 8.1.7 of the Administration, Information and Comprehensive Overview Report for the proposed additional water quality samples to be taken by Beaufort West Municipality.

Beaufort West Municipality need to continue with the analysing of the following water quality constituents to optimise treatment processes for drinking water quality.

Table 6.3.1.1: Water quality constituents to be analysed to optimize treatment processes for drinking water quality.	
Physico-Chemical	Microbiological (Recommended when physico-chemical constituents indicate a loss of process control)
<ul style="list-style-type: none"> pH (Taste, corrosivity) Turbidity (turbidity indicates poor water treatment, cross-contamination and / or corrosion, and is problematic in that it prevents effective disinfection). Water treatment residual chemicals and disinfectants (for example, aluminium from aluminium sulphate dosing, free chlorine residual from disinfection via chlorination). 	<ul style="list-style-type: none"> Total coliforms (evaluation of the efficiency of water treatment processes, microbial growth in the distribution system or post-treatment contamination of drinking water); Faecal coliforms or E.coli (water is contaminated with faecal waste of human or animal origin).

Beaufort West Municipality need to continue with the implementation of the O&M Manuals at all their WTWs. Examples of preventative and corrective actions for which operational procedures should be documented include the following:

- Selection of alternate raw water source if available;
- Altering plant flow rate (for example, by reducing the loading on the works, but managed to ensure ability to supply demand);
- Jar testing for coagulant control and optimisation;
- Altering mixing intensity, changing treatment chemicals;
- Adjusting pH;
- Varying chemical feed rates and feed points;
- Adjusting filtration loading rate and / or operation;
- Adjusting the frequency and manner of backwashing cycles of the filters;
- Implementation of a filter evaluation and maintenance programme;
- Increasing disinfectant dose; secondary / booster disinfection;
- Mains flushing, cleaning and localised disinfection, and
- Developing standard operating procedures for handling leakages and pipe breakages.

It is also important to note that all operational manuals of treatment unit processes such as chemical dosing, coagulation sedimentation, filtration, disinfection etc. should contain operational limits, monitoring programmes, verification procedures and pre-determined corrective actions.

Monitoring data provide important feedback on how the water supply system is working and should be frequently assessed. The strategies and procedures for monitoring the various aspects of the water supply system should always be documented. Monitoring plans should include the following:

- **Parameters to be monitored.**

Operational and Compliance Monitoring: Parameters included in Beaufort West Municipality's Sampling Programmes.

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- **Sampling location and frequency**

Operational and Compliance Monitoring: Location and frequency of samples to be taken are included in the Municipality's Operational and Compliance Sampling Programmes.

- **Sampling needs and equipment**

Operational Monitoring: Process Controllers at the various WTWs ensure that adequate equipment is available at the WTWs for the operational monitoring.

Compliance Monitoring: Samples are analysed at an external accredited laboratory.

- **Schedules for sampling**

Operational Monitoring: Existing schedules are available at the WTWs and recorded by the Process Controllers.

Compliance Monitoring: Samples are analysed at an external accredited laboratory and loaded onto DWS's IRIS.

- **Methods for quality assurance and validation of sampling results.**

- Operational Monitoring: The Process Controllers at each plant ensures that the correct techniques are used for the operational sampling and that the sampling equipment is properly calibrated.

- Compliance Monitoring: Service Provider (Accredited Laboratory is used).

- **Responsibilities and necessary qualifications of staff.**

Operational Monitoring: The Supervisors and Process Controllers at each of the WTWs are responsible for the operation of the plants and for the taking of the necessary samples.

Compliance Monitoring: External Accredited Laboratory

- **Requirements for documentation and management of records including how monitoring of results will be recorded and stored.**

Operational Monitoring: The records are currently documented at each of the WTWs.

Compliance Monitoring: The records are documented and recorded at the external laboratory and also given through to the Manager Technical Services in electronic and hard copy format.

- **Requirements for reporting and communication of results.**

Operational Monitoring: Records are reported and communicated to the Manager Technical Services.

Compliance Monitoring: Results are loaded onto DWS's IRIS.

6.3.2 Quality of Water Returned to the Resource: Urban

The current operational and compliance monitoring of the effluent at all the WWTWs is not adequate and the current sampling programmes does not meet the minimum requirement of DWS as stipulated in the Green Drop certification criteria. Limited operational sampling is only done at the Beaufort West WWTW. Only Microbiological (Faecal Coliforms) compliance sampling is done by an external accredited laboratory on a monthly basis for the Beaufort West and Murraysburg WWTWs.

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To ensure that the WWTWs of Beaufort West Municipality functions optimally and produces final effluents that comply with the requirements of the Water Act on a continuous basis, it is necessary to ensure that three important aspects are checked on a regular basis:

- Condition of infrastructure
- Correct and sustainable functioning of mechanical and electrical equipment and instrumentation.
- Whether the unit treatment processes are operated within the prescribed operational parameters.

It is therefore recommended that Beaufort West Municipality undertake the following regular inspections and audits:

- Annual Detailed Audit of Assets, Infrastructure and Wastewater Section Personnel.
- Annual Monitoring of the Wastewater Treatment Plants (Treatment Processes).

Annual Detailed Audit of Assets, Infrastructure and Wastewater Section Personnel:

This audit may be carried out by the Municipality's own personnel or external Asset Management Consultants. It comprises a survey and inspection of all the wastewater collection, treatment and disposal infrastructure (civil works, mechanical equipment, buildings, grounds), and updating the existing asset register. Of particular importance is recording the condition of the infrastructure, reassessing the useful life time of the same, and controlling whether the scheduled maintenance tasks have been performed.

The organogram of the wastewater treatment should also be updated, with specific attention being paid to the required number and qualifications of personnel required by DWS at each wastewater treatment plant under their new Regulation 3630 (June 2023). The organogram should be aligned with the following two programmes of the municipality:

- Skills Development Programme
- Career Path Planning

Where there are gaps in the organogram related to the DWS requirements, these should be included in the WSDP and Skills Development Programmes of Beaufort West Municipality.

Annual Monitoring of the Wastewater Treatment Plants:

These monitoring visits should comprise an audit of all the operational practices at the treatment plant and an assessment of the performance of the different unit processes observations, taking samples at various points in the treatment train, and comparing the results with the target levels set for each process.

Samples are typically taken of the following (and analysed for the parameters indicated in parenthesis):

- Raw sewage (COD, TKN, TP, pH, alkalinity, EC, ammonia, metals (if industrial effluents present))
- After Primary settling (COD, pH, EC)
- After biofilters (COD (filtered), ammonia (filtered), pH)
- After humus tanks (COD, TSS, ammonia, pH)
- In activated sludge reactor (MLSS, VMLSS, DO, DSVI, pH, COD (filtered), ammonia (filtered); nitrate (filtered))
- After secondary settling tanks (COD, ammonia, TSS, DO)
- After maturation ponds (COD, ammonia, pH, TSS)
- Final effluent (COD, ammonia, nitrate, orthophosphate, TSS, pH, EC)

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The Annual Process Audits could typically be carried out by a wastewater treatment specialist.

It is further recommended that Beaufort West Municipality also undertake their own internal process audits from time to time, and the Water Research Commission guideline document Guideline for the Inspection of Wastewater Treatment Works, Boyd and Mbelu, 2008, that was developed to assist municipalities with these inspections. The following is an excerpt from this guideline document, indicating the aims and rationale for various types of inspections as may be required for the various WWTWs in Beaufort West Municipality's Management Area:

PURPOSE OF THE GUIDELINE DOCUMENT:

This guideline document deals with the requirements for undertaking an inspection at a WWTW. The purpose of the guideline document is to:

- *Assist the Process Controller to:*
 - *prepare for an inspection at the WWTW; and*
 - *take corrective action where a problem is identified.*
- *Assist the Inspector to:*
 - *undertake an inspection at a WWTW; and*
 - *give guidance where a problem is identified.*

The guideline describes checklists for those unit processes that are most frequently encountered at South African WWTW. A list of proposed additional reading material that every WWTW should have on site is set out in Appendix A of the guideline.

OVERVIEW OF THE GUIDELINE

Part I: Guidelines

Part I of the document sets out a guideline for undertaking an inspection at a WWTW to support the checklists set out in Part II. The guideline sets out the why, what and how of undertaking an inspection for various performance areas and lists performance indicators to guide the Inspector.

This section gives the Inspector, the Process Manager and the Process Controller a better understanding of the importance of the inspection, whether it is a daily visual inspection or a more comprehensive external or internal inspection. It is important to note that this section should be read in conjunction with a reputable handbook, such as those set out in Appendix A, for the operation of a WWTW.

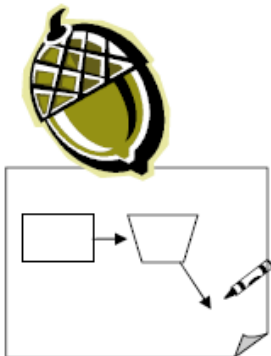
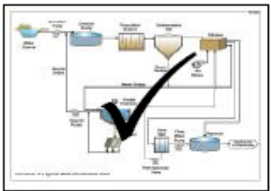
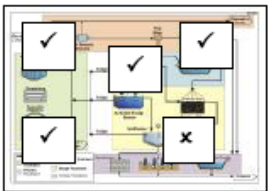
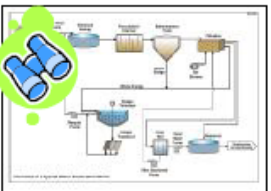
Part II: Checklists

Part II of this document sets out checklists that should be completed at various times throughout the year, depending on the operational status of the WWTW.

The table below sets out the various checklists and when they should be used.

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Checklist	When should the checklist be used?
<p>1 <i>The WWTW in a nutshell</i></p> 	<p>This checklist will help the person undertaking the inspection to get an understanding of the unit processes making up the WWTW and should be undertaken with the Process Manager.</p> <ul style="list-style-type: none"> All Process Managers and Process Controllers should complete this checklist when commencing employment at the WWTW and again if any upgrades are done to the works. External Inspectors should complete this checklist prior to undertaking an inspection. Examples of flow diagrams of various configurations are set out in Appendix B and C.
<p>2 <i>Primary Assessment</i></p> 	<p>This checklist gives an overall evaluation of the WWTW.</p> <ul style="list-style-type: none"> The inspection should be undertaken by an experienced person, preferably external to the WWTW who will make a decision on whether the comprehensive inspection needs to be undertaken or not.
<p>3 <i>Comprehensive Inspection</i></p> 	<p>This checklist includes individual checklists for each unit process. It should be used by the regulators and other Inspectors (both external and internal) when a WWTW has failed the primary assessment i.e all aspects have failed or certain parts of the WWTW have serious failures. This checklist will aid in the identification of the problems and will help to make improvements.</p>
<p>4 <i>Quarterly Inspection</i></p> 	<p>This inspection should be undertaken quarterly once the WWTW has been subjected to a comprehensive inspection and/or primary assessment, and has been deemed to be running optimally. Ideally the regulator should undertake this inspection, however the Process Manager or Process Controller could also undertake this inspection.</p>

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Industrial Consumers: Beaufort West Municipality can promote WDM activities at the wet industrial consumers in order for them to potentially lower their current water demand by means of improved practices or reuse of waste water. The revenue could potentially decrease as a result of re-use practices.

Beaufort West Municipality can encourage the large users to implement suggested re-use practices by means of incentives, informative billing to communicate monthly water consumption and monitoring and communicating actual savings achieved.

Industrial consumers that discharge industrial effluent into the Municipality's sewer system is not yet monitored with regard to quantity and quality. The quality and volume of industrial effluent discharged into the sewer system need to be monitored by the Municipality, in order to determine whether the quality comply with the standards and criteria. It is also necessary to consider limits above which volumetric monitoring will be necessary at new industries and existing smaller industries, where expansion is likely to take place. The Municipality needs to ensure that all industrial consumers apply for discharge permits and they must supply and maintain a flow meter measuring the volume of water that is discharged into the sewer system. It is also recommended that the accounts generated by the Municipality include for each cycle a summary of the COD and flow results to enable industries to keep a record and look at ways of improving where possible.

Beaufort West Municipality is committed to ensure that no industrial effluent is discharged into the sewer system unless it complies with the required standards and criteria.

Percentage compliance to Effluent Release Acceptable Limits:

The target towards which Beaufort West Municipality needs to work is at least 90% compliance against critical criteria as included in the license or General Authorisation for the plant. DWS's requirements and penalties for effluent quality compliance are included in Table 6.3.3 of the Administration, Information and Comprehensive Overview Report. The final effluent Microbiological quality compliance percentages, for the last financial, are included in Tables 6.3.2.2 of the Administration, Information and Comprehensive Overview Module. The Municipality's W₂RAPs, once compiled, need to include recommendations to improve the overall wastewater quality compliance percentages for the various WWTWs, which need to be implemented by the Municipality. The recommendations from the recent (2024) completed WWTW Process Audits also need to be implemented.

The purpose of the W₂RAPs are to reduce the CRRs of the WWTWs through the implementation of the Improvement / Upgrade Plans and to improve the quality of the final effluent discharged from the various WWTWs.

Number of Monitoring Points for Effluent Release Sufficient:

Beaufort West Municipality's existing Operational and Compliance Sampling Programmes are included in Tables 8.1.9.2 and 8.1.9.3 of the Administration, Information and Comprehensive Overview Report. **The current Operational and Compliance sampling programmes for the WWTWs are not adequate and the Municipality needs to implement the recommended sampling programmes.**

The current Operational Alert Levels should be checked regularly by the municipality in order to ensure that the various unit processes in the plant performs optimally. If these pre-determined Alert Levels are exceeded at any of the control points where samples are taken for operational purposes, then certain actions should be taken to bring the operational parameters back to within the target ranges.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 6: WATER RESOURCES

The recommended Operational and Compliance Sampling Programmes for the Beaufort West and Murraysburg WWTW are indicated in the table below.

Table 6.3.2.1: Recommended Operational and Compliance Sampling Programmes for the Beaufort West and Murraysburg WWTWs			
Sampling Point	Frequency of Sampling	Samples taken by	Parameters to be sampled
Beaufort West WWTW			
Influent	Daily	PC	Settleable Solids
	Monthly	External Lab	pH, EC, COD, TKN, Ammonia Nitrogen, Ortho Phosphate, Total Alkalinity
Bioreactor: Anoxic Tank	Monthly	External Lab	pH, Nitrate, Nitrite, TSS, DO
Bioreactor: Aeration	Once per Shift	PC	DO, pH, VSC, SVI
	Monthly	External Lab	pH, Settleable Solids, COD, Ammonia Nitrogen, Nitrate, Nitrite, DO, DSVI
Secondary Settling Tank	Daily	PC	pH, EC
	Monthly	External Lab	pH, COD, Ammonia Nitrogen, Nitrate, Nitrite, TSS, Ortho-Phosphate, Total Alkalinity
RAS	Monthly	External Lab	TSS
Final Effluent	Once per Shift	PC	Free Chlorine, Total Chlorine
	Daily	PC	pH, Temperature, EC
	Monthly	External Lab	pH, EC, Faecal Coliforms, COD, Ammonia Nitrogen, Nitrate, Nitrite, TSS, Ortho-Phosphate, Free Chlorine, Total Chlorine
Murraysburg WWTW			
Influent	Daily	PC	Settleable Solids
	Monthly	External Lab	pH, COD, EC, Ammonia Nitrogen
Final Effluent	Daily	PC	pH, Temperature, EC
	Monthly	External Lab	pH, COD, EC, Faecal Coliforms, SAR, Ammonia Nitrogen

The proposed Operational Alert Levels for the various WWTWs and the corresponding actions that should be taken when these levels are reached or exceeded are included in the table below.

Table 6.3.2.2: Recommended operational alert levels for the various WWTWs		
Operational Samples	Alert Level	Actions to be taken
Activated Sludge Systems (Recommended)		
Raw Sewage	COD > 1 000 mg/L Ammonia > 100 mg/L as N 5.5 > pH > 9.5 EC > 150 mS/m Settling Solids > 20 mL/L	<ul style="list-style-type: none"> Check for possible illegal industrial effluent discharge. Do more frequent measurements of DO levels, pH and MLSS in the activated sludge reactor.
At outlet of bioreactor	DO < 0.5 mg/L	<ul style="list-style-type: none"> Increase aeration capacity or cycles.
	MLSS < 2 000 mg/L	<ul style="list-style-type: none"> Reduce discharge of WAS and allow MLSS levels to increase to 4 000 mg/L.
	MLSS > 6 000 mg/L	<ul style="list-style-type: none"> Gradually waste more sludge on a daily basis to reduce the MLSS to 4 000 mg/L.
	pH < 7.0	<ul style="list-style-type: none"> Add lime to the inlet works to maintain the pH in the reactor at 7.0 or slightly above. Check denitrification process.
Secondary settling tank	COD > 75 mg/L	<ul style="list-style-type: none"> Check for sludge carry over from secondary settling tanks. Check RAS recycle rates. Check for bulking sludge. Check for rising sludge.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 6: WATER RESOURCES

Table 6.3.2.2: Recommended operational alert levels for the various WWTWs		
Operational Samples	Alert Level	Actions to be taken
		Take action to rectify as appropriate
Oxidation Pond Systems (Recommended)		
Raw Sewage	COD > 1 000 mg/L Ammonia > 100 mg/L as N 5.5 > pH > 9.5 EC > 150 mS/m Settling Solids > 20 mL/L	<ul style="list-style-type: none"> Check for possible illegal industrial effluent discharge.
Tertiary Pond	COD > 400 mg/L Ammonia > 100 mg/L as N 6 > pH > 9 EC > 200 mS/m SAR > 5 Faecal Coliforms > 100 000 per 100ml	<ul style="list-style-type: none"> Aerate ponds or provide additional ponds for a total retention period of 25 days.

Samples to be monitored at the WWTWs must include inflow, outflow, process flows, industrial effluent and sludge. Determinants and frequencies as required by the Licence or General Authorisation or as per best practice: Low end techn / small size = 1x / month, medium techn / size = 1x / week and high techn / macro size = 1x / day.

6.3.3 Quality of Water Returned to the Resource: Rural

This function is with the EHPs of the Central Karoo District Municipality and the quality of the water returned to the Water Resource system in the rural areas is not monitored by Beaufort West Municipality.

6.3.4 Pollution Contingency Measures Plan

Beaufort West Municipality will continue to undertake the following measures to prevent pollution of the Water Resource Systems.

- Investigating all sewage pump stations to ensure that emergency storage capacities and backup generators are available at the sewage pump stations, to prevent any possible spillages.
- Timeous upgrading of the WWTWs, to handle both volume and nutrient loading, in order to reduce the risk of spills and sub-standard effluent.
- Regular monitoring of treated effluent discharged to the Water Resource System at all the WWTWs.
- Enforce their Wastewater Bylaw.

W₂RAPs need to be compiled for the various WWTWs and sewer drainage networks, in order to reduce the CRRs of the various WWTWs. The Wastewater Risk Ratings for the various WWTWs, from which the trends can be noted, are included in Table 6.3.7.2.

6.3.5 Quality of Water Taken from Source: Urban – Percentage Monitored by WSA

The raw water quality of the various resources is not yet adequately monitored by Beaufort West Municipality, as indicated in Table 8.1.7.2 under Topic 8 of the Administration, Information and Comprehensive Overview Report. The additional raw water quality sampling required is indicated in the table.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 6: WATER RESOURCES

6.3.6 Quality of Water Taken from Source: Rural – Percentage Monitored by WSA

Beaufort West Municipality will not be involved in any water quality monitoring on the farms in the rural areas, where the farmers utilise their own water sources. This function is with the EHPs of the Central Karoo District Municipality and they take samples on the farms when requested by the farm owners.

6.3.7 Quality of Water Returned to the Source: Urban – Percentage Monitored by WSA

The recommended Operational and Compliance Sampling programmes for the WWTWs need to be implemented, as included in Table 6.3.2.1. Beaufort West Municipality is committed to focus on the timeous upgrading of the WWTWs, to handle both volume and nutrient loading, in order to reduce the risk of spills and sub-standard effluent. The table below gives an overview of the design and operating capacities of the WWTWs as included in DWS's 2022 Green Drop Report, DWS's 2023 Green Drop Progress Report and the design and operating capacities as included in the WSDP.

Table 6.3.7.1: Design and operating capacities of the various WWTWs									
WWTW	DWS's 2022 Green Drop Report			DWS's 2023 Green Drop Progress Report			WSDP		
	Hydraulic Capacity	Operating Flow	% Operational / Capacity	Hydraulic Capacity	Operating Flow	% Operational / Capacity	Hydraulic Capacity (MI/d)	Operating Flow 23/24 (MI/d)	% Operational / Capacity
	MI/d	MI/d	%	MI/d	MI/d	%	MI/d	MI/d	%
Beaufort West	4.659	2.656	57	4.600	3.004	65.3	4.659	4.090 *	87.8
Merweville	0.390	-	NI	0.100	-	0.0	0.111	0.071 *	64.0
Nelspoort	0.200	-	NI	0.200	-	0.0	0.240	0.180 *	75.0
Murraysburg	0.500	0.385	77	1.000	0.300	30.0	0.500	0.536 *	107.2

Note: * Estimated from the System Input Volume

The DWS also followed a risk-based regulatory approach that provides early warning signs of WWTWs that contain a certain measure of risk, and in directing the type of intervention required to manage and mitigate the identified risk and move to a more favourable position of compliance and ultimately, excellence. The current Cumulative Risk Ratios (CRR = A*B+C+D) of the WWTWs in Beaufort West Municipality's Management Area, as calculated by the DWS during 2011, 2013, 2022 and 2023 were as follows.

Table 6.3.7.2: Cumulative Risk Ratio of the various WWTWs (% Deviation = Actual CRR / Max CRR)				
WWTW	2011	2013	2022	2023
Beaufort West	35.3%	23.5%	47.1%	64.7%
Merweville	23.5%	58.8%	35.3%	91.7%
Nelspoort	29.4%	64.7%	35.3%	93.3%
Murraysburg	NA	94.1%	52.9%	80.0%

Note: Low < 50%, Medium 50% - < 70%, High 70% - < 90%, Critical 90% - 100%

Currently the DWS is working towards a revised Cumulative Risk Ratio which is as follows:

$CRR_r = CRR * H * I$, where

H = Environmental Sensitivity Weighting

I = Effective Management Weighting (Green Drop Score)

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 6: WATER RESOURCES

Beaufort West Municipality therefore needs to address the following, in order to further reduce their current CRR.

- Forward planning and upgrading / refurbishment of treatment plants to ensure adequate capacity for the flows received;
- Operate and maintain the WWTWs within design- and equipment specifications;
- Have trained, qualified and registered staff in place;
- Get mentoring / coaching contracts in place where there is a great demand for adequately skilled process controllers and supervision;
- Monitoring of flow to- and from the plants;
- Sampling and monitoring of effluent quality;
- Appropriate authorisation in accordance with the National Water Act (36 of 1998); and / or
- Where plant is overloaded, introduce unorthodox methods to ensure enhancement of effluent quality.

Beaufort West Municipality works towards improving the quality of the treated effluent discharged from their various WWTWs.

6.3.8 Quality of Water Returned to the Source: Rural – Percentage Monitored by WSA

Beaufort West Municipality will not be involved in any water quality monitoring on the farms in the rural areas, where water is returned to the Water Resource System. This function is with the EHPs of the Central Karoo District Municipality.

6.3.9 Water Quality Results Available in Electronic Format?

Beaufort West Municipality is committed to ensure that all water quality and final effluent quality sample results are loaded onto DWS's IRIS as required for the Blue and Green Drop Assessment Processes.

6.3.10 Percentage Time (Days) within SANS241 Standards per Year

See Table 8.1.7.5 for the summary of the July to June water quality compliance percentages for the last two financial years for each of the water distribution systems. Beaufort West Municipality will ensure that their water quality compliance percentages for each financial year are also included in their annual WSDP Performance and Water Services Audit Report, once compiled.

6.4 OPERATION

Volumes are registered on the DWS's WARMS for the various resources. A registered water use however does not guarantee that the water use is accurate or lawful. Validation and verification of the accuracy and lawfulness of the water use is needed to qualify as an Existing Lawful Use. **It is important for the municipality to confirm the correct registration volumes and existing lawful use volumes for all their sources. This information, with the safe yields of the surface and groundwater sources, is critical to accurately determine which sources need to be augmented for the different schemes. Beaufort West Municipality further needs to continue to ensure that all the individual sources are metered and that the abstraction volumes are recorded on at least a monthly basis.**

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 7: FINANCE

7. FINANCIAL PROFILE

One of the goals of the Sector is that all water services providers are accountable, cost-effective, efficient, and viable, and implement appropriate employment and gender equity policies. The WSA can influence the financial viability of water services and water services providers through the following mechanisms:

- Investment choices
- Choices related to the use of the local government equitable share
- Tariff policy and the setting of tariffs
- Credit control policies and revenue management
- The contract (service delivery agreement) between the water services authority and an external water services provider, specifically the service obligations and the financial conditions of the agreement.

Beaufort West Municipality's 2024/2025 IDP list the following key issues relating to infrastructure delivery:

- Limited funding available to deal with backlogs.
- The inability of households to pay for basic services due to high levels of poverty and unemployment.
- Illegal water and electricity connections.

A Financial Recovery Plan was approved by Council on 23 March 2022. Financial recovery plans are prepared for municipalities where interventions are implemented in terms of Section 139, read together with Section 142, of the MFMA. They are largely prepared for municipalities under financial distress.

The mandatory FRP will be used as an instrument to guide the municipality in addressing the financial crisis in the municipality as well as to ensure that the municipality regains its financial health within the shortest timeframe whilst ensuring that all issues which adversely affect the financial health of the municipality are comprehensively addressed. This will allow the Municipality to give effect to the financial recovery plan and the overall recovery process. The strategic objective of this financial recovery plan is to address the current financial distress by focusing on improving the short-term financial liquidity of the municipality and by improving the long-term financial sustainability of the municipality.

The overall financial situation of the Municipality is not sustainable and the municipality need to develop a radical revenue enhancement strategy that will be implemented to get it out of its financial crises. The 2024/2025 IDP include the following Objectives and Interventions (Financial Management):

Table 7.1: Financial Management Objectives and Interventions	
Objectives	Intervention
To ensure financial sustainability through improved billing system, improved revenue collection and identification of additional revenue sources	<ul style="list-style-type: none">• Ensure correct accountholders are billed monthly and that the municipal accounts are reaching the customers who are responsible for payment.• Identify debtors that can afford to pay and enforce the Credit Control and Debt Collection Policy.• To ensure completeness, correctness and validity of the General Valuation Roll and supplementary valuations.• The reduction of outstanding debtors is critical for financial viability and liquidity, by applying strict credit control measures religiously and without fail.• To improve quality of data, financial reporting and other decision-making processes and customer satisfaction.• Installation of prepaid meters to ensure maximization of revenue and reduced distribution losses.• To ensure the re-registering of all indigent consumers before the end of the financial year.• Develop and submit business plans for government grant funding programmes to optimize grant funding programmes.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 7: FINANCE

Table 7.1: Financial Management Objectives and Interventions

Objectives	Intervention
Progress from Qualified Audit opinion to Unqualified or Clean Audit outcome	<ul style="list-style-type: none"> To ensure compliance with applicable laws and regulations. Maintain accurate financial information and record management. To ensure integrated asset management system through the value chain of recording and uploading of asset in an automated method. Create an efficient, effective and accountable administration and functional Governance Structures. To ensure the application and implementation of SCM processes to derive value for money and address irregular, fruitless and wasteful expenditure.

The FRP list the following key issues:

- Budget Management:** To ensure that the municipality tables a funded budget and has sufficient revenue baseline to address its budget deficit.
- Trading Tariffs:** Need to ensure that all services reflect a surplus in the near future and the cost of delivering a service is fully recovered and allows for maintenance of assets linked to that service.
- Revenue Improvement:** Ensure that the billing system fully accounts for all properties within the municipality and that all services are correctly billed at a correct tariff.
- Expenditure and Creditor Management:** Improve the days of paying outstanding creditors and ensure that creditors are paid within 30 days in line with section 65(2)(e) of the MFMA.

7.1 EXPENDITURE

7.1.1 Ratios and Efficacy Indicators

The table below indicates the key financial indicators and ratios as included in the 2024/2025 MTREF Budget.

Table 7.1.1.1: Financial Performance Indicators and benchmarks

Financial Indicator	Basis of Calculation	2023/2024 Pre-Audit outcome	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Borrowing Management					
Capital Charges to Operating Expenditure ⁽⁶⁾	Interest & Principal Paid / Operating Expenditure	0.8%	0.7%	0.5%	0.2%
Capital Charges to Own Revenue	Finance charges and repayment of borrowing / Own Revenue	0.7%	0.6%	0.5%	0.2%
Borrowed funding of "own" capital expenditure	Borrowing / Capital expenditure excl. transfers and grants and contributions	0.0%	0.0%	0.0%	0.0%
Safety of Capital					
Gearing	Long Term Borrowing / Funds and Reserves	1994.7%	255.8%	119.5%	37.2%
Liquidity					
Current Ratio	Current assets / Current liabilities	1.4	1.4	2.1	2.8
Current Ratio adjusted for aged debtors	Current assets less debtors > 90 days/current liabilities	1.4	1.4	2.1	2.8
Liquidity Ratio ⁽¹⁾	Monetary Assets / Current Liabilities	0.4	0.5	1.0	1.5
Revenue Management					
Annual Debtors Collection Rate (Payment level %)	Last 12 months receipts / Last 12 months billing	138.6%	116.2%	143.5%	144.9%
Current Debtors Collection Rate (Cash receipts % of Ratepayer & Other Revenue)		116.2%	143.5%	144.9%	147.6%

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 7: FINANCE

Table 7.1.1.1: Financial Performance Indicators and benchmarks

Financial Indicator	Basis of Calculation	2023/2024 Pre-Audit outcome	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Outstanding Debtors to Revenue	Total outstanding debtors to annual revenue	24.7%	25.4%	23.9%	26.0%
Longstanding Debtors Recovered	Debtors > 12 months recovered / Total debtors > 12 months old				
Creditors Management					
Creditors System Efficiency ⁽⁵⁾	% of Creditors paid within terms				
Creditors to Cash and Investments		37.2%	258.9%	108.6%	64.3%
Other Indicators					
Electricity Distribution Losses	Total volume losses (kW)				
	Total cost of losses				
	% Volume (units purchased and generated less units sold/units purchased and generated)				
Water Distribution Losses	Total volume losses (Kl)				
	Total cost of losses				
	% Volume (units purchased and generated less units sold/units purchased and generated)				
Employee Costs ⁽⁷⁾	Employee costs / (Total Revenue – Capital Revenue)	27.1%	27.8%	26.5%	26.9%
Remuneration	Total remuneration / (Total Revenue – Capital Revenue)	31.2%	29.2%	27.9%	28.3%
Repairs and Maintenance ⁽⁸⁾	R&M / (Total Revenue excluding Capital Revenue)	2.0%	1.8%	1.7%	1.7%
Finance Charges and Depreciation	FC&D / (Total Revenue – Capital Revenue)	6.2%	6.2%	5.8%	5.7%
IDP Regulation Financial Viability Indicators					
Debt Coverage ⁽⁴⁾	Total Operating Revenue – Operating Grants) / Debt service payments due within financial year)	140.7	146.0	178.1	181.6
O/S Service Debtors to Revenue ⁽³⁾	Total outstanding service debtors / annual revenue received for services	56.4%	65.4%	60.5%	64.0%
Cost Coverage ⁽²⁾	(Available cash + Investments) / monthly fixed operational expenditure	4.7	1.0	1.5	2.3

Source: Medium Term Revenue and Expenditure Framework for Beaufort West Municipality 2024/2025: Table SA8 – Performance indicators and benchmarks

Notes:

- (1) **Liquidity Ratio:** Measures the municipality's ability to pay its bills and is calculated by dividing the monetary assets (due within one year) by the municipality's current liabilities. A higher ratio is better.
- (2) **Cost Coverage:** It explains how many months expenditure can be covered by the cash and other liquid assets available to the Municipality excluding utilisation of grants.
- (3) **Outstanding Service Debtors:** Measures how much money is still owed by the community for water, electricity, waste removal and sanitation compared to how much money has been paid for these services. It is calculated by dividing the total outstanding debtors by the total annual revenue. A lower score is better.
- (4) **Debt Coverage:** The number of times debt payments can be accommodated within Operating revenue (excluding grants). This in turn represents the ease with which debt payments can be accommodated by the municipality.
- (5) **Creditors System Efficiency:** The proportion of creditors paid within terms (i.e. 30 days). This ratio is calculated by outstanding trade creditors divided by credit purchases.
- (6) **Capital Charges to Operating Expenditure:** Is calculated by dividing the sum of capital interest and principle paid by the total operating expenditure.
- (7) **Employee Costs:** Measures what portion of the revenue was spent on paying employee costs. It is calculated by dividing the total employee cost by the difference between total revenue and capital revenue.
- (8) **Repairs and Maintenance:** This represents the proportion of the operating expenditure spent on repairs and maintenance.

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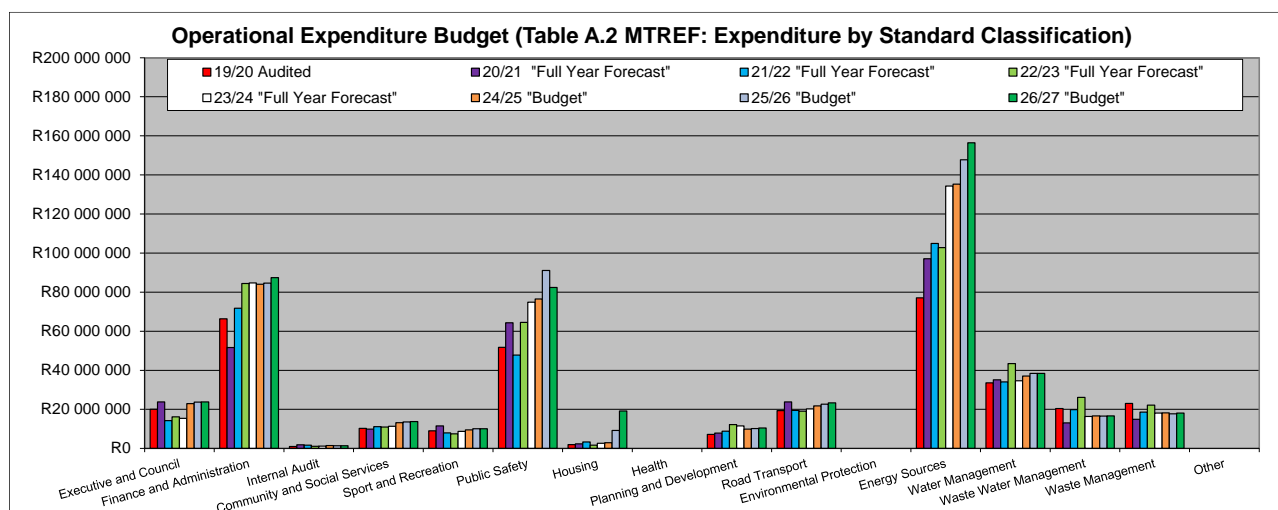
TOPIC 7: FINANCE

7.1.2 Water Balance Cost / Revenue

See Topic 5 for the WC/WDM measures to be implemented by Beaufort West Municipality in order to reduce the current NRW and Water Losses for the various water distribution systems. The NRW and Water Losses are a direct loss of income for the Municipality. The Municipality's existing five block stepped rising water tariff structure does not adequately discourages the wasteful or inefficient use of water.

7.1.3 Operating Cost

The following graph gives an overview of the historical and planned future operational expenditure budgets of Beaufort West Municipality.



It is evident from the graph that the largest portion of the budget is spent on buying electricity from Eskom, with a drastic increase over the last four financial years. The future planned expenditure by type for Beaufort West Municipality, as included in the approved 2024/2025 MTREF Budget, is as follows.

Expenditure Items	% of total 2023/2024 Expenditure	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Employee related costs	29.2%	R126 707 000	R138 817 000	R143 484 000	R148 463 000
Remuneration of Councillors	1.6%	R6 806 000	R7 133 000	R7 475 000	R7 812 000
Bulk purchase – Electricity	21.5%	R93 450 000	R105 318 000	R121 853 000	R127 336 000
Inventory Consumed	5.5%	R23 764 000	R25 503 000	R26 749 000	R28 388 000
Debt Impairment	14.8%	R64 527 000	R75 382 000	R80 577 000	R73 383 000
Depreciation and Asset Impairment	6.2%	R26 805 000	R29 266 000	R30 217 000	R31 117 000
Interest	0.5%	R2 252 000	R1 847 000	R1 392 000	R262 000
Contracted Services	7.0%	R30 268 000	R27 528 000	R34 443 000	R46 418 000
Transfers and Subsidies	0.0%	R0	R0	R0	R0
Irrecoverable debts written off	4.8%	R20 832 000	R0	R0	R0
Operational costs	8.9%	R38 630 000	R38 604 000	R40 616 000	R38 323 000
Losses on disposal of Assets	0.0%	R0	R0	R0	R0
Other Losses	0.0%	R0	R0	R0	R0
Total	100.0%	R434 041 000	R449 398 000	R486 807 000	R501 502 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A4 – Budgeted Financial Performance (Revenue and Expenditure)

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TOPIC 7: FINANCE

7.1.3.1 Operating Costs: Water

The total estimated future operational costs for water services for the next three financial years are summarised in the table below.

Table 7.1.3.1.1: Estimated future operational costs for water services				
Description (Functional Classification)	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Water Management	R34 632 000	R37 062 000	R38 411 000	R38 422 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A2 –Budgeted Financial Performance (Revenue and Expenditure by Functional Classification)

7.1.3.2 Operating Costs: Sanitation

The total estimated future operational costs for sanitation services for the next three financial years are summarised in the table below.

Table 7.1.3.2.1: Estimated future operational costs for sanitation services				
Description (Functional Classification)	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Waste Water Management	R16 350 000	R16 697 000	R16 515 000	R16 663 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A2 –Budgeted Financial Performance (Revenue and Expenditure by Functional Classification)

Maintenance activities have been increasingly focused on reactive maintenance as a result of the progressive deterioration and failure of old infrastructure. Consequently, there has been dilution of preventative maintenance of other infrastructure. Expenditure on repairs and maintenance does not keep track with the increase in asset values as well as the ageing of the infrastructure.

An Integrated Maintenance Plan is necessary that optimises maintenance activities, appropriate to its specific needs and the local environment, and identifies the systems and resources required to support this. A regime of planned preventative maintenance should be established for all infrastructure assets classified as critical and important in the Asset Register. Consideration should be given to the establishment of a maintenance management system to enable Beaufort West Municipality to better manage its risks, and more effectively plan and prioritise the wave of renewals that are going to be required over the next 20 years.

It is important to note that the maintenance budget requirements are going to increase substantially over the next twenty years in real terms, in line with the envisaged pace of development. It is estimated that the budget requirements will double over this period.

The recommendations for Beaufort West Municipality, with regard to their Operational Budgets, are as follows:

- Develop an AMP, which will indicate the real replacement values and service lives of the assets and the funds required to provide for adequate operation and maintenance of the infrastructure. Current gaps include unrealistically low depreciation charges, which have to be rectified and ring-fenced into an asset replacement fund, as well as additional budget requirements above inflation for infrastructure development.
- The new depreciation charges will have to form part of the operating budget and subsequent tariffs, linked to a ring-fenced asset replacement fund.
- It is critical for Beaufort West Municipality to ensure that sufficient funding is allocated towards an asset replacement fund, in order to ensure adequate rehabilitation and maintenance of the existing water and sewerage infrastructure.

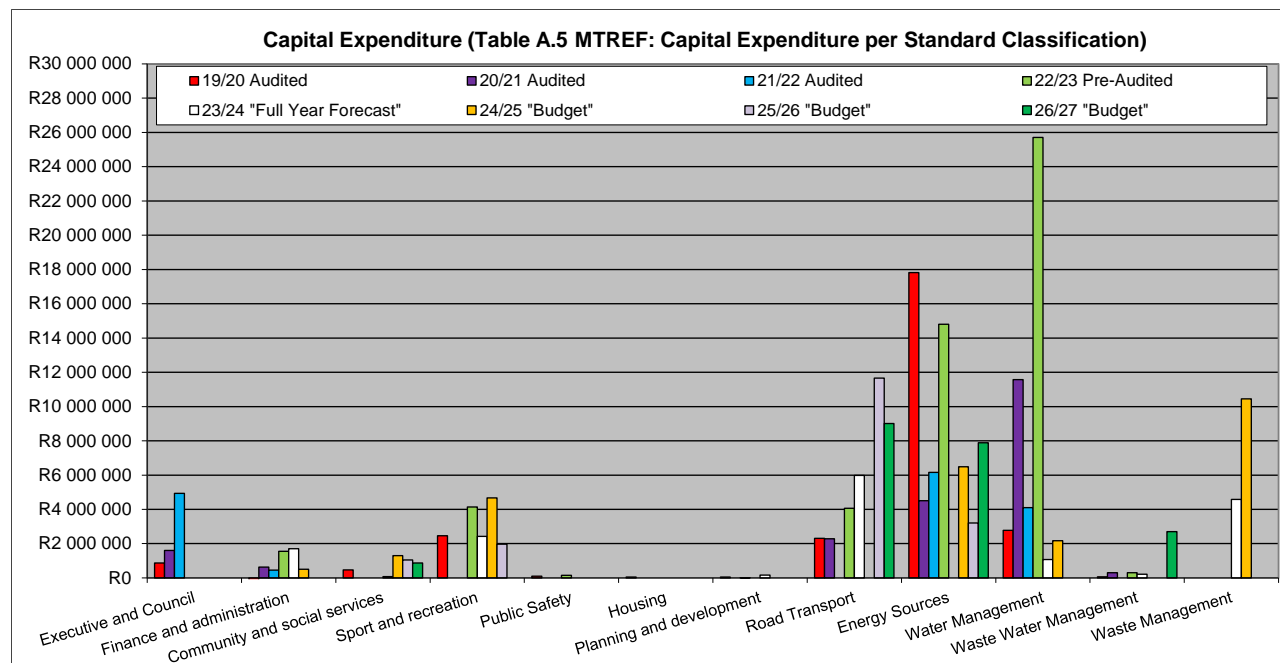
WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 7: FINANCE

- Water services operational surpluses have to be allocated to essential water services requirements in the future.
- Beaufort West Municipality needs to ensure that their Credit Control and Debt Collection measures are strictly enforced.

7.1.4 Capital Expenditure

The graph below gives an overview of the historical and planned future capital expenditure per Standard Classification for Beaufort West Municipality.



The future estimated capital expenditure per functional classification are summarised in the table below.

Table 7.1.4.1: Estimated capital expenditure per functional classification of Beaufort West Municipality's future capital budget				
Capital Expenditure Standard	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Executive and Council	R0	R0	R0	R0
Finance Administration	R1 707 000	R500 000	R0	R0
Community and social Services	R77 000	R1 304 000	R1 052 000	R870 000
Sports and Recreation	R2 422 000	R4 666 000	R1 967 000	R0
Public Safety	R0	R0	R0	R0
Planning and Development	R164 000	R0	R0	R0
Road Transport	R5 985 000	R0	R11 665 000	R9 004 000
Energy Sources	R0	R6 480 000	R3 210 000	R7 893 000
Water Management	R1 074 000	R2 174 000	R0	R0
Waste Water Management	R216 000	R0	R0	R2 706 000
Waste Management	R4 586 000	R10 451 000	R0	R0
Total Capital Expenditure	R16 231 000	R25 575 000	R17 894 000	R20 473 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A5 - Capital Expenditure by Vote, Functional Classification and Funding Source

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The Opening Cost of the water and sewerage infrastructure that will need to be replaced over the next five years (RUL < 5 yrs) is R28.578 million. The asset renewal needs for the water infrastructure assets over the next ten years is R2.315 million per year. The reinvestment required is R4.578 million in the first five years and R18.570 million in the second five-year period. The age of 48.29% of the water infrastructure assets is greater than twenty years. About 5.68% of the water supply infrastructure is in a poor or very poor condition and the condition backlog is in the order of R8.154 million. The bulk of the backlog is made up of reservoir assets.

The asset renewal needs for the sewerage infrastructure assets over the next ten years is R3.084 million per year. The reinvestment required is R24.000 million in the first five years and R6.842 million in the second five-year period. The age of 64.01% of the sewerage infrastructure assets is greater than twenty years. About 2.99% of the sewerage infrastructure is in a poor or very poor condition and the condition backlog is in the order of R3.163 million. The bulk of the backlog is made up of the sewer pump stations and the WWTWs.

These values are based on the Opening Cost of the water and sewerage infrastructure currently included in the Asset Register. Table 4.1.10.3 however indicates the required annual budget for the replacement of the old water and sewerage infrastructure and the required annual O&M budget, which is based on the CRC of the water and sewerage infrastructure included in the WSDP.

The extent to which each type of water and sewerage asset portfolio has been consumed are summarised under Topic 3 in the Tables under Section 3.1.1 of the Administration, Information and Comprehensive Overview Report. The infrastructure components with low percentage figures (% CV/OC) need dedicated renewals programmes targeting these assets. If this is not done, there is the risk that the on-going deterioration will escalate to uncontrolled proportions, with considerable impact on consumers, the economy of the area and the service levels that can be provided in Beaufort West Municipality.

The recommendations for Beaufort West Municipality, with regard to their Capital Funding, are as follows:

- Take the recommended projects, as identified through the Water and Sewer Master Plans and the WSDP, into account during the planning and prioritization process for new infrastructure. Prioritize from the desired list, those items which can be implemented from available funding in the particular financial year.
- Undertake revised master planning at least once every five years and use the Master Plans to list the desired infrastructure development requirements and reflect these in the IDP.
- Assign a high priority to the implementation of the WC/WDM Strategy in order to postpone additional capital investment for as long as possible, both from the water availability perspective as well as from the treatment of increased effluent volumes. The costs of physical water loss, the capital requirements for new water resources infrastructure, and the constraints of poor water availability on water dependent economic growth means that WC/WDM is a critical management priority for stretching the financial resources of the Municipality. WC/WDM is almost always a more cost-effective solution than the implementation of new infrastructure, and no new infrastructure should be developed until unauthorized water has been reduced to manageable volumes. Beaufort West Municipality's current NRW and Water Losses are extremely high and at unacceptable levels.
- To adopt appropriate technology solutions for the water and sewerage infrastructure challenges. Techniques such as value engineering should also be adopted to ensure that investments in infrastructure and other solutions are cost effective over the full life-cycle and designed to be fit for purpose.
- To ensure adequate funding for the full lifecycle cost of the new water and sewerage infrastructure, which will include funds for the operation and maintenance of the infrastructure and regular refurbishment.
- Balance land-use and development planning (SDFs) in accordance with the availability of water and the capacity of WTWs and WWTWs that are in place or that will be implemented.

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- To focus strongly on revenue collection, in order to improve the Municipality's own funding sources, over and above the Grants received from National and Provincial Government. The Municipality also needs to continue to actively implement their Customer Care, Credit Control and Debt Collection and Indigent Policies in order to minimize the percentage of non-payment for municipal services.
- To identify all possible sources of external funding over the next five financial years to assist Beaufort West Municipality to address the bulk water and sewerage infrastructure backlogs and the extremely high NRW and water losses that exist in the various towns as indicated in the tables under Topic 3 and Topic 5.
- Develop IAMPs for all water and sewerage infrastructure, which will indicate the real replacement values, the service life of the assets and the funds required to provide for adequate asset replacement. The renewals burden is set to increase sharply over the next 20 years and it is therefore important for Beaufort West Municipality to commit to a substantial and sustained programme of capital renewal works. The current level of expenditure on capital renewal is inadequate and there is a critical need for Council to commit to increase the budget for the maintenance and rehabilitation of the existing infrastructure substantially.

7.1.4.1 Capital Expenditure: Water

The future three-year water capital infrastructure projects of Beaufort West Municipality are summarised in the table below (Approved 2024/2025 Capital Budget).

Table 7.1.4.1.1: Future water infrastructure capital projects			
Project	2024/2025	2025/2026	2026/2027
Repairs to vandalized Switchgear for critical boreholes	R1 217 392	-	-
New Telemetric System	R956 522	-	-
Total	R2 173 914	-	-

The future water capital requirements per system are summarised in the table below.

Table 7.1.4.1.2: Future water capital requirements per system	
Project	Cost
Beaufort West	
Refurbishment of vandalised and non-operational boreholes	R12 850 000
Augmentation of groundwater resources (Karoo National Park)	R60 000 000
Ensure adequate bulk water pipeline and internal water reticulation capacity (WMP)	R9 676 000
Ensure adequate reservoir storage capacity (WMP)	R31 060 000
Ensure adequate water pump station capacity (WMP)	R4 000 000
Water Demand Management Items (WMP)	R15 497 940
Refurbishment of the Beaufort West WTW	R8 000 000
Sub Total	R141 083 940
Merweville	
Ensure adequate bulk water pipeline and internal water reticulation capacity (WMP)	R721 000
Ensure adequate reservoir storage capacity (WMP)	R3 285 000
Ensure adequate water pump station capacity (WMP)	R0
Water Demand Management Items (WMP)	R781 340
Sub Total	R4 787 340
Nelspoort	
Ensure adequate bulk water pipeline and internal water reticulation capacity (WMP)	R0
Ensure adequate reservoir storage capacity (WMP)	R3 285 000
Ensure adequate water pump station capacity (WMP)	R0
Water Demand Management Items (WMP)	R798 840
Upgrade of the WTW	R18 000 000

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Table 7.1.4.1.2: Future water capital requirements per system	
Project	Cost
Sub Total	R22 083 840
Murraysburg	
Ensure adequate bulk water pipeline and internal water reticulation capacity (WMP)	R2 510 000
Ensure adequate reservoir storage capacity (WMP)	R7 004 000
Ensure adequate water pump station capacity (WMP)	R0
Water Demand Management Items (WMP)	R1 462 820
Sub Total	R10 976 820
Total	R178 931 940

7.1.4.2 Capital Expenditure: Sanitation

The future three-year sewerage capital infrastructure projects of Beaufort West Municipality are summarised in the table below (Approved 2024/2025 Capital Budget).

Table 7.1.4.2.1: Future sewerage infrastructure capital projects			
Project	2024/2025	2025/2026	2026/2027
Upgrading of Existing Irrigation Pump Station at WWTW – Beaufort West	-	-	R2 705 546
Total	-	-	R2 705 546

The future sewer capital requirements per system are summarised in the table below.

Table 7.1.4.2.2: Future sewer capital requirements per system	
Project	Cost
Beaufort West	
Ensure adequate internal sewer drainage and rising capacity (SMP)	R11 851 000
Ensure adequate sewer pump capacity (SMP)	R0
Upgrade WWTW	R49 800 000
New final effluent irrigation PS	R17 000 000
Sub Total	R78 651 000
Merweville	
Ensure adequate internal sewer drainage and rising capacity (SMP)	R6 883 000
Ensure adequate sewer pump capacity (SMP)	R0
Upgrade WWTW	R5 000 000
Sub Total	R11 883 000
Nelspoort	
Ensure adequate internal sewer drainage and rising capacity (SMP)	R1 386 000
Ensure adequate sewer pump capacity (SMP)	R1 800 000
Upgrade WWTW	R500 000
Sub Total	R3 686 000
Murraysburg	
Ensure adequate internal sewer drainage and rising capacity (SMP)	R15 000 000
Ensure adequate sewer pump capacity (SMP)	R1 750 000
Upgrade WWTW	R10 000 000
Sub Total	R26 750 000
Total	R120 970 000

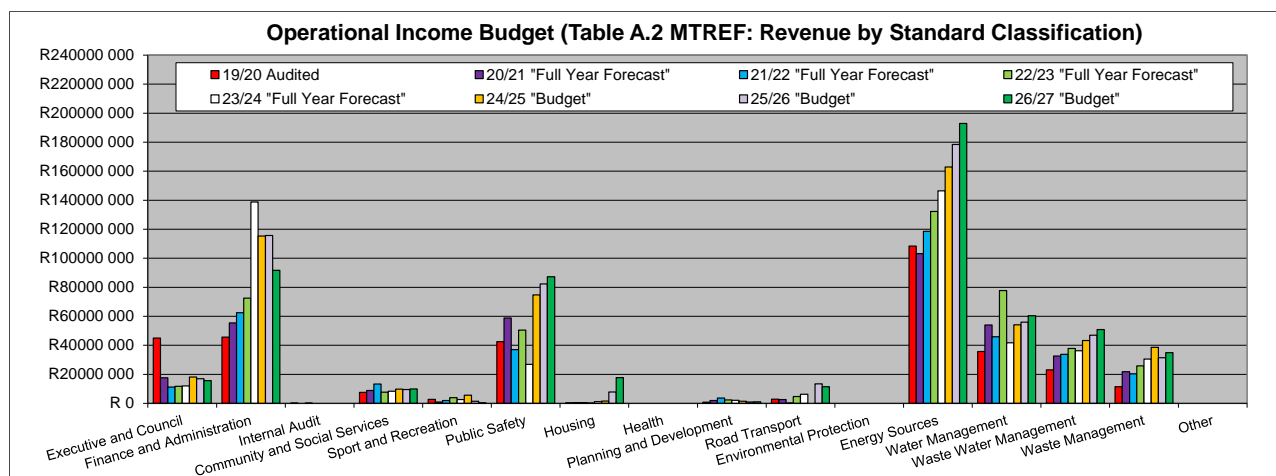
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7.2 INCOME

7.2.1 Operating Income

The following graph gives an overview of the historical and planned future operational income budgets of Beaufort West Municipality.



The future planned revenue by source for Beaufort West Municipality, as included in the 2024/2025 MTREF Budget, is as follows.

Table 7.2.1.1: Revenue items by source, as included in the 2024/2025 Budget				
Revenue Item	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Service Charges - Electricity	R108 534 000	R120 473 000	R136 133 000	R142 398 000
Service Charges - Water	R13 718 000	R20 853 000	R22 198 000	R23 529 000
Service Charges – Waste Water Management	R23 340 000	R24 740 000	R26 225 000	R27 798 000
Service Charges – Waste Management	R15 045 000	R16 399 000	R17 875 000	R19 483 000
Sale of Goods and Rendering of Services	R795 000	R942 000	R1 017 000	R1 095 000
Agency Services	R1 606 000	R1 766 000	R1 945 000	R2 062 000
Interest earned from Receivables	R11 209 000	R11 992 000	R12 711 000	R13 474 000
Interest earned from Current and Non-Current Assets	R2 115 000	R2 221 000	R2 336 000	R2 406 000
Rental from Fixed Assets	R1 838 000	R2 022 000	R2 143 000	R2 272 000
Licences or Permits	R298 000	R316 000	R335 000	R355 000
Operational Revenue	R1 279 000	R1 351 000	R1 422 000	R1 432 000
Property Rates	R48 421 000	R55 152 000	R58 589 000	R62 104 000
Fines, penalties and forfeits	R70 464 000	R73 189 000	R80 508 000	R85 338 000
Licences or Permits	R192 000	R203 000	R216 000	R228 000
Transfers and subsidies - Operational	R101 752 000	R102 942 000	R110 994 000	R124 485 000
Interest	R3 107 000	R3 449 000	R3 655 000	R3 875 000
Operational Revenue	R32 926 000	R35 832 000	R37 982 000	R40 261 000
Other Gains	R0	R25 587 000	R25 587 000	R0
Total	R436 639 000	R499 429 000	R541 871 000	R552 595 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A4 – Budgeted Financial Performance (Revenue and Expenditure)

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7.2.1.1 Operating Income: Subsidies

The main subsidy for funding the operational costs associated with water and sanitation supply is the equitable share. The total estimated future operational income from transfers and grants are summarised in the table below.

Table 7.2.1.1.1: Operating Income: Transfers and Grants				
Transfers and Grants	Record Prior (R)			
	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
National Government				
Local Government Equitable Share	R83 574 000	R88 849 000	R92 718 000	R96 074 000
Municipal Infrastructure Grant	R719 000	R782 000	R810 000	R862 000
Local Government Financial Management Grant	R2 185 000	R2 000 000	R2 000 000	R2 100 000
EPWP Integrated Grant	R1 372 000	R1 226 000	R0	R0
Sub Total	R87 350 000	R92 857 000	R95 528 000	R99 036 000
Provincial Government				
Provincial Treasury WC Financial Management Capacity Building Grant	R0	R600 000	R0	R0
Provincial Treasury WC Municipal Financial Recovery Services Grant	R1 000 000	R0	R0	R0
Department of Infrastructure Title Deeds Restoration Grant	R0	R90 000	R157 000	R0
Department of Infrastructure Human Settlements Development Grant (Beneficiaries)	R1 135 000	R1 437 000	R7 637 000	R17 732 000
Department Cultural Affairs & Sport Replacement Funding for most vulnerable B3 Municipalities	R7 158 000	R7 060 000	R7 296 000	R7 491 000
Department of LG Thusong Service Centres Grant (Sustainability Operational Support Grant)	R0	R0	R150 000	R0
Department of LG Community Development Workers Operational Support Grant	R226 000	R226 000	R226 000	R226 000
Department of LG Western Cape Municipal Interventions Grant	R800 000	R0	R0	R0
Department of LG Municipal Energy Resilience Grant	R600 000	R0	R0	R0
Sub Total	R10 919 000	R9 413 000	R15 466 000	R25 449 000
Other				
Chemical Industries Education & Training Authority	R2 124 000	R672 000	R0	R0
Sub Total	R2 124 000	R672 000	R0	R0
Total	R100 893 000	R102 942 000	R110 994 000	R124 485 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West Municipality 2024/2025: Table SA18 Transfers and Grants Receipt

7.2.1.2 Operating Income: Water

The total estimated future operational income for water services for the next three financial years are summarised in the table below.

Table 7.2.1.2.1: Estimated future operational income for water services				
Description (Standard Classification)	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Water Management	R 41 786 000	R 54 182 000	R55 907 000	R60 349 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West Municipality 2024/2025: Table A2 –Budgeted Financial Performance (Revenue and Expenditure by Standard Classification)

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7.2.1.3 Operating Income: Sanitation

The total estimated future operational income for sanitation services for the next three financial years are summarised in the table below.

Table 7.2.1.3.1: Estimated future operational income for sanitation services				
Description (Standard Classification)	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
Waste Water Management	R36 299 000	R43 353 000	R46 947 000	R50 817 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West Municipality 2024/2025: Table A2 –Budgeted Financial Performance (Revenue and Expenditure by Standard Classification)

7.2.2 Capital Income

It is important for Beaufort West Municipality to manage their charges for water and sanitation services and the control of consumer payments effectively, in order to ensure that adequate income is generated to fund their water and sewerage capital projects. The future funding sources of Beaufort West Municipality's total capital budget are summarised in the table below.

Table 7.2.2.1: Sources of funding for the future capital budgets of Beaufort West Municipality				
Capital Funding Source	2023/2024 Full Year Forecast	2024/2025 Budget	2025/2026 Budget	2026/2027 Budget
National Government	R12 221 000	R19 279 000	R16 593 000	R18 589 000
Provincial Government	R1 847 000	R3 478 000	R0	R0
District Municipality	R0	R0	R0	R0
Transfers and Subsidies	R318 000	R0	R0	R0
Borrowing	R0	R0	R0	R0
Internally generated funds	R1 844 000	R2 818 000	R1 302 000	R1 884 000
Total Capital Funding	R16 230 000	R25 575 000	R17 895 000	R20 473 000

Source: Medium Term Revenue and Expenditure Framework for Beaufort West 2024/2025: Table A5 - Capital Expenditure by Vote, Standard Classification and Funding

7.2.2.1 Capital Income: Water

The future water capital infrastructure projects will be funded through grants, as indicated in the table below.

Table 7.2.2.1.1: Future capital funding sources for the water capital projects					
Project	Own	Loans	MIG	WSIG	DLG
2024/2025					
Repairs to vandalized Switchgear for critical boreholes	-	-	-	-	R1 217 392
New Telemetric System	-	-	-	-	R956 522
2025/2026					
-	-	-	-	-	-
2026/2027					
-	-	-	-	-	-

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7.2.2.2 Capital Income: Sanitation

The future sewerage capital infrastructure projects will be funded through grants, as indicated in the table below.

Table 7.2.2.2.1: Future capital funding sources for the sewerage capital projects					
Project	Own	Loans	MIG	WSIG	DLG
2024/2025					
-	-	-	-	-	-
2025/2024					
-	-	-	-	-	-
2026/2027					
Upgrading of Existing Irrigation PS at WWTW - Beaufort West	-	-	R2 705 546	-	-

7.3 TARIFF AND CHARGES

The state of the economy has an adverse effect on the consumers. As a result municipalities' revenues and cash flows are expected to remain under pressure. Furthermore municipalities should carefully consider affordability of tariff increases, especially as it relates to domestic consumers while considering the level of services versus the associated cost. Water tariffs should always be cost reflective and the water tariff structure must therefore ensure that:

- Water tariffs are fully cost-reflective, including the cost of maintenance and renewal of purification plants, water networks and the cost associated with reticulation expansion;
- Water tariffs are structured to protect basic levels of service and ensure the provision of free water to the poorest of the poor (indigent); and
- Water tariffs are designed to encourage efficient and sustainable consumption.

Beaufort West Municipality's current five block step water tariff structure does not adequately promote the efficient use of water by consumers or discourage the wastage of water. The tariffs for the higher consumption blocks are only a little bit higher than the tariffs for the lower consumption blocks, which are not adequate. The first 6 kl of water is provided free to residential consumers who qualify for indigent relief. It is expected that this tariff structure will continue to be implemented in the future.

The sustainable supply of potable water is becoming an ever increasing challenge. This scarce commodity has to be optimally managed. The increase in the price of electricity and chemicals for purification has contributed to the cost of delivering the service.

The table below gives some comments on the specific blocks, with regard to Beaufort West Municipality's residential block stepped tariff structure, for the various years for water services.

Table 7.3.1: Comments on the Municipality's residential block stepped water tariff structure						
Block (kl/month)	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	Comments
0 - 6	R13-38	R14-32	R15-18	R16-09	R17-06	Free Basic Water
7 – 15	R15-36	R16-44	R17-43	R18-48	R19-59	Low volume use
16 – 25	R17-53	R18-76	R19-89	R21-08	R22-34	Typical use volume, including limited garden irrigation
26 – 35	R18-43	R19-72	R20-90	R22-18	R23-51	Above average use, including garden irrigation
36 - 70	R23-04	R24-65	R26-13	R27-72	R29-38	Wasteful use and/or severe garden irrigation
> 70						Significant waste and/or unnecessary garden irrigation

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The water tariffs of George Municipality, Drakenstein Municipality and Overstrand Municipality for the 2022/2023 financial year and their block stepped water tariff structures, that adequately promote the efficient use of water, are indicated in the table below.

Table 7.3.2: 2022/2023 Residential water tariff structures of three Municipalities that adequately promote the efficient use of water					
George Municipality		Drakenstein Municipality		Overstrand Municipality	
Block (kl/month)	Rand per Kl	Block (kl/month)	Rand per Kl	Block (kl/month)	Rand per Kl
0 - 6	R0-00	0 - 6	R5-99	0 – 6	R6-38
6 - 15	R19-44	7 - 10	R10-63	7 – 18	R13-08
16 - 20	R22-40	11 - 15	R15-25	19 – 30	R21-22
21 - 30	R29-11	16 - 30	R19-80	31 – 45	R32-68
31 - 50	R36-48	31 - 45	R27-64	46 – 60	R42-43
51 - 100	R44-98	46 - 55	R58-42	> 60	R56-58
> 100	R76-67	> 55	R87-63		

The Compulsory National Standards (Regulations under section 10 of the Water Services Act) state the following on the supply of water to a household through a water services work or consumer installation designed to provide an uncontrolled volume of water.

- 1) *A tariff set by a water services institution for the supply of water through a water services work or consumer installation designed to provide an uncontrolled volume of water to a household must include a volume based charge that –*
 - a) *support the viability and sustainability of water supply services to the poor;*
 - b) *discourages wasteful or inefficient water use; and*
 - c) *take into account the incremental cost that would be incurred to increase the capacity of the water supply infrastructure to meet an incremental growth in demand.*
- 2) *The requirements of sub regulation (1) are deemed to have been met where the tariff is set as a volume based charge that provides for a rising block tariff structure which includes –*
 - a) *three or more tariff blocks with the tariff increasing for higher consumption blocks;*
 - b) *a consumption level for each block defined as a volume consumed by a household during any 30 day period;*
 - c) *a first tariff block or lowest tariff block with a maximum consumption volume of six kilolitres and which is set at the lowest amount, including a zero amount, required to ensure the viability and sustainability of water supply services; and*
 - d) *a tariff for the last block or highest consumption block set at an amount that would discourage high water use and that reflects the incremental cost that would be incurred to increase the capacity of the water supply infrastructure to meet an incremental growth in demand.*

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The water tariff structure of Beaufort West Municipality should remain a rising block tariff system, which discourages wasteful or inefficient use of water. The determination of tariff policies should seek to address both commercial and social welfare concerns. The **CAFES**-principles (Sansom et al. 2002) are outlined below:

- **Conserving.** Tariffs should encourage consumers to purchase enough water to meet their needs without being wasteful.
- **Adequate.** Future investment should also be considered when setting the tariffs.
- **Fair.** The utility should achieve financial sustainability while maintaining access for poor communities.
- **Enforceable.** Tariffs that cannot be enforced are unlikely to be sustained.
- **Simple.** The tariffs should be easy for the Municipality to administer and easy for customers to understand. Consumers generally show greater willingness to pay water bills that they understand.

Wasteful or inefficient use of water is discouraged through increased tariffs. It is suggested that the following tariff structure characteristics should remain in Beaufort West Municipality's Structure in order to ensure efficient water use:

- Maintain a rising block tariff structure.
- Keep number of blocks in the tariff to a minimum. One block to address free basic water (the first step) and another to address the "cut-off" volume where consumers are discouraged to use water above this monthly volume (highest block) are required. In addition another three blocks could be used to distinguish between low users, typical use of high water use. Six blocks in a tariff often make good sense, as indicated in Table 7.3.1.
- The volumetric steps should be kept the same for all the areas within Beaufort West Municipality's Management Area.
- The cost of water in the maximum step should severely discourage use in this category. The volumetric use for the highest category could be 60 kl/month, above which residential water use could be considered to be wasteful or unnecessary. Garden use requiring in excess of this volume should be reduced in accordance with xeriscape practices.

The MFMA Circular No.78 of 7 December 2015 stipulated the following w.r.t. the water and sanitation tariff increases:

Municipalities should consider the full cost of rendering the water and sanitation services when determining tariffs related to these two services. If the tariffs are low and result in the municipality not recovering their full costs, the municipality should develop a pricing strategy to phase-in the necessary tariff increases in a manner that spreads the impact on consumers over a period of time.

Municipalities are urged to design an Inclining Block Tariff (IBT) structure that is appropriate to its specific circumstances, and ensures an appropriate balance between low income consumers and other domestic, commercial and business customers, and the financial interests of the municipality. While considering this structure, municipalities are advised to evaluate if the IBT system will be beneficial to them depending on consumption patterns in their areas.

In light of the current drought being experienced across large parts of the country, and to mitigate the need for water tariff increases, municipalities must put in place appropriate strategies to limit water losses to acceptable levels. In this regard municipalities must ensure that water used by their own operations is charged to the relevant service, and not simply attributed to water losses.

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The recommendations for the water and sewage tariffs of Beaufort West Municipality are as follows:

- Beaufort West Municipality will continue to re-evaluate the tariffs they charge for their water and sanitation services on an annual to ensure that all the O&M expenditure for water and sanitation services are always recovered through their water and sanitation services income, to address the bulk infrastructure backlogs and to ensure the adequate rehabilitation and maintenance of all existing water and sewerage infrastructure within the various towns.
- The large commercial and industrial consumers could lower their current water demand by means of improved practices or re-use of wastewater. Beaufort West Municipality should note that revenue could potentially decrease as a result of reuse practices.
- The current water tariff codes can be further improved to adequately differentiate between the different types of consumers and their water usage. The Municipality can investigate the possibility to uniquely describe the “Municipal” water usage with a distinction between the different user types, for example parks, office usage, fire-fighting, etc.
- A financial analysis needs to be done of the current water and sanitation tariffs in order to determine how the tariffs can be adjusted to better discourage the wasteful or inefficient use of water and still ensure adequate income for the municipality. The cost of water in the highest category should severely discourage use in this category, above which residential water use could be considered to be wasteful or unnecessary.
- A financial analysis needs to be done to determine if the Municipality can do away with the current fix sewage tariff structure and introduce a percentage of water usage as a flat charge rate for sanitation, if financially viable. Volumetric usage for sanitation services, whereby charges are determined according to water usage, with maximum ceilings and charged accordingly. This will need to include a free sanitation bracket, similar for free water, for indigent registered households. This will also further deter wasteful water use.
- Beaufort West Municipality needs to start with the monitoring of the volume and nutrient loading of all industrial effluent discharged by industrial consumers into the sewer system. A formula for the calculation of the extraordinary treatment cost to industrial consumers for the industrial effluent they discharge into Beaufort West Municipality’s sewer system needs to be put in place to form part of the existing tariff structure. The performance of WWTWs in general can be severely compromised by certain industrial effluent discharges. It is therefore also important for Beaufort West Municipality to recalculate their treatment costs annually, in order to ensure that there is no under or over recovery of costs from industrial consumers.

Regular sampling of the quality of industrial effluent discharged into the sewer system needs to be done and all industrial consumers need to be charged according to the quality of the effluent discharged into the Municipality’s sewer system.

7.4 FREE BASIC SERVICES

Beaufort West Municipality will keep on using part of their equitable share for the funding of the free basic services to the indigent registered households. Beaufort West Municipality only provides free services to the indigent registered households and this service is subsidized from the equitable share allocation.

Beaufort West Municipality’s tariffs support the viability and sustainability of water supply services to the poor through cross-subsidies (where feasible) and discourage the wasteful or inefficient use of water. Free basic water and sanitation services are linked to Beaufort West Municipality’s Indigent Policy and all indigent households receive free basic water and sanitation services. Poor consumers, who are not registered as indigent and who are residing in formal housing, receive no free basic water services.

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It is important for Beaufort West Municipality to enforce their indigent qualification criteria rigorously in order to ensure that those who do not qualify are removed from the allocation list. The Municipality needs to determine whether the current Indigent Support Policy is not too generous and creates a situation where too many citizens in Beaufort West Municipality's Management Area are making no monetary contribution toward the cost of delivering services to the community.

Beaufort West Municipality can investigate the financial viability of changing the fixed sanitation tariff structure to a stepped tariff based on water consumption in the future. This will need to include a free sanitation bracket, similar to free water, for the indigent households. This will also further deter wasteful water use.

7.5 METERING, BILLING AND INCOME

It is important for Beaufort West Municipality to continue with the reading of all their bulk water meters. The bulk meters and meter chambers also need to be properly maintained and the meters need to be protected from vandalism.

Consumer friendly billing: Beaufort West Municipality provides consumers with accounts that are clear and easy to understand. A graphical presentation will make the account even more consumers friendly.

Beaufort West Municipality's Customer Care, Credit Control and Debt Collection Policy and Credit Control and Debt Collection By-law provide for credit control procedures which are fair and equitable, provide for warnings and adequate notice, provide for consumer representations, allow alternative payment arrangements, and set out a fair procedure that will be applied in the event of non-payment. Where a consumer continues to fail to pay for services provided after the application of such procedures and a fair warning, Beaufort West Municipality credit control and debt collection by-law allows for actions that will limit its financial loss and promote good payment habits.

Beaufort West Municipality is committed to actively implement their Credit Control and Debt Collection By-law in order to reduce the percentage of non-payment by their consumers even further.

The Engineering Department needs to work with the Finance Department in order to ensure that all water used is metered, which include the free basic water, unbilled metered consumption, unbilled unmetered consumption and also the water used for irrigation purposes on the parks. Beaufort West Municipality is committed to ensure that all connections providing an uncontrolled volume of water supply are metered and that tariffs are applied in proportion to water use.

It is recommended that a detail Swift Analysis be done of the Treasury data of Beaufort West Municipality, in order to identify the following for each of the systems.

- Treasury records without GIS link;
- Identified unmetered erven included in the Treasury data;
- Developed erven with a meter, but with zero consumption;
- Developed erven with a meter, but with consumption less than 0.1 kl/d; and
- Developed erven with a substantial increase or decrease in water demand.

8. WATER SERVICES INSTITUTIONAL ARRANGEMENTS AND CUSTOMER SERVICES

The primary pieces of legislation for WSAs are as follows:

- The Constitution of the Republic South Africa Act 108 of 1996
- The Water Services Act 108 of 1997
- The Local Government: Municipal Structures Act 117 of 1998
- The Local Government: Municipal Systems Act 32 of 2000 (the Systems Act)
- The Local Government : Municipal Finance Management Act 56 of 2003 (MFMA)

In addition to the key pieces of local government legislation, the following legislation also impact on the role of the WSA:

- The National Water Act 36 of 1998
- The Division of Revenue Act (DORA) (published annually)
- The National Health Act 61 of 2003
- The Disaster Management Act 57 of 2002

8.1 MUNICIPAL STRATEGIC SELF-ASSESSMENT (MuSSA)

8.1.1 Water and Sanitation Services Planning

Sections 12 and 13 of the Water Services Act (Act No 108 of 1997) place a duty on WSAs to prepare and maintain a WSDP, as part of the process of preparing an IDP. The DWS has developed a new eWSDP website to assist WSAs with the WSDP process and to provide a framework for the capturing of the data. The WSDP of Beaufort West Municipality needs to be updated regularly.

The Municipality also needs to report annually and in a public way on progress in implementing the plan (WSDP Performance- and Water Services Audit Report), as part of Beaufort West Municipality's Annual Report, as required in terms of Section 18 of the Water Services Act, 1997 (Act No.108 of 1997), as well as the "Regulations relating to compulsory national standards and measures to conserve water", as issued in terms of Sections 9(1) and 73(1)(j) of the Water Services Act.

The Water Safety Plans for the various WTWs and water distribution systems and the W₂RAPs for the WWTWs and sewer drainage networks (once compiled) need to be updated regularly. Updated WTW and WWTW Process Audits were compiled during the 2023/2024 financial year.

The 2008 Water and Sewer Master Plans and the updated 2021 High Level Water Master Plan summarise the projects (Master Plan Items) necessary in order to cope with the increased future demands and developments within the Beaufort West Municipality's systems. The Water and Sewer Master Plans need to be updated more regularly.

8.1.2 Management Skill Level (Technical)

Performance Agreements are in place with the various Managers and Beaufort West Municipality is committed to fill the vacant positions on the approved organogram as soon as possible. Beaufort West Municipality is committed to work towards the following compliance, with regard to the Management Skill Levels of the Municipality.

- Approved Technical Management Organisational Organogram which meets the Municipality's water and sanitation business requirements and that key posts are filled (Technical Director, Water Services Manager and Sanitation Services Manager, etc.).

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- Sufficient Technical Management and Technical Support staff.
- Technical management and technical support staff have the correct skills / qualifications and experience as per Job Description requirements.
- Managers and technical support staff regularly attend appropriate water and sanitation services skills development / training to support professionalisation.
- Key technical managers (Section 56 and other Senior Management) have signed and monitored Performance Agreements.

8.1.3 Staff Skill Level (Technical)

A Work Place Skills Plan for Beaufort West Municipality is in place, which lists the training to be provided during the new financial year. The training of Beaufort West Municipality's personnel involved in the management of water and sanitation services are the most important factors that determine the ability of Beaufort West Municipality to deliver safe and reliable water and to treat the effluent at the WWTWs to an acceptable standard. Training of all staff involved in water supply and sanitation services on matters related to treatment processes and quality monitoring and control is essential because their actions (or failure to act) will have a major impact on the well-being of the communities and the environment as well as the reputation of the municipality.

Beaufort West Municipality can also start to actively focus on in-house training, which requires the identification of trainers (from senior operators / officers / professional ranks) for the development and facilitation of courses which relate to specific organizational knowledge and systems requirements. Beaufort West Municipality's internal reports such as the Operation and Maintenance Manuals and this WSDP have the necessary information on which the in-house courses can be based. This will assist Beaufort West Municipality's Human Resources Department in general and the skills development facilitator in particular to develop and implement effective workplace skills plans relevant to Human Capacity Development requirements.

WTWs: It is important for Beaufort West Municipality to classify all WTW and operators along the lines of the new Regulation 3630 requirements by establishing a programme for certification of works, operators, technicians and managers. The process will include reviewing the skills needed and aligning resources to these needs as well as reviewing total staff numbers necessary to meet all the objectives in the National Water Act and the new Regulation 3630 requirements.

It is important for Beaufort West Municipality to establish a mentoring role for all their operators and ensuring an adequately trained and classified workforce with dedicated training programmes for supervisors and operators. Budgets need to be established to address the shortfall of skilled staff, rethink methods to retain qualified personnel and plan for succession and clear career paths for experienced staff. With such a program a source of specific resources of skilled operators, technicians and managers will be established.

Process Controller registration renewal is conditional on meeting specified training requirements. Beaufort West Municipality must ensure that every Process Controller employed must complete the required hours of training every year, over the five years between registration renewals.

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The following training is required per Process Controller / Supervisor per year.

Table 8.1.3.1: Annual Process Controller and Supervisor training requirements		
Class of Process Controller	Unit Standard Credits	Training
In Training	30	Continued Education
Class I	30	
Class II	30	
Class III	30	
Class IV	30	
Class V	10*	Continued Education / Refresher Training
Class VI	10*	

Note: * Professional Credits: From Class V, Process Controllers must register for Professional Process Controller Registration

The current number of Process Controllers at each of the WTWs and the required number of Process Controllers are included in Table 8.1.3.2 of Topic 8 of the Administration, Information and Comprehensive Overview Report. **Additional Process Controllers need to be appointed from some of the WTWs, as indicated in Table 8.1.3.2 of Topic 8 of the Administration, Information and Comprehensive Overview Report.**

The Occupational Health and Safety Act contain provisions directing employers to maintain a safe workplace and to minimize the exposure of employees and the public to workplace hazards. It is therefore important for Beaufort West Municipality to compile a Legal Compliance Audit of their WTWs, which will provide the management of Beaufort West Municipality with the necessary information to establish whether the Municipality is in compliance with the legislation or not. **It is further recommended that Beaufort West Municipality arrange for chlorine audits to be done at all their disinfection facilities, in order to identify any potential shortcomings.**

WWTWs: It is important for Beaufort West Municipality to classify all WWTWs and operators along the lines of the new Regulation 3630 requirements by establishing a programme for certification of works, operators, technicians and managers. The process will include reviewing the skills needed and aligning resources to these needs as well as reviewing total staff numbers necessary to meet all the objectives in the National Water Act and the new Regulation 3630 requirements.

Beaufort West Municipality is also committed to manage and operate their sewage pump stations effectively to prevent any possible spillages. It is important for Beaufort West Municipality to upgrade their WWTWs when necessary, in order to reduce the risk of source contamination. The WWTWs will be managed and operated to comply with the permitted standards.

It is important for Beaufort West Municipality to establish a mentoring role for all their operators in order to ensure an adequately trained and classified workforce with dedicated training programmes for supervisors and operators. Budgets need to be established to address the shortfall of skilled staff, rethink methods to retain qualified personnel and plan for succession and clear career paths for experienced staff. With such a program a source of specific resources of skilled operators, technicians and managers will be established.

The current number of Process Controllers at each of the WWTWs and the required number of Process Controllers are included in Table 8.1.3.4 of Topic 8 of the Administration, Information and Comprehensive Overview Report. **Additional Process Controllers need to be appointed from some of the WWTWs, as indicated in Table 8.1.3.4 of Topic 8 of the Administration, Information and Comprehensive Overview Report.**

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8.1.4 Technical Staff Capacity (Numbers)

All critical water vacant positions as indicated on the approved Organogram needs to be filled as soon as possible. Beaufort West Municipality needs to review the skills needed at each of the WTWs and WWTWs according to the classification of the plants and need to align resources to these needs as well as reviewing total staff numbers necessary to meet all the objectives in the National Water Act and the new Regulation 3630 requirements.

Aligning the career paths to the occupational categories will assist the personnel to understand levels within across teams. Simplification of job titles to conform to respective occupational categories will assist in developing compatible and comparable career paths within the different Departments. Occupational categories will provide differentiation between levels. This approach will allow for more specific job designations in organograms with explicit career path connotations.

8.1.5 Water Resource Management (WRM)

See Topic 6 for the future demand of the water resource management of the municipality.

8.1.6 Water Conservation and Water Demand Management (WC/WDM)

See Topic 5 for the functionality requirements for WC/WDM of the municipality.

8.1.7 Drinking Water Safety and Regulatory Compliance

Drinking Water Quality Monitoring Programme: Operational monitoring of process indicators shall comply with the minimum requirement specified in SANS 241:2015 for characterising raw water quality, on-going levels of operational efficiency in a water treatment system and acceptable final water quality to the point of delivery, as summarised in Table 8.1.7.1 below.

Table 8.1.7.1: Minimum monitoring frequency for process risk indicators (SANS241-2:2015: Table 1)			
Determinand	Raw Water	Final Water	Distribution System
Conductivity or total dissolved solids	Daily	Daily	Not applicable
pH value	Daily	Once per shift ^a	Fortnightly
Turbidity	Daily	Once per shift ^a	Fortnightly
Disinfectant residuals	Not applicable	Once per shift ^a	Fortnightly
E.Coli (or faecal coliforms) ^b	Not applicable	Weekly	Fortnightly but dependent on population served ^d
Heterotrophic plate count ^c	Not applicable	Weekly	Fortnightly
Treatment chemicals ^d	Not applicable	Monthly	Not applicable
<p>a: A shift is defined as an eight-hour work period.</p> <p>b: If non-compliant with the numerical limits specified in SANS 241-1, implement corrective action and immediate follow-up sampling at an increased sampling frequency.</p> <p>c: If non-compliant with the numerical limits specified in SANS 241-1, implement corrective action and follow-up sampling.</p> <p>d: Includes all risk determinands that are added or formed as a result of the use of treatment chemicals (for example aluminium, iron and chlorine). If non-compliant with the numerical limits specified in SANS 241-1 in the final water, the distribution system monitoring frequencies of Table 3 in SANS241-2:2015 apply.</p>			

Table 8.1.7.2 of the Administration, Information and Comprehensive Overview Module indicates the required additional samples to be taken by Beaufort West Municipality.

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These requirements may be relaxed to a monthly frequency for groundwater supply systems (due to the reduced variability of groundwater quality), provided that no health-related determinands are detected at levels exceeding the numerical limits in SANS 241-1 during the risk assessment.

The minimum microbiological monitoring frequency (for E.Coli or faecal coliforms) within the distribution system shall comply with the requirements set out in Table 8.1.7.2 (from SANS 241:2015), provided that the water services institution or water services intermediary (or both) is able to provide appropriate guarantee that the water complies with the numerical limits specified in SANS 241-1.

Table 8.1.7.2: Minimum sample numbers for E.Coli (or faecal coliforms) in schemes (SANS 241-2:2015: Table 2)	
Population Served	Total number of samples per month ^a - Minimum
< 5 000	2
5 000 – 100 000	1 per 5 000 head of population + 1 additional sample ^b
100 000 – 500 000	1 per 10 000 head of population + 11 additional samples ^b
> 500 000	1 per 20 000 head of population + 36 additional samples ^b
a: During a rainy season, sampling should be carried out more frequently to ensure that all spatial and temporal risks are identified.	
b: See WHO, Guidelines for drinking-water quality.	

The table below indicates the compliance of the E.Coli monitoring frequency in the water distribution systems of Beaufort West Municipality, in terms of the minimum requirements of SANS:241-2: 2015 (Table 2). The period assessed was for samples taken from July 2023 to June 2024.

Table 8.1.7.3 Beaufort West Municipality's compliance of the monthly E.Coli monitoring frequency for the water distribution systems and at the WTWs in terms of the minimum requirements of SANS 241-2:2015 (Table 2).			
Distribution System	Population served	Required number of monthly samples (SANS 241-2:2015: Table 2)	Average Number of monthly E.Coli samples taken by Municipality during 2023/2024
Beaufort West	40 753	8.2	12.0
Merweville	1 903	2.0	2.0
Nelspoort	1 914	2.0	2.0
Murraysburg	6 061	2.0	1.8
Total	50 631	14.2	17.8

It can be noted from the above table that the number of monthly E.Coli samples taken by the Municipality during the 2023/2024 financial year was more than the required number of samples for all the water distribution systems, except for Murraysburg, where two more samples were required to ensure compliance.

The purpose of a Water Quality Compliance Risk Assessment is to obtain an overview of the ability of Water Services Institutions to meet the numerical limits specified in SANS 241-1 on a sustained basis. Pending the nature of any hazards / risks identified, adequate monitoring of the identified hazards / risks needs to be maintained while the Water Services Institutions also puts in place the necessary corrective and verification measures. This is not a once-off process since the nature of risks could vary as social, economic and environmental activities are subject to constant change.

It is therefore required under the Blue Drop Certification Programme that a Water Quality Compliance Risk Assessment is done on an annual basis; requiring that Monitoring Programmes would require amendment as informed by the Water Safety Planning Process.

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The Water Quality Compliance Risk Assessment plan should therefore include at least one full SANS 241 analysis per year and if any changes in the environment or process or delivery (or all) occur, at least monthly drinking water quality monitoring from source, through treatment and distribution, to the end user. The outcome of the risk assessment and the objectives of the monitoring programmes should further influence the design and implementation of the monitoring programmes.

Risk defined monitoring programmes require additional monitoring of all determinands identified in the risk assessment that might result in non-compliance with the numerical limits specified in SANS241-1. To verify that ongoing optimized operations of water treatment and distribution systems are sustained, determinands exceeding the numerical limits specified in SANS241-1 shall be monitored in the following manner:

- Raw water non-compliance – risk defined monitoring on raw and final waters;
- Final water non-compliance – risk defined monitoring on raw, final and critical distribution system sampling points; and
- Distribution water non-compliance – risk defined monitoring on the critical distribution system sampling points at the minimum frequencies indicated in Table 8.1.7.4 below:

Table 8.1.7.4: Frequency of analysis for determinands identified during the risk assessment exceeding the numerical limits in SANS 241-1 (SANS 241-2:2015: Table 3)			
Risk	Frequency		
	Raw water	Final water	Critical distribution system points
Acute health bacteriological risk determinands	Table 8.1.7.1	Table 8.1.7.1	Table 8.1.7.2
Protozoan parasite risk determinands.	Not applicable	Monthly	Not applicable
Acute health chemical risk determinands	Weekly	Weekly	Monthly
Chronic health risk determinands	Monthly	Monthly	Monthly
Aesthetic risk determinands	Monthly	Monthly	Quarterly
Operational risk determinands ^a	Weekly	Weekly	Monthly
a: Aluminium should be monitored on the final water in accordance with Table 8.1.7.1 and monthly on the distribution system			

The monitoring frequencies given in Table 8.1.7.4 above also apply to determinands that deteriorate between the points of delivery (input points to contracted bulk customers and the distribution delivery points to customers) to the extent that the determinands exceed the numerical limits specified in SANS 241-1.

Monitoring for all determinands included in the risk informed monitoring programme shall continue until such time that the water services institution or water services intermediary (or both) can substantiate that the identified determinand no longer constitutes an unacceptable risk.

The Drinking Water Quality Compliance Risk Assessment may be interpreted as follows:

- If the determinand exceeds the numerical limit specified in SANS241-1 in both the raw and final water, it implies that the existing treatment system or operation thereof is not removing the determinand.
- If the determinand that exceeds the numerical limit in the raw water is removed to the extent that it complies with SANS 241-1 in the final water, it implies that the installed infrastructure is adequate to deal with the problem.
- If both raw and final water comply with the numerical limits specified in SANS241-1, risks are deemed within acceptable limits.

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- Drinking water treatment chemicals can contribute to the risks present in treated waters. Aluminium, iron, disinfectant residuals and ammonia are examples of determinands that can be impacted by operational processes. The treatment process shall be optimized and these determinands shall be included in the prescribed monitoring programme if determinands exceed the limits specified in SANS241-1. Determinands, such as trihalomethanes, that may form between the input points to contracted bulk customers and the distribution delivery points to the extent that they exceed the numerical limits given in SANS241-1, shall be included as part of the risk defined monitoring programme.
- If enteric viruses are detected in source waters or if there is any evidence that source waters are affected by human faecal pollution then evidence of the efficacy of treatment barriers should be obtained. Demonstrations of the effective operation of these barriers within the water treatment system includes the maintenance of data records of determinands for final water as given in Table 8.1.7.1.
- Although the monitoring for viruses in the final water is not compulsory, such analysis currently provide the only direct indication of the overall efficacy of a treatment plant to remove viruses and should be included wherever possible.

The water quality compliance sample results for the last two financial years are included in Annexure E for each of the water distribution systems. The overall percentage of compliance of the water quality samples taken over the last two financial years are summarised in the table below per distribution system (SANS 241: 2015 Limits).

Table 8.1.7.5: Percentage compliance of the water quality samples for the last two financial years per performance indicator						
Performance Indicator	Performance Indicator categorised as unacceptable Yes / No (Table 4 of SANS 241-2:2015)		% Sample Compliance according to SANS 241-2015 Limits		Number of Samples taken into account	
	23/24	22/23	23/24	22/23	23/24	22/23
Beaufort West						
Acute Health Chemical	No (Excellent)	-	100.0%	-	16	-
Acute Health Microbiological	No (Excellent)	No (Good)	100.0%	96.6%	144	146
Chronic Health	No (Excellent)	-	99.4%	-	310	-
Aesthetic	No (Excellent)	-	97.3%	-	558	-
Operational Efficiency	No (Excellent)	No (Good)	93.0%	92.9%	546	154
Beaufort West Reclamation Plant						
Acute Health Chemical	No (Excellent)	No (Excellent)	100.0%	100.0%	60	29
Acute Health Microbiological	No (Excellent)	No (Excellent)	100.0%	100.0%	48	27
Chronic Health	No (Excellent)	No (Excellent)	100.0%	99.4%	213	163
Aesthetic	No (Excellent)	No (Excellent)	100.0%	100.0%	132	99
Operational Efficiency	No (Excellent)	No (Excellent)	100.0%	97.2%	48	36
Merweville						
Acute Health Chemical	No (Excellent)	-	100.0%	-	11	-
Acute Health Microbiological	No (Excellent)	No (Good)	100.0%	95.2%	24	21
Chronic Health	No (Excellent)	-	100.0%	-	63	-
Aesthetic	No (Excellent)	-	100.0%	-	98	-
Operational Efficiency	No (Excellent)	Yes (Unacceptable)	93.1%	74.1%	87	27
Nelspoort						
Acute Health Chemical	No (Excellent)	-	100.0%	-	5	-
Acute Health Microbiological	No (Excellent)	No (Excellent)	100.0%	100.0%	24	22
Chronic Health	No (Excellent)	-	97.0%	-	67	-
Aesthetic	Yes (Unacceptable)	-	72.0%	-	100	-
Operational Efficiency	Yes (Unacceptable)	No (Good)	87.1%	92.3%	93	26
Murraysburg						

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Table 8.1.7.5: Percentage compliance of the water quality samples for the last two financial years per performance indicator						
Performance Indicator	Performance Indicator categorised as unacceptable Yes / No (Table 4 of SANS 241-2:2015)		% Sample Compliance according to SANS 241-2015 Limits		Number of Samples taken into account	
	23/24	22/23	23/24	22/23	23/24	22/23
Acute Health Chemical	Yes (Unacceptable)	-	60.0%	-	5	-
Acute Health Microbiological	Yes (Unacceptable)	No (Excellent)	81.8%	100.0%	22	19
Chronic Health	No (Excellent)	-	100.0%	-	59	-
Aesthetic	Yes (Unacceptable)	-	77.3%	-	88	-
Operational Efficiency	No (Good)	Yes (Unacceptable)	92.8%	70.4%	83	27

The table below gives an overview of the four categories under which the risks posed by micro-organism, physical or aesthetic property or chemical substance of potable water is normally classified.

Table 8.1.7.6: Four categories under which the risks posed by micro-organism, physical or aesthetic property or chemical substance of potable water is normally classified	
Category	Risk
Acute Health	Determinand that poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified in this part of SANS 241.
Aesthetic	Determinand that taints water with respect to taste, odour and colour and that does not pose an unacceptable health risk if present at concentration values exceeding the numerical limits specified in SANS 241.
Chronic Health	Determinand that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified in SANS 241.
Operational	Determinand that is essential for assessing the efficient operation of treatment systems and risks from infrastructure

It is also important to note that all operational manuals of treatment unit processes such as chemical dosing, coagulation sedimentation, filtration, disinfection etc. should contain operational limits, monitoring programmes, verification procedures and pre-determined corrective actions. Corrective actions identified for each control measure need to be adhered to as soon as critical limits have been exceeded. The corrective actions are an important component of the management aspects of the Water Safety Plans and should be effective in restoring performance to acceptable levels when critical limits are exceeded.

Corrective actions must be supported by a contingency plan. This plan is a detailed management response to failures and will identify individual responsibilities and a time constraint for remedy. The corrective actions identified by the Water Safety Plan Team should also include long term actions designed to prevent non-compliance and reduce the need for contingency plans to be re-actioned.

Monitoring data provide important feedback on how the water supply system is working and should be frequently assessed. Regularly assessed monitoring records are a necessary element of the Water Safety Plan as they can be reviewed, through external and internal audit, to identify whether the controls are adequate and also to demonstrate adherence of the water system to the water quality targets. The strategies and procedures for monitoring the various aspects of the water supply system should be documented.

Monitoring plans should include the following:

- Parameters to be monitored.
- Sampling location and frequency
- Sampling needs and equipment
- Schedules for sampling
- Methods for quality assurance and validation of sampling results.
- Responsibilities and necessary qualifications of staff.

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- Requirements for documentation and management of records including how monitoring of results will be recorded and stored.
- Requirements for reporting and communication of results.

The parameters selected by Beaufort West Municipality for operational monitoring should

- reflect the effectiveness of each control measure;
- provide a timely indication of performance;
- be readily measure; and
- provide opportunity for an appropriate response.

Drinking Water Sample Analysis (Credibility): Beaufort West Municipality should continue and improve the level and frequency of regular sampling (Operational and Compliance Monitoring) and reporting on water quality.

The knowledge, skills, motivation and commitment of staff involved in the management of drinking water quality are the most important factors that determine the ability of Beaufort West Municipality to deliver safe and reliable water. Training of all staff involved in water supply services on matters related to treatment processes and quality monitoring and control is essential because their actions (or failure to act) will have a major impact on the well-being of the communities.

It is important for the Process Controllers to check all sampling equipment every time before use, in order to ensure that test results are reliable and not “contaminated” by faulty instruments. All field instruments used for checking physical properties must also be calibrated in accordance with the manufacturer’s manual before any water sample is collected. Buffer solutions are required for correct calibration to ensure accuracy of measurements.

Blue Drop Status: Beaufort West Municipality is committed to work with the DWS and the other role-players in order to further improve their Blue Drop Scores for the various WTWs and water distribution systems. Beaufort West Municipality will continue with the regular updating of their detail WTW Process Audits for all the WTWs and the Municipality and will ensure that the Operation and Maintenance Manuals for the WTWs are used by the Process Controllers. The old Water Safety Plans will be updated for the various WTWs and water distribution systems. The Preventative Actions and Control Measures identified as part of the updating of the Water Safety Plans need to be implemented in order to address the potential risks identified through the Water Safety Plan process.

8.1.8 Basic Sanitation

See Topic 2 for the future requirements for the basic sanitation facilities of the municipality.

8.1.9 Wastewater / Environmental Safety and Regulatory Compliance

Wastewater Quality Monitoring Programme: The current sampling (Operational and Compliance Monitoring) and reporting on quality of treated sewage effluent discharged from the WWTWs is not yet adequate for Beaufort West Municipality, as indicated in Tables 8.1.9.2 and 8.1.9.3 of the Administration, Information and Comprehensive Overview Module. The following requirements from the DWS should also be adhered to, as part of the ongoing monitoring of the various WWTWs:

- What is the current condition of the Works?
- Does the Works comply with the license agreement?
- Is there monitoring and recording of the final effluent quality?

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- Is there monitoring and recording of incoming sewage to the Works?
- Are monitoring records available on site?
- Is there compliance to the monitoring frequency?
- Are the monitoring results and records submitted to DWS?
- Does an external consultant visit the Works on a regular basis (Process Audit)?
- How is the sludge managed and disposed?
- Is the plant fenced off with proper entrance gate?
- Is the O&M manual up to date according to the operation of the Works?

Accurate and full records of all aspects of the operation and maintenance of the WWTWs should always be kept. The Process Controllers on site should keep a pocket book in which they should note any significant event on the works, such as a peculiar colour of the water, failure of equipment or strange smells and they must record the date and time at which these events occur. All incidents also need to be recorded in an Incident Register.

The Process Controllers at the WWTW will need to implement the required control measures and operational and compliance sampling programmes in order to ensure that the various unit processes at the WWTWs performs optimally. If these predetermined Alert Levels are exceeded at any of the control points where samples are taken for operational purposes, specific actions need to be taken to bring the operational parameters back to within the target ranges.

Wastewater Sample Analysis (Credibility): Beaufort West Municipality should continue and further improve the level and frequency of regular sampling (Operational and Compliance Monitoring) and reporting on wastewater quality.

The knowledge, skills, motivation and commitment of staff involved in the management of wastewater quality are the most important factors that determine the ability of Beaufort West Municipality to comply with the quality of treated effluent discharge from the WWTWs. Training of all staff involved in sanitation services on matters related to treatment processes and quality monitoring and control is essential because their actions (or failure to act) will have a major impact on the environment.

It is important for the Process Controllers to check all sampling equipment every time before use, in order to ensure that test results are reliable and not “contaminated” by faulty instruments. All field instruments used for checking physical properties must also be calibrated in accordance with the manufacturer’s manual before any effluent sample is collected. Buffer solutions are required for correct calibration to ensure accuracy of measurements.

Green Drop Status:

Beaufort West Municipality is committed to work with the DWS and the other role-players in order to further improve on their 2022 Green Drop Scores for the various WWTWs and to get the Municipality ready for the next round of assessments. Beaufort West Municipality will update their W₂RAPs as necessary in order to reduce their current CRRs for the various WWTWs. The following processes will also further assist the Municipality in the process of reducing the CRRs for their WWTWs.

- Forward planning and upgrading / refurbishment of treatment plants to ensure adequate capacity for the flows received;
- Operate and maintain the WWTWs within design- and equipment specifications;
- Have trained, qualified and registered staff in place;

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TOPIC 8: WATER SERVICES INSTITUTIONAL ARRANGEMENTS AND CUSTOMER SERVICES

- Get mentoring / coaching contracts in place where there is a great demand for adequately skilled process controllers and supervision;
- Monitoring of flow to- and from the plants;
- Sampling and monitoring of effluent quality;
- Appropriate authorisation in accordance with the National Water Act (36 of 1998); and / or
- Where plant is overloaded, introduce innovative methods to ensure enhancement of effluent quality.

8.1.10 Infrastructure Asset Management (IAM)

See Topic 3, Section 3.1.1. for the future demand requirements for Asset Management.

8.1.11 Operation and Maintenance of Assets

See Topic 4 for the future demand requirements for the operation and maintenance of the water and sewerage infrastructure assets of the municipality.

8.1.12 Financial Management

See Topic 7 for the future financial management functionality requirements.

8.1.13 Revenue Collection

See Topic 7 for the future revenue collection functionality requirements.

8.1.14 Financial Asset Management

See Topic 3, Section 3.1.1. for the future demand requirements for the financial asset management of the municipality.

8.1.15 Information Management (IT)

The Information and Communication Technology (ICT) services aid and assist in achieving the IDP Strategic Objectives in the following manner.

- A stable technology environment and infrastructure to support business units and departments in achieving their objectives.
- Reduced down time of systems.
- Increased support and optimized application and infrastructure resulting in increased productivity within Beaufort West Municipality.
- Secure and govern IT assets.
- Reduce cost through IT without compromising support and productivity.
- Bring innovation through IT when required to support economic growth.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

TOPIC 8: WATER SERVICES INSTITUTIONAL ARRANGEMENTS AND CUSTOMER SERVICES

8.1.16 Organisational Performance Monitoring

Beaufort West Municipality has a Performance Management System in place. The performance indicators as included in the SDBIP are regularly reviewed in order to promote a culture of performance management among its political structures, political office bearers and councillors and in its administration and administer its affairs in an economical, effective, efficient and accountable manner.

The 2023/2024 water and sanitation KPIs and targets, as included in the 2024/2025 IDP, are summarised in the table below.

Table 8.1.16.1: Future water and sanitation KPIs (SDBIP)		
KPI Name	Unit of Measurement	2023/2024 Target
Number of formal residential properties that receive piped water (credit and prepaid water) that is connected to the municipal water infrastructure network and which are billed for water or have prepaid water meters as at 30 June.	Number of residential properties which are billed for water or have pre-paid meters as at 30 June 2024.	16 307
Number of formal residential properties connected to the waste water sanitation/sewerage network for sewerage service, irrespective of the number of closets (toilets) which are billed for sewerage as at 30 June	Number of residential properties which are billed for sewerage as at 30 June 2024.	16 307
Provide free basic water to active indigent households as defined in paragraph 9(1) of the Municipality's Credit Control and Debt Collection Policy as at 30 June 2024	Number of active indigent households receiving free basic water as at 30 June 2024.	9 658
Provide free basic sanitation to active indigent households as defined in paragraph 9(1) of the Municipality's Credit Control and Debt Collection Policy as at 30 June 2024	Number of active indigent households receiving free basic sanitation as at 30 June 2024	9 658
Limit unaccounted for water quarterly to less than 25% during 2023/2024 [(Number of kilolitres water purchased or purified – number of kilolitres water sold (including free basic water) / number of kilolitres water purchased or purified x 100]	% unaccounted water	30%
95% of water samples in Beaufort West jurisdiction area comply with SANS241 micro biological indicators	% of water samples compliant to SANS 241	95%
95% of the approved project budget spent on the upgrade of existing irrigation pump station at the Waste Water Treatment Works in Beaufort West by 30 June 2024	% of budget spent	95%

8.1.17 Water and Sanitation Service Quality

Access to safe drinking water is essential to health and is a human right. Safe drinking water that complies with the SANS:241 Drinking Water specification does not pose a significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Beaufort West Municipality is therefore committed to ensure that their water quality always complies with national safety standards.

The Water Safety Plans and W₂RAPs of Beaufort West Municipality need to include Improvement / Upgrade Plans for the residual medium and high risks. The purpose of the Improvement / Upgrade Plans is to address the existing significant risks where the existing controls are not effective or absent. The corrective measures need to be linked to specific persons for implementation. Updated Water Safety Plans need to be compiled for all the water supply systems and W₂RAPs for all the WWTWs and sewer drainage networks.

8.1.18 Customer Care (CRM)

Beaufort West Municipality is committed to maintain the existing high level of customer service in their urban areas and to record all the necessary information for the WSDP on an annual basis. The present Customer Services and Complaints Management System allows for the recording and management of all water and sanitation related complaints. The Municipality is committed to ensure that all water and sanitation related complaints are recorded and that the complaints are addressed within the required time period.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

9.1 EXISTING NEEDS PERSPECTIVE

The table below gives an overview of the short-term risk assessment for Beaufort West Municipality, as completed for Beaufort West Municipality during the 2023/2024 financial year by the DLG.

Table 9.1.1: Short-Term risk assessment for Beaufort West Municipality (DLG, 2023/2024)				
Key Performance Area	Beaufort West	Merweville	Nelspoort	Murraysburg
Risk Category	High	Moderate	Moderate	High
Existing Sources – Groundwater	Moderate	Moderate	Low	Low
Existing Sources – Surface water	Low	-	Low	-
Raw water dams	Moderate	Moderate	Moderate	Moderate
Total residual storage	Moderate	Low	Moderate	High
Raw water pump stations	Moderate	Moderate	Moderate	Moderate
Bulk supply: Gravity and rising mains	Moderate	Low	Moderate	Moderate
WTWs	Moderate	Low	Moderate	Moderate
Water Losses and dilapidated infrastructure	High	Low	High	High
Telemetric monitoring systems	High	Low	High	Low
Standard Operating Procedures	Moderate	Low	Moderate	Low
Bylaws status	Moderate	Low	Moderate	Low
Technical shortages and training needs	Moderate	Moderate	Moderate	Moderate
Water Tariffs status	Low	Low	Low	Low
Water Authorisations	Moderate	High	Low	High
Current Monitoring: Quality	Low	Low	Moderate	Moderate
Current Monitoring: Volume	Low	Low	Moderate	Moderate
Current Monitoring: Water Levels	Low	Low	Moderate	Moderate
Vandalism	High	Low	Low	High
Budget	High	High	High	High
Contamination	Low	Low	High	High
Drought	High	High	Moderate	Moderate
Competing Water Users	High	Low	Low	Low
Loadshedding	High	High	High	High

The Department of Local Government's Short-Term Assessment Study included the following conclusions for the four towns:

Beaufort West: The town is currently struggling with vandalism on the production boreholes and the depletion of water at well-fields like Brandwacht. It is recommended that the rehabilitation of boreholes in terms of managed aquifer recharge (MAR) and security at boreholes be addressed. A stormwater and demand management master plan and business plan are needed to help the municipality to address the rehabilitation of the boreholes in terms of managed aquifer recharge (MAR) and security issues. The town has a problem with the lack of information that is being received by the Finance Department to ensure that the water being provided is being paid for. If no rainfall occurs in the next rainfall season (12 months) the town will be at risk of a drought.

Merweville: The instalment of new water meters ensured that the town has cut its consumption by 50%. A new telemetry system was also installed, which is useful in calculating the volume used per day. A WULA was submitted in 2023. If no rainfall occurs in the next rainfall season (12 months) the town will be at risk of a drought.

Nelspoort: The quality of the water is not good, but a new WTW is being planned for the 2024/2025 financial year. This will improve the quality of water and supply to the public. The town currently has sufficient water and is not a risk of a drought in the near future.

Murraysburg: A lack of management can be seen when looking at the abstraction, treatment and distribution of water. This has resulted in the town having an unacceptable blue drop score. Vandalism is also a significant risk at one of the reservoirs in town, which would need to be replaced to ensure a more sustainable water supply in the future. A WULA was submitted in 2023.

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

The table below gives an overview of the Existing Needs Perspective for Beaufort West Municipality, with regard to the various WSDP Business Elements.

Table 9.1.2: Existing Needs Perspective for Beaufort West Municipality																		
Section	Interpret Situation Assessment	Intervention Required?	%	Solution Description	%	Is there an existing project / activity addressing this problem?	%	Project Reference	Does this current listed project / activity address the problem totally?	%	Project / Activity approved by Council as part of WSDP database?	%	Approved by Council in project / activity database and part of 5 yr IDP cycle projects?	%	Project / Activity listed in 3 yr MTEF Cycle?	%	Total Points	Current Demand Overall Scoring %
Topic 1: Settlement Demographics and Public Amenities																		
Settlements summary	Various Spatial Planning and Housing challenges	Yes	100	Current Housing need is 6 555 households. Continue with the implementation of the recommended SDF proposals for each of the towns and ensure that new developments are in line with these proposals and recommendations.	100	Yes	100	Various	Partially	50	Yes	100	Yes	100	Yes	100	650	78.6
	Insufficient infrastructure capacity to accommodate new developments. Bulk water and sewerage infrastructure need to be aligned with the Water and Sewer Master Plans and housing projects can only continue once the required bulk water and sewerage infrastructure are in place.	Yes	100	Large number of boreholes in Beaufort West vandalized and yield from groundwater resources in Beaufort West reduced by 47%, due to vandalized and non-operational boreholes. Establish assurance of supply levels of all water sources. Ensure that the provision of bulk water and sewerage infrastructure are aligned with the Housing Strategy (Housing Pipeline) and that housing projects only continue once the required bulk water and sewerage infrastructure are in place, as indicated in the Water and Sewer Master Plans and this WSDP.	100	Yes	100	Various	Partially	50	Yes	100	Yes	100	Yes	100	650	78.6
Summary by settlement group	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Assessment score by settlement type	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Amenities summary	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Topic 2: Service Levels Profile																		
Direct Backlog: Water	There are 23 households in Beaufort West, 9 households in Merweville and 7 households in Murraysburg with communal water services in informal areas. There are 29 households in Murraysburg in informal areas with no communal water services.	Yes	100	Compile a Water and Sanitation Service Level Policy. Continue to ensure that there is at least one communal tap for every 25 households in informal areas.	100	No	0	BW2425004	Yes	100	Yes	100	No	0	No	0	400	57.1
	There are still an estimated 63 households on the farms in the rural areas without basic water services.	Yes	100	Compile a Water and Sanitation Service Level Policy. Assist private landowners in the rural areas as far as possible with the provision of basic water services to all the households in the Municipality's Management Area with existing water service levels below RDP standard, once practical guidelines and funding become available from the DWS.	100	No	0	BW2425006	Yes	100	Yes	100	No	0	No	0	400	57.1
Direct Backlog: Sanitation	There are 23 households in Beaufort West, 9 households in Merweville and 29 households in Murraysburg with no communal sanitation services in informal areas.	Yes	100	Compile a Water and Sanitation Service Level Policy. Install communal toilets in the informal areas to ensure that there is at least one communal toilet for every 5 households in informal areas.	100	No	0	BW2425005	Yes	100	Yes	100	No	0	No	0	400	57.1
	There are still an estimated 520 households on the farms in the rural areas without basic sanitation services.	Yes	100	Compile a Water and Sanitation Service Level Policy. Assist private landowners in the rural areas as far as possible with the provision of basic sanitation services to all the households in the Municipality's Management Area with existing sanitation service levels below RDP standard, once practical guidelines and funding become available from the DWS.	100	No	0	BW2524007	Yes	100	Yes	100	No	0	No	0	400	57.1
Water services infrastructure supply level profile	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Water reliability profile	There are 29 households in Murraysburg in informal areas with no communal water services. There are still an estimated 63 households on the farms without basic water services.	Yes	100	Continue to install communal taps in the informal areas in order to ensure that the ratio of number of households per facility complies with the target of 25 or less households per tap. Assist private landowners as far as possible with the provision of basic water services to all the households on the farms in the rural areas with existing water service levels still below RDP standard, once practical guidelines and funding become available from DWS.	100	No	0	BW2425004 & BW2425006	Yes	100	Yes	100	No	0	No	0	400	57.1
Sanitation services infrastructure supply level profile	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Sanitation reliability profile	There are an estimated 61 households in the informal areas with no communal toilets. There are still an estimated 520 households on the farms without basic sanitation services.	Yes	100	Install communal sanitation services for the 61 households in informal areas in order to ensure that the ratio of number of households per facility complies with the target of 5 of less households per toilet facility. Assist private landowners as far as possible with the provision of basic sanitation services to all the households on the farms in the rural areas with existing sanitation service levels still below RDP standard, once practical guidelines and funding become available from DWS.	100	No	0	BW2425005 & BW2425007	Yes	100	Yes	100	No	0	No	0	400	57.1

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EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

Table 9.1.2: Existing Needs Perspective for Beaufort West Municipality																		
Section	Interpret Situation Assessment	Intervention Required?	%	Solution Description	%	Is there an existing project / activity addressing this problem?	%	Project Reference	Does this current listed project / activity address the problem totally?	%	Project / Activity approved by Council as part of WSDP database?	%	Approved by Council in project / activity database and part of 5 yr IDP cycle projects?	%	Project / Activity listed in 3 yr MTEF Cycle?	%	Total Points	Current Demand Overall Scoring %
Water services: Education	The water service levels of the two primary schools in the rural areas are not known.	No	100	Confirm the water service levels of the primary schools in the rural areas. Provide basic water services to the schools if the current water service levels are below RDP standard.	100	No	0	BW2425008	Yes	100	Yes	100	No	0	No	0	400	57.1
Water services: Health	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Sanitation services: Education	The sanitation service levels of the two primary schools in the rural areas are not known.	No	100	Confirm the sanitation service levels of the primary schools in the rural areas. Provide basic sanitation services to the schools if the current sanitation service levels are below RDP standard.	100	No	0	BW2425008	Yes	100	Yes	100	No	0	No	0	400	57.1
Sanitation services: Health	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Health and education facilities	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Topic 3: Water Services Asset Management																		
General information	Asset Management Plan is not in place.	Yes	100	Develop an Asset Management Plan.	100	No	0	BW2425012	Yes	100	Yes	100	No	0	No	0	400	57.1
Operation	Updated Water Safety Plans are required for all WTWs and water distribution systems	Yes	100	Update Water Safety Plans	100	No	0	BW2425010	Yes	100	Yes	100	Yes	100	No	0	500	71.4
	Shortcomings were identified in WTW Process Audits.	Yes	100	Implement recommendations from the WTW Process Audits. Implement proposed interim solutions for improving the operation of the WTW, as well as proposed refurbishment and upgrade and extension work. Ensure adequate budget is allocated for the future upgrading and refurbishment work.	100	Partially	50	BW2425028 BW24029	Yes	100	Yes	100	Yes	100	No	0	550	78.6
	Updated W ₂ RAPs are required for all WWTWs and sewer drainage networks	Yes	100	Update W ₂ RAPs	100	No	0	BW2425011	Yes	100	Yes	100	Yes	100	No	0	500	71.4
	Shortcomings were identified in the WWTW Process Audits.	Yes	100	Implement recommendations from the WWTW Process Audits. Implement proposed interim solutions for improving the operation of the WWTW, as well as proposed refurbishment and upgrade and extension work. Ensure adequate budget is allocated for the future upgrading and refurbishment work.	100	Partially	50	BW2425036 BW2425037 BW2425038 BW2425039	Yes	100	Yes	100	Yes	100	No	0	550	78.6
Functionality observation	Inadequate capacity of existing water and sewerage infrastructure to meet future requirements	Yes	100	Provide additional reservoir storage capacity for the towns with inadequate storage capacity. Upgrade existing water pump stations and provide new water pump stations for the identified areas. Upgrade existing WTWs and WWTWs as recommended. Upgrade existing sewer pump stations and provide new sewer pump stations for the identified areas.	100	Partially	50	Various	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
Asset assessment spectrum	Insufficient funds to support maintenance of existing infrastructure. Deteriorated water and sewerage infrastructure. Inadequate O&M allocation for the replacement of old water and sewerage infrastructure and the operation and maintenance of the existing infrastructure.	Yes	100	Increase O&M budget for repairs and maintenance of infrastructure. A budget of approximately 2% of the total asset value per annum should be allocated towards the replacement of the existing water and sewerage infrastructure (Best Practice). In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the system remains in good condition (Best Practice).	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
Water and Sanitation schemes	Inadequate capacity of existing water and sewerage infrastructure to meet future requirements	Yes	100	Upgrade sections of the water reticulation network and sewer drainage network as proposed in the Water and Sewer Master Plans.	100	Partially	50	Various	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
Topic 4: Water Services Operation and Maintenance																		
O&M Plan	O&M tasks and O&M Schedules for the various water and sewerage infrastructure components not all in place	Yes	100	Operation and Maintenance tasks for the various water and sewerage infrastructure components, as indicated under Sections 4.1.1 to 4.1.10 of the "Future Demand and Functionality Requirements" WSDP Master Plan should be implemented. Ensure the required O&M schedules are in place and signed off.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6
Is there an O&M Plan?																		
Resources	Inadequate O&M allocation for the replacement of old water and sewerage infrastructure and the operation and maintenance of the existing infrastructure.	Yes	100	A budget of approximately 2% of the total asset value per annum should be allocated towards the replacement of existing water and sewerage infrastructure (Best Practice). In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the system remains in good condition (Best Practice).	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	No	0	550	78.6
	Insufficient process controllers for the WTWs and WWTWs	Yes	100	Beaufort West Municipality needs to ensure that the number of process controllers at each of the WTWs and WWTWs and the class of process controller complies with the required number of process controllers and class of process controller per plant (New Regulation 3630).	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6
Information	All incidents at the WTWs and WWTWs to be recorded and Incident Management Protocols to be followed.	Yes	100	All incidents at the WTWs and WWTWs and on the water reticulation networks and sewer drainage networks need to be recorded and Incident Management Protocols, to be included in the Water Safety Plans and W ₂ RAPs, need to be followed after an incident.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6
	Required O&M Manuals are not in	Yes	100	Ensure that the required O&M Manuals are in place for all the water and	100	Partially	50	Part of O&M	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6

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EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

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	place for all infrastructure.			sewerage infrastructure.				Budget										
Activity control and management	O&M tasks and O&M Schedules for the various water and sewerage infrastructure components not all in place	No	100	Groundwater: Implement recommended daily, weekly, monthly and six monthly O&M activities for the boreholes.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Surface water infrastructure: Implement preventative maintenance procedures.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Bulk and water reticulation networks and fittings: Compile daily, weekly, monthly and annual maintenance checklists for the maintenance activities for the water reticulation networks and fittings.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	WTWs: Evaluate the existing O&M schedules for the WTWs against the recommended O&M tasks and ensure all required activities are adequately monitored and recorded.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Water PSs: Compile weekly and monthly maintenance checklists for the recommended activities for all the water PSs and all PSs need to be inspected on at least a weekly basis.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Reservoirs: Compile maintenance checklists for the recommended reservoir maintenance activities and document all inspections.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Remote monitoring and Control Systems: Ensure adequate maintenance is carried out on the SCADA systems and compile maintenance checklists for the recommended activities.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Sewer PSs: Compile weekly and quarterly maintenance checklists for the recommended activities for all the sewer PSs and all centrifugal pump stations need to be inspected on at least a weekly basis.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	Bulk and sewer drainage networks: Annual, monthly and weekly schedules for maintenance should be drawn up for the bulk and sewerage networks. Regular cleaning of sewer lines and all blockages and their precise locations should be recorded.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
		No	100	WWTWs: Evaluate the existing O&M schedules for the WWTWs against the recommended O&M tasks and ensure all required activities are adequately monitored and recorded.	100	Partially	50	Part of O&M Budget	Yes	100	Yes	100	Yes	100	Partially	50	600	85.7
Topic 5: Conservation and Demand Management: Water Resource Management																		
Reducing unaccounted for water and water inefficiencies	Extremely high NRW and Water Losses. Financial system does not include all billed metered consumption volumes.	Yes	100	Implement the proposed WC/WDM Strategy and the 25 WC/WDM items. Ensure adequate budget is allocated under the Capital and Operational budgets towards the implementation of the WC/WDM initiatives.	100	Partially	50	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	550	78.6
	Large water users (AADD > 20 kl/d) to be identified through a Swift analysis	Yes	100	Swift analysis needs to be done, where after meetings should be set up with the Large Water Users to discuss water consumption status, potential water saving volumes and to cultivate a water saving awareness within each large water user.	100	No	0	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	500	71.4
Leak and meter repair programmes	Leak Repair and Assistance Programmes are required for the low cost housing developments.	Yes	100	Implement a Leak Repair and Assistance Programme that investigates and repairs leaks at all domestic households in low cost housing developments and poor areas with consumption above 15 kl/month. An exercise could also be initiated to check for visual leakage at public buildings, using more than 60 kl/month.	100	No	0	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	500	71.4
	Old water reticulation networks result in regular pipe bursts and add to the water losses.	Yes	100	Allocate sufficient budget for the successful implementation of a pipeline replacement programme. The location of pipe failures should in the future be recorded, preferably with accurate GPS coordinates. A PRP Study needs to be done for Beaufort West Municipality.	100	No	0	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	500	71.4
	Unmetered erven and erven with a water meter, but with zero consumption, need to be identified through a Swift analysis.	Yes	100	Swift analysis needs to be done. Install water meters at all the unmetered erven and inspect metered erven with zero consumption.	100	No	0	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	500	71.4
Consumer / End use demand management: Public information and Education programmes	WDM measures not yet implemented at all schools	Yes	100	At least once a year, a schools education programme on water conservation should be undertaken. The Municipality should assist the school(s) with the monitoring (water audit) of their water consumption. Beaufort West Municipality can also focus on the implementation of an extensive schools WDM programme, which can include annual competitions between schools (Say with a prize for the lowest consumption, the lowest per capita consumption and for the best WDM Strategy poster design, etc.). A schools WDM programme should receive a high priority.	100	No	0	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	500	71.4
	Informative billing and consumer education material is needed.	Yes	100	Continue to focus on the installation of water saving devices (specific water efficient toilets) and raising awareness regarding conservation projects and the installation of these products in order to reduce water demand. The use and installation of these fittings should be included as a condition for the approval of building plans as well as provided for in the Water Services By-law.	100	Partially	50	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	550	78.6
Conjunctive use of surface and	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS

EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

Table 9.1.2: Existing Needs Perspective for Beaufort West Municipality																		
Section	Interpret Situation Assessment	Intervention Required?	%	Solution Description	%	Is there an existing project / activity addressing this problem?	%	Project Reference	Does this current listed project / activity address the problem totally?	%	Project / Activity approved by Council as part of WSDP database?	%	Approved by Council in project / activity database and part of 5 yr IDP cycle projects?	%	Project / Activity listed in 3 yr MTEF Cycle?	%	Total Points	Current Demand Overall Scoring %
groundwater																		
Working for Water	Adequate	No	100	-	100	-	100	-	-	100	-	100	-	100	-	100	700	100
Topic 5: Conservation and Demand Management: Water Balance																		
Water balance	Shortcomings were identified with regard to the current bulk flow metering at the four WWTWs.	Yes	100	Continue to ensure that the volume of water supplied from all water resources are metered (each individual source separately), the raw water and final water at the WTWs and the volume of water supplied to the various zones (at Reservoirs). The inflow at the WWTWs, the volume of treated effluent re-used and the volume of treated effluent returned to the water resource system also need to be metered at all the WWTWs.	100	Partially	50	BW2425016 BW2425017 BW2425018 BW2425019	Yes	100	Yes	100	Yes	100	No	0	550	78.6
Topic 6: Water Resources																		
Current water sources	Confirm existing lawful use and registration volumes for all systems.	Yes	100	Ensure the required authorisations (licences) are in place for all the water resources, as well as the required registrations.	100	Yes	100	Part of O&M Budget	Yes	100	Yes	100	Yes	100	No	0	600	85.7
Additional sources available	Augmentation of the existing water resources in order to increase assurance of supply.	Yes	100	Augmentation of the groundwater sources in Beaufort West (Karoo National Park)	100	No	0	BW2425040	Yes	100	Yes	100	Yes	100	No	0	500	71.4
		Yes	100	Refurbishment of vandalized and non-operational boreholes in Beaufort West.	100	No	0	BW2425001	Yes	100	Yes	100	Yes	100	No	0	500	71.4
Monitoring	Groundwater Monitoring Programme only implemented on an ad-hoc basis.	Yes	100	Ensure that the key groundwater management functions are implemented. The monitoring data must be analysed by a geohydrologist on an annual basis in order to assess the effects of abstraction and recharge on the boreholes and aquifer. Groundwater monitoring must continue on at least a monthly basis. Monthly monitoring of water levels, water chemistry and abstraction must be conducted by the Municipal staff. Beaufort West Municipality needs to ensure that all electronic data (i.e. dataloggers) are downloaded once quarterly by a geohydrologist. Monitoring data must be annually reviewed by a geohydrologist.	100	No	0	BW2425013	Yes	100	Yes	100	Yes	100	No	0	500	71.4
Water quality	Current operational and compliance wastewater quality monitoring programmes for the WWTW are not adequate	Yes	100	Ensure comprehensive operational and compliance wastewater quality monitoring programmes are implemented for all four WWTWs (To ensure proper process control and compliance wrt Authorisation requirements)	100	Partially	50	BW2425015	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6
	Current operational water quality monitoring programmes are not adequate.	Yes	100	Ensure comprehensive operational water quality monitoring programmes are implemented for all four systems (Compliance with SANS241:2015 requirements).	100	Partially	50	BW2425014	Yes	100	Yes	100	Partially	50	Partially	50	550	78.6
Operation	All industrial consumers to be monitored w.r.t. the quality of effluent discharge into the Municipality's sewer system.	Yes	100	The quality of industrial effluent discharged into the Municipality's sewer system needs to be monitored, as well as volumetric monitoring at the larger users. Adaptation of the current procedures must be undertaken in accordance with any changes to the wastewater discharge criteria set by DWS. It will also be necessary to consider limits above which volumetric monitoring will be necessary at new industries and existing smaller industries, where expansion is likely to take place.	100	No	0	Part of O&M Budget	Yes	100	Yes	100	Yes	100	No	0	500	71.4

WSDP MASTER PLAN: FUTURE DEMAND AND FUNCTIONALITY REQUIREMENTS EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

9.2 WATER MASTER PLAN PERSPECTIVE

The table below gives an overview of the Water Master Plan Perspective for Beaufort West Municipality.

Table 9.2.1: Water Master Plan Perspective		
Question	Yes / No	Score
Is there a Water Master Plan that addresses future requirements with regard to the following?		
Existing needs that will take more than 5 years to resolve?	Yes	60%
Resource Development Plan for a 5, 10 and 15 year scenario?	Yes	60%
Infrastructure Development Plan for a 5, 10 and 15 year scenario?	Yes	60%
Functionality Needs Prediction for a 5, 10 and 15 year scenario?	Yes	40%
Did Council approve any projects that should have started this current year that address the following?		
Existing needs that will take more than 5 years to resolve?	Yes	40%
Resource Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Infrastructure Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Functionality Needs Prediction for a 5, 10 and 15 year scenario?	Yes	40%
Are these future projects included in the next 5 year IDP programme for the following?		
Existing needs that will take more than 5 years to resolve?	Yes	40%
Resource Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Infrastructure Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Functionality Needs Prediction for a 5, 10 and 15 year scenario?	Yes	40%
Taking into consideration the current financial and institutional capacity of the WSA, score the probability scenario of the timeous implementation of these projects in relation to:		
Existing needs that will take more than 5 years to resolve?	Yes	40%
Resource Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Infrastructure Development Plan for a 5, 10 and 15 year scenario?	Yes	40%
Functionality Needs Prediction for a 5, 10 and 15 year scenario?	Yes	40%
Total		43.75%

The only water and sewerage capital infrastructure projects included in Beaufort West Municipality's approved 2024/2025 MTEF Capital Budget are the following (Next three years).

- Repairs to vandalized switchgear for critical boreholes for R1 217 392 (2024/2025)
- New telemetric system R956 522 (2024/2025).
- Upgrading of existing irrigation pump station at Beaufort West WWTW R2 705 546 (2026/2027).

The new NWRS 2 list the following steps to raise the water profile in development planning:

- Water must be placed at the center of integrated planning and decision-making, with a specific aim to respond to and support the achievement of national development and sector goals.
- Current budgets need to adequately provide for water, which might mean they have to be doubled to cater for the present needs.
- Current financial values need to appreciate water as a scarce resource and should thus reflect the real value of water. This requires a new value system across all sectors and stakeholders.
- Water efficiency and curbing water losses should be high on the agenda of each individual and institution in the country.
- Water management must be formally embedded in the sector businesses with associated accountability.

The DWS will insist in the future that all water infrastructure which they fund is value engineered against the life-cycle cost with a specific emphasis on energy costs. Evidence will be required that the technical design is appropriate for the nature of the resource and that operation and maintenance of the assets is reasonably within the capability of the institution responsible. New water resources infrastructure will also not be developed or authorized unless effective WC/WDM interventions have been put in place in the affected area.

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The identification of projects necessary to ensure the provision of adequate levels of water and sanitation services is based primarily on the findings of the Water and Sewer Master Plans. Master Planning is typically based on a forward planning horizon of 20 years, but is usually updated every three to five years, taking into account improved water demand estimates and subsequent infrastructure developments which may have taken place. The recommended projects from the Beaufort West Master Plans were incorporated into the WSDP.

The Master Plans represent the ideal infrastructure development required to meet projected future water requirements over the next few years, while realistic capital investment in infrastructure projects is determined by budget availability. As a result, prioritization of projects is necessary to identify what can be done within the available and projected budget constraints. The prioritization of projects is done through the IDP and annual budget planning process.

Recommended infrastructure projects for implementation in the future by Beaufort West Municipality will be based on the following plans and processes:

- Water and Sewer Master Plans and Water and Waste Water Treatment Works Master Plans/studies;
- Infrastructure replacement needs (Asset Register);
- Ad-hoc technical investigations;
- Budget proposals; and
- Asset Management Plans.

The future master plan items for the internal water and sewerage infrastructure and networks are included under Topics 3. The future water and sewerage capital infrastructure projects for Beaufort West Municipality are also included in Table 7.1.4.1.1 and Table 7.1.4.2.1 under Topic 7.

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9.3 OVERALL TOPIC STRATEGIES

The table below gives an overview of the Strategies and Objectives for Beaufort West Municipality

Table 9.3.1: Strategies, Objectives and Key Performance Indicators for Beaufort West Municipality									
Nr	Objective / Strategy	Key Performance Indicator	Baseline 2023/2024	Linked Project	FY2024/25	FY2025/26	FY2026/27	FY2027/28	FY2028/29
Topic 1: Settlement Demographics and Public Amenities									
	Implemented by other Department	-	-	-	-	-	-	-	-
Topic 2: Service Levels Profile									
TL6	Provide, maintain and expand basic services to all people in the municipal area.	Number of formal residential properties that receive piped water (credit and prepaid water) that is connected to the municipal water infrastructure network and which are billed for water or have prepaid water meters as at 30 June.	16 307	Part of O&M Budget	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set
TL8	Provide, maintain and expand basic services to all people in the municipal area.	Number of formal residential properties connected to the waste water sanitation/sewerage network for sewerage service, irrespective of the number of closets (toilets) which are billed for sewerage as at 30 June	16 307	Part of O&M Budget	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set
TL10	Provide, maintain and expand basic services to all people in the municipal area.	Provide free basic water to active indigent households as defined in paragraph 9(1) of the Municipality's Credit Control and Debt Collection Policy as at 30 June 2024	9 658	Part of O&M Budget	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set
TL12	Provide, maintain and expand basic services to all people in the municipal area.	Provide free basic sanitation to active indigent households as defined in paragraph 9(1) of the Municipality's Credit Control and Debt Collection Policy as at 30 June 2024	9 658	Part of O&M Budget	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set	Targets still to be set
New	Ensure all households on the farms are provided with at least basic water services, subject to DWS guidance.	Support all applications received for basic water services on the farms (Subject to availability of financial resources and sustainability of type of service).	-	BW2425006	-	-	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)
New	Ensure all households on the farms are provided with at least basic sanitation services, subject to DWS guidance.	Support all applications received for basic sanitation services on the farms (Subject to availability of financial resources and sustainability of type of service).	-	BW2425007	-	-	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)	100% of applications received are supported (Subject to availability of funding and sustainability of type of service)
New	Provision of communal taps to households in informal areas based on the standard of 1 water point to 25 households.	Number of communal taps installed in relation to the number of informal households.	-	BW2425004	-	-	Provide at least 1 water point to every 25 households in informal areas	Provide at least 1 water point to every 25 households in informal areas	Provide at least 1 water point to every 25 households in informal areas
New	Provision of communal toilet facilities to households in informal areas based on the standard of 1 toilet to 5 households.	Number of toilet structures provided in relation to the number of informal households.	-	BW2425005	-	-	Provide at least 1 toilet to every 5 households in informal areas.	Provide at least 1 toilet to every 5 households in informal areas.	Provide at least 1 toilet to every 5 households in informal areas.
Topic 3: Water Services Asset Management									
	Sustainable, safe and healthy environment	95% of the approved project budget spent on the upgrade of existing irrigation pump station at the Waste Water Treatment Works in Beaufort West by 30 June 2024	95%	BW2425003	95%	95%	95%	-	-
New	Ensure adequate storage capacity	Ensure adequate storage capacity for all towns (At least 48hrs AADD)	-	Various Projects	-	-	All towns with storage capacity above 48 hrs AADD	All towns with storage capacity above 48 hrs AADD	All towns with storage capacity above 48 hrs AADD
New	Implement projects included in the Water Master Plan	Ensure adequate water pump station and water reticulation capacity.	-	Various Projects	-	-	Upgrade existing water pump stations and provide new pump stations as identified in the Water Master Plan. Upgrade water reticulation networks as proposed in the Water Master Plan.	Upgrade existing water pump stations and provide new pump stations as identified in the Water Master Plan. Upgrade water reticulation networks as proposed in the Water Master Plan.	Upgrade existing water pump stations and provide new pump stations as identified in the Water Master Plan. Upgrade water reticulation networks as proposed in the Water Master Plan.
New	Implement projects included in the Sewer Master Plan	Ensure adequate sewer pump station and sewer drainage network capacity.	-	Various Projects	-	-	Upgrade existing sewer pump stations and provide new pump stations as identified in the Sewer Master Plan. Upgrade sewer drainage networks as proposed in the Sewer Master Plan.	Upgrade existing sewer pump stations and provide new pump stations as identified in the Sewer Master Plan. Upgrade sewer drainage networks as proposed in the Sewer Master Plan.	Upgrade existing sewer pump stations and provide new pump stations as identified in the Sewer Master Plan. Upgrade sewer drainage networks as proposed in the Sewer Master Plan.
Topic 4: Water Services Operation and Maintenance									
TL29	Sustainable, safe and healthy environment	95% of water samples in Beaufort West jurisdiction area comply with SANS241 micro biological indicators	95%	Part of O&M Budget	95%	95%	95%	95%	95%
New	Implement recommendations from detail WTW Process Audits.	% Of recommendations, as included in the WTW Process Audits, implemented.	-	Various Projects	-	-	50% of recommendations implemented	70% of recommendations implemented	90% of recommendations implemented
New	Implement recommendations from detail WWTW Process Audits.	% Of recommendations, as included in the WWTW Process Audits, implemented.	-	Various Projects	-	-	50% of recommendations implemented	70% of recommendations implemented	90% of recommendations implemented
New	Implement recommendations as included in the Improvement / Upgrade Plan of the Water Safety Plan	% Of recommendations, as included in the Improvement / Upgrade Plan of the Water Safety Plan, implemented.	-	BW2425010	-	-	50% of recommendations implemented	70% of recommendations implemented	90% of recommendations implemented

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EXISTING NEEDS PERSPECTIVE, WATER MASTER PLAN PERSPECTIVE AND OVERALL TOPIC STRATEGIES

Table 9.3.1: Strategies, Objectives and Key Performance Indicators for Beaufort West Municipality									
Nr	Objective / Strategy	Key Performance Indicator	Baseline 2023/2024	Linked Project	FY2024/25	FY2025/26	FY2026/27	FY2027/28	FY2028/29
New	Implement recommendations as included in the Improvement / Upgrade Plan of the W ₂ RAPs.	% Of recommendations, as included in the Improvement / Upgrade Plan of the W ₂ RAPs, implemented.	-	BW2425011	-	-	50% of recommendations implemented	70% of recommendations implemented	90% of recommendations implemented
New	Quality of final effluent comply with authorisation limits for final effluent.	% Compliance with WWTW final effluent authorisations	-	Part of O&M Budget	-	-	70%	80%	90%
New	Water Quality sampling programme complies with requirements.	Water Quality Sampling Programme complies with the minimum SANS241:2015 monitoring frequency for process indicators.	-	BW2425014	-	-	90%	95%	100%
New	Ensure adequate budget for the O&M of the existing water and sewerage infrastructure	Ensure a budget of at least 1.5% of the total value of the water and sewerage assets is allocated towards the annual O&M of the systems.	-	Part of O&M Budget	-	-	A budget of 1.5% or more of the value of the water and sewerage assets is allocated towards the O&M of the systems.	A budget of 1.5% or more of the value of the water and sewerage assets is allocated towards the O&M of the systems.	A budget of 1.5% or more of the value of the water and sewerage assets is allocated towards the O&M of the systems.
New	Ensure adequate budget for the replacement of old water and sewerage infrastructure	Ensure a budget of at least 2% of the total value of the water and sewerage assets is allocated towards the replacement of existing infrastructure per annum.	-	Various Projects	-	-	A budget of 2% or more of the value of the water and sewerage assets is allocated towards the replacement of existing infrastructure.	A budget of 2% or more of the value of the water and sewerage assets is allocated towards the replacement of existing infrastructure.	A budget of 2% or more of the value of the water and sewerage assets is allocated towards the replacement of existing infrastructure.
New	Reporting on water quality and wastewater quality compliance percentages	Report annually on the percentage of water quality and wastewater quality compliance.	-	Part of O&M Budget	-	-	At least annual publication of water quality and wastewater quality compliance percentages.	At least annual publication of water quality and wastewater quality compliance percentages.	At least annual publication of water quality and wastewater quality compliance percentages.
Topic 5: Conservation and Demand Management: Water Resource Management									
TL19	Uphold sound financial management principles and practices.	Limit unaccounted for water quarterly to less than 25% during 2023/2024 [(Number of kilolitres water purchased or purified – number of kilolitres water sold (including free basic water) / number of kilolitres water purchased or purified x 100]	30%	Part of O&M Budget	< 30%	< 30%	< 30%	< 30%	< 30%
Topic 5: Conservation and Demand Management: Water Balance									
New	Detail IWA Water Balances for all the systems and monthly WTW flows for all the treatment plants.	Ensure all bulk water is metered at source, at WTW (incoming and outgoing) and at all bulk storage reservoirs and the meters are read and recorded on at least a monthly basis.	-	BW2425016 BW2425017 BW2425018 BW2425019	-	-	90% Compliance	95% Compliance	100% Compliance
New	Monthly WWTW flows for all the treatment plants.	Ensure all incoming flow and outgoing flow at WWTWs are metered, as well as final effluent re-used for irrigation purposes and that meters are read and recorded on at least a monthly basis.	-	BW2425016 BW2425017 BW2425018 BW2425019	-	-	90% Compliance	95% Compliance	100% Compliance
Topic 6: Water Resources									
New	Implementation of Groundwater Management Programme	Ensure groundwater management programme for boreholes are implemented and raw water quality is monitored at least annually.	-	BW2425013	-	-	Implement Groundwater Management Programme and monitor raw water quality at least annually.	Implement Groundwater Management Programme and monitor raw water quality at least annually.	Implement Groundwater Management Programme and monitor raw water quality at least annually.
New	All water sources are authorised.	% of Abstraction from sources registered and authorised by the DWS.	-	Part of O&M Budget	-	-	75% Compliance	85% Compliance	100% Compliance
New	Ensure adequate yield and allocations from water resources to meet the projected future water requirements.	Ensure yields and allocations are adequate to meet the projected five year water requirements for all systems.	-	BW2425001 BW2425040	-	-	100% Adequate supply to meet water requirements for all systems	100% Adequate supply to meet water requirements for all systems	100% Adequate supply to meet water requirements for all systems
New	Monitoring of industrial consumers.	% Monitoring of effluent discharged by industrial consumers (Quantity and Quality) and charged according to the quality of effluent discharged by them.	-	Part of O&M Budget	-	-	50% Of all Industrial Consumers monitored w.r.t. quality and quantity of effluent discharged by them	70% Of all Industrial Consumers monitored w.r.t. quality and quantity of effluent discharged by them	90% Of all Industrial Consumers monitored w.r.t. quality and quantity of effluent discharged by them
Topic 7: Financial									
	Implemented by other Department	-	-	-	-	-	-	-	-
Topic 8: Institutional Arrangements and Customer Care									
New	Ensure adequate Process Controllers at the WTWs (Regulation 3630)	% Compliance w.r.t the number of existing Process Controllers at the WTWs and the required number of Process Controllers	-	Part of O&M Budget	-	-	WTWs meeting the requirements, w.r.t. the number of Process Controllers per shift.	WTWs meeting the requirements, w.r.t. the number of Process Controllers per shift.	WTWs meeting the requirements, w.r.t. the number of Process Controllers per shift.
New	Ensure adequate Process Controllers at the WWTWs (Regulation 3630)	% Compliance w.r.t the number of existing Process Controllers at the WWTWs and the required number of Process Controllers	-	Part of O&M Budget	-	-	50 % Of plants meeting the requirements, w.r.t. the number of Process Controllers per shift.	70 % Of plants meeting the requirements, w.r.t. the number of Process Controllers per shift.	90 % Of plants meeting the requirements, w.r.t. the number of Process Controllers per shift.